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CRUACH CLENAMACRIE WIND FARM

CHAPTER 9:

GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND SOILS

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RESPONSIBILITIES

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ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ABC	Argyll and Bute Council
AOD	Above Ordnance Datum
BFI HOST 19	Base Flow Index
BGS	British Geological Survey
BPA	Borrow Pit Assessment
CEMP	Construction Environmental Management Plan
DTM	Digital Terrain Model
DWPA	Drinking Water Protected Area
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
GCR	Geological Conservation Review
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater-Dependent Terrestrial Ecosystem
HMP	Habitat Management Plan
Met Office	UK Meteorological Office
NPF4	Fourth National Planning Framework
NVC	National Vegetation Classification
OS	Ordnance Survey
PMP	Peat Management Plan
PROPWET	Catchment Wetness Index
PSRA	Peat Slide Risk Assessment
PWS	Private Water Supply
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SPR HOST	Standard Percentage Runoff
SSSI	Site of Special Scientific Interest
UKTAG	United Kingdom Technical Advisory Group

9 GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND SOILS

9.1 Introduction

This Chapter of the Environmental Impact Assessment (EIA) Report describes the existing geological, hydrogeological, hydrological and peat conditions within the Application Boundary. This section also identifies and assesses the potential impacts that may be caused by Cruach Clenamacrie Wind Farm and associated infrastructure and ancillary features (hereafter the Proposed Development). The potential impacts include preparation, construction works, restoration of construction works, operation and decommissioning. The mitigation measures that could be employed to address any adverse effects are also set out in this Chapter.

The Chapter is supported by a number of Technical Appendices which provide additional in-depth information on relevant aspects of the Proposed Development. These Technical Appendices are:

- **Appendix 9.1** Peat Slide Risk Assessment;
- **Appendix 9.2** Outline Peat Management Plan;
- **Appendix 9.3** Groundwater-Dependent Terrestrial Ecosystems Assessment;
- **Appendix 9.4** Drainage Impact and Watercourse Crossing Assessment; and
- **Appendix 9.5** Borrow Pit Assessment.

Key findings of these Technical Appendices are summarised within this Chapter.

9.2 Legislation, Policy and Guidance

In preparing this section of the EIA Report, consideration has been given to relevant statutory requirements and planning policy/guidance at all levels. This includes, but is not limited to, the following:

9.2.1 Legislation

- Water Environment and Water Services (Scotland) Act 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 ;
- Environmental Protection Act 1990;
- Pollution Prevention and Control (Scotland) Regulations 2012; and
- Flood Risk Management (Scotland) Act 2009.

9.2.2 Policy

- Scottish Government (2023) Fourth National Planning Framework (NPF4); and
- Argyll and Bute Local Development Plan 2.

9.2.3 Guidance

- Guidance on Developments on Peatland – Site Surveys (The Scottish Government, 2017);
- Engineering in the Water Environment: Good Practice Guide, River Crossings (SEPA, 2010);
- Good Practice during Wind Farm Construction (Scottish Renewables, SNH, SEPA, Forestry Commission Scotland & HES, 2019);
- Scottish Government (2006) Planning Advice Note 51: planning, environmental protection and regulation;
- SEPA (2014) Position Statement WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs;

- The Scottish Environment Protection Agency's (SEPA) Guidance for Pollution Prevention (GPP) with particular reference to:
    - GPP 1: Understanding your environmental responsibilities – good environmental practices, 2021;
    - GPP 2: Above ground oil storage tanks, 2021;
    - GPP 3: Use and design of oil separators in surface water drainage systems, 2022;
    - GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer, 2021;
    - GPP 5: Works and maintenance in or near water, 2018;
    - GPP 6: Working on construction and demolition sites, 2023;
    - GPP 13: Vehicle washing and cleaning, 2021;
    - GPP 21: Pollution incident response planning, 2021; and
    - GPP 22: Dealing with spills, 2018.

9.3 Consultation

Consultation in relation to issues concerning geology, hydrogeology, hydrology and peat have been undertaken with several statutory and non-statutory consultees and interested parties, including the Scottish Government, Argyll and Bute Council (ABC), SEPA, NatureScot, Scottish Water and local stakeholders including landowners and members of the public. Responses were not received from all those consulted, including ABC and various community councils. Responses received to the Scoping Report with relevance to geology, hydrogeology, hydrology and peat are provided in **Table 9.1**.

TABLE 9.1: CONSULTEE RESPONSES RELEVANT TO GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND PEAT

CONSULTEE	RESPONSE	ACTION
Scottish Government Energy Consents Unit	A peat slide risk assessment (PSRA) should be undertaken following guidance in *The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition)*.	A PSRA is provided in **Appendix 9.1**.
	Any borrow pits should be considered in the EIA report, following guidance set out in *PAN 50: Controlling the Environmental Effects of Surface Mineral Workings*. The following information should be included: location, size, nature, proposed depth of excavation compared to topography and water table, proposed drainage and settlement traps, turf and overburden removal and storage for reinstatement, and details of the proposed restoration profile. Impacts from borrow pit workings (including dust, blasting and impact on water) should also be appraised.	A Borrow Pit Assessment is provided in **Appendix 9.5**.

CONSULTEE	RESPONSE	ACTION
Scottish Water (SW)	**Drinking Water Protected Area (DWPA)** The two most southerly turbines are within the Loch Nell catchment, which feeds Tullich Water Treatment Works. A further two turbines are on the edge of the buffer zone. There would be low risk to the supply catchment but SW would prefer for turbines to be moved out of the catchment and buffer zone. SW provides a list of protection measures for activities within DWPA and drinking water catchments. Anyone working on site should be made aware of the DWPA and relevant protection measures.	SW's preference is noted, but as a result of other constraints it has not been possible to move turbines out of the DWPA and buffer zone. The Applicant notes SW's protection measures and advice, would ensure that all works on site would be compliant with these measures and that site staff are aware of the requirements.
SEPA	Application requires a site-specific Peat Management Plan (PMP) - which demonstrates mitigation hierarchy outlined in NPF4 Policy 5.	Provided as **Appendix 9.2**.
	Application must include a scaled plan of sensitivities (e.g. peat, GWDTE etc.) overlain with the Proposed Development. This is to illustrate that the EIA process has informed the layout to first avoid, then reduce, then mitigate significant impacts on the environment.	The Proposed Development design has changed throughout the EIA process in response to environmental constraints. Design iterations are shown on **Figures 4.1**, **4.2** and **4.3**. Constraints mapping is shown on F**igures 5.1** and **5.2**.
	T2 and T6 are on deep peat (6.5.2 Scoping Report), despite the Phase 1 survey indicating peat is mostly absent and undisturbed (6.4.1 Scoping Report). We stress that avoidance should be the priority.	Turbines have been relocated as far as possible through the iterative design process and are no longer sited on deep peat.
	If development is within 250 m of groundwater supply source, provide evidence in the EIA Report.	No groundwater supply source has been identified within 250m of any proposed infrastructure.
	Detailed information on flood risk unlikely to be required, given watercourse crossings are designed to accommodate the 1 in 200-year event plus climate change and other infrastructure is located well away from watercourses. See guide for Climate change allowances.	Flood risk and watercourse crossing design are discussed in **Appendix 9.4**.
	Minimise watercourse crossings and direct impacts on water features.	Watercourse crossings are discussed in **Appendix 9.4**.
	Refer to Flood Risk Standing Advice for crossing designs. If the risk of flooding increases for a nearby receptor, provide a Flood Risk Assessment.	Changes to downstream flood risk is assessed in **Appendix 9.4**.

