# Chapter 7: Geology, Hydrology, Hydrogeology and Peat

# Chapter 7
# Geology, Hydrology, Hydrogeology and Peat

## Introduction

**7.1** This chapter considers the potential effects of the An Càrr Dubh Wind Farm (hereafter referred to as 'the Proposed Development') on geology, hydrology, hydrogeology and peat. It details the baseline environmental conditions, based on desk studies and a comprehensive field survey conducted from May 2021 to May 2022. A description of potential effects and their significance, together with mitigation measures is also provided, including an assessment of the cumulative effects.

**7.2** This chapter should be read alongside **Chapter 8: Ecology** due to interactions between both chapters in terms of the potential effects on water quality and potential effects on Ground Water Dependent Terrestrial Ecosystems (GWDTEs). Potential effects on any GWDTEs are considered within this chapter. The assessment is based on the project description and construction methods described in **Chapter 4: Project Description**.

**7.3** The hydrology, geology, water resources assessments and peat surveys were undertaken by Kaya Consulting Limited; East Point Geo provided expert input into the peat assessment, including the Peat Management Plan and Peat Landslide Hazard and Risk Assessment.

**7.4** The chapter is supported by the following appendices:

- **Appendix 7.1: Watercourse Crossings**
- **Appendix 7.2: Peat Survey Report**
- **Appendix 7.3: Outline Peat Management Plan**
- **Appendix 7.4: Peat Landslide Hazard and Risk Assessment**
- **Appendix 7.5: Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment**

## Scope of the Assessment

### Effects Assessed in Full

**7.5** The following effects were identified for consideration in this assessment:

- Direct effects during construction on surface and ground water quality, public and private water supplies, GWDTEs, hydrology, channel morphology and peat;
- Direct effects during operation on hydrology; and
- Cumulative effects during construction on surface and ground water quality, hydrology and peat.

### Effects Scoped Out

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

- Effects on bedrock geology during both construction and operation; and
- Operational effects on surface water quality and quantity, public and private water supplies.

## Assessment Methodology

### Legislation and Guidance

#### Legislation

**7.7** This assessment is carried out in accordance with the principles contained within the following legislation:

- The Flood Risk Management (Scotland) Act 2009;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR);
- The Water Framework Directive (2000/60/EC) (WFD), and Water Environment and Water (Scotland) Act (WEWS Act) 2003;
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ('the EIA Regulations');
- The Control of Pollution Act 1974 (as amended) Part II: Pollution of Water;
- The Scotland River Basin District (Standards) Directions 2014;
- The Scotland River Basin District (Status) Directions 2014;
- The Public Water Supplies (Scotland) Regulations 2014;
- The European Drinking Water Directive (Council Directive 98/83/EC);
- The Private Water Supplies (Scotland) Regulations 2006;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017;
- The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013; and
- The Waste Management Licensing (Scotland) Regulations 2011.

#### Guidance

**7.8** This assessment is carried out in accordance with the principles contained within the following documents:

- The Scottish Environment Protection Agency (SEPA)'s Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs), including:
  - GPP1: Understanding your environmental responsibilities – good environmental practices;
  - GPP2: Above ground oil storage tanks;
  - GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;
  - GPP5: Works and maintenance in or near water;
  - PPG6: Working at construction and demolition Sites;
  - GPP8: Safe storage and disposal of used oils;
  - GPP21: Pollution incident response planning;
  - GPP22: Dealing with spills; and
  - GPP26: Safe storage – drums and intermediate bulk containers.

- Scottish Government Planning Advice Notes (PANs) and Guidance (including PAN 51 Planning, Environmental Protection and Regulation; PAN 1/2013 Environmental Impact Assessment, as amended; and PAN 79 Water and Drainage);
- Scottish Executive (2013) River crossings and migratory fish: Design guidance;
- SEPA (2022) Technical Flood Risk Guidance for Stakeholders, Version 13;
- SEPA (2022) Water Environment (Controlled Activities) (Scotland) Regulations 2011 – A Practical Guide, Version 9.1;
- SEPA (2015) Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005, WAT-PS-06-02: Culverting of Watercourses – Position Statement and Supporting Guidance, Version 2;
- SEPA (2010) Engineering in the Water Environment Good Practice Guide – River Crossings, WAT-SG-25;
- SEPA (2009) Engineering in the Water Environment Good Practice Guide – Temporary Construction Methods, WAT-SG-29;
- SEPA (2021) Sector Specific Guidance: Construction Sites, WAT-SG-75;
- SEPA (2009) Policy No. 19, Groundwater protection policy for Scotland;
- SEPA (2006) Special requirements for civil engineering contracts for the prevention of pollution, WAT-SG-31;
- SEPA (2017) Land Use Planning System, SEPA Guidance Note 31 (LUPS-31): Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems;
- SEPA (2018) Flood Risk and Land Use Vulnerability Guidance, Version 4;
- SEPA (2019) Climate change allowances for flood risk assessment in land use planning, Land Use Planning System SEPA Guidance, Version 1;
- SEPA (2010) Regulatory Position Statement – Developments on Peat;
- Forestry Commission (2017) The UK Forestry Standard;
- Scottish Water standards and policies, including Sewers for Scotland 3rd edition (2015) and Water for Scotland 3rd edition (2015);
- CIRIA (2015) The Sustainable Drainage Systems (SuDS) Manual (C753);
- CIRIA (2001) Control of water pollution from construction Sites: Guidance for consultants and contractors (C532);
- CIRIA (2016) Groundwater Control – design and practice (C515);
- Argyll and Bute Council (2015) Argyll and Bute Local Development Plan Written Statement;
- Argyll and Bute Council (2016) Argyll and Bute Local Development Plan Supplementary Guidance;
- Scottish Government, Scottish Natural Heritage and SEPA (2017) Peatland Survey – Guidance on Developments on Peatland;
- Scottish Renewables, Scottish Natural Heritage (SNH) (now NatureScot), SEPA and Forestry Commission Scotland (2019) Good Practice during Windfarm Construction;
- SNH (2015) Constructed tracks in the Scottish Uplands;
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments (Second Edition);
- Department for Environment Food and Rural Affairs (DEFRA) (2009) Code of Practice for the sustainable use of soils on construction sites; and
- Marine Scotland (2021) Freshwater and diadromous fish and fisheries associated with onshore wind farm and transmission line developments: generic scoping guidelines.

## Consultation

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

**Table 7.1: Consultation responses**

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|---|---|---|---|
| SEPA<br>28th June 2021 and 12th May 2021 | Formal Scoping Consultation | Due to ongoing issues associated with the cyber-attack in December 2020, SEPA was unable to respond to the consultation in a site-specific manner. SEPA referred the Applicant to their standing advice and other guidance which is available on their website at https://www.sepa.org.uk/environment/land/planning/. | This chapter considers the SEPA standing advice and guidance in the chapter. |
| SEPA<br>10th June 2022 | Post Scoping Consultation | The Applicant proposed a meeting with SEPA (in the absence of a site-specific response to Scoping) to discuss the design iterations made to balance the multiple constraints on the Site (e.g. hydrology, deep peat, GWDTE) and to discuss sizing of watercourse crossings.<br>SEPA requested written information regarding the design iterations in advance of a meeting.<br>SEPA noted that referring to the proposed condition specified by the council regarding watercourse crossings, it is for the local authority to determine what design is best at what locations. In general SEPA advise that their standing advice should be followed as a minimum as well as reference made to NatureScot (previously SNH) (2015) Constructed tracks in the Scottish Uplands. | Further consultation with Argyll and Bute Council (ABC) was carried out to discuss appropriate condition for the sizing for watercourse crossings.<br>SEPA standing advice and NatureScot guidance was followed in the assessment.<br>Further consultation was undertaken with SEPA through the gate check process. The Gate Check Report was submitted to consultees, including SEPA, on 9th November 2022. SEPA responded on 17th November 2022 (see below). |
| SEPA<br>17th November 2022 | Gate Check Consultation | SEPA welcomed the inclusion of good peat probing information within the report. Given the variability of peat depths over short distances, they consider the approach to sampling peat has been successful and good baseline information has been gathered to inform the layout. SEPA request that the final peat probing plans show the infrastructure just as an outline (or with the probes on top) so that it is possible to see the colour of the probes in the exact location of the infrastructure. | **Figure 7.7** shows the infrastructure outline with peat depths on top and is displayed at a large scale to clearly see probed depth category. |
| | | SEPA advise that as well as avoiding deep peat the layout should also be shown to avoid any good quality peat-forming habitat, and a layout plan showing such areas should be included, if relevant. | **Appendix 8.2: Habitats and Vegetation Survey Report** sets out detailed information on habitats, which are mapped on **Figures 8.3** and **8.4**. Annex B of **Appendix 8.2** sets out details of peat condition at key infrastructure locations. |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|---|---|---|---|
| | | SEPA note that useful information is provided on the potential for impacts on GWDTE habitats, including the identification of GWDTE point features. SEPA note that in many cases direct and indirect impacts on them have been avoided. The schedule of mitigation should include specific measures to protect the habitats where this has not been possible, such as on the track between T11 and T12. | The GWDTE assessment (**Appendix 7.5**) sets out specific mitigation measures to protect the habitats where direct and indirect effects cannot be avoided. |
| | | SEPA note that although a 50 metres (m) buffer has been applied around water features, the gate check report indicates it was not possible to comply with the 50m buffer in all locations. SEPA notes that there are a number of small lochans or large bog pools on the Site and they should be protected in a similar manner. Working within the 50m buffer can be acceptable to SEPA if it is shown to avoid impacts on other aspects that SEPA have an interest in – such as deep peat – as long as there are no known downstream sensitive receptors and additional mitigation is outlined in the schedule of mitigation. Such areas should however be clearly identified and justified. | Locations where the 50m water feature buffer is encroached are identified and justified in **Appendix 7.1**. This includes small lochans and bog pools. Site specific additional mitigation, if required, is outlined in **Appendix 7.1** and also in the schedule of mitigation. |
| SEPA<br>8th June 2022 | Data Request for Groundwater Abstraction/PWS data | SEPA provided data on seven Controlled Activities Regulation (CAR) abstraction licences within the search area on 10th January 2023, as follows:<br>■ CAR/L/1019459 – Douglas Water Hydro Scheme, Argyll – Hydropower scheme. This is located over 3 kilometres (km) from the Site boundary and there is no infrastructure proposed within the Douglas Water catchment, so it is not considered further.<br>■ CAR/L/1038965 – Blarghour Farm, By Dalmally, Argyll – Blarghour Hydro Scheme. Potential effects on Blargour Hydro Scheme are considered in the assessment.<br>■ CAR/L/1107257 – Kames Hydro Scheme, Kames, Argyll. Potential effects on Kames Hydro Scheme are considered in the assessment.<br>■ CAR/L/1115821 – Allt a'Chrosaid Hydro, Balliemeanoch – This is over 3km north of the Site boundary and there is no infrastructure proposed in the Allt a'Chrosaid catchment, so it is not considered further.<br>■ CAR/L/1165432 – Maltlands Hydro, Maltlands, Inveraray – This is located 200m from the eastern site boundary, at the junction of the existing access track and A819. This is a small hydropower scheme, which abstracts water from the Allt Riabhachan watercourse. Potential effects on Maltlands Hydro are considered in the assessment.<br>■ CAR/R/1116662 and CAR/R/1116664 – Inveraray SDB, Black & Veatch Site Offices – Abstractions for industrial process Water from the Douglas Water, the Allt Eas a Chosain, an unnamed tributary of the Douglas Water, and an unnamed tributary of the Dalchenna Burn. This is over 5km from the nearest proposed turbine, but 50m from the proposed Inverary bypass to be used for construction access. Use of the access track will have no impact on water volumes in the nearby watercourses and this is not considered further. | Data used to inform the baseline assessment. Effects on the Blargour, Kames and Maltlands Hydro Schemes are assessed in this chapter, as there is Proposed Development within their catchment areas. |
| Scottish Water<br>20th May 2021 | Formal Scoping Consultation | Scottish Water records indicate that the Proposed Development falls within a drinking water catchment where a Scottish Water abstraction is located. Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. Douglas Water supplies Inveraray Water Treatment Works (WTW) and Scottish Water notes that it is essential that water quality and water quantity in the area are protected. In the event of an incident occurring Scottish Water should be notified immediately.<br>Scottish Water notes that the turbines are in the upper reaches of the catchment therefore the activity is likely to be of lower risk, however care should be taken and water quality protection measures must be implemented. Scottish Water also needs to understand the access routes to fully advise of the potential risk to water quality, as well as any changes to the turbine layouts. | Data used to inform the baseline assessment. Scottish Water asset maps were obtained.<br>The turbine and access routes are provided in **Figure 7.1**. The Inveraray Water Treatment Works (WTW) is located on the proposed Inverary bypass construction access route. Water quality protection and mitigation measures are proposed. |
| | | Scottish Water notes that the soils in this catchment appear to be peats and peaty gleys and note that peat that is in unfavourable condition or disturbed can exacerbate the release of organic material into the water environment. Water containing a high organic content can affect WTW processes and water supply. Scottish Water would welcome consideration of the precautions specific to protecting drinking water in peatland areas and any opportunities for peat restoration. If peatland restoration is to be undertaken Scottish Water would request further details of this are sent to them for review. | Peatland restoration is proposed as part of the Outline Restoration and Enhancement Plan (OREP). Details are provided in **Appendix 8.5: Outline Restoration and Enhancement Plan (OREP)** and summarised in this chapter. The Applicant would welcome review and comment from Scottish Water. |
| | | Scottish Water has produced a list of precautions for a range of activities. This details protection measures to be taken within a DWPA, the wider drinking water catchment and if there are assets in the area. Site specific risks and mitigation measures will require to be assessed and implemented. These documents and other supporting information can be found on the activities within the catchments page of the website at www.scottishwater.co.uk/slm. | The website and documents were reviewed. The following are of particular relevance:<br>■ Precautions to protect drinking water and Scottish Water assets during windfarm construction and operational activities; and<br>■ Precautions to protect drinking water and Scottish Water assets during peat restoration activities. |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
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| | | | The drinking water catchment areas and Scottish Water assets were assessed in this chapter. Site specific risks and mitigation measures have been assessed and recommended within this chapter. |
| | | Scottish Water advises that there are a number of Scottish Water assets in the eastern part of the Site. There is a 180mm HPPE raw water main, a 6" uPVC raw water main and a 6" PVC potable water distribution main, as well as Inveraray WTW being in close proximity to the Site boundary. This should be confirmed however through obtaining plans from Scottish Water Asset Plan Providers.<br>All Scottish Water assets potentially affected by the activity should be identified, with particular consideration being given to access roads and pipe crossings. If necessary, local Scottish Water personnel may be able to visit the Site to offer advice. All of Scottish Water's processes, standards and policies in relation to dealing with asset conflicts must be complied with.<br>In the event that asset conflicts are identified then early contact should be made with Scottish Water. | Scottish Water asset maps were reviewed on the Scottish Water Extranet GIS and nearby assets that are potentially affected are discussed in the baseline assessment.<br>Asset plans were obtained for the Inveraray area and all areas of the Site where Scottish Water assets are present.<br>Contact with Scottish Water will be made at detailed design stage and before and during construction. |
| | | Scottish Water advise that they will not accept any surface water connections into our combined sewer system. | There are no proposed surface water connections into the combined sewer system. |
| The Scottish Government, Energy Consents Unit<br>August 2021 | Formal Scoping Opinion | The Scottish Ministers recommend that the Applicant discuss and agree Baseline Fish Surveys and Pre and Post development surveys with the Argyll District Salmon Fishery Board (ADSFB). | No baseline fish surveys have been carried out for the EIA. An overview of fish populations is contained within **Chapter 8**. The consultation with the ADSFB is summarised below. |
| | | The Scottish Ministers consider that where there is a demonstrable requirement for Peat Landslide Hazard and Risk Assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide the Scottish Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures. | A PLHRA has been prepared following the recommended guidance and is appended as **Appendix 7.4**. |
| | | The Scottish Ministers request that the Applicant investigates the presence of any private water supplies (PWS) which may be impacted by the Proposed Development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the Applicant should provide an assessment of the potential impacts, risks, and any mitigation which would be provided. | PWS data (properties and/or source supply locations) were provided by Argyle and Bute Council (see below) to inform the assessment. |
| NatureScot<br>2nd July 2021 | Formal Scoping Consultation | NatureScot advise that impacts on nationally important carbon-rich soils, deep peat and priority peatland habitat is a key issue that needs to be addressed in the EIA.<br>NatureScot notes that the Site covers a Class 2 area of the Carbon and Peatland map and as such there is a requirement for a complete peat probing survey to be undertaken, and an associated NVC survey, to ascertain the quality and distribution of peatland and priority habitats across the Site as per NatureScot guidance. | This chapter assesses the potential effects on carbon-rich soils, deep peat and priority peatland habitats.<br>A complete peat probing survey was carried out in two stages. Phase 1 survey (100m grid) was carried out to inform initial design. Phase 2 detailed probing and coring was carried out around infrastructure and tracks (see **Appendix 7.2**).<br>An NVC survey was also undertaken and is reported in **Chapter 8** and **Appendix 8.2**. |
| | | NatureScot advise that if site surveys, and subsequently the EIA Report, confirm areas of significant protection (Group 2) through the presence of areas of carbon rich soils, deep peat and priority peatland habitat, then it will have to be demonstrated *"that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation"* (Scottish Planning Policy, 2020) (https://www.gov.scot/publications/scottish-planning-policy/). | **Chapter 3:Site Selection and Design Strategy**, the Outline PMP (**Appendix 7.3: Peat Management Plan**) and the OREP (**Appendix 8.5: Outline Restoration and Enhancement Plan**) detail the process that has been taken to avoid deep peat and priority peatland, and the mitigation measures proposed. |
| | | NatureScot notes that the Scoping Report makes a commitment to a Peat Management Plan (PMP) and Habitat Management Plan (HMP) associated with Ornithology. NatureScot advises that a similar commitment to a HMP should be made in relation to impacts on the ecological resources of the Site. | The Outline PMP is appended as **Appendix 7.3**.<br>An outline restoration and enhancement plan has been prepared which covers measures relating to peatlands, ornithology and ecology. This is included as **Appendix 8.5**. |
| | | NatureScot request that the table in Annex 3 of their Scoping Response is completed and submitted as part of the EIA Report. This will help NatureScot assess potential impacts, and their significance. | The requested table has been amended for the project whilst retaining the information requested by NatureScot. This is included as an annex to **Appendix 8.2**. |
| | | NatureScot also advise the following in response to questions posed in the Scoping Report:<br>■ The Applicant should seek to use digital layer of British Geological Society (BGS) map and not use the older paper version. | The digital layer of the BGS map was used in the baseline assessment.<br>The Phase 1 peat survey covered the whole of the eastern area of the Site.<br>Peat depths below 50cm were recorded. |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|---|---|---|---|
| | | ■ The peat survey methodology needs to ensure that the initial 100m x 100m grid survey covers the whole site and not be limited to areas with proposed infrastructure. In addition, peat depth below 50 centimetres (cm) must be recorded and mapped appropriately. Carbon-rich soils include soils with a peat layer less than 50cm. The use of 1m or 2m threshold for peat stability survey may be appropriate but are not detailed enough for assessing the impacts of land restoration and reinstatement. The peat map depth should include a shaded contour interval that record absence of peat not just 0-50cm. The sampling strategy need to be clearly explained to avoid bias towards deeper or shallower peat. There needs to be details included on the number of cores that will be sampled and how representative locations will be defined.<br>■ Other impacts need to be considered in addition to peat stability, (i.e. the functionality of the peatland resource and associated ecological impacts). | The interpolated peat depth map (**Figure 7.7**) shows shaded contours that record the absence of peat.<br>The sampling strategy and the details of coring are provided in **Appendix 7.2**.<br>The functionality of the peatland resource and ecological impacts are considered in **Chapter 8**. |
| Argyll District Salmon Fishery Board (ADSFB)<br>23rd May 2021 | Formal Scoping Consultation | The ADSFB advise that the Proposed Development has potential to affect salmon and trout populations and their habitats in the Barr Water tributary: Abhainn a Chnocain and its sub-catchments of Allt an Tuirie, Allt Domhain and Allt a Bhlair in the ADSFB area. Fish surveys undertaken by Argyll Fisheries Trust show that Atlantic salmon, Brown trout and possibly European Eels are widespread in the Barr Water catchment. ADSFB advise that the fragmentation of habitat caused by poorly situated stream crossings (culverts) and pollution from the construction phase of the Proposed Development can cause damage to fish populations.<br>ADSFB recommend that pre and post development surveys are undertaken to ensure that no damage to habitats and fish populations have occurred as a result of the works and demonstrate that stream crossings have not prevented the movement of fish. | The Proposed Development is not located in any of the watercourses or catchments mentioned in ADSFBs response.<br>Watercourses have been treated as sensitive receptors during the design and implementation of this project. Standard good practice mitigation is applied as standard mitigations are effective, hence it is considered that fish surveys are not required to assess the potential effects.<br>An overview of fish populations is contained within **Chapter 8** and fish habitat surveys will be carried out pre- and post- construction.<br>New stream crossings were minimised during initial design. **Appendix 7.1** provides details on new and existing crossings.<br>Potential effects on water quality are covered in this assessment and mitigation measures proposed. Most of these effects can be mitigated by the use of embedded mitigation measures during construction (e.g. SuDS and sensitive crossing design). Other site-specific mitigation measures are recommended in the chapter, if required. |
| ADSFB<br>9th November 2022 | Gate Check Consultation | ADSFB noted that the gate check report refers to standard mitigation that will be put in place to protect fisheries during construction and operation of the Proposed Development. However, ADSFB request further assurance that the Applicant will demonstrate that they will not damage or prevent access to fish habitats.<br>Noted that delivery of projects by contractors may not always go to plan and they request some mechanism to ensure that the Proposed Development does not impact on the fish populations or their habitat. ADSFB does not believe that 'standard mitigation' provides them with this assurance.<br>Recommends that pre and post development surveys are undertaken to ensure that no damage to habitats and fish populations has occurred as a result of the works and demonstrate that stream crossings have not prevented the movement of fish between habitats downstream and downstream of the crossings. | Embedded mitigation measures at watercourse crossing locations include:<br>■ Use of bottomless arch or single span crossings wherever possible in the first instance;<br>■ Retention/recreation of natural stream beds where possible;<br>■ Closed pipes used as a last resort; and<br>■ Commitment to set any pipe culverts below the existing watercourse bed wherever possible.<br>Pre- and post- construction fish habitat surveys will be carried out (see **Chapter 8**) and there will be an Ecological Clerk of Works (ECoW) involved throughout the construction works to ensure things are built correctly and in the correct location. |
| Argyll Fisheries Trust (AFT)<br>24th March 2022 | Post Scoping Consultation | AFT represent the interests of the:<br>■ ADSFB who are a statutory consultee for Atlantic salmon fish present in the Kames River (Awe catchment) and the Erallich Water and Allt Bail a Ghobhainn tributaries of the River Aray (Inveraray); and<br>■ Loch Awe Improvement Association (LAIA) who administer the protection order for freshwater fish on Loch Awe and therefore have interest in the brown trout spawning habitat in Allt Blarghour, Ardchonnel Burn and Kames River tributaries of Loch Awe.<br>AFT note that it is important to identify important stream spawning and juvenile nursery habitat associated with lochs and ensure that:<br>■ Stream crossings do not affect the movement of both adult and juvenile fish between refuge habitat (lochs and deeper areas of streams) and spawning and nursery habitat; and<br>■ The spoil created by infrastructure works should be managed to avoid any impact on the condition of the habitat (siltation) or water quality.<br>AFT recommend that the trout populations in the area be considered as wild brown trout. | Watercourse crossings have been designed to not affect the banks and beds of watercourses wherever possible (see above).<br>Watercourses and water features have been buffered by 50m where possible and SuDS measures have been embedded into project design to minimise the risk of siltation from construction and/or spoil heaps entering the water environment. |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|---|---|---|---|
| Argyll and Bute Council (ABC), Flood Risk/ Drainage Impact Officer<br>28th May 2021 | Formal Scoping Consultation | ABC note that the Site is largely free from the indicative limits of fluvial flooding as per the SEPA Flood Maps. Where the flood limits do overlay the Site the risk is associated with Allt Blarghour and Kames River. It should be noted that many of the smaller tributaries throughout the Site have catchment areas of less than 3km$^2$ and are thus too small to be included on the fluvial flood maps. The primary risk to the Site appears to be from surface water flooding, with localised instances of flooding expected across much of the catchment. These areas typically tend to be along the small tributaries or associated with the numerous lochs.<br>Based on the Scoping turbine layout, ABC noted that no turbines appear to be within the indicative limits of flooding and the Scoping Report states that all turbines will be set at least 50m away from watercourses where practicable. Where a 50m buffer is not possible, development will be outside the 1 in 200-year fluvial flood extent. ABC advise that this approach is acceptable. | This chapter considers flood risk in the baseline assessment.<br>A 50m buffer is achieved for most watercourses and lochs. Locations where a 50m buffer cannot be achieved are described in the assessment and **Appendix 7.1**. |
| | | ABC advise that any watercourse crossings should be designed in a way so as not to reduce the existing capacity of the channel, and ideally should be designed to convey the 200-year plus climate change flow. ABC recommend that this be made a planning condition should consent be granted, as follows *"Any proposed watercourses should be designed to convey the 1 in 200 year plus climate change (56% allowance) flood event"*.<br>ABC advise that if watercourse crossings are not able to be designed to pass the 1 in 200 year event (with climate change allowance) due to constraints onsite, then evidence showing that the proposed crossings will not reduce capacity in the channel (post-development) is required.<br>ABC recommend that consideration should be given to options such as bottomless culverts when designing crossings, and any changes to existing crossings should not reduce the existing capacity of the crossing (e.g. culverts should not be made smaller).<br>ABC recommend that the 200-year flows plus climate change are calculated so that water crossings can be built to an acceptable capacity. | Further post Scoping consultation was undertaken with ABC to discuss sizing of watercourse crossings and the recommended planning condition (see below).<br>Bottomless culverts and/or bridges were considered when designing new crossings.<br>Any changes to existing crossings will not reduce the existing capacity of the crossing (e.g. culverts will not be made smaller).<br>Refer to post Scoping consultation below. |
| | | ABC recommend that drainage of surface water be designed in accordance with CIRCA C753 and SuDS guidance. They also advise that the drainage design should meet the council's checklists for surface water drainage proposals and SuDS design and implementation.<br>ABC recommend that surface water drainage should be designed such that post development surface water runoff does not exceed the pre-development surface water runoff.<br>ABC recommend that this be made a planning condition should consent be granted, as follows *"Surface water drainage should be designed in accordance with CIRIA C753 and ensure that post development surface water runoff does not exceed the pre-development surface water runoff. The surface water drainage system should be in operation prior to the start of construction"*. | Surface water runoff will be managed within the Site using standard (SuDS) which will attenuate runoff to greenfield rates. The drainage design will be designed following CIRIA753 and SuDS guidance. |
| ABC, Local Biodiversity Officer<br>28th May 2021 | Formal Scoping Consultation | ABC also advise the following in response to questions posed in the Scoping Report:<br>■ the Applicant should contact the Argyll Fisheries Trust for additional baseline information.<br>■ deep peat is more than 0.5m. Infrastructure should avoid deep peat wherever possible and the Applicant should liaise with NatureScot as the lead authority on peatlands. | Argyll Fisheries Trust was contacted by email in March 2022; further details are provided in **Chapter 8**.<br>Deep peat was avoided where possible and the Applicant has consulted with NatureScot (see above). |
| ABC, Planning Case Officer<br>Emails 26th May 2022 and 15th June 2022 | Post Scoping Consultation | Consultation to discuss watercourse crossing sizing and drainage design. The Applicant noted that sizing crossings to pass the 1 in 200 year flow plus climate change allowance could potentially lead to large culverts/crossings, which are not necessarily applicable for peatland watercourses in rural upland areas and could potentially cause damage to morphology of channels and peatlands (e.g. due to increased scour by oversized culverts). In addition, flood risk in the rural upland area is not an issue, so crossings designed for smaller return period flows may be more applicable in this environment.<br>The Applicant also requested more information on the level of drainage design detail that the council are looking for in the planning application and EIA-Report.<br>ABC advised that they would be comfortable to revise the wording of the suggested condition to the effect of *"Watercourse crossings should maintain and not reduce the existing capacity of the channel"*.<br>On drainage design, ABC advised that outline design would be sufficient (e.g. runoff calculations to inform sizing and an outline plan of the drainage locations and type). | Noted. Watercourse crossings will be designed to maintain and not reduce the existing capacity of the channel. Watercourse dimensions and catchment areas are provided in **Appendix 7.1**.<br>An outline drainage strategy is provided in **Appendix 4.4: Outline Drainage Strategy**. |
| ABC, Environmental Health Officer<br>7th June 2021 | Response to Data Request for Private Water Supply Information | Private water supply data was provided by ABC for the search area, which covers the Site and a 2.5km buffer from the Site boundary.<br>ABC also provided the extent of Scottish Water mains coverage in the area. | Data used to inform the baseline assessment. |

## Study Area

**7.10** The Site is located within the Kames River, Allt Blarghour, River Aray and Douglas Water catchments. The Kames River and Allt Blarghour catchments drain in a westerly direction towards Loch Awe. The River Aray and Douglas Water catchments drain in an easterly direction towards Loch Fyne. There are many watercourses and lochans within the Site, including the Eas an Amair (a tributary of the Allt Blarghour), the Erallich Water and Allt Bail' a Ghobhainn (tributaries of the River Array), and numerous smaller named and unnamed tributaries.