CONSULTEE	RESPONSE	ACTION
	Proposals on peatland or carbon-rich soils must address the requirements of NPF4 Policy 5. Proposals should demonstrate avoidance of peatland in near-natural condition.	Peat mapping is provided in **Figure 9.5** and the influence of peat on design is shown in **Figure 9.9**. A Peat Management Plan is provided in **Appendix 9.2**.
	In line with Policy 5d of NPF4, the development proposal should include plans to restore and/or enhance the site into a functioning peatland system capable of achieving carbon sequestration.	This is discussed in **Appendix 10.5** – outline Habitat Management Plan.
	Handling and temporary storage of peat should be minimised. Disposal of peat is not acceptable. It should be clearly demonstrated that all peat disturbed by the development can be used in site reinstatement . The faces of cut batters, especially in peat over 1m, should be sealed to reduce water loss of the surrounding peat habitats.	Peat handling methods are discussed in **Appendix 9.2** - Peat Management Plan. There are no plans to dispose of peat.
	Groundwater Dependent Terrestrial Ecosystems (GWDTE) are protected under the Water Framework Directive. Any GWDTE within 100m of excavations shallower than 1m or 250m of excavations deeper than 1m need to be assessed on a location-specific basis.	GWDTE are assessed in detail in **Appendix 9.3**.
	Borrow pit proposals need to include details of location, size and depth of excavations and restoration plans for each proposed pit.	Borrow pit location and outline design is provided in **Appendix 9.5**.
	A schedule of mitigation supported by the above site-specific maps and plans must be submitted.	Mitigation specific to Geology, Hydrogeology, Hydrology and Soils is provided in **Section 9.7**.
	The submission needs to state that there will be no discarding of materials that are likely to be classified as waste as any such proposals would be unacceptable under waste management licensing. Further guidance on this may be found in the document Is it waste - Understanding the definition of waste.	There are no proposals to discard any materials that would be classified as waste.
NatureScot	The Proposal is located adjacent to the Loch Etive Woods Special Area of Conservation (SAC) and the Clais Dhearg Site of Special Scientific Interest (SSSI). Assessment of hydrological connectivity is required and measures to protect the SAC and SSSI need to be set out.	Effects on designated sites are addressed in **Section 9.6.1.5.3** and **9.6.2.6**.

CONSULTEE	RESPONSE	ACTION
	In accordance with Guidance on Developments on Peatland – Site Surveys (The Scottish Government, 2017), detailed survey on a 10m by 10m grid basis around the centre of each proposed turbine base or other infrastructure including borrow pits and proposed temporary storage sites is recommended.	Peat depth survey details and results are provided in **Appendices 9.1** and **9.2**.
	NPF4 states where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify: i. The baseline depth, habitat condition, quality and stability of carbon rich soils; ii. The likely effects of the development on peatland, including on soil disturbance; and iii. The likely net effects of the development on climate emissions and loss of carbon.	Peat depth survey details and results are provided in Technical **Appendices 9.1** and **9.2**. Peat presence has formed a key constraint to design. The influence of peat on design is shown in **Figure 9.9**.

9.4 Methodology

9.4.1 Study Area

For most constraints and sensitivities, the Study Area is considered to be an area up to 2 kilometres (km) from the Application Boundary.

Geological sensitivities do not transmit over any significant distance, except potential considerations relating to mining activity. For mining, activities up to 2km from the Application Boundary have been considered. For other geological considerations, the Study Area extends 1km from the Application Boundary.

For hydrological concerns, areas downstream up to 5km have been considered, as impacts such as pollution events can be transmitted downstream for significant distances. The Study Areas for this assessment are shown in **Figure 9.1**.

9.4.2 Assessment Method

The assessment is undertaken through a desk-based study and site inspection of existing geological, hydrogeological, hydrological and peat-related features within the Site and the wider area around the Application Boundary. The existing conditions are described and potential risks that may be associated with the Proposed Development are identified and assessed. These include:

- physical changes to overland drainage and surface water flows;
- water contamination from particulates and suspended solids;
- water contamination from fuels, oils, concrete batching or foul drainage;
- changes in or contamination of water supply to vulnerable receptors;
- increased downstream flood risk;
- modification to groundwater flow paths;
- soil erosion and compaction; and
- peat instability.

No potential effects have been scoped out of the assessment.

Initial desk-based studies were undertaken to determine and verify the baseline conditions at the Site through review and collation of available and relevant information relating to geology, hydrogeology, hydrology and peat. This includes a review of published mapping, including Ordnance Survey (OS) topographical mapping at 1:25,000 and 1:50,000 scales, British Geological Survey (BGS) geological mapping, Scotland's Soils and peat/carbon mapping, aerial and satellite imagery and site-specific data such as any available site investigation data, geological and hydrogeological reports, digital terrain models (DTM, to provide slope data) and geological literature.

Private water supply (PWS) data were requested from ABC.

Multiple site visits and a reconnaissance survey were undertaken to:

- verify the information collected during the baseline desk study;
- undertake a visual assessment of the main surface waters and verify any PWS, including intakes, that could be affected by the Proposed Development;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- allow appreciation of the Site, including awareness of gradients, access route options (including potential watercourse crossings), prevailing ground conditions, and to assess the relative location of all the components of the Proposed Development; and
- collection of peat and substrate information where exposures are present, for example in watercourse channels and alongside infrastructure.

The reconnaissance survey was undertaken from 28 February – 2 March 2022. The weather was predominantly dry and bright, with some rain showers and variable wind. Ground conditions were very wet, reflecting previous wet weather.

In parallel with the reconnaissance survey, a peat probing exercise was undertaken. This involved undertaking a peat depth survey with a hand-held probe on a 100m grid across the Proposed Development, to identify areas of peat and natural variation in the peat substrate across the Site. These surveys were undertaken in February and March 2022.

Following the infrastructure design process, a second phase of peat survey work was scheduled in November 2023. The Phase 2 surveys involved recording peat depths at 50m intervals along the centre line of proposed new access tracks, with 10-25m offsets to either side. Along existing tracks which would require upgrading, peat points alternated to left and right every 50m and were recorded at a distance of 10-20m from the existing track. Peat depths were recorded on a 10-20m grid across the footprints of hardstandings, compounds and borrow pits. Supplementary Phase 2 surveys, to inform infrastructure design were undertaken in February, May and June 2024. Although it was attempted to complete surveys on a 10m grid for all infrastructure, this was not always possible for safety reasons.

Following the field surveys, a geomorphological mapping exercise was undertaken to link the topographic features with the underlying geology and to identify areas within the Application Boundary that may potentially be at risk from peat landslide. This used the collected field data, DTM, topographical mapping and aerial imagery.

The information obtained from the review of existing data, site surveys and guidance documentation formed the basis of the assessment of the potential effects associated with the Proposed Development. Where potential likely significant effects were identified, mitigation measures have been proposed.

A PSRA was undertaken in accordance with the Scottish Government's Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments[1]. The PSRA was informed by the peat depth model, reconnaissance survey, peat depth surveys, geomorphological mapping and terrain classification produced from a DTM. The assessment used a combined qualitative (contributory factor) and quantitative (factor of safety) approach to determine the likelihood of peat landslides. Areas with the highest likelihood were compared with identified receptors to identify and determine appropriate mitigation measures. The assessment is provided in **Appendix 9.1**.

A PMP was prepared to investigate anticipated volumes of peat required to be removed for construction of the Proposed Development and appropriate reuse of the excavated material. The PMP was informed by the collated peat depth probing described above, combined with a full appraisal of potential reuse opportunities, for example reinstatement and landscaping associated with the infrastructure and mapping of drainage ditches and degraded peat. Where opportunities were identified to integrate the PMP with wider environmental enhancement measures, such as peatland restoration and biodiversity enhancement, the PMP identifies the volume and type of peat to be used for this activity. The assessment is provided in **Appendix 9.2**.

An assessment of GWDTE was undertaken based on the NVC mapping undertaken by the ecology team. Where areas of potentially moderate or high GWDTE were identified in proximity to proposed infrastructure, additional investigation was undertaken to: identify if the wetland areas were truly groundwater-dependent; refine their mapped extent; conceptualise the hydrogeology; and assess any potential effects on these areas. The assessment is provided in **Appendix 9.3**.