**7.11** The study area for the geology, hydrology, hydrogeology assessment is shown in **Figure 7.1**. The study area for the hydrology and hydrogeology assessment comprises the Site itself and watercourses/waterbodies downstream. The study area for geology and peat comprises the locations of proposed infrastructure, although a wider area was peat probed to cover early design iterations. Proposed and existing access tracks were also included in the peat survey.

**7.12** The study area for detailed assessment of groundwater abstractions, including private water supplies, and ground water dependent terrestrial ecosystems (GWDTE) is within a 250m buffer zone from the permanent infrastructure, as per SEPA guidance. However, a wider search area for private water supplies was undertaken for the assessment.

## Desk Based Research and Data Sources

**7.13** The following data sources have informed the assessment:

- Ordnance Survey mapping at 1:10,000 and 1:25,000 scales;
- British Geological Survey (BGS) online digital mapping at 1:50,000 and 1:625,000 scales;
- Scottish Soil mapping at 1:250,000 scale;
- NatureScot (formerly SNH) Carbon and Peatland 2016 mapping at 1:250,000 scale;
- Aerial imagery of the Site and surrounding area;
- The Flood Estimation Handbook (FEH) Web-service[1];
- SEPA Flood Maps[2];
- Ordnance Survey (OS) Terrain 5 Topographic Data (5m resolution);
- Scotland's Environment Website and Interactive Map[3];
- NatureScot Site Link Interactive Map[4];
- Scottish Water Asset Plans of the Site; and
- Private Water Supply Data provided by ABC.

## Field Survey

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

- 22nd to 26th March 2021. Weather conditions were mixed with fairly wet conditions.
- 9th to 12th August 2021. Warm and dry conditions onsite with one wet day.
- 30th to 31st August. The Site conditions were warm and dry.
- 10th to 11th November 2021. The Site conditions were overcast and cold.
- 25th to 26th January 2022. The Site conditions were overcast and wet.
- 21st to 22nd February 2022. The Site conditions were cold and windy with snowstorms.
- 7th to 11th March 2022. The Site conditions were overcast and mostly dry.
- 14th to 17th March 2022. The Site conditions were mixed with overcast and wet and windy days.
- 23rd to 27th May 2022. The Site conditions were mixed with overcast and wet and windy days.
- 25th October 2022. Weather conditions were mild and dry.

## Assessing Significance

### Sensitivity

**7.15** The criteria used to assess the sensitivity of water and geological features are summarised in **Table 7.2**.

**Table 7.2: Criteria to assess the sensitivity of receptor**

| Sensitivity of Receptor | Typical Indicators |
|---|---|
| High | ■ Receptor is of national or international value (i.e. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), and RAMSAR).<br>■ Overall water quality classified by SEPA as high and salmonid spawning grounds present.<br>■ Abstractions for public water supply.<br>■ Groundwater classified under the WFD as 'good' or groundwater resource with numerous sensitive users/receptors.<br>■ The flooding of property (or land use of great value) that has been susceptible to flooding in the past.<br>■ Watercourse floodplain/hydrological feature that provides critical flood alleviation benefits.<br>■ Natural channel and of high morphological diversity.<br>■ Receptor supports GWTDE confirmed as highly groundwater dependent.<br>■ Class 1 or 2 priority peatland. |
| Medium | ■ Receptor is of regional or local value (e.g. Local Nature Reserve).<br>■ Overall water quality classified by SEPA as good or moderate, salmonid species may be present, and may be locally important for fisheries.<br>■ Smaller watercourse lying upstream of larger river that is an SSSI, SAC SPA or RAMSAR. May be subject to improvement plans by SEPA.<br>■ Abstractions for private water supplies.<br>■ Groundwater resource with sensitive users/receptors.<br>■ Environmental equilibrium copes well with natural fluctuations but cannot absorb some changes greater than this without altering part of its present character.<br>■ The flooding of property (or land use of great value) that may be susceptible to flooding.<br>■ Watercourse/floodplain/hydrological feature that provide some flood alleviation benefits.<br>■ Semi-natural channel, with morphological diversity. May have some minor morphological constraints.<br>■ Receptor supports GWTDE confirmed as moderately groundwater dependent.<br>■ Unmodified active peatland.<br>■ Deep (>1.0m depth) peat unless minor area. |
| Low | ■ Receptor is of low environmental importance (e.g. water quality classified by SEPA as bad or poor, fish sporadically present or restricted). |

[1] UK Centre for Ecology and Hydrology (undated) Flood Estimation Handbook Web Service [online]. Available at: https://fehweb.ceh.ac.uk/
[2] SEPA (undated) Flood Maps [online]. Available at: https://scottishepa.maps.arcgis.com/
[3] Scottish Government (undated) Scotland's environment [online]. Available at: https://map.environment.gov.scot/sewebmap/
[4] NatureScot (undated) SiteLink [online]. Available at: https://sitelink.nature.scot/map

| Sensitivity of Receptor | Typical Indicators |
|---|---|
| | ■ Not subject to water quality improvement plans by SEPA.<br>■ Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character.<br>■ No abstractions for public or private water supplies.<br>■ No significant groundwater resource and no identified sensitive users/receptors.<br>■ No flooding of property or land use of great value.<br>■ Watercourse/floodplain/hydrological feature that provides minimal flood alleviation benefits.<br>■ Heavily engineered or artificially modified and may dry up during summer months.<br>■ No GWDTE confirmed as either moderately or highly groundwater dependent.<br>■ No or shallow peat (0.5m to <1.0m depth) and/or modified peat. |

### Magnitude

**7.16** The magnitude of change has been assessed based on the criteria presented in **Table 7.3**. These criteria are based on professional judgement and experience of other similar studies.

**Table 7.3: Criteria for estimating the magnitude of effect**

| Magnitude | Description/Typical Example |
|---|---|
| Major | ■ Fundamental changes to the hydrology, water quality, geology, or hydrogeology (in terms of quantity, quality, and morphology).<br>■ A >10% change in average or >5% change in flood flows.<br>■ The extent of flood risk areas (as classified by NPF4 – i.e. land or built form with an annual probability of being flooded of greater than 0.5% including an appropriate allowance for future climate change) will be significantly increased.<br>■ Change that would render water supply unusable for longer than month.<br>■ Change resulting in total loss of feature or integrity of feature or use. |
| Moderate | ■ Material but non-fundamental changes to the hydrology, water quality, geology, or hydrogeology (in terms of quantity, quality, and morphology).<br>■ A >5% change in average and minimal change in flood flows. Extent of flood high risk areas will be moderately increased/or decreased.<br>■ Change that would render water supply unusable for days or weeks with no alternative. |
| Minor | ■ Detectable but non-material changes to the hydrology, water quality, geology, or hydrogeology (in terms of quantity, quality, and morphology).<br>■ A >1% change in average flows and no increase in flood flows.<br>■ Change that would render water supply unusable for short period (days) or for longer period if alternative supply put in place. |
| Negligible | ■ No perceptible changes to the hydrology, water quality, geology, or hydrogeology (in terms of quantity, quality, and morphology).<br>■ A <1% change in average and no change in flood flows.<br>■ No change in water supply or minor change (days) where alternative is put in place. |

### Significance

**7.17** The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 7.4** below. **Major** and **Moderate** effects are considered significant in the context of the EIA Regulations.

**Table 7.4: Significance criteria**

| Magnitude | Sensitivity | | |
|---|---|---|---|
| | High | Medium | Low |
| Major | Major | Major-Moderate | Moderate |
| Moderate | Moderate | Moderate | Minor |
| Minor | Minor | Minor | Minor-None |
| Negligible | None | None | None |

### Assessment Limitations

**7.18** The assessment was based on existing, available data, supplemented by hydrology and peat depth surveys of the Site. It is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on geology, hydrology, hydrogeology and peat.

## Existing Conditions

### Climate

**7.19** The average annual temperature within the coastal areas of Western Scotland is between 9.5 to 9.9°C (Met Office website). The average annual rainfall on the Site is approximately 2,663 millimetres (mm) (Flood Estimation Handbook Web-service).

### Topography

**7.20** The topography of the Site is shown in **Figure 7.1** and in **Figure 7.3.1** (**Appendix 7.3**). The higher ground runs on a north-east to south-west axis through the Site. The highest point is the summit of Beinn Bhreac at 526m Above Ordnance Datum (AOD),with other high summits within the Site including Garbh Achadh at 510m AOD and Cruach Mhic Eoich at 444m AOD.

**7.21** The Site is an upland area, where local topography will affect the peat and hydrology distribution. Higher linear bedrock ridges are separated by low lying depressions, where watercourses, lochs and areas of deeper peat are more likely to be present.

**7.22** Ground levels generally slope from the central upland area to the west towards Loch Awe and to the east towards Loch Fyne.

### Watercourses and Surface Water

**7.23** The Kames River, Allt Blarghour, and Ardchonel Burn catchments drain the Site in a westerly direction prior to entering Loch Awe to the west. The Erallich Water and Douglas Water catchments drain the Site in an easterly direction prior to entering Loch Fyne to the south-east of the Site. Key watercourses and waterbodies within and downstream of the Site are shown in **Figures 7.1**, **7.2.1** and **7.2.2** and described below. Typical watercourses within the Site are shown in **Image 7.1a** and **7.1b**.

Image 7.1: Typical watercourses within the Site – a) Eas An Amair and b) unnamed watercourse at crossing location 12

**7.24** In the northern part of the Site the Eas an Amair flows in a northerly direction prior to joining the Allt Blarghour to the north of the Site. Four named lochs and lochans (Loch Sionnaich, Lochan Dubh Mhuilinn, Loch an Eilein Duibh, Loch nan Car) are located within the headwaters of the Eas an Amair within the Site. Additionally, several small unnamed tributaries flow in a northerly direction from the Site to enter the Allt Blarghour. Most of the turbines and associated infrastructure are located within the Eas an Amair catchment and the wider Allt Blarghour catchment.

**7.25** In the western part of the Site the Allt a' Ghlinn flows in a westerly direction from the Site prior to joining the Kames River to the west. Several other small named and unnamed tributaries flow in a westerly direction from the Site to enter the Kames River. These include Allt an Sgadain, Allt Lon nan Laogh, Allt na h-Airigh Maldain. This area also drains three named lochans within the Site – Lochan Uaine, Lochan Eisge Mhoir and Lochan Allt an Sgadain. Only limited infrastructure (the proposed Met mast and associated track) is located within the Kames River catchment (**Figure 7.1**).

**7.26** In the north-western part of the Site several small unnamed tributaries flow in a northerly direction from the Site to form the Ardchonel Burn to the north of the Site. There is no infrastructure proposed within the Ardchonel Burn catchment.

**7.27** In the southern part of the Site several small unnamed tributaries and Lochan Long drain in a southerly direction from the Site to join the Douglas Water to the south. There is no infrastructure proposed within the Douglas Water catchment.

**7.28** In the north-eastern part of the Site several small named (Alltan Airigh Mhic Choinnich and Allt an t-Sluichd) and unnamed tributaries flow in an easterly direction from the Site to form the Erallich Water to the east of the Site. This area also drains two named lochans within the Site – Lochan Erallich and Lon Chlachan Dubha. The Erallich Water joins the River Aray to the east of the Site, which then enters Loch Fyne. The three most easterly turbines and associated infrastructure (T1, T2 and T3) and the upper part of the access track are within the Erallich Water catchment.

**7.29** In the eastern part of the Site a number of watercourses flow through the Site in an easterly direction prior to joining the River Aray. These include the Allt Bail a Ghobhainn, the Quakers Burn and the Allt Riabhachan. Two small waterbodies (the Steallaire Ban Loch and Fish Pond) are located adjacent to the Site boundary within the Allt Riabhachan catchment. The access track is within these catchments.

**7.30** In the south eastern part of the Site several watercourses, including the Crom Allt pass through the Site and enter Loch Fyne to the south-east. The proposed construction access track (Inveraray bypass) is located in this area.

## Hydrology and Flood Risk

**7.31** The SEPA flood maps show the likely extent of flooding for high, medium, and low likelihood for fluvial (river), pluvial (surface water) and tidal flows.

**7.32** The SEPA flood maps indicates a medium to high risk of fluvial flooding along the Allt Blarghour, Allt Riabhachan and Kames River. The predicted flood extents[5] are generally constrained close to the main river channel and do not extend into the Site. The Allt Riabhachan is predicted to flood out of bank at its confluence with the River Aray; the predicted flood extent covers an area of the A819 road approximately 230m north of the access track junction within the Site. Flood free access to and from the Proposed Development to Inveraray will still be available during flooding of the Allt Riabhachan along the proposed access track.

**7.33** The SEPA flood maps predict small areas of Site noted to be at medium to high risk of pluvial (surface water) flooding. These areas are mainly located around the waterbodies, lochs and lochans across site. There are small areas of predicted pluvial flooding in close proximity to the channel along sections of the Eas an Amair and Alltan Airigh Mhic Choinnich. No development is proposed in these areas; the crossing of the Eas an Amair is outwith the predicted pluvial flood risk area.

## Existing Site Drainage

**7.34** A flow pathway analysis was undertaken using OS Terrain 5m Topographic Data. The analysis was supplemented by observations made during field surveys to assess potential overland flow routes within the Site.

**7.35** Ground conditions across the upland part of the Site are near natural and have not been heavily modified. There are limited, often sporadic and disconnected, artificial drainage ditch networks in the upland areas of the Site. The eastern part of the Site is forested and has an associated artificial drainage network.

**7.36** Ground to the east of Beinn Bhreac generally drains away to the north-east via Erallich Water, while ground to the west generally drains west away towards Loch Awe via Eas an Amair to Allt Blarghour or Allt an Sgadain to the Kames River. Some areas of the north of the Site drain west via Allt Blarghour to Loch Awe. Catchment areas of the main watercourses and drainage divides are shown on **Figure 7.1**.

## Watercourse Crossings

**7.37** New watercourse crossings were reduced as far as practicable by using existing tracks where possible and minimising the number of crossings during initial design interactions. The Proposed Development requires 31 existing crossings and 74 new crossings; this includes small watercourse crossings mapped in the field and watercourses shown on Ordnance Survey maps. Details of all watercourse crossings (existing and proposed) are provided in **Appendix 7.1** with the locations shown on **Figure 7.2**.