An assessment of drainage requirements to manage surface runoff and potential downstream flood risk was undertaken for the Proposed Development. The assessment also included an inventory of all proposed watercourse crossings, both for new structures and for existing crossings that may require upgrading. This assessment is provided in **Appendix 9.4**.

An assessment of bedrock suitability for track and hardstanding construction was undertaken, together with a mapping exercise to identify potentially suitable locations for use as borrow pits for the Proposed Development. The assessment is provided in **Appendix 9.5**.

A number of data sources have been considered in writing this chapter, the main sources include:

- OS topographical mapping;
- BGS geological mapping, superficial and bedrock;
- Centre for Ecology and Hydrology Flood Estimation Handbook Web Service;
- ABC's PWS records;
- Scotland's Soils mapping; and
- SEPA's *A functional wetland typology for Scotland*.

9.4.3 Effects Evaluation

The significance of potential effects has been classified taking into account three principal factors:

- the sensitivity of the receiving environment;
- the potential magnitude of the effect; and
- the likelihood of that effect occurring.

[1] Scottish Government (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Available at: https://www.gov.scot/publications/peat-landslide-hazard-risk-assessments-best-practice-guide-proposed-electricity/, accessed August 2024.

This approach is based on guidance contained with the Scottish Natural Heritage (now NatureScot)/Historic Environment Scotland publication Environmental Impact Assessment Handbook v5[2].

9.4.3.1 Receptor Sensitivity

The sensitivity of a receptor represents its environmental value or importance, and its ability to absorb the anticipated effect without resulting in perceptible change. Four levels of sensitivity have been used, as defined in **Table 9.2**.

TABLE 9.2: SENSITIVITY RATINGS

SENSITIVITY	DEFINITION
Very High	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance e.g. SACs, RAMSAR sites.
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance e.g. National Nature Reserves, SSSIs.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance e.g. Geological Conservation Review (GCR) sites.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance e.g. Local Nature Reserves, Local Geodiversity Sites.

9.4.4 Effect Magnitude

The magnitude of effect includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined as **Table 9.3**.

TABLE 9.3: MAGNITUDE RATINGS

MAGNITUDE	DEFINITION
Substantial	Substantial changes, over a significant area, to key characteristics or to the geological/hydrogeological/peatland classification or status for more than 2 years.
Moderate	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status.
Slight	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.

[2] SNH/HES (2018). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland [v5]. Available at: https://www.nature.scot/doc/archive/environmental-impact-assessment-handbook-version-5-2018#:~:text=Environmental%20Impact%20Assessment%20Handbook%20version%205%20-%202018.%20This%20publication, accessed September 2024.

MAGNITUDE	DEFINITION
Negligible or No change	Any change would be negligible, unnoticeable or there are no predicted changes.

9.4.4.1 Likelihood of Effect

The likelihood of an effect occurring is evaluated as unlikely, possible or likely.

9.4.5 Effects Significance

The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect. Potential effects are concluded to be of major, moderate, minor or negligible significance. Potential effects are assessed taking into account the proposed embedded and additional mitigation measures. The assessment concludes with a review of various effects to determine if they would be significant. Effects assessed as major or moderate are deemed to be significant; those assessed as minor or negligible are deemed to be not significant, as defined in **Table 9.4**.

TABLE 9.4: EFFECTS SIGNIFICANCE MATRIX

SENSITIVITY	MAGNITUDE	LIKELIHOOD	SIGNIFICANCE
Very High	Substantial	Likely	**Major**
		Possible	**Major**
		Unlikely	**Moderate**
	Moderate	Likely	**Major**
		Possible	**Moderate**
		Unlikely	**Moderate**
	Slight	Likely	**Moderate**
		Possible	Minor
		Unlikely	Minor
	Negligible/No Change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	**Major**
		Possible	**Major**
		Unlikely	**Moderate**
	Moderate	Likely	**Moderate**
		Possible	**Moderate**
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Minor

SENSITIVITY	MAGNITUDE	LIKELIHOOD	SIGNIFICANCE
	Negligible/No Change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Moderate	Substantial	Likely	**Major**
		Possible	**Moderate**
		Unlikely	Minor
	Moderate	Likely	**Moderate**
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Negligible
	Negligible/No Change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible
Low	Substantial	Likely	**Moderate**
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible/No Change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

In addition to sensitivity, magnitude and likelihood of an effect, effects can be direct or indirect; primary or secondary; cumulative; transboundary; short-term, medium-term or long-term; permanent or temporary; and beneficial or adverse.

9.4.6 Difficulties and Uncertainties

The reconnaissance survey involved walking through and around the Site to gather visual information concerning elements such as slope, rock outcrop, ground conditions, types of watercourses, drainage pathways and the presence or absence of springs or groundwater seepages. No ground investigation was undertaken as part of the visit. As a result, information is limited to detail that can be gathered from a visual

survey of this kind. Uncertainties may arise as a result of preceding weather; e.g. very wet conditions may cause over-estimation of the watercourse nature or ground conditions that would be considered 'normal' for this area.

The information gathered has been combined with information derived from surveys to map peat depths, as well as details from other disciplines such as vegetation and archaeological surveys, and photography to give as full a picture of conditions within the Application Boundary as possible. All reasonable attempts were made to ensure that good coverage of the Site was included. However, it is possible from the type of surveys undertaken that some information was not collected.

The number of visits undertaken and professional experience ensures that difficulties and uncertainties are unlikely to have had any effect on the assessment or its conclusions.

9.5 Baseline

9.5.1 Meteorology and Climate

The Proposed Development is located 5km south-east of Connel and approximately 7km east of Oban in the ABC area and is situated within the UK Meteorological (Met) Office's Western Scotland Climate District. Much of western Scotland is exposed to strong, rain-bearing westerly winds, particularly in areas along the west coast.

The Western Scotland Climate District is generally milder and wetter than the east due to the prevailing south-westerly, moisture-bearing North Atlantic winds. Temperatures for the district are variable and depend on factors such as topography and distance from the coast. Mean annual temperatures for the district range between 8.0 to 9.9°C[3].

9.5.1.1 Rainfall

Dunstaffnage Climate Monitoring Station[4] is situated approximately 6.5km north-west of the Proposed Development. Rainfall patterns at the Proposed Development are likely to be similar to those observed at Dunstaffnage.

Average annual rainfall from 1991-2020 for the Dunstaffnage monitoring station was 1,727.89 millimetres (mm) compared to 1,818.14mm for the Western Scotland Climate District. The altitude at Dunstaffnage monitoring station is 3m above Ordnance Datum (AOD).

Chart 9.1 shows the average monthly rainfall distribution for the Dunstaffnage monitoring station and, to compare, the Western Scotland Climate District for the period 1991-2020.

[3] Met Office (2016). Western Scotland: climate. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/western-scotland_-climate---met-office.pdf, accessed September 2024.

[4] Met Office (2022). UK climate averages, Dunstaffnage. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gfh1hk7v1, accessed September 2024.

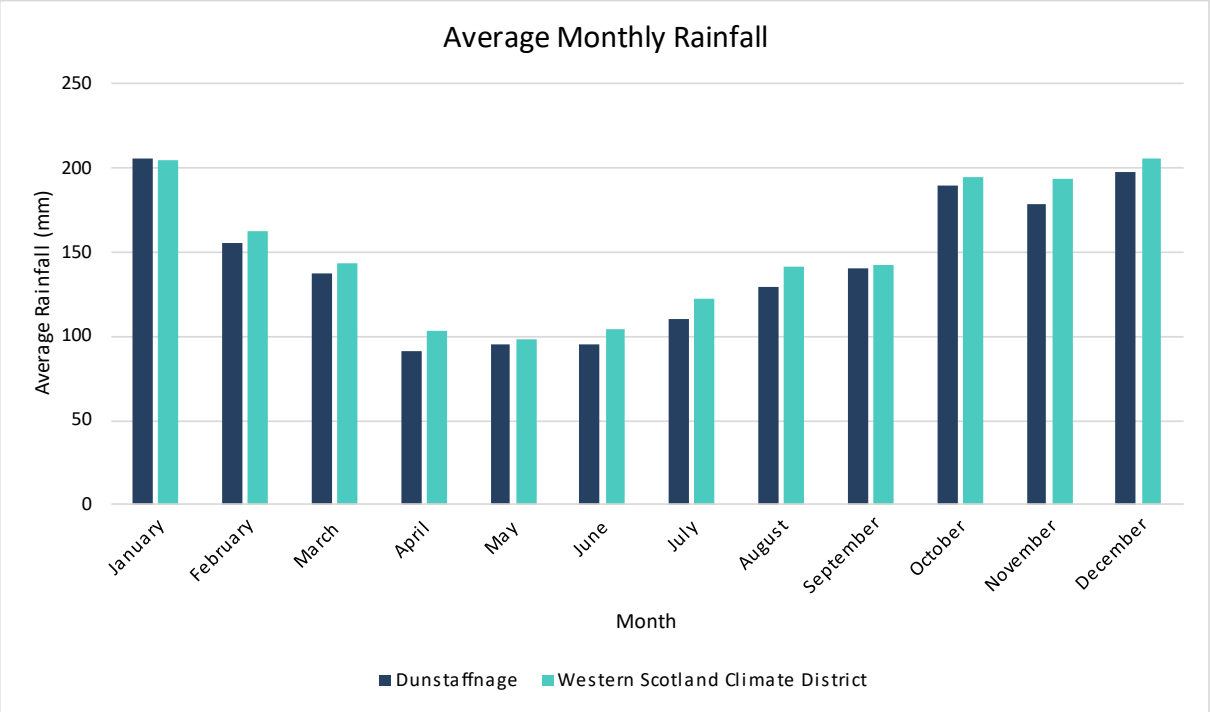

CHART 9.1: MONTHLY RAINFALL AVERAGES FOR DUNSTAFFNAGE MONITORING STATION AND WESTERN SCOTLAND CLIMATE DISTRICT FROM 1991-2020.

9.5.2 Geology

Geological information is derived from the BGS GeoIndex[5] online geological mapping at a 1:50,000 scale and the BGS Lexicon of Named Rock Units[6]. Geological mapping is shown in **Figures 9.2** and **9.3**.

9.5.2.1 Bedrock Geology

The Site is situated on bedrock of the Lorn Plateau Volcanic formation, mainly comprising extrusive basalts and andesites, of late Silurian to early Devonian age.

Some north-east to south-west trending microdiorite and appinitic diorite dykes are present within the Site, which form part of the North Britain Siluro-Devonian Calc-Alkaline Dyke Suite. Some lenses of tuff and agglomerate of the Lorn Plateau Volcanic Formation are found in the far west of the Site.

There is one minor displacement fault trending north-east to south-west, in the south-west of the Site.

9.5.2.2 Mineral Extraction

The Coal Authority[7] and BGS GeoIndex show no records of active or historic mining within the Application Boundary. However, six records were identified within 2km and are listed in **Table 9.5**.

[5] BGS (2024). GeoIndex Online Geological Mapping, British Geological Survey. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed September 2024.
[6] BGS (2024). BGS Lexicon of Named Rock Units. Available at: https://www.bgs.ac.uk/technologies/the-bgs-lexicon-of-named-rock-units/, accessed September 2024.
[7] Coal Authority (2024). The Coal Authority Map Viewer. Available at: https://datamine-cauk.hub.arcgis.com/, accessed September 2024.

TABLE 9.5: FORMER QUARRIES NEAR THE PROPOSED DEVELOPMENT

REFERENCE NO.	NAME	COMMODITY	STATUS	DISTANCE & DIRECTION FROM THE APPLICATION BOUNDARY
214327	Auchnacloich Plantation	Unknown	Ceased	1.9km north-west of Site entrance
214326	Fearnoch Wood	Unknown	Ceased	0.6km west of Site entrance
214336	Fearnoch Forest	Unknown	Ceased	0.3km west of Site access
155464	Fearnoch	Unknown	Ceased	1.0km east of Site entrance
214354	Barguillean Farm	Unknown	Ceased	1.7km south-east of Site access
214350	Creag an Taghain	Unknown	Ceased	1.7km south-east of Site access

9.5.2.3 Superficial Geology

There is very little mapped superficial geology within the Application Boundary. BGS GeoIndex identifies some small areas of peat north of turbine T5 and the construction compound, as well as to the north-west of watercourse crossing WC6.

No areas of artificial ground are identified within the Application Boundary.

9.5.3 Soils and Peat

The Soil Survey of Scotland[8] digital soils mapping indicates that the soil coverage within the Application Boundary is predominantly peaty gleys and peaty gleyed podzols of the Sourhope Association. Peaty gleys are described as poorly drained acidic soils which support wet heathland and rough grassland communities.

Areas of brown earth soil and a small area of humus-iron podzols with peaty gleys are present along the upper section of the access track. Further details on soils within the Application Boundary are provided in **Table 9.6**.

TABLE 9.6: SOIL TYPES WITHIN THE APPLICATION BOUNDARY

SOIL ASSOC.	PARENT MATERIAL	COMPONENT SOILS	LANDFORMS	VEGETATION	AREA %
Sourhope	Drifts derived from Old Red Sandstone intermediate lavas	Peaty gleys with dystrophic blanket peat with peaty gleyed podzols	Terraced hills with gentle and strong slopes: moderately rocky	Bog and northern bog heather moor blanket. Atlantic and Boreal heather moor.	94.48%
Sourhope	Drifts derived from Old Red Sandstone intermediate lavas	Brown earths	Lowlands and hill sides with gentle to very steep slopes: moderately rocky	Acid bent-fescue grassland. Dry Atlantic heather moor. Broadleaved Woodland	4.22%

[8] Scottish Government (2024). The National Soil Map of Scotland. Available at: https://map.environment.gov.scot/Soil_maps/?layer=1#, accessed September 2024.

SOIL ASSOC.	PARENT MATERIAL	COMPONENT SOILS	LANDFORMS	VEGETATION	AREA %
Strichen	Drifts derived from arenaceous schists and strongly metamorphosed argillaceous schists of the Dalradian Series	Humus-iron podzols with peaty gleys	Hummocky valley moraines	Acid bent-fescue grassland. Permanent pastures. Rush Pastures and sedge mires.	1.27%
Strichen	Drifts derived from arenaceous schists and strongly metamorphosed argillaceous schists of the Dalradian Series	Peaty gleyed podzols with peaty gleys with dystrophic semi-confined peat	Hummocky valley and slope moraines	Atlantic and Boreal heather moor Heath-rush – fescue grassland. Rush pastures and sedge mires.	0.03%

NatureScot's Carbon and Peatland Map[9] classifies soils into five carbon classes, as well as three classes for mineral soils, non-soil or unknown. The map was consulted to understand where the carbon-rich soils, deep peat and priority peatland habitat are located within the Application Boundary.

The map indicates that much of the Site is underlain by Class 2 peatland, considered to be nationally important carbon-rich soils, deep peat and priority peatland habitat. Smaller areas of Class 5 peatland, described as carbon-rich soils and deep peat, are present near the south and south-western parts of the Site and underly the majority of the Site access.

A section of Class 0 is present underlying the northern end of the Site access. Class 0 is described as mineral soils where peatland habitats are not typically found.

Details of each peatland class and the associated areas are provided in **Table 9.7**. Soils and peat coverage is shown in **Figure 9.4**.