**7.38** Named watercourses that are crossed by the proposed infrastructure include Eas an Amair, Erallich Water, Alltan Airigh Mhic Choinnich and Allt Bail' a' Ghobhainn. The remaining crossings are on small, unnamed watercourses and tributaries. The average channel width of watercourses to be crossed is 0.8m, ranging from 0.1m to 3.7m wide. The majority of watercourses are within peatland and tend to be narrow watercourses within the peat, sometime flowing underground within peat pipes.

**7.39** Catchment areas upstream of each watercourse crossing were calculated based on watershed analysis using the available topographic data, supplemented by field observations. The catchment areas at crossing locations range from <0.01 to 2.84km$^2$, with the largest catchment at the Eas an Amair crossing (crossing ID2).

## Water Supplies, Discharges, Hydropower, Abstractions and Services

**7.40** Scottish Water asset plans show a number of assets and pipework associated with the Inveraray Water Treatment Works (WTW) located at NGR 208350 707700 and shown on **Figure 7.1**. There is a water abstraction point from the Douglas Water and also from an offtake from the Steallaire Ban Loch and the Allt Riabhachan watercourse to the north, which supplies water to the WTW. The drawings show supply pipework runs from the abstraction locations to the WTW and the pipework is located along or close to existing tracks in places. There are also a number of active and abandoned distribution pipes along the track adjacent to the WTW and a covered reservoir. The locations of the pipework and Scottish Water assets will be considered in detail in advance of construction.

[5] The SEPA Flood Maps were viewed online. SEPA's terms and conditions of use state that the flood information sown in the Flood Maps can be viewed to inform flood risk considerations for a Proposed Development site as part of a planning application, but the flood information must not be displayed or published. The flood information is indicative and of a strategic nature.

**7.41** SEPA provided data on seven licenced abstractions (details are provided in **Table 7.1**). Abstractions that are close to the Proposed Development and could potentially be affected include the Blarghour, Kames and Maltlands hydropower schemes described below.

**7.42** Three hydropower schemes are located in close proximity to the Site; the locations are shown in **Figure 7.1**. The Blarghour hydropower scheme is located on the Allt Blarghour at NGR 202265 713043 approximately 40m from the northern Site boundary. The Kames hydropower scheme is located on the Kames River at NGR 199489 710242, approximately 130m west of the western Site boundary. The Maltland hydropower scheme is located on Inveraray estate at NGR 208830 709940 approximately 200m east of the eastern Site boundary and draws water from the Allt Riabhachan watercourse.

**7.43** The contributing catchment areas to the hydropower schemes were delineated using GIS software and 5m resolution OS Terrain 5 elevation data. The total catchment area draining to the Blarghour and Kames schemes were estimated to be 6.25km$^2$ and 6.16km$^2$, respectively. The catchment of the Allt Riabhachan watercourse is 4.86 km$^2$.

**7.44** ABC provided information on Private Water Supplies (PWS) from their database, using a search area of the Site with a 2.5km buffer. The search returned a total of 15 PWS; none of which are within the Site itself and only two are within 1km of the Site (**Table 7.5**). Their locations with respect to the Proposed Development are shown in **Figures 7.1** and **7.3**.

**Table 7.5: Private water supplies within 1km of the Site boundary**

| PWS Source Name | Easting | Nothing | Supply Ref. | Type[6] | Source Type | No. of Properties Supplied |
|---|---|---|---|---|---|---|
| Electric Cottage | 208334 | 709944 | AABMK0795 | B | Spring (Ground source) | 1 |
| Barvrack House | 207551 | 706259 | AABMK0794 | B | Burn (Surface influenced) | 2 |

### Water Quality and Protected Areas

**7.45** Under the terms of the Water Framework Directive (WFD), all river basin districts are required to be characterised. The process requires SEPA to produce an initial assessment of the impact of all significant pressures acting on the water environment.

**7.46** Surface water bodies are defined as being whole or parts of rivers, canals, lochs, estuaries, or coastal waters. The main purpose of identifying water bodies is so that their status can be described accurately and compared with environmental objectives.

**7.47** The WFD applies to all surface waters, but for practical purposes SEPA has defined a size threshold above which a river or loch qualifies automatically for characterisation. Rivers must have a catchment area of 10km$^2$ or more. In addition to these larger water bodies, smaller waters have been characterised where there is justification by environmental concerns and to meet the requirements of regulatory legislation such as for drinking water supplies.

**7.48** Classification of status by SEPA considers water quality, hydromorphology, biological elements (including fish, plant life and invertebrates), and specific pollutants known to be problematic. The classification grades through High, Good, Moderate, Poor, and Bad status. This provides a holistic assessment of ecological health. Heavily modified waterbodies, which can no longer be considered to be natural, are classified on the basis of 'ecological potential'.

**7.49** In terms of the Site, the following watercourses are large enough to be classified:

- The Allt Blarghour (Water body ID 10274) was classified as an overall status of 'Moderate' in 2020.
- The Kames River (Water body ID 10273) was overall classified as 'Moderate' in 2020.
- The Erallich Water (Water body ID 10225) was overall classified as 'Moderate' in 2020. The River Array (Waterbody ID 10224) which the Erallich Water joins, was classified as overall 'Moderate' in 2020.
- The Douglas Water (Water Body ID 10226) was overall classified as 'Moderate' in 2020.

**7.50** There are no surface water-related designated sites within the Site.

**7.51** The Site falls within a drinking water catchment where a Scottish Water abstraction is located. The Douglas Water supplies Inveraray WTW (described above).

### Geology and Soils

**7.52** The solid bedrock geology mapping (**Figure 7.4**) shows the Site is comprised mainly of two rock types, quartzite underlain by folded, metamorphic schists, with igneous intrusions in places. The bedrock on which infrastructure will be located comprises:

- Crinan Grit Formation – Quartzites – previously sedimentary rock formed in deep sea marine environment, subsequently being metamorphosed;
- Dalradian Supergroup – Metagabbro and Metamicrogabbro – previously igneous rocks formed as intrusions which have since undergone metamorphism;
- Mull Dyke Swarm – Basalt and Microgabbro – igneous intrusions, poor in silica which formed dykes and sills;
- Scottish Highlands Siluro-Devonian Calc-Alkaline Minor Intrusion Suite – igneous intrusions, rich in silica which formed batholiths, plutons sills and dykes;
- Tayvallich Slate and Limestone Formation – Metalimestone metamorphic rock; and
- Tayvallich Slate and Limestone Formation – Pelite, graphitic metamorphic rock.

**7.53** There are three structural geology features across the Site[7]. Two small fault-lines are present in the south-east of the Site, just east of Garbh Achadh, which run roughly north to south and north-east to south-west. These faults are associated with the deep bedrock gullies just north of the proposed access track at this location. A much larger structural fault runs east to west in the north of the Site and defines the boundary of the geological change from Crinan Grit quartzites to the south and the Tayvallich Slate and Limestone Formation to the north.

**7.54** The superficial bedrock geology mapping (**Figure 7.4**) shows parts of the Site are underlain by glacial till deposits. Large areas of the Site are shown to have no superficial deposits, despite there being peat present across site. The superficial deposits comprise:

- Devensian Till – Diamicton – sedimentary deposits of glacigenic origin. These detrital deposits were formed by glacial action during the Quaternary Period.
- Hummocky Glacial Deposits – Diamicton, Sand and Gravel – sedimentary deposits of glacigenic origin, also formed during the Quaternary.

**7.55** Scottish Soil mapping (**Figure 7.5**) shows that the Site is underlain by several soil types including:

- Peaty Gleys, with dystrophic semi-confined peat, derived from arenaceous schists and strongly metamorphosed argillaceous schists of the Dalradian Series.
- Peaty Podzols, with dystrophic semi-confined peat, derived from arenaceous schists and strongly metamorphosed argillaceous schists of the Dalradian Series. These are located in low ground in the west of the Site around the lochans and on sections of the proposed access track.
- Alluvial Soils on a small section of the eastern access track.
- Humus-iron podzols on the southern part of the Inveraray bypass track.

**7.56** The SNH (now NatureScot) Carbon and Peatlands Map 2016 (**Figure 7.6**) indicates that carbon-rich soils, deep peat, and large areas of priority peatland habitat are present within the Site, including the following classes:

- Class 2 (yellow): Nationally important carbon-rich soils, deep peat, and priority peatland habitat (i.e. land covered by peat-forming vegetation or vegetation associated with peat formation). Class 2 peat covers the vast majority of the Site, including the turbines and associated infrastructure and the upper part of the proposed access track.

[6] Type: Type A supplies are larger PWS, or those with a commercial activity, and are defined as Regulated supplies, which supply either a commercial activity or 50 or more people in domestic premises. These supplies are subject to regular testing by D&GC. Type B supplies are smaller supplies that serve only domestic properties (<50 persons).

[7] BGS Linear Features at 1:50K scale, Scottish Government (undated) Scotland's environment [online]. Available at: https://map.environment.gov.scot/sewebmap/

- Class 5 (green): No peatland habitat recorded, but soils are carbon-rich and deep peat is present. The proposed and existing accesses in the eastern part of the Site are within areas of Class 5 peatland.

### Peat

**7.57** Detailed peat depth surveys were undertaken within the Site. The results of the peat survey are shown in **Figure 7.7** and presented in full in **Appendix 7.2**. Typical peat deposits within the Site are shown in **Image 7.2**.

**Image 7.2: Typical peat deposits within the Site – a) large area of undisturbed peat in background and b) eroded area of peat (peat hags)**

**7.58** A total of 5,363 peat depth probes were collected over the Phase 1 and Phase 2 peat surveys. Of these:

- 21% of probes were recorded as having a depth of less than 25cm. These probes are not classified as peat.
- 18% of probes were recorded as having a peat depth of between 25-50cm. These probes are classified as organo-mineral soils and not formally considered to be peat.
- 26% of probes were recorded as having a peat depth of between 50-100cm.
- 35% of probes were recorded as having a peat depth greater than 100cm.
- The deepest peat of over 4.9m was recorded in numerous localities, spread across site, although generally the west and north areas of the Site produced more deep peat probes.

**7.59** A total of 18 cores were taken across the Site at the locations shown in **Figure 7.7**. The cores are described in detail in **Appendix 7.2**. It was determined that the acrotelm layer was between 0.1m and 0.9m in the cores surveyed. Some open sections of peat hag in eroded areas also allowed for measurement of acrotelm depths, which were noted to be up to 0.9m.

**7.60** A variety of base material was found to underly the areas cored:

- 50% of the cores obtained had a bedrock base;
- 11% had a clay base; and
- The substrate underlying 39% of the cores could not be identified as the lower layers of peat were often too saturated to retrieve.

**7.61** The results from the early phases of the surveys were used to feed into the design (deep peat was avoided where possible) and the requirements for further peat depth surveying.

**7.62** Peat was recorded across the majority of the Site, with 61% of probes recording depths over 50cm. The deeper areas of peat tended to be in the lower lying valleys within the undulating topography of the central and south-east site, as well as in the lower ground in the west, north-west, north and north-east of the Site. Generally, the high linear rocky ridges contained no peat or shallow peat, while the lower valleys, depressions and plateaus contained areas of deeper peat.

**7.63** The peat survey results were used to inform the Peat Management Plan (**Appendix 7.3**) and Peat Landslide Hazard and Risk Assessment (**Appendix 7.4**).

### Groundwater

**7.64** The Site is underlain by highly indurated metamorphic rocks which are classified as having low aquifer productivities. The low productivity aquifer (Class 2C) covers the entirety of the Site and has limited groundwater in the near surface weathered zone and fractures. Flow is virtually all through fractures and other discontinuities. Up to 2L/s from rare springs.

**7.65** The groundwater body underlying the Site is the Oban and Kintyre waterbody, in the Argyll Sub Basin District, which is classified by SEPA as having an overall classification of 'Good'.

**7.66** SEPA groundwater flood maps indicate that the Site is not at risk of groundwater flooding.

### Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

**7.67** Areas of potential GWDTEs were identified during the ecology NVC surveys and are shown and described in **Chapter 8** and **Appendix 8.2**. A walkover survey of potential GWDTE polygons and target notes (TNs) within 250m of the proposed infrastructure was undertaken by a team of two hydrologists. Further details of the GWDTEs onsite are contained in the **Appendix 7.5**.

**7.68** Based on field observations, several of the potential GWDTEs were considered to have a groundwater contribution that was moderate or high. However, in some localities the groundwater contribution was confirmed to be low, predominantly sourced from surface water contributions.

**7.69** Moderately and highly dependent GWDTEs are shown on **Figure 7.3** with recommended buffers from infrastructure as per SEPA guidance[8]. Those that are within 100m of the roads, tracks, trenches and compounds (<1m excavation) or within 250m of proposed turbines and borrow pits (>1m excavation) are described and assessed in detail in **Appendix 7.5**.

## Implications of Climate Change

**7.70** Scottish Planning Policy (SPP) states that *"the planning system should promote a precautionary approach to flood risk from all sources, including coastal, watercourse (fluvial), surface water (pluvial), groundwater, reservoirs and drainage systems (sewers and culverts), taking account of the predicted effects of climate change"*. The National Planning Framework 4 (NPF4)[9] notes *"Development proposals will be sited and designed to adapt to current and future risks from climate change"*.

**7.71** The UKCP18 projections show a general trend towards warmer, wetter winters and hotter, drier summers. Based on RCP8.5, the central estimate of future change in winter mean precipitation to the year 2050 (the anticipated life of the Proposed Development) is +18% and the central estimate of change in summer mean precipitation is -14%.

**7.72** Temperatures in West Scotland are projected to increase, with projected increases in summer temperatures greatest. The central estimate of increase in winter mean temperature is 1.9ºC and summer mean temperature is 2.2ºC.

**7.73** In April 2022, SEPA published new guidance[10] on climate change in Scotland which provides a regional based approach to estimate uplift in future river flows in Scotland. For large river catchments (over 50km$^2$), the peak (200-year) design flow should be increased by 59% in the Argyll River Basin to account for projected climate change increases to the year 2100. In addition, the peak rainfall intensity allowance for the Argyll region of Scotland is 46% to the year 2100. Thus, this part of Scotland is likely to get wetter with higher peak flows in the rivers in the future.

**7.74** Site drainage and watercourse crossing designs will consider future estimates of increased precipitation and flows and will follow an adaptive approach, as per relevant guidance documents from SEPA and ABC. Based on consultation with ABC (see **Table 7.1**) and cognisance of the peatland hydrology, new watercourse crossings will be designed to maintain and not reduce the existing capacity of the channels to avoid oversizing the crossings in the upland peatlands.

[8] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

[9] National Planning Framework 4 (NPF4) will be coming into operation early in 2023. If it is passed through government, it will supersede Scottish Planning Policy (SPP).