TABLE 9.7: CARBON AND PEATLAND CLASSES PRESENT WITHIN THE APPLICATION BOUNDARY

PEATLAND CLASS	DESCRIPTION	AREA %
Class 0	Mineral soil - Peatland habitats are not typically found on such soils.	5.47%
Class 2	Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas of potentially high conservation value and restoration potential.	75.88%
Class 5	Soil information takes precedence over vegetation data. No peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat.	18.65%

A Phase 1 peat depth surveying covering the Site was undertaken by WRc in late February and early March 2022. A Phase 2 survey was undertaken by WRc in November 2023 and supplementary Phase 2 surveys were undertaken in February, May and June 2024. The survey results were used to inform the infrastructure design to minimise incursion into areas of deep peat.

[9] NatureScot (2016). Carbon and Peatland Map. Available at: https://map.environment.gov.scot/Soil_maps/?layer=10, accessed September 2024.

The peat depth surveys indicate that the majority of the Site has no peat. Pockets of peat and deep peat are scattered throughout the Site and are generally associated with the hollows between the many small hills which characterise the Site.

Further details of peat depth and peat depth variation are provided in **Technical Appendix 9.1** and **9.2**. An overview map of the peat depth distribution within the Proposed Development is shown in **Figure 9.5**.

9.5.4 Topography

The Site is characterised by upland moor with irregular and undulating landforms. The highest point within the Site is the summit of Cruach Clenamacrie at 273m AOD. The wider area is characterised by similarly undulating areas of relatively high ground, notably Deadh Choimhead to the south at 383m AOD.

While most of the hill slopes within the Site are relatively gentle, steeper areas are present, notably along the south and south-east of the Application Boundary. Generally, the main Site area slopes northwards from higher ground in the west and south-east. The Site is located in the headwaters areas of the River Lonan, Allt Nathais and Lusragan Burn, meaning that there are a number of small watercourses scattered throughout the Proposed Development.

The Site access runs through an area of commercial forestry managed by Forestry and Land Scotland. The Site access drops from approximately 190m AOD in the west to 30m AOD at the Site entrance, which is the lowest area within the Application Boundary.

9.5.5 Hydrogeology

The bedrock unit at the Site is classed as a low productivity aquifer of unnamed extrusive Silurian to Devonian rocks[10]. According to the BGS GeoIndex small amounts of groundwater are present in the near-surface weathered zone and flow is virtually all through fractures and discontinuities. Additionally, where springs are present, there can be a flow rate of up to 2 litres per second [11].

Regional groundwater flow will tend to mimic natural topography. As the Site is located on high ground, drainage is directed to north, east, south and west from different parts of the Site, although the majority of the site drains north and north-west.

The superficial deposits within the Site are limited and, where present, are predominantly peat. Peat bodies will hold some groundwater, but drainage is impeded and poor. Flow within peat is known to be extremely slow, although it can contribute some limited baseflow to local watercourses.

9.5.5.1 Groundwater Vulnerability

Groundwater vulnerability is ‘the tendency and likelihood for general contaminants to move vertically through the unsaturated zone and reach the water table after introduction at the ground surface’[12].

Groundwater vulnerability classes range from 1, “only vulnerable to conservative pollutants in the long term when continuously and widely discharged/leached”, to 5, “vulnerable to most pollutants, with rapid impact in many scenarios”[13].

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[10] BGS (2024). GeoIndex Online Geological Mapping, British Geological Survey. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed September 2024.
[11] *ibid*
[12] Dochartaigh, B., Doce, D., Rutter, H. and MacDonald, A. (2011). British Geological Survey, User Guide: Groundwater Vulnerability (Scotland) GIS dataset, Version 2. http://nora.nerc.ac.uk/id/eprint/17084/1/OR11064.pdf, accessed September 2024.
[13] *Ibid*.

The majority of the Site has groundwater with an assigned value class of 5. Small areas of land to the north-east of turbine T5 and watercourse crossing WC6 are assigned a value class of 4a, defined as 'vulnerable to those pollutants not readily adsorbed or transformed'.

9.5.5.2 Groundwater-Dependent Terrestrial Ecosystems

GWDTE are defined by the United Kingdom Technical Advisory Group (UKTAG) as:

"A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations or substances (and potentially pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body"[14].

In line with the guidance provided in UKTAG[15], a dual approach to identifying GWDTE has been used. This involves detailed study of vegetation communities to determine the potential level of groundwater dependency, combined with detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is able, therefore, to provide a source of water to associated habitats.

A habitat mapping exercise was completed as part of the ecology baseline assessment, which was used to identify potential GWDTE within the Application Boundary. The results of the habitat mapping exercise are discussed in **EIA Report Chapter 10: Ecology** and shown in **Figure 10.1.3**.

GWDTE have been assessed separately. Details are provided in **Appendix 9.3**.

Within the Site, potentially groundwater-dependent NVC communities identified are:

- M4 *Carex rostrata-Sphagnum recurvum* mire
- M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire
- M10 *Carex dioica-Pinguicula vulgaris* mire
- M11 *Carex demissa-Saxifraga aizoides* mire
- M15 *Scirpus cespitosus-Erica tetralix* wet heath
- M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture
- M25 *Molinia caerulea-Potentilla erecta* mire
- M29 *Hypericum elodes-Potamogeton polygonifolius* soakway
- W4 *Betula pubescens-Molinia caerulea* woodland

NVC Communities identified by SEPA as being potentially highly or moderately groundwater-dependent, depending on the hydrogeological setting, are listed in SEPA's publication 'Planning guidance on onshore windfarm developments'[16]. M9, M10, M11, M23, M29 and W4 have potentially high groundwater dependency in Scottish situations. M15 has potentially moderate groundwater dependency and M25 has potentially low groundwater dependency in Scottish situations, dependent on the hydrogeological setting. M4 is classified as having moderate groundwater dependency by UKTAG but is not classified by SEPA.

[14] UKTAG (2004). Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems. UK Technical Advisory Group on the Water Framework Directive. Available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf, accessed September 2024.
[15] Ibid.
[16] SEPA (2017). Planning guidance on onshore windfarm developments. Scottish Environment Protection Agency, Land Use Planning System Guidance Note 4 (LUPS-GU4). Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf, accessed September 2024.

9.5.6 Hydrology

Catchment data have been derived from the Flood Estimation Handbook Web Service[17].

The Proposed Development is situated across three catchment areas: Lusragan Burn, River Lonan and Allt Nathais. The majority of the Site is located within the Allt Nathais catchment, while smaller sections of the Site are within the Lusragan Burn catchment in the north-west and the River Lonan catchment in the south-west. Catchment areas are shown in **Figure 9.6**.

The catchment wetness index (PROPWET) is the proportion of time that soils in a catchment are wet (i.e. when soil moisture deficits are less than 6mm). For all catchments PROPWET is 0.79, indicating that soils in the Site are wet for 79% of the time. The area has a baseflow index (BFI HOST 19) of between 0.31 and 0.39, indicating a low input of groundwater baseflow to surface watercourses. The standard percentage runoff (SPR HOST) is 50-53%, indicating the percentage of rainfall on-Site which is converted into surface runoff from rainfall events. this represents a relatively high runoff risk where soils have limited capacity to store rainfall and/or slow infiltration rate and will quickly saturate, leading to rapid runoff.

Catchment statistics for the three main catchments within the Application Boundary are provided in **Table 9.8**.

TABLE 9.8: CATCHMENT STATISTICS

CATCHMENT NAME	PROPWET	BFI HOST19	SPR HOST	AREA %
Lusragan Burn	0.79	0.31	52.13	16.14
River Lonan	0.79	0.39	53.82	19.23
Allt Nathais	0.79	0.39	50.14	64.63

9.5.7 Watercourses

Watercourses within the Application Boundary appear to be mainly natural or in near-natural condition, with generally high levels of sinuosity, defined as having lots of river meanders.