[10] SEPA (2019) Climate change allowances for flood risk assessment in land use planning, Land Use Planning System SEPA Guidance, Version 1

## Future Baseline in the Absence of the Proposed Development

**7.75** Without the Proposed Development, the main change to the future baseline would be as a result of climate change, as described above. Increased rainfall will result in higher peak flows in the watercourses in the future. In addition, there may be more drought periods in the summer months, with drier, hotter conditions predicted resulting in lower flows during the summer months.

## Design Considerations

**7.76** A 50m infrastructure buffer from all blue-line watercourses and water features shown on 1:25,000 Ordnance survey maps was applied at the early project design phase. Digital Ordnance Survey water feature data was obtained for the Site area and buffered accordingly. Smaller watercourses and drains identified during the survey work were considered and buffered wherever possible. Locations where the recommended buffers could not be met are assessed in detail in **Appendix 7.1** and summarised in the Effects Assessment within this chapter.

**7.77** From the outset of the project, the widespread presence of deep peat has been treated as a key constraint to siting and routing wind farm infrastructure. Through a series of design workshops, the overlap of infrastructure with the deepest peat deposits has been minimised. Details of the iterative design approach are provided in **Chapter 3** of the EIA Report and form the first tier of the peat management strategy ('prevent') at the Proposed Development. The second tier of the strategy is to reuse excavated peat, and the approach to reuse is described in the Peat Management Plan (**Appendix 7.3**). No need has been identified for recycling or disposal of excavated materials.

**7.78** Through careful design, including consideration of early PLHRA likelihood results, the vast majority of proposed infrastructure has been sited or routed away from areas of Moderate peat landslide likelihood or Factor of Safety <1.4 (using best estimate parameters).

**7.79** Watercourse crossings were avoided and minimised as much as possible during early iterations of the turbine and track layouts.

**7.80** A 100m buffer was maintained where possible between all GWDTE from the track and turbine layouts where excavation was to be over 1m deep. Where excavation was to be over 2.5m depth (e.g. turbine foundations) a buffer of 250m from GWDTE was applied where possible. Locations where the recommended buffers could not be met are assessed in detail in **Appendix 7.5** and summarised in the Effects Assessment within this chapter.

## Micrositing

**7.81** A 50m Infrastructure Location Allowance (ILA) will be used for the Proposed Development's infrastructure (refer to **Chapter 4**), i.e. 50m either side of all infrastructure. However, it should be noted that micrositing of infrastructure within the ILA closer to watercourses within the watercourse and GWDTE buffers will not be undertaken. Micrositing within the ILA will be undertaken to move infrastructure further away from sensitive water features, GWDTE and deeper peat, where possible.

## Good Practice Measure

**7.82** A number of good practice pollution prevention and control measures will be put in place during place during forestry felling operations and the construction of the turbines and access tracks. These will be embedded into the project design and reflect best practice guidance and recognised industry standards, as well as the Applicant's experience of constructing wind farms. Many of the measures mitigate several potential effects (e.g. mitigation to minimise sedimentation and pollution such as Sustainable Drainage Systems (SuDS) which can also serve to attenuate surface water run-off and minimise flood risk). Embedded mitigation measures are described in the Schedule of Good Practice, Mitigation and Monitoring Measures (**Appendix 4.3: Schedule of Mitigation, Good Practice, Enhancement and Monitoring**) and the outline Construction Environmental Management Plan (CEMP) (**Appendix 4.2: Outline Construction Management Plan (CEMP)**) and include:

- SuDS to minimise/attenuate surface run-off from new hardstanding and tracks;
- SuDS to reduce sedimentation and erosion;
- SuDS to reduce pollution and accidental spillage;
- Pollution control measures to be put in place at watercourse crossings;
- Peat management measures; and
- Measures to reduce sedimentation, erosion, and pollution during forestry felling.

**7.83** Drainage measures for new access tracks and infrastructure include (but are not limited to):

- Appropriately sized culverts passing under the tracks that do not restrict flow and allow small watercourses, intercepted field drains and ephemeral streams/surface water flow pathways to pass under the tracks;
- Interceptor drainage ditches on the upgradient side of all proposed infrastructure to intercept and divert 'clean' surface water run-off draining towards the construction areas; and
- Installation and maintenance of swales and track drains to intercept, collect and treat runoff from access tracks and hardstanding areas of the Site and channel runoff to stilling ponds for sediment settling.

**7.84** Forestry felling and removal will follow the good practice guidance and legal requirements set out in Section 6.7 (Forests and Water) of the UK Forestry Standard (Forestry Commission 2017).

**7.85** As a minimum, the contractor will be required to follow the guidance contained in SEPA GPPs and to follow the SEPA's general binding rules (GBR) under the Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended (CAR Regulations).

**7.86** As concrete batching is proposed onsite, specific measures will be put in place to manage run-off from these operations, which is highly alkaline and can cause pollution if it gets into watercourses. Good practice described in SEPA wat-sg-75 guidance will be followed to isolate, collect, reuse and dispose of run-off from concrete operations. Concrete wash water and waste will be sent offsite to a licensed facility for treatment and/or disposal, in accordance with the Duty of Care for Waste.

**7.87** In terms of watercourse crossings, engineering activities on minor watercourses do not normally require authorisation under the SEPA CAR Regulations. SEPA defines minor watercourses as those not shown on the 1:50,000 scale Ordnance Survey maps. The majority of new crossings required for the Proposed Development are over small, minor watercourses and fall under General Binding Rules 6 and 9. These crossings will not require registration or a licence under CAR; however, the work will follow general good construction practice and SEPA GBR 6 and GBR 9.

**7.88** Several watercourse crossings will either require registration or a simple licence under CAR and will require specific mitigation measures. Bridging solutions will be designed to avoid affecting the bed and banks of watercourses. Fording of watercourse will be avoided. Design and implementation of crossings will follow best practice, including recommendations in SEPA (2010) Engineering in the Water Environment Good Practice Guide – River Crossings, Scottish Renewables et al. (2019) Good Practice during Windfarm Construction and SNH (2015) Constructed tracks in the Scottish Uplands.

**7.89** During construction, temporary construction SuDS will be put in place at each watercourse crossing to ensure no sedimentation from construction works or pollution from plant or machinery can enter the watercourse. This could be a series of settlement ponds or settlement tanks and silt fences.

**7.90** A Construction Site Licence (CSL) will be obtained from SEPA under the CAR Regulations in advance of the construction works. This will include a detailed Pollution Prevention Plan (PPP) to ensure that any discharges of water run-off from the Site to the water environment do not cause pollution. This will be prepared in advance of construction and authorisation from SEPA is required before construction commences.

**7.91** Prior to construction and on completion of ground investigations and micrositing, a site waste management plan shall be produced, including for site soil and peat management good practice. Any excavated peat will be appropriately managed and re-used. This is detailed further in the Peat Management Plan (**Appendix 7.3**).

**7.92** A detailed CEMP will be developed and agreed with ABC and SEPA in advance of the works. An outline CEMP is provided as **Appendix 4.2**. The CEMP will establish a framework to ensure that health and safety and environmental best practices are adopted throughout the works and will include:

- A Surface Water Management Plan, or similar, which will detail proposed surface drainage measures to treat and deal with all the surface runoff from the Site, to be designed in accordance with SuDS principles and all best practice guides and recognised industry standards.
- The approved PPP which will detail the proposed mitigation measures as identified within this EIA to address each identified pollution risk.
- A plan to monitor and plan the timing of works to avoid construction during periods of the heaviest rainfall.
- A plan to detail emergency procedures in the event of spillages or any other breach.

- A plan to detail monitoring and inspections of the water quantity and quality of sensitive private water supplies and watercourses. All actions will be recorded.
- A Site Waste Management Plan to detail proposals for managing the extraction and storage of waste.
- A Peat Management Plan (see **Appendix 7.3**).

**7.93** The assessment of effects is undertaken assuming that good practice embedded mitigation is an integral part of project design. Additional mitigation is identified during the assessment to address localised site or issue specific likely significant adverse effects and is described within the 'Proposed Mitigation' section.

## Assessment of Effects

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

### Construction Effects

#### Predicted Construction Effects

**7.95** The following effects have been assessed in full:

- Effects during construction on surface and ground water quality and quantity (including effects on private and public water supplies and hydro schemes);
- Effects on channel morphology (bank erosion and channel form) during construction;
- Effects during construction on run-off rates and flood risk;
- Effects during construction on GWDTEs; and
- Direct and indirect disturbance of peat during construction.

**7.96** The sensitivity of receptors has been assessed in **Table 7.6**, using the criteria in **Table 7.2**.

**Table 7.6: Sensitivity of receptors**

| Receptors | Sensitivity | Comment |
|---|---|---|
| Watercourses and Waterbodies:<br>■ Eas an Amair;<br>■ Erallich Water;<br>■ Allt Bail' a Ghobhainn;<br>■ Smaller named and unnamed watercourses within the Site; and<br>■ Small lochans within and close to the Site. | Water quality – Medium<br>Flood Risk – Low<br>Morphology – High | The Allt Blarghour, Kames River, Erallich Water and Douglas Water were all classified by SEPA as 'moderate' ecological status. The River Aray, the receiving water environment for the Erallich Water, has 'moderate' ecological status.<br>Abstractions from the Douglas Water, Steallaire Ban Loch and the Allt Riabhachan watercourse supply Inveraray WTW. There is no Proposed Development in the catchments upgradient of the water abstraction points.<br>There are no properties downstream of the project infrastructure that are at currently at flood risk on the named and unnamed watercourses within the Site.<br>The majority of watercourses within the Site are natural channels, typical of peatland channels and generally of high morphological diversity.<br>There are numerous lochans within and close to the Site. These are connected hydrologically to the watercourses within the Site. |
| Peat | High | The Site contains extensive areas of Class 2 peatland with deep peat recorded across the Proposed Development during the peat surveys.<br>Removal, disturbance, oxidation or erosion of peat can release carbon and cause disturbance to the peat habitat. |
| Groundwater | Low | The Proposed Development is located on low productivity aquifers. The groundwater body is classified by SEPA as 'Good'.<br>There are no known groundwater abstractions on the Site. |
| Groundwater Dependent Terrestrial Ecosystems | High | Several GWDTEs were determined to be either moderately or highly groundwater dependent in the Site. |

**7.97** The main environmental effects are predicted to occur during construction. The activities that will occur during construction that may have an impact on the water environment and peat, include site clearance and vegetation (forestry) removal; use of heavy plant machinery; increase of hardstanding areas; construction and upgrading of access tracks; watercourse crossings; associated earthworks/excavation/re-profiling and construction traffic on access tracks.

**7.98** There are up to 13 turbines (the foundations of which will require excavation of approximately 3.5-5m deep over a typical foundation diameter of 22.8m), and associated crane hardstanding, one construction compound, three borrow pits, and a new substation. There is 6.6km of existing track that will be upgraded along with 16.5km of new access track (5.6km of which will be floated).

**7.99** During the initial design stage, a buffer of 50m was applied to all watercourses and water features identified from Ordnance Survey mapping wherever possible. Watercourses were also identified during the Site walkover survey and where possible a 50m buffer from these small watercourses was achieved. Therefore, apart from the exceptions below (labelled A-I on **Figure 7.2** and described in detail in **Appendix 7.1**), all infrastructure is at least 50m away from watercourses and water features:

- A – There is a short section (~43m) of new access track proposed east of the temporary construction compound that could not achieve the 50m watercourse buffer. Due to other constrains (primarily associated with engineering and the gradient at this location) the track section encroaches to within 41m of a small unnamed waterbody.
- B – Turbine T4, located upslope of Loch nan Car. The turbine location itself is over 50m from the watercourse. However, due to other constraints (including localised areas of deep peat and engineering constraints associated with the alignment of the access track), a ~64m length of proposed track, temporary hardstanding and clearance area encroaches to within 31m of a small unnamed watercourse to the north.
- C – There is a ~115m section of new access track proposed between T5 and T6 that could not achieve the 50m water feature buffer. Due to other constrains (including proximity of GWDTE M32 spring and localised areas of deep peat) the track section encroaches to within 21m of a Loch nan Car.
- D – There is a short section of new access track proposed east of T9 that could not achieve the 50m watercourse buffer. Due to other constraints (primarily deeper peat to the north of the track) the track section encroaches to within 45m of a small unnamed watercourse to the south.
- E – There is a short section of new access track proposed north of T11 that could not achieve the 50m watercourse buffer. Due to other constraints (including the proximity of another watercourse to the west, and the orientation of the hardstanding relative to T11) the track section encroaches to within 47m of a small unnamed watercourse to the east.
- F and G – There are two short sections of new access track to T13 that could not achieve the 50m watercourse buffer. Due to other constraints (including the proximity of other watercourses) the northern section (F) encroaches to within 41m of a small unnamed watercourse and the southern section (G) encroaches to within 43m of a small unnamed waterbody.
- H – Borrow Pit 2 could not achieve the 50m watercourse buffer. BP2 encroaches to within 5m of a small unnamed watercourse to the north however it should be noted that BP2 is located in an existing quarried area and the Site survey noted that there was not a surface waterbody within the quarry at the time of the survey despite this being shown on OS 25k basemapping.
- I – Borrow Pit 1 could not achieve the 50m watercourse buffer. BP1 encroaches to within 10m of a small unnamed watercourse to the south-west however it should be noted that BP1 is located within an existing quarried area and aerial imagery shows a small areas of ponded surface water within the low part of the quarry.

**7.100** Existing access tracks were used as much as possible to avoid new watercourse crossings and land take. However, given the hydrological setting and remote nature of the Proposed Development, 74 new watercourse crossings were unavoidable. Construction of new watercourse crossings and upgrade of existing crossings could potentially impact channel morphology during construction.

**7.101** There are 105 watercourse track crossings required; of which 31 are existing track crossings that may need upgraded and 74 are new crossings (**Appendix 7.1**). They are mainly small watercourses on minor watercourses and will be covered by SEPA's General Binding Rules. These crossings will not require registration or a licence under CAR; however, the work will follow general good construction practice and GBR 6 and GBR 9. 23 of the larger watercourses to be crossed, including ID2 – Eas an Amair, ID27 – Alltan Airigh Mhic Choinnich, ID31 and ID36 – Erallich Water, ID72 – Allt Bail' a' Ghobhainn, ID84 and ID85 – Steallaire Ban, ID86 – Allt Riabhachan and ID101 – Allt Riabhachan, will require authorisation under the CAR Regulations (either registration or a simple licence depending on the culvert/bridge design). Full details of crossings and CAR requirements are provided in **Table 1**, **Appendix 7.1**.

### Effects During Construction on Surface and Ground Water Quality and Quantity (and Public and Private Water Wupplies)

**7.102** The potential effects on surface water quality during construction are:

- Pollution of surface waters caused by the release of sediment to watercourses from excavated material during construction, heavy plant movement on the access tracks and construction compounds and the felling of forestry/vegetation;
- Pollution of surface water caused by the release of hydrocarbon pollution resulting from accidental oil or fuel leaks or spillages. There is also a risk posed by concrete (and other construction material) spillages during concrete batching and during the formation of hardstanding areas at the turbine bases; and
- Pollution/sediment run-off at existing watercourse crossings (where these are being upgraded), during construction of new watercourse crossings for access tracks.

**7.103** The potential effects on groundwater quality include:

- The risk of hydrocarbon pollution of groundwater resulting from accidental oil or fuel leaks from construction traffic and construction works. There are also potential pollution effects caused by silt and sediment disturbed during construction infiltrating into the groundwater and pollution from concrete batching and concrete spillages.

**7.104** Risks to surface water quality will be greatest during construction when works involve the exposure of bare earth which could result in increased erosion and sedimentation. Without mitigation, the increase in sediment concentration in runoff from construction areas and access tracks may result in excessive levels of suspended sediment in watercourses.

**7.105** Felling can result in increased surface water runoff and sediment runoff. Direct construction felling of an area of 3.7 hectares (ha) of forestry is required for the access track.

**7.106** Pollutants can enter the watercourses in the event of accidental spills or leaks from machinery and vehicles and in the event of an accidental release of concrete or other building materials. Pollutants and silt/sediment could enter watercourses directly, or via the network of artificial drains though the Site or via overland flow pathways. Shallow groundwater could also be affected.

**7.107** An assessment of the potential effects on watercourses and water features at locations where the 50m buffer could not be achieved is set out in **Table 2** of **Appendix 7.1** and summarised below:

- A – This is a small waterbody (lochan) that sits upgradient (~10m higher) of a proposed track which has been aligned with the contours of the Site to facilitate delivery of the turbine components. Run-off from the track will not flow towards the waterbody and there is no flood risk from the waterbody. The buffer width achieved (43m) is considered adequate for size of water feature and the hydrological setting.
- B – This is the upstream part of a small watercourse that is downgradient of proposed infrastructure which has been aligned to, as far as possible, avoid deeper pockets of peat and follow the contours of the Site to facilitate the engineering design and construction of the Proposed Development. Flow path analysis indicates that surface water runoff paths are from the infrastructure towards the watercourse. The buffer width achieved (39m from track and 31m from temporary hardstanding) is considered adequate for size of water feature and the hydrological setting, however additional mitigation will be put in place to reduce the risk of sediment/silt run-off during construction.
- C – Due to the presence of a number of other constraints, including pockets of deep peat and the presence of GWDTEs and associated buffers, Loch nan Car is 21m downgradient of a proposed track. Flow path analysis indicates that surface water runoff paths are from the proposed track towards the loch and additional mitigation will be put in place to reduce the risk of sediment/silt run-off during construction.
- D – A small (1m wide) watercourse is ~45m downgradient of a proposed track which has been located to seek to avoid deeper pockets of peat to the north identified through the peat probing. Due to the small catchment upstream of the watercourse, the track is not considered to be at flood risk. Flow path analysis indicates that surface water runoff paths are from the proposed track towards the watercourse and additional mitigation will be put in place to reduce the risk of sediment/silt run-off during construction.
- E – A small (1m wide) watercourse is ~47m downgradient of a proposed track which has been located to avoid encroaching into the 50m buffer of another watercourse to the west. Due to the small catchment upstream of the watercourse, the track is not considered to be at flood risk. Flow path analysis indicates that surface water runoff paths are from the proposed track towards the watercourse and additional mitigation will be put in place to reduce the risk of sediment/silt run-off during construction.
- F – This is a small (1m wide) watercourse that sits at a slightly higher elevation than the proposed track, which is 41m away. A slight adjustment of the track would result in encroachment into an adjoining 50m buffer of another watercourse to the east. Run-off from the track will not flow towards the watercourse and there is no flood risk from the watercourse. The buffer width achieved (41m) is considered adequate for size of water feature and the hydrological setting.
- G – This is a small waterbody (lochan) that sits at a slightly higher elevation than the proposed track, which has been designed to access the turbine which has been located to avoid deeper pockets of peat as identified through the detailed peat survey. Run-off from the track will not flow towards the waterbody and there is no flood risk from the waterbody. The buffer width achieved (43m) is considered adequate for size of water feature and the hydrological setting.
- H – The small (0.8m wide) watercourse is upgradient of the existing quarry that is proposed to be used as a borrow pit for the Proposed Development. Given the elevation difference it is unlikely that surface run off from the quarry will enter the watercourse, however additional mitigation will be put in place as a precaution.
- I – The small (1.2m wide) watercourse is located within an afforested area and is higher than the existing quarried area. Given the elevation difference it is considered unlikely that use of the borrow pit will affect water quality at the watercourse, however additional mitigation will be put in place as a precaution. There is a small area of ponded surface water within the low part of the quarry; and care should be taken if dewatering the quarry prior to excavation.

**7.108** With the embedded mitigation measures described above in place, including buffers, following good practice construction and site drainage management guidance from relevant bodies (e.g. SEPA, CIRIA, Scottish Renewables and The UK Forestry Standard), the magnitude of the effect of increased sediment/silt runoff causing a deterioration in surface water quality in waterbodies and watercourses within and downstream of the Site during construction is considered to be Minor and of short duration. The sensitivity of all downstream receptors is **medium**, with respect to water quality, and the significance of the effect is Minor.

**7.109** Embedded mitigation measures to minimise the risk of pollution and accidental spillage will minimise the likelihood and severity of such incidents happening, however, there is still a residual risk. The magnitude of effect of pollution of surface water and groundwater caused by the release of hydrocarbon pollution and concrete resulting from accidental oil or fuel leaks or spillages is considered to be of short duration and Minor and the significance of the effect is Minor.

**7.110** There are no PWS sources within the Site, but two within 1km of the Site (**Figure 7.3**). The PWS source their water either from groundwater springs or surface watercourses. Location of the PWS source locations with respect to the proposed infrastructure is shown in **Figure 7.3**. Given that construction can potentially affect both surface and shallow groundwater quality and quantity, it follows that construction can potentially affect nearby and downgradient PWS.

**7.111** An assessment of PWS sources and supplied properties was carried out based on SEPA Guidance[11] and professional experience. The SEPA guidance recommends all groundwater abstractions within a 250m buffer zone of excavations deeper than 1m and a 100m buffer of excavations less than 1m be identified and assessed in detail. Excavations deeper than 1m will be required

[11] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

during construction of the turbine foundations and at borrow pits, with excavations for tracks, trenches and compounds typically less than 1m. The 100m and 250m buffers from proposed infrastructure are shown on **Figure 7.3**. No PWS sources or supplied properties are within or close to the recommended buffers, hence no detailed assessment is required. However, **Table 7.7** provides an overview of nearby PWS, the distances from proposed infrastructure and an initial assessment.

**Table 7.7: Private water supplies within 1km of the Site**

| PWS Source Name | Easting | Northing | Source Type | Number of Properties Supplied | Distance from Proposed Infrastructure | Comments and Initial Assessment | Scoped In/Out |
|---|---|---|---|---|---|---|---|
| Electric Cottage | 208334 | 709944 | Spring (groundwater) | 1 | ~350m north of existing access track.<br>~700m east of borrow pit 2 (BP2) | Source is located within the Allt Riabhachan catchment.<br>The source location is downgradient of the borrow pit at an elevation of ~65mAOD, compared to BP2 which sits at ~153m AOD. Thus there is an elevation difference between the spring source and BP2 of ~88m. The source location is just over 350m north of the existing access track.<br>Surface water flow paths indicate surface water run-off pathways from infrastructure would not flow towards the PWS.<br>Proposed excavation at the borrow pit approximately ~700m away and at ground levels 88m higher than the PWS is not considered to impact groundwater quality or quantity at the PWS source. | Scoped out and not considered further. |
| Barvrack House | 207551 | 706259 | Burn (surface influenced) | 2 | ~600m west of existing access track. | There is no infrastructure upgradient within the catchment of the PWS source.<br>The source location is located at ~50m AOD and is upgradient of the existing access track (which is at ~16m AOD). The PWS won't be impacted by the Proposed Development. | Scoped out and not considered further. |

**7.113** The Inveraray WTW is located within the Site, just north of the existing track (Inveraray bypass) that will be used during construction and upgraded. Water supplying the WTW is abstracted from the Douglas Water to the west, the Steallaire Ban Loch and the Allt Riabhachan watercourse to the north. Based on a detailed review of catchment areas and infrastructure (see **Figure 7.1** and **Table 7.8**), there is no proposed infrastructure in the catchments upgradient of the abstraction points. Hence, there is considered to be **no effects on abstractions** for public water supplies as a result of the Proposed Development.

**7.114** However, supply pipework runs from the abstraction locations to the WTW and the pipework is located along or close to the existing tracks in places (e.g. along the western part of the Inveraray bypass track and on a short section of the main access track). In addition, there are some distribution pipes and a covered reservoir close to the WTW. The tracks will be used during construction and there are two short sections of proposed new track close to the SW assets. Without mitigation, the effect on the SW assets is considered to be of **Moderate** magnitude and **Moderate** significance. Additional mitigation is proposed to avoid effects on the SW assets.

### Effects on Channel Morphology (Bank Erosion and Channel Form) During Construction

**7.115** For the majority of watercourses, the effect on channel morphology (bank erosion and channel form) during construction is assessed to be of Negligible magnitude, as embedded mitigation measures, including a minimum 50m buffer zone (where possible) and environmentally sensitive bridge design, have been incorporated into the project design. Locations where the 50m buffer could not be met are described and assessed in **Appendix 7.1**; none of the locations where the buffer has been encroached will result in effects on channel morphology.

**7.116** Oversized crossings can potentially cause increased scour and erosion in the channel downstream in sensitive peatland channels. Following consultation with ABC (see **Table 7.1**) crossings were designed to maintain and not reduce the existing capacity of the channel, which will minimise the effects on channel morphology.

**7.117** The crossing of the Eas an Amair (ID27) will be more complex, requiring a large structure to bridge the 3.7m wide channel. The crossing will require a simple licence under the CAR Regulations. The bed and banks of the watercourse will be re-established to their previous condition immediately after construction.

**7.118** The watercourses in the Site are considered to be of high sensitivity in terms of morphology. Any impact on channel morphology is considered to be short-lived, localised and of Minor magnitude and the effect is considered to be of Minor significance.

### Effects During Construction on Run-off Rates, Flood Risk and Ground-water Levels/Recharge

**7.119** In accordance with the Risk Framework within Scottish Planning Policy (SPP), new development should be limited to areas outside the medium risk 200-year (0.5% Annual Probability (AP)) functional floodplain. National Planning Framework 4 (NPF4)[12] defines a flood risk area as one that lies within the 200-year floodplain, including an appropriate allowance for future climate change. There is no proposed infrastructure within SEPA's mapped floodplains of any watercourse. A 50m buffer from watercourses and surface water bodies has been achieved for most of the proposed infrastructure, apart from the exceptions described in **Paragraph 7.98**.

**7.120** New and upgraded watercourse crossings will be designed to maintain and not reduce the existing capacity of the channel. The Site is rural and there are no properties or assets at risk of flooding downstream of the Site. It is considered that this is an appropriate approach to take in an upland peatland environment.

**7.121** Compaction of soils and increased areas of hardstanding reduces the infiltration rate leading to a greater rate and volume of surface water runoff. Clear felling forestry and other vegetation can also lead to an increase in surface water runoff rates. This results in a 'flashier' catchment response and could increase flood risk downstream. While the magnitude of the change would not be anticipated to be great due to the small area of hardstanding or semi-permeable surfaces (**Table 7.8**) compared to the total catchment areas.

[12] National Planning Framework 4 (NPF4) will be coming into operation early in 2023. If it is passed through government, it will supersede Scottish Planning Policy (SPP).

**Table 7.8: Areas of land take for the Proposed Development within each Main River Catchment (in $m^2$)**

| | Kames River Catchment (at hydro scheme dam)[13] | Eas an Amair Catchment[14] | Allt Blarghour Catchment (at hydro scheme dam)[15] | Allt Blarghour Catchment (downstream limit)[16] | Erallich Water Catchment[17] | Allt Bail' a Ghobhainn Catchment[18] | Quakers Burn Catchment[19] | Allt Riabhachan Catchment (Maltlands hydro scheme)[20] | Crom Allt Catchment[21] |
|---|---|---|---|---|---|---|---|---|---|
| Permanent | 2,495$m^2$ | 99,918$m^2$ | 24,502$m^2$ | 134,714$m^2$ | 56,111$m^2$ | 25,217$m^2$ | 8,880$m^2$ | 33,580$m^2$ | 19,085$m^2$ |
| Temporary | 11$m^2$ | 36,876$m^2$ | 11,153$m^2$ | 53,367$m^2$ | 28,110$m^2$ | 0$m^2$ | 0$m^2$ | 0$m^2$ | 0$m^2$ |
| Total Land Take | 2,506$m^2$ | 136,793$m^2$ | 35,655$m^2$ | 188,081$m^2$ | 84,221$m^2$ | 25,217$m^2$ | 8,880$m^2$ | 33,580$m^2$ | 19,085$m^2$ |
| Total Watercourse Catchment Area | 6,161,100$m^2$ | 3,897,000$m^2$ | 6,247,125$m^2$ | 13,474,300$m^2$ | 10,144,900$m^2$ | 2,618,925$m^2$ | 521,200$m^2$ | 4,861,450$m^2$ | 1,992,550$m^2$ |
| % of Catchment Area | 0.04% | 3.51% | 0.57% | 1.40% | 0.83% | 0.96% | 1.70% | 0.69% | 0.96% |

**7.122** The construction of infrastructure, such as access tracks, could affect (block or realign) natural flow pathways, resulting in changes to the local runoff rate and volume and potentially resulting in the change in contributing catchment areas. This would also have an effect on the rate and volume of water reaching receiving watercourses and other downstream receptors.

**7.123** Changes to the rate and volume of infiltration due to the construction of infrastructure could also affect recharge rates to the groundwater body. Excavations for turbine foundations and in the borrow pits during construction could also result in Minor, local changes to groundwater levels, as water would tend to fill up the excavated areas.

**7.124** The Proposed Development incorporates SuDS and other embedded good practice mitigation measures to minimise the risk of increased run-off and flood risk (see **Good Practice Measures** section above) and the discharge of attenuated surface water runoff from the working areas and access tracks into the watercourses will be limited to greenfield runoff rates entering each watercourse from the Site at present.