Key watercourses within the catchment are shown in **Figure 9.6**.

9.5.7.1 Allt Nathais Catchment

The Allt Nathais catchment has a total area of 18.5km^2 and drains 64.63% of the land within the Application Boundary.

The Allt Nathais is the smallest of the three catchments but drains the largest area within the Application Boundary, including turbines T3, T4, T5 and T6, the construction compound area, substation and Site access. This catchment contains three of the eight watercourses located within the Application Boundary. These watercourses all combine to form the Eas nan Meirleach, a tributary to the Allt Nathais. The Allt Nathais flows directly into Loch Etive approximately 1.2km north of the Application Boundary.

An additional unnamed watercourse, which runs parallel to the south-eastern margin of the Application Boundary, forms a tributary to the Allt na Seabhaig. The Allt na Seabhaig is also a tributary to the Allt Nathais.

[17] CEH (2024). Flood Estimation Handbook Web Service. Centre for Ecology and Hydrology. Available at: https://fehweb.ceh.ac.uk/ (subscription service), accessed September 2024.

9.5.7.2 River Lonan Catchment

The River Lonan Catchment has a total area of 20.7km^2 and drains 19.23% of the land within the Application Boundary.

The River Lonan catchment drains the south and south-west of the Site. Three of the watercourses near the western end of the site named Allt Fròg ach, Allt Oishnean and an unnamed tributary drain this area and flow south-west towards to the River Lonan.

The River Lonan then flows west into Loch Nell approximately 2.9km south-west of the Application Boundary.

9.5.7.3 Lusragan Burn Catchment

The Lusragan Burn Catchment has a total area of 21.8km^2 and drains 16.14% of the land within the Application Boundary.

The Lusragan Burn catchment drains the north-west of the Site. The remaining unnamed watercourse is a tributary, located just north of Cruach Clenamacrie, which flows northwards into the Allt an t-Sean-achaidh and onwards into the Black Lochs. The outflow from the Black Lochs via the Lusragan Burn eventually reaches the sea at Connel, just upstream of the Falls of Lora, approximately 4.5km north-west of the Application Boundary.

9.5.8 Water Quality

9.5.8.1 Surface Waterbodies

SEPA's Water Classification and Water Environment Hubs[18] [19] have been consulted to determine the existing baseline water quality for the main watercourses and waterbodies within the Application Boundary. Details are summarised in **Table 9.9**.

TABLE 9.9: SURFACE WATER QUALITY STATUS

WATERBODY NAME AND ID	STATUS		PRESSURES
Feochan Mhor/River Nell (u/s Loch Nell) (called River Lonan on OS mapping) ID: 10303	Condition in 2020	Overall: Moderate Water flows & levels: Moderate Physical condition: Good Water quality: Good	Water storage and abstraction for hydroelectricity generation
	Classification in 2022	Overall: Moderate Biology (fish): High Hydromorphology: Moderate	
Lusragan Burn/Black Lochs ID: 10305	Condition in 2020	Overall: High Water flows & levels: High Physical condition: High Water quality: High	None

[18] SEPA (2022), Water Classification Hub. Available at: https://informatics.sepa.org.uk/WaterClassificationHub/ , accessed September 2024.
[19] SEPA (2021). Water Environment Hub. Available at: https://informatics.sepa.org.uk/RBMP3/, accessed September 2024.

WATERBODY NAME AND ID	STATUS		PRESSURES
	Classification in 2022	Overall: High Biology (fish): High Hydromorphology: High	
Allt Nathais **ID: 10306**	Condition in 2020	Overall: Moderate Water flows & levels: Good Physical condition: Moderate Water quality: High	Modifications to bed, banks and shores from farming
	Classifiction in 2022	Overall: Moderate Biology (fish): High Hydromorphology: Moderate	

9.5.8.2 Groundwater

SEPA's Water Environment Hub[20] has been consulted to determine the existing baseline water quality for the groundwater body associated with the Site. Overall status, chemical status and water quality of the Oban and Kintyre waterbody (ID: 150698) have all been classified as 'Good' in the latest available records from 2020.

9.5.8.3 Receiving Waterbodies

SEPA's Water Environment and Water Classification Hubs[21] [22] have also been consulted to determine the existing baseline water quality for the Site's receiving waterbodies. The details are summarised in **Table 9.10**. The River Lonan drains west into Loch Nell. The Lusragan Burn and Allt Nathais drain north into Loch Etive.

TABLE 9.10: SUMMARY OF RECEIVING WATERBODY QUALITY STATUS

WATERBODY NAME AND ID	STATUS		PRESSURES
Loch Nell **ID: 100246**	Condition in 2020	Overall: Good Water flows & levels: High Physical condition: High Water quality: Good	None
	Classification in 2022	Overall: Good Biology (fish): High Hydromorphology: High	

[20] ibid.
[21] SEPA (2021). Water Environment Hub. Available at: https://informatics.sepa.org.uk/RBMP3/, accessed September 2024.
[22] SEPA (2022), Water Classification Hub. Available at: https://informatics.sepa.org.uk/WaterClassificationHub/, accessed September 2024.

WATERBODY NAME AND ID	STATUS		PRESSURES
Loch Etive ID: 200073	Condition in 2020	Overall: Good Water flows & levels: no data Physical condition: High Water quality: High	None
	Classification in 2022	Overall: Good Biology (fish): Good Hydromorphology: High	

9.5.9 Water Resources

No wells or springs are identified on OS mapping within the Site or within 2km of the Application Boundary. BGS GeoIndex[23] identifies two boreholes to the north of the A85.

Data obtained from ABC regarding PWS indicates that there are no PWS present within the Application Boundary, however 19 have been identified within 2km of the Application Boundary. Details of PWS identified are provided in **Table 9.11** and are shown in **Figure 9.7**.

TABLE 9.11: PWS WITHIN OR NEAR THE APPLICATION BOUNDARY

ID	SUPPLY NAME	SOURCE LOCATION	SOURCE TYPE	DISTANCE TO APPLICATION BOUNDARY	LINKAGE
1	Eltham Cottages	NM 9813 3229	Groundwater - Spring	0.7km E	None – located upslope
2	Achnacloich House	NM 9500 3155	Surface - Watercourse	0.7km N	Potential – located downstream of turbines T3 and T5.
3	Fearnoch Village Supply	NM 9630 3223	Surface - Watercourse	0.8km W	None – located upslope
4	Dailnamac	NM 9830 3230	Surface - Watercourse	0.9km E	None – located upslope
5	Muckairn House	NM 9780 3340	Surface - Watercourse	1km NE	None – located in a different catchment
6	Glenmachrie	NM 9224 2847	Groundwater - Spring	1.1km SW	None – located in a different sub-catchment
7	Balindoer	NM 9850 3050	Surface - Watercourse	1.2km E	None – located in a different sub-catchment

[23] BGS (2024). GeoIndex Online Geological Mapping, British Geological Survey. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed September 2024.