**7.125** The catchment areas of the hydro schemes and the main watercourses downstream of the Site are provided in **Table 7.8**. The total area of proposed hardstanding or semi-permeable surfaces within each catchment ranges from 2,506$m^2$ to 188,081$m^2$ (see **Table 7.8**). This represents between 0.04-3.5% of the total catchment areas; the Eas an Amair catchment being the highest. The percentage of land take within the hydro scheme catchment areas are 0.04%, 0.57% and 0.69% for the Kames, Blarghour and Maltlands schemes, respectively.

**7.126** Based on the small percentage of the total catchment areas impacted by temporary and permanent hardstanding, the effect of construction on run-off rates and flood risk is considered to be of Minor to Negligible magnitude and the significance will be minor to none on watercourses, waterbodies and hydro schemes downstream of the Proposed Development.

**7.127** Excavations for turbine foundations and borrow pits could impact groundwater recharge levels. The effect is considered to be of short duration, localised and reversible and is considered to be of minor magnitude and minor significance on the groundwater body.

### Effects During Construction on GWDTEs

**7.128** Based on the results of the GWDTE survey by hydrologists and ecologists and the desk-based assessment, a number of adjustments were made to the turbine and track locations to consider the presence of moderate and highly dependent GWDTEs. Where possible, the 250m buffer has been avoided for siting turbines and borrow pits, and 100m buffer has been avoided for siting roads, tracks and trenches, as per SEPA guidance[22]. However it has not been possible to avoid these in all locations. **Chapter 3** provides more detail on why it was not possible to avoid the 100m and 250m buffer areas, largely due to the presence of other constraints on the Site.

**7.129** There are six main areas of moderate or highly dependent GWDTEs where infrastructure is proposed within the recommended buffers. These are shown in **Figure 7.3** and assessed in detail in **Appendix 7.5**. The assessment methodology and results are summarised below.

**7.130** A site-specific qualitative risk assessment of each GWDTE location was carried out based on the available data on local geology, hydrology, ecology and hydrogeological regime at each location. There is no available data on sub-surface flows and in the absence of data, it is considered that the movement of sub-surface water is primarily driven by topography.

**7.131** Flow routing analysis was carried out in QGIS software using 5m-resolution Ordnance Survey Terrain data. In the absence of data on ground water levels and flow paths, analysis of topography and surface water flows paths was used to infer hydrological and hydrogeological connectivity to the project infrastructure.

**7.132** The assessment of impact on a groundwater flow path is made with reference to distance, slope, aspect, typical water table levels and features such as watercourses. The assessment is made with imperfect knowledge of the exact extent that a particular impact may have and imperfect knowledge of specific sub-surface flow paths. As such, it takes a precautionary approach using the available information.

**7.133** In summary the results of the Site specific assessments are:

- GWDTEs TN1 to TN3 (acid flushes)
  - The track between T11 and T12 crosses the Eas an Amair watercourse and is within the 100m buffer of three GWDTE locations. In addition, T11 and borrow pit 1 are within 250m of the GWDTEs. Based onsite hydrology and ecology surveys (see **Table 2**, **Appendix 7.5**), the GWDTEs here are considered to be moderately dependent on groundwater, as it is likely that there is both surface water and groundwater contribution to the flow.
  - The proposed access track is located within 30m of the GWDTEs. The track will be a floating track to the south as it crosses the area of deep peat and a non-floating track at the watercourse crossing location. Surface and sub-surface flow paths are

[13] The met mast and track is within the Kames River catchment.
[14] T4, T5, T6, T11, T12 and T13, permanent compound (including substation and BESS), BP3, and tracks are within the Eas an Amair catchment. The Eas an Amair is a tributary of the Allt Blarghour.
[15] T7, T8 and T9 and tracks are within the Allt Blarghour catchment, upstream of the hydro scheme dam.
[16] T4, T5, T6, T7, T8, T9, T10, T11, T12 and T13, permanent compound (including substation and BESS), BP3, and tracks are within the Allt Blarghour catchment.
[17] T1, T2, T3, construction compound and tracks are within the Erallich Water catchment.
[18] A short section of existing and proposed track is within the Allt Bail' a Ghobhainn catchment.
[19] BP2 and existing track are within the Quakers Burn catchment.
[20] The existing track and two short sections of proposed track are within the Allt Riabhachan catchment.
[21] BP1 and existing track (Inveraray bypass) are within the Crom Allt catchment.
[22] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

from the south (**Image 1**, **Appendix 7.5**). Floating tracks are designed to maintain hydrological connectivity and allow sub-surface flow through the underlying peat; hence it is considered that the floating track will not interrupt shallow and sub-surface flow to the GWDTEs. The non-floating track section is short and perpendicular to flow direction to the GWDTEs and is not considered to have a significant effect on any groundwater flow to the GWDTEs. There is a risk runoff from the tracks could result in increased sediment/pollution draining towards the GWDTEs.

  - Flow path analysis indicates that the GWDTEs are in a different sub-catchment to the borrow pit and T11 and excavations here are unlikely to affect the GWDTEs (**Image 1**, **Appendix 7.5**). The track is considered to have an effect of Negligible to Minor magnitude on the GWDTEs. Given the moderate groundwater dependence of the GWDTEs (as it is partly sourced by surface/sub-surface water draining the peat), the effect on the GWDTEs is considered to be of Minor magnitude, but temporary, resulting in an effect of Minor significance during construction.

- GWDTE TN4 (blanket bog, with some M6)
  - T12 and its associated access track are located 140m south-east of a GWDTE. Based onsite hydrology and ecology surveys TN4 is considered to be at most moderately dependent on groundwater, but most likely low.
  - Flow path analysis indicates that the GWTDE drains towards the Eas an Amair watercourse to the north (**Image 1**, **Appendix 7.5**) and the surface water catchment to the GWDTEs comprises drainage from the proposed turbine location. T12 is located on a higher bedrock ridge at an elevation of ~355m AOD. The GWDTE is at ~330m AOD, ~25m below the turbine location. Given the elevation difference, it is considered unlikely that excavations for turbine infrastructure (assumed to be 3.5-5m deep for the foundations) will have an impact on groundwater flows to the GWDTE. In addition, the Site surveys suggest that the GWDTE is only at most moderately dependent on groundwater and partly surface water fed, associated with the peat bog. Therefore, the effect on the GWDTE is considered to be of Negligible magnitude and temporary, resulting in an **effect significance of none** during construction.
- GWDTE TN5 (bryophyte-dominated spring)
  - The track between turbines T5 and T6 is located 66m east of a highly dependent GWDTE. Flow path analysis indicates that the GWTDE drains towards a watercourse to the north (**Image 2**, **Appendix 7.5**) and the surface water catchment to the GWDTE is fairly small, comprising the rocky outcrop to the south of the GWDTE. The GWDTE spring is at an elevation of 354m AOD.
  - The proposed track is upgradient of the GWDTE at an elevation ranging from 365m to 355m AOD and is a non-floating track. Surface water flow paths, based on available topography data (**Image 2**, **Appendix 7.5**), indicate that flow paths from the proposed track are to the south in the southern part of the track and to the north in the northern section of the track; the flow paths do not flow directly to the GWDTE. It is considered unlikely that excavation of the track 66m away from the spring source and sitting some 10m higher than the GWDTE spring will have a significant effect on groundwater flows to the GWDTE. However, given the unknowns regarding groundwater levels and flow paths and the high groundwater dependence of the GWDTE, the effect on the GWDTE is considered to be of Minor magnitude, but temporary, resulting in an effect of Minor significance during construction.
- GWDTE TN6 (bryophyte-dominated spring)
  - T8 is located ~215m south-east of a highly dependent GWDTE on the southern side of a rocky ridge. A small watercourse lies between the turbine and the GWDTE. Surface water flow paths (**Image 2**, **Appendix 7.5**) indicate that the GWTDE drains towards Loch nan Car to the north, while the proposed turbine location flows towards the small watercourse. The GWDTE spring is at an elevation of 370m AOD and the turbine sits at 392m AOD, with a watercourse and a rocky linear ridge separating the two. It is considered that they are not hydrologically connected and it is unlikely that excavation at the turbine will affect groundwater flows to the spring source. The effect on the GWDTE is considered to be of Negligible magnitude resulting in an **effect significance of none** during construction.
- GWDTE TN7 (bryophyte-dominated spring)
  - The temporary construction compound is located 90m north-east of a highly dependent GWDTE. A second GWDTE TN was mapped to the south of TN7, however as this is outside of the 100m infrastructure buffer it was not assessed in detail.
  - The spring is located upgradient of the construction compound and is situated at ~ 438m AOD. The construction compound is lower at ~ 434m AOD. Surface water flow paths indicate that the GWTDE drains towards a watercourse to the east (**Image 3**, **Appendix 7.5**), while flow paths from the construction compound area are to the south-east, north-west and north and are not directed towards the GWDTE. It is considered unlikely that any excavations (<1m in depth at the compound) will have an effect on groundwater flows to the GWDTE, as the GWDTE will likely be fed from a groundwater catchment upgradient (west) of the GWDTE. The effect on the GWDTE is considered to be of Negligible magnitude resulting in an **effect significance of none** during construction.
- GWDTE TN8 and Moderately Dependent GWDTE Polygons (bryophyte-dominated spring and flushes)
  - A series of highly dependent GWDTEs were located at the north-facing foot of a large scree slope. A sequence of springs and flushes were found around this locality, all of which were confirmed to be highly groundwater dependent. During early design iterations the track infrastructure was moved south to avoid these GWDTEs.
  - Surface water flow paths, based on available topography data (**Image 4**, **Appendix 7.5**), are from south to north and the track is within the same surface water catchment as the GWDTEs. The track is considerably higher than the GWDTEs, at an elevation of 466m AOD, when compared to the elevation of GWDTE TN8, which sits at the foot of the steep slope at 421m AOD. Given the elevation difference (45m) and the distance from the track to the GWDTEs (at least 100m) it is considered that excavation during construction of the track will have an effect of Negligible magnitude on the GWDTE, resulting in an **effect significance of none**.

### Direct and Indirect Disturbance of Peat During Construction

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

**7.135** The alteration of the geological environment by the excavation of the subsoil and peat required to build the infrastructure such as turbine bases, construction compounds, access tracks, borrow pits and felling will result in some alteration of the geological environment. In particular, any underlying topsoil and peat may be temporarily removed and will need to be managed appropriately.

**7.136** Activities, or effects of activities, which have the potential to alter the geological environment include:

- Earthworks and site drainage;
- Reduction in water table levels resulting in the drying out, oxidation and potential erosion of peat;
- Excavation and removal of peat;
- The disturbance and loading of peat by vehicle tracking; and
- Forest felling activities.

**7.137** A summary of the requested peat and habitat information at each infrastructure location, as requested by NatureScot in their Scoping Response is provided as an Annex to **Appendix 8.2**.

**7.138** The Outline PMP (**Appendix 7.3**) considers the excavation and reuse of peat based on a peat depth model interpolated from Phase 2 peat depth data across the Site. Excavation calculations have been undertaken for all site infrastructure, including permanent excavations (turbine foundations and the main hardstandings, the main compound with substation, the met mast and all tracks of cut and fill construction) and temporary excavations (secondary crane hardstandings and laydowns, the construction compound and borrow pits). All excavated infrastructure includes an additional excavation allowance for a 2:1 cut around each footprint (which varies with peat depth). Excavation calculations treat all soils ≥0.5m as peat, with the uppermost 0.3m as acrotelm, and all soils <0.5m as organic soils. All peat and soils that are temporarily excavated will be stored locally and directly reinstated at their point of origin following construction. All permanently excavated peat and soils require alternative uses, ideally as restoration materials.

**7.139** Based on the calculations described above, a total of c.46,140m$^3$ of acrotelmic peat, 88,171m$^3$ of catotelmic peat and 14,902m$^3$ of soil will be excavated during construction. Of this, 17,576m$^3$ of acrotelmic peat, 37,668m$^3$ of catotelmic peat and 3,871m$^3$ of soil will be directly reinstated at the point of origin.

**7.140** It is proposed that the majority of permanent infrastructure are dressed using organic soils rather than peat. The exceptions are 622m$^3$ of acrotelm required to dress the perimeters of turbines and hardstandings, and 7,904m$^3$ of acrotelm required to dress the marginal slopes of cut and fill tracks. 1,669m$^3$ of acrotelm and 1,002m$^3$ of catotelm will be directly reinstated in Borrow Pit 3. The other two borrow pits, which are set outside deep peat areas will be reinstated with the topsoils initially excavated from them. Borrow Pit 3

lies partially within peat, and may be suitable for some peat reuse (allowing hydrological connectivity between peat within the pit outside), however it is not currently part of the reuse proposals and will be held in reserve should the need arise for additional peat reuse capacity.

**7.141** Based on an evaluation of areas of hagged peat across the Site, all remaining excavated peat after direct reinstatement and minimal landscaping will be reused in restoring eroded peatland. As part of the geomorphological assessment of peat at the Proposed Development, over 240 hagged areas were mapped with the potential for restoration. Of these, c.200 areas were well vegetated and intervention is not proposed (since recovery appears to be ongoing). Of the remainder, approximately 20 areas are too distant (greater than c.100m) from proposed infrastructure to be trafficked to with excavated peat, and therefore have been identified for reprofiling using standard reprofiling techniques (which do not require imported peat for restoration). The remaining 23 have been checked for slope angle (<5°) and stability (using outputs from the PLHRA, see **Appendix 7.4**) and have been identified as candidates for restoration using excavated peat. Each hagged area has been assessed for the proportion of intact vegetated peat within its boundary (i.e. likely areas of isolated peat deposits with turved tops) and a target infill depth identified. Infill depths are c.1.5m for slopes <3°, no greater than 1.0m for 3-4° and no greater than 0.5m for 4-5° slopes. Site won rock material will be used to construct porous berms sufficient to retain the lower catotelmic peat in-situ once emplaced. Acrotelmic peat will be placed over the catotelmic peat to provide a vegetated top surface, with seeding with a locally appropriate seed mix to be undertaken if any bare peat remains (e.g. due to a shortfall in acrotelmic material). Because reinstated materials will be placed below the surrounding peat levels, they should remain wet and be conducive to recovery, particularly with fencing and preclusion of grazing in critical areas. More detail is provided in **Appendix 8.5**. All of the proposed restoration areas are directly accessible from proposed tracks and will require minimal trafficking across intact peat in order to work.