ID	SUPPLY NAME	SOURCE LOCATION	SOURCE TYPE	DISTANCE TO APPLICATION BOUNDARY	LINKAGE
8	Balindoer No 2	NM 9850 3050	Groundwater - Spring	1.2km E	None – located in a different sub-catchment
9	Achnameadhonach River	NM 9857 3061	Surface - Watercourse	1.3km E	None – located in a different sub-catchment
10	Gorstain Farm	NM 9838 2948	Groundwater - Spring	1.4km SE	None – located in different sub-catchment
11	Achanlochan Farm and Brenva Cottages	NM 9870 3130	Surface - Watercourse	1.4km E	None – located in a different sub-catchment
12	1 Kilvaree	NM 9210 3160	Surface - Watercourse	1.7km NW	None – located in a different sub-catchment
13	Kilvaree No 2	NM 9210 3160	Groundwater - Spring	1.7km NW	None – located in a different sub-catchment
14	Duntanachan	NM 9660 2830	Groundwater - Spring	1.7km S	None – located upstream
15	Cottage No 1	NM 9640 3390	Surface - Watercourse	1.7km NW	None – located in a different catchment
16	Bar Glas	NM 9790 2850	Surface - Watercourse	1.8km SE	None – located upstream
17	Barguillean Farm	NM 9811 2845	Groundwater - Spring	1.9km SE	None – located in a different sub-catchment
18	Rhunacairn	NM 9617 3393	Surface - Watercourse	1.9km N	None – located in a different catchment
19	Clachadubh	NM 9470 2740	Groundwater - Spring	1.9km S	None – located upstream

The source location for Achnacloich House may be incorrect as the property supplied is approximately 2.5km distant from the provided source location. A visit to the provided source location was undertaken, but no supply infrastructure was identifiable in the field. It is likely that the source is located further downstream or in an alternative catchment area from the location provided, which would reduce or remove the potential risk to the supply.

9.5.10 Flood Risk

SEPA's Indicative Flood Map[24] was consulted to gain an overview of the likelihood of flooding at the Proposed Development and the wider area.

Flood risk is shown to be minor within the Application Boundary, with some localised regions of surface water (pluvial) flood risk. These localised regions are scattered around the Site and are mainly associated with watercourses and areas of boggy ground. Most of the areas at risk have a high likelihood of flooding, defined as having a 10% chance of a flood event in a given year. Some areas have a medium likelihood, defined as having a 0.5% chance of flooding each year.

There is no risk of river or coastal flooding within the Site.

9.5.11 Designated Sites

NatureScot's SiteLink map[25] was reviewed to identify designated sites with a potential linkage to the Proposed Development.

SITE NAME	QUALIFYING FEATURES RELATING TO GEOLOGY HYDROGEOLOGY, HYDROLOGY OR PEAT	DISTANCE FROM APPLICATION BOUNDARY	LINKAGE
Loch Etive Woods Special Area of Conservation (SAC)	Alder woodland on floodplains	80m from access; 0m from main Site	Yes, located downstream of proposed Site and access
Claish Dhearg Site of Special Scientific Interest (SSSI)	Oligotrophic lochs, open water transition fen	0m	Yes, located downstream of proposed Site and access

9.6 Likely Significant Effects

9.6.1 Construction

9.6.1.1 Proposed Development Characteristics

The construction phase would involve several different elements. **EIA Report Chapter 5: Project Description** describes the Proposed Development elements in detail. The elements with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- physical changes to overland drainage and surface water flows;
- water contamination from particulates and suspended solids;
- water contamination from fuels, oils, concrete and suspended solids;
- changes in or contamination of water supply to vulnerable receptors;
- increased flood risk;
- modification to groundwater flow paths;
- soil erosion and compaction; and

[24] SEPA (2024) Online Indicative Flood Map. Available at: https://map.sepa.org.uk/floodmaps, accessed September 2024.
[25] NatureScot (2024). SiteLink Map. Available at: https://sitelink.nature.scot/map, accessed September 2024.

- peat instability.

During operation, activities with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- surface water drainage, including treatment and discharge of surface drainage;
- maintenance of tracks and trackside drainage;
- long-term drainage around permanent infrastructure; and
- additional extraction and processing of rock for necessary maintenance.

The elements to be assessed are the same as for the construction phase.

9.6.1.2 Physical Changes to Overland Drainage and Surface Water Flows

Changes to overland drainage patterns would arise principally from construction of the Site access and internal access track network with subsidiary effects from construction of the turbine foundations, crane hardstandings and ancillary infrastructure.

The new access tracks would require installation of trackside drainage and cross-drains to protect the tracks from water damage. Modifications to the existing access track would require relocation of some trackside drainage, where track widening is required, and additional cross-drains may be necessary. Constructed drains would be no longer and deeper than necessary to provide the required track drainage. Cross-drains would be installed at an appropriate frequency to minimise concentration of flows from the catchment areas above the track, to minimise changes to the hydrological regime. All drainage infrastructure would be designed with suitable capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change, as per SEPA guidance.

All long-term and temporary drainage infrastructure would be established on a running basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. Where possible, trackside drainage would be laid up to 100m ahead of track construction works on a running basis.

A number of watercourses would be crossed by the access track. Seven crossings of regulated watercourses have been identified and details are provided in **Appendix 9.4**. Two of these crossings would require upgrading of an existing structure, while five crossings would be new structures.

All crossings would be designed with sufficient capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change. All necessary permissions for watercourse crossing works would be obtained prior to commencement of associated works.

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **likely**.

The effect of physical changes to overland drainage from construction works is assessed as **minor**, long-term, adverse and **not significant**.

9.6.1.3 Water Contamination from Particulates and Suspended Solids

All work at the Proposed Development involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies. Surface water from the areas surrounding the turbine bases, all hardstanding areas (including crane pads, substation, construction compounds and laydown areas) and borrow pits would be prevented

from entering the working areas by appropriate use of peripheral bunding and cut-off drains. These would help to divert clean water around and away from the working areas.

During excavation works for turbine foundations, cut sections of track, cut areas for hardstandings and borrow pits, silt fencing or appropriate alternative sediment control protection would be installed on the downslope side of the excavation to prevent inadvertent discharge of silty water into any watercourse within the Application Boundary. Pre-construction installation of long-term drainage would provide an additional level of sediment control.

All engineering work adjacent to watercourses, including track construction and installation of watercourse crossings, would have appropriate sediment control measures established prior to any ground works. Vegetation would be retained along watercourse banks to act as additional protection.

There are seven main watercourse crossings required for the Proposed Development. Of these, WC6 and WC7, may require in-stream works to extend or replace the existing circular culverts depending on the structural assessment of the existing crossings. Should in-stream works be required, they would make use of a temporary dam upstream of the crossing, with over-pumping of water if necessary, to allow replacement or modification of in-stream infrastructure while minimising the risk of sediment contamination of the water.

For areas of larger excavation, such as turbine bases and crane pads or borrow pit excavations, temporary water control measures may be used. These may include use of temporary settlement ponds or the use of proprietary treatment systems such as Siltbusters, as appropriate.

Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20m of a watercourse or within areas of identified deeper peat, to minimise mobilisation of sediment in heavy rainfall. The following 'stop' conditions are recommended to guide construction activity (**Table 9.12**).

Monitoring of rainfall for 'stop' conditions would require access to a suitable local source of data, such as the Met Office's monitoring station at Dunstaffnage, to allow identification of these conditions being exceeded in order to allow appropriate action to be taken.

Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

Vegetation cover would be re-established as quickly as possible on track verges and cut slopes, by re-laying of excavated peat acrotelm (the vegetated upper layer of peat), to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered, if necessary, in specific areas and areas of particular sensitivity.

TABLE 9.12: RECOMMENDED 'STOP' CONDITIONS FOR EARTH MOVING ACTIVITIES[26]

'STOP' RULE	REQUIREMENTS
High intensity rainfall	Rainfall during construction greater than 10mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25mm
7-day cumulative rainfall (1)	Preceding 7 days of rainfall greater than 50% of the monthly average
7-day cumulative rainfall (2)	Preceding 7 days of rainfall greater than 50mm

All necessary permissions relating to construction works, plus accompanying pollution prevention plans, would be obtained prior to any construction work commencing within the Application Boundary. All the

[26] CH2M & Fairhurst (2018). Outline Peat Management Plan, Appendix 10.6, A9 Dualing – Dalwhinnie to Crubenmore, DMRB Stage 3 Environmental Impact Assessment. Available at: https://www.transport.gov.scot/media/41104/appendix-a106-outline-peat-management-plan.pdf, accessed September 2024.

management and control measures, including emergency response procedures, would be set out in a Construction Environmental Management Plan (CEMP), produced by the appointed Contractor prior to any works commencing. This would be a live document and would be updated as required throughout construction.

A water quality monitoring programme would be established at key locations around the Proposed Development. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in **Table 9.13.**

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described above, the magnitude of effect is considered to be **slight**. The likelihood of the effect is considered to be **likely**.

The effect of particulates and suspended solids from construction works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.1.4 Water Contamination from Fuels, Oils or Foul Drainage

Spillage of fuels, oils, wet concrete or concrete washout water could have an adverse effect on surface water quality, and major spillages could have a potential influence on all three catchments (Lusragan Burn, River Lonan and Allt Nathais).

Oil and fuel storage handling within the Site would be undertaken following published guidance, in particular Guidance on Pollution Prevention – Above ground oil storage tanks: GPP 2[27] and in compliance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 and the Water Environment (Miscellaneous) (Scotland) Regulations 2017. The details would be contained in the CEMP and are summarised as follows:

- Risk assessments would be undertaken by the principal Contractor and all hazardous substances and non-hazardous pollutants that would be used and/or stored within the Site would be identified. Hazardous substances likely to be within the Site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used within the Site. Herbicides would not be used.
- All deliveries of oils and fuels would be supervised by the Site manager or nominated deputy.
- All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater.
- Any valve, filter, sight gauge, vent pie or other ancillary equipment would be located within the containment area.
- Waste oil would not be stored within the Site but would be removed to dedicated storage or disposal facilities.
- Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.
- Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.
- Refuelling and servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants. This area would have a self-contained drainage system fully separated from the main drainage system within the compound.

[27] NetRegs (2021). Above ground oil storage tanks. Available at: https://www.netregs.org.uk/media/1890/guidance-for-pollution-prevention-2-2022-update.pdf, accessed September 2024.

- Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.
- The access track would be designed and constructed to promote good visibility, where possible, and two-way access where visibility is restricted, to minimise risk of vehicle collisions.

It is anticipated that Site welfare facilities would be located at the construction compound and would use one of the following:

- a suitably sized holding tank with waste water removed from the Proposed Development by tanker for disposal at a licensed disposal facility, in line with construction phase proposals;
- a waste treatment package plant with associated discharge would be installed as a longer-term alternative; or
- waterless composting toilet facilities with bottled water provided for washing and drinking.

All relevant water environment authorisations would be put in place should there be any requirement for these.

Spillage and emergency procedures would form part of the CEMP and would be prominently displayed at the Site, and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses, by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available on-Site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sandbags would also be readily available for use to prevent spread of spillages and create dams if appropriate;
- where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the Site by a licensed waste carrier to a suitable landfill facility;
- the emergency contact telephone number of a specialist oil pollution control company would be displayed within the Site; and
- sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Site.

SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident, in line with SEPA's requirements.

A water quality monitoring programme would be established at key locations around the Proposed Development. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in **Table 9.13**.

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of effect is considered to be **moderate**. The likelihood of effect is considered to be **unlikely**.

The effect of water contamination from fuels, oils, concrete batching or foul drainage from construction works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.1.5 Changes in or Contamination of Water Supply to Vulnerable Receptors

Vulnerable receptors that have the potential to be affected by the Proposed Development works have been identified. These include PWS and potential GWDTE (**Figure 9.7**; **Table 9.11**). Each vulnerable receptor is considered in more detail below.

9.6.1.5.1 PWS

Nineteen PWS have been identified that have potential to be at risk from the Proposed Development, defined as being within 2km of the Application Boundary. These are detailed in **Table 9.11**.

One of the PWS identified has potential linkage due to its location downstream of the Proposed Development. The indicated PWS source for Achnacloich House is downstream of the following infrastructure: turbines T3, T4, T5 and T6; watercourse crossings WC1, WC2, WC3, WC4 and WC5; the construction compound; substation, and all associated access tracks. The source location is indicated to be 0.7m downstream of the Application Boundary and 1.3km from the nearest proposed infrastructure, WC3.

It is likely that this source has been mis-located as there was no visible infrastructure apparent during a site visit to the location and the property supplied is 2.5 km distant. It has not been possible to confirm with the property owners where the source location is; however, it is likely that the source is actually further downstream or abstracts from a different watercourse.

It is recommended that contact is made with the property owners prior to construction in order to determine the location of their supply source, and for this to be confirmed on the ground.

However, additional protection measures are recommended in case this PWS does abstract from the Eas nam Meirleach at this or a different point. These would include:

- Use of additional silt fencing between excavation works and the watercourse channel for all works within 50m of the Eas nam Meirleach and its tributaries;
- Use of bottomless crossing structures, such as arch culverts or bottomless box culverts, for all new watercourse crossing structures within the main Site area (WC1-5 inclusive);
- Visual monitoring of the watercourses immediately downstream of works within 50m of the watercourse bank, at least twice daily (before works begin and immediately after works finish) including a photographic record;
- In-situ testing for turbidity at the same time as the visual checks.

The distance from the proposed works and the protection measures would reduce the potential for any effect to a minimal level, and it is not anticipated that there would be any detectable effects on the PWS.

Full details of the required monitoring would be provided within the pollution prevention plan for the Proposed Development.

PWS are considered to be of **very high** sensitivity. The magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **unlikely**.

The effect of changes in or contamination of water supply to vulnerable receptors from construction works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.1.5.2 GWDTE

A detailed assessment of the interactions between the Proposed Development and potential GWDTE has been undertaken. Nine potentially groundwater-dependent NVC habitats have been identified within the Site: M4 mire, M15 wet heath and M25 mire have potentially moderate groundwater dependency, and M9 mire, M10 mire, M11 mire, M23 rush-pasture, M29 soakway and W4 woodland have potentially high groundwater dependency in Scottish situations, dependent on hydrological setting. Although some of the

NVC communities identified are relatively small in extent, they are of high conservation importance and, therefore, measures should be taken to mitigate habitat loss and/or disruption where possible.

The potentially groundwater-dependent habitats are widely distributed around the Site making it impossible to avoid them in places. Some areas of identified habitat types are located within 100m of excavations less than 1m in depth and/or within 250m of excavations deeper than 1m.

The potentially groundwater-dependent habitats have been assessed specifically within the context of the Proposed Development, considering the local bedrock and superficial geology, peat distribution and local observations. No groundwater discharges were identified at any location within the Site. The superficial deposits, consisting mainly of peat, would largely act to insulate the groundwater in the bedrock from the ground surface, effectively preventing groundwater discharge at surface. The bedrock is noted to have very limited groundwater potential and no indications of groundwater at surface were apparent during any of the Site surveys.

It is determined, as a result of the above, that none of the nine potentially groundwater-dependent communities identified within the Site are actually groundwater-dependent, but are likely to rely on a mix of surface water, shallow throughflow in surface vegetation and rainwater.

Details of the full GWDTE assessment are provided in **Appendix 9.3**.

The potential GWDTE within the Site are considered to of **high** sensitivity as a result of the conservation importance of the habitats. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **likely**.

The effect of changes in or contamination to water supply to GWDTE from construction works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.1.5.3 Designated Sites

Two designated sites have been identified as having a hydrological linkage to the Proposed Development, the Clais Dhearg SSSI and Loch Etive Woods SAC. Both sites are adjacent to the Application Boundary.

Precautions would be taken during construction to ensure that any potentially contaminating materials would not be permitted to enter any project area watercourses. All works that have the potential to affect the Loch Etive Woods SAC or Clais Dhearg SSSI would be supervised by the ECoW, and additional levels of protection would be installed if advised by the ECoW during site works. The sediment management, pollution prevention measures and spillage and emergency procedures set out in **Sections 9.6.1.3** and **9.6.1.4** would also be applied and would form protective measures for the two designated sites.

Dust suppression sprays