**7.142** Calculations undertaken in the Outline PMP indicate capacities in excess of c.21,400m$^3$ for acrotelmic peat and c.46,200 m$^3$ for catotelmic peat in the 23 restoration areas identified. The total volume of peat required for direct reinstatement, landscaping and peatland restoration is balanced with the total volume of peat that is estimated will be excavated during construction. While there is slightly less acrotelm available than would be needed for full vegetation cover and slightly more catotelm available than required, it is anticipated that post-consent micrositing and detailed site survey will enable identification of suitable reuse opportunities for all peat excavated onsite. The majority of peat being reused will be placed in areas where it will remain wet and support recovery of the wider peatland at An Carr Dubh. Further details are provided in the OREP.

**7.143** It is recommended that the Outline PMP is revised post-consent with more detailed restoration design agreed prior to construction and on completion of ground investigations and micrositing within the Site.

**7.144** Through careful design, including consideration of early PLHRA likelihood results, the vast majority of proposed infrastructure has been sited or routed away from areas of Moderate peat landslide likelihood or Factor of Safety <1.4 (using best estimate parameters). Only three locations overlap with such areas, one c.1km up the access track from the treeline in the east of the Site, one south-east of Cruach Mhic Eoich between the junction to T3 and T4, and one east of the substation compound. Due to the limited overlap between infrastructure and the lower stability zones, source areas and volumes are modelled to be small, and risks are calculated to be **low**, in particular because no GWDTE are likely to be affected and there is no credible connectivity of debris to main watercourses or water supplies.

**7.145** Assuming embedded mitigation measures detailed above are incorporated into project design and are effective, the magnitude of the effect on peat is Minor. Overall, the effect on peat is Minor.

### Proposed Mitigation

**7.146** With embedded mitigation measures incorporated into project design, including SuDS pollution control and attenuation measures, there are no potentially significant effects on hydrology, water quality, morphology or PWS. Details of the embedded mitigation will be set out in detail prior to construction in the PPP, CEMP and construction method statements. The PPP will require approval by SEPA to obtain a CAR CSL. The PPP will also contain details of the location specific additional mitigation for relevant infrastructure and the contractor will be legally obliged to comply with the pollution control and drainage measures agreed in the PPP and CSL. An ECoW will be present onsite during construction to monitor and assess the works and check the mitigations outlined in the PPP are adhered to and function properly. If monitoring or assessment identifies non-compliance, ineffective mitigations, or effects beyond those predicted in the EIA Report, this will be raised with the Contractor who will be required to demonstrate and deliver compliance.

**7.147** Pre- and post-construction fish habitat surveys in key watercourses will be carried out to microsite the watercourse crossings away from potentially sensitive habitats wherever possible, and to confirm the habitat baseline. The monitoring plan will be set out in the CEMP.

**7.148** Additional mitigation and SuDS (e.g. silt fences, settlement ponds) will be installed around the following working areas, crossings and access tracks during construction to reduce the risk of sediment/silt run-off to the water environment during construction:

- Watercourse crossings of the proposed and existing tracks.
- Buffer encroachment B – proposed track, temporary hardstanding and clearance area associated with T4.
- Buffer encroachment C – proposed track between T5 and T6 close to Loch nan Car.
- Buffer encroachment D – proposed track east of T9.
- Buffer encroachment E – proposed track north of T11.
- Buffer encroachment H – Borrow Pit is within 5m of a small unnamed watercourse to the north. No works will be undertaken within 10m of the watercourse and additional mitigation will be put in place to prevent silt run-off to the watercourse.
- Buffer encroachment I – Borrow Pit 1 is within 10m of a small unnamed watercourse to the south-west. No works will be undertaken within 10m of the watercourse and additional mitigation will be put in place to prevent silt run-off to the watercourse. There is a small area of ponded surface water within the low part of the quarry; and care should be taken if dewatering the quarry prior to excavation.

**7.149** The bed and banks of watercourses and crossing locations will be re-established to their previous condition immediately after construction.

**7.150** Dewatering will be avoided where possible and permanent physical cut-offs will be avoided.

**7.151** Additional mitigation and monitoring are proposed to minimise the effects on GWDTEs, as follows:

- The track between T11 and T12 is proposed to be floated and will be designed to enable subsurface flows to be maintained. Monitoring will be put in place to assess the quantitative and chemical effect of the infrastructure to ensure that the groundwater flow and quality to the GWDTEs (TN1, TN2 and TN3) are not statistically significantly changed post construction. Monitoring will be carried out based on SEPA guidance and will comprise groundwater monitoring at the three seeps.
- The track between T5 and T6 will be designed to enable subsurface flows to be maintained, with suitable culverts installed under the track so that it does not cut off natural flow pathways. Monitoring will be put in place to assess the quantitative and chemical effect of the infrastructure to ensure that the groundwater flow and quality to GWDTE TN5 are not statistically significantly changed post construction. Monitoring will be carried out based on SEPA guidance and will comprise groundwater monitoring at the spring and at a series of groundwater monitoring wells.
- Pre-construction monitoring at the above locations will commence at least six months before construction commences. Monitoring reports will be prepared, and remedial actions identified if statistically significant changes to the groundwater flow or chemistries to sensitive receptors are identified.

**7.152** Any excavated peat will be stored appropriately nearby and re-used as soon as possible for reinstatement or restoration (see paragraphs above).

**7.153** In addition to the reuse of excavated peat to restore eroded areas, reprofiling and drain blocking will be undertaken using standard blocking techniques, most likely peat dams or wave dams (to be determined by Peatland ACTION best practice at the time of construction). It is anticipated that all restoration works (including the hagg 'repairs') will be undertaken by a specialist restoration contractor, rather than the Balance of Plant (BoP) contractor, with excavators working on reprofiling and drain blocking in the periods between hagg repairs and diverting to the latter activities when peat becomes available. Further details of the restoration and enhancement plans for peat are provided in the OREP (**Appendix 8.5**). Drain blocking is accepted as a best practice measure for peatland restoration; it is an intervention based on accepted theoretical principles, and its positive effects upon water tables have been observed both anecdotally and in a number of published studies. On this basis, it is considered reasonable at the present time to predict Minor positive effects on the peat resource at An Carr Dubh from the proposed reprofiling and drain blocking measures, albeit that the magnitude of these effects is more difficult to predict, as the evidence base in this respect is currently evolving.

**7.154** Mitigation of peat landslide risk may be achieved through further micrositing and/or careful construction management and through such mitigation, landslide risks are interpreted to be Negligible post-mitigation.

**7.155** Cognisance of Scottish Water services and pipework will be required during detailed design and prior to and during construction works, particularly relating to the pipework suppling water to and from the Inverarary WTW. The Applicant will undertake detailed

discussion with Scottish Water, including onsite meetings to avoid pipework and plan suitable mitigation measures to install during construction to ensure no damage to SW assets.

**7.156** An ECoW (or equivalent) will be onsite throughout the construction to monitor the effectiveness of the embedded and additional mitigation measures.

### Residual Construction Effects

**7.157** With embedded mitigation, additional mitigation, including the peat restoration and enhancement plans, and monitoring described above, the residual construction effects are either Minor, Minor (positive) or none and are summarised in **Table 7.9**.

**Table 7.9: Summary of residual construction effects**

| Effect | Significance Before Additional Mitigation (including embedded mitigation measure) | Additional Mitigation | Significance After Additional Mitigation |
|---|---|---|---|
| Construction | | | |
| Effect on water quality of downstream watercourses and waterbodies | Minor | Additional mitigation/SUDS (e.g. silt fences, settlement ponds) will be put in place during the construction and working at:<br>■ Watercourse crossings;<br>■ Proposed track, temporary hardstanding and clearance area associated with T4;<br>■ Track section between T5 and T6 close to Loch nan Car;<br>■ Proposed track east of T9;<br>■ Proposed track north of T11;<br>■ Borrow Pit 2; and<br>■ Borrow Pit 1. | Minor |
| Effect on water quality and quantity on PWS | None | N/A | None |
| Effect on water quality and quantity on abstractions for public water supply | None | N/A | None |
| Effect on water quality and quantity on public water supply and distribution assets | Moderate | Cognisance of Scottish Water services and pipework during detailed design and prior to and during construction works. The Applicant will undertake detailed discussion with Scottish Water, including onsite meetings to avoid pipework and plan suitable mitigation measures to install during construction to ensure no damage to SW assets. | None |
| Construction | | | |
| Effects on channel morphology (bank erosion and channel form) | Minor | Sensitive crossing design and the bed and banks of watercourses and crossing locations will be re-established to their previous condition immediately after construction. | Minor |
| Effects of Proposed Development on run-off rates, flood risk | Minor or None | N/A | Minor or None |
| Effects on groundwater levels and recharge | Minor | Avoidance of dewatering and physical cut-off where possible. | None |
| Effects on GWDTE | Minor or None | The tracks between T11 and T12 and between T5 and T6 will be floated and/or designed to enable subsurface flows to be maintained.<br>Pre- and post-construction groundwater monitoring will be undertaken at GWDTE TNs 1, 2, 3 and 5. | Minor or None |
| Effects on Peat | Minor (negative) | Post-consent detailed restoration design (reprofiling and drain blocking) (see **Appendix 8.5**) will be undertaken to maximise potential benefits to the peat resource and habitats. | Minor (positive) |

## Operational Effects

### Predicted Operational Effects

**7.158** Following construction of the Proposed Development, all infrastructure will be left in situ to permit maintenance.

**7.159** The potential operational effects of the Proposed Development are associated with the permanent Site infrastructure, including the access tracks, turbine bases, substation and hardstanding areas and any required maintenance work during operation.

**7.160** The assessment of operational effects considers that the pollution prevention controls, and permanent drainage installed during construction will remain in place during operation. Hence, operational effects on peat, hydrogeology, surface water quality and water supplies are considered to be Negligible.

**7.161** During operation, the increase in hardstanding areas (turbine bases, substation and tracks) could result in a slight increase in the rate and volume of surface water runoff, leading to an increase in flood risk downstream. However, given the permanent SuDS drainage measures and the size of the areas of hardstanding compared to the catchment areas of the downstream watercourses, the magnitude of the effect on flood risk downstream is considered to be Negligible and thus is assessed to have an effect significance of none.

**7.162** There is not expected to be any long-term effect on sub-surface flows during operation, hence the effect on GWDTEs is considered to be Negligible and thus is assessed to have an effect significance of none.

### Proposed Mitigation

**7.163** No specific mitigation is proposed during operation.

### Residual Operational Effects

**7.164** There are no residual operational effects on the water and soil environment.

## In-Combination Effects with the Blade Transfer Areas During Construction

### Blade Transfer Area 1 – Tarbert

**7.165** Based on an initial review, BTA1 is potentially at risk of fluvial flooding from a small watercourse to the north of the Site. A staged flood risk assessment will be undertaken to inform the planning application for BTA1.

**7.166** The SNH Carbon and Peatland Maps (2016) show there is no peat at the BTA1 site with the entire site classed as mineral soil, hence there will be no effects on peat.

**7.167** BTA1 is in a different catchment from the Proposed Development, hence the in-combination effects on hydrology and flood risk are not significant.

#### Blade Transfer Area 2 – Achnaba

**7.168** Based on an initial review, BTA2 is potentially at flood risk from surface water, or the overtopping of the upslope burn. From a review of the topographic data, it appears that the watercourse will historically have flowed through the location of the proposed transfer area. Surface water management and drainage measures will be required.

**7.169** The SNH Carbon and Peatland Maps (2016) show there is no peat at the Site with the entire site classed as mineral soil, hence there will be no effects on peat.

**7.170** BTA2 is in a different catchment from the Proposed Development, hence the in-combination effects on hydrology and flood risk are not significant.

### Cumulative Effects During Construction

#### Predicted Cumulative Effects During Construction

**7.171** There are a number of proposed and completed developments within the surrounding area, the majority of which are in different catchments than the Site, meaning that there is less chance of a cumulative effect occurring. However, the Blarghour wind farm is located within the Allt Blarghour catchment, to the north of the Proposed Development.

**7.172** Assuming that nearby wind farm schemes (i.e. Blarghour) are designed and constructed in line with SPP, NPF4 and national guidelines with respect to SuDS and GPPs, there should be no cumulative effect on the downstream catchments.

**7.173** Cumulative Effects on peat are not anticipated, given proposed restoration plans and avoidance/minimisation of peat.

#### Proposed Mitigation

**7.174** No specific mitigation is proposed.

#### Residual Cumulative Effects During Construction

**7.175** There are no residual cumulative effects on the water and soil environment.

### Cumulative Effects During Operation

**7.176** There are no predicted cumulative effects during operation.

## Interrelationship Between Effects

**7.177** Excessive levels of suspended sediment in watercourses as a result of construction activities can have an indirect effect on watercourse ecology and fish. However, with embedded and additional site-specific mitigation (e.g. adherence to GPP), SuDS, buffers etc) there is considered to be no significant residual effect on water quality of the downstream watercourses. Therefore, effects on fisheries remain scoped out of this assessment (see **Chapter 8**).

## Further Survey Requirements and Monitoring

**7.178** Groundwater monitoring will be put in place to assess the quantitative and chemical effect of the infrastructure to ensure that the groundwater flow and quality to GWDTEs TN1, TN2, TN3 and TN5 are not statistically significantly changed post construction. Monitoring will be carried out based on SEPA guidance and will comprise groundwater monitoring at the spring/seeps and at a series of groundwater monitoring wells. Details of the monitoring will be agreed with SEPA and set out in the CEMP.

**7.179** Pre- and post- construction fish habitat surveys will be carried out (see **Chapter 8**) and there will be an ECoW involved throughout the construction works monitor effectiveness of the measures implemented.

**7.180** Mitigation of residual peat instability risks will be supported by good practice construction measures and by monitoring both during and after construction. Further details are provided in **Appendix 7.4**, **Sections 6.3** and **6.4**.

**7.181** Satisfactory implementation of the PMP in order to mitigate peat loss/disturbance will be assured by monitoring both during and after construction. Further details are provided in **Appendix 7.3**, **Section 7.6**.

**7.182** An ECoW (or equivalent) will be onsite throughout the construction to monitor the effectiveness of the embedded and additional mitigation measures.

## Summary of Significant Effects

**7.183 Table 7.10** below summarises the likely predicted significant effects of the Proposed Development on Geology, Hydrology, Hydrogeology and Peat. All of the other likely effects prior to mitigation were either of none or Minor significance, assuming embedded good practice mitigation measures are in place during construction.

**7.184** With additional mitigation, the likely residual effects were either of none, Minor or Minor (positive) significance.

**Table 7.10: Summary of significant effects**

| Predicted Effect | Significance | Mitigation | Significance of Residual Effect |
|---|---|---|---|
| Construction | | | |
| Effect on water quality and quantity on public water supply and distribution assets | Moderate | Cognisance of Scottish Water services and pipework during detailed design and prior to and during construction works. The Applicant will undertake detailed discussion with Scottish Water, including onsite meetings to avoid pipework and plan suitable mitigation measures to install during construction to ensure no damage to SW assets. | None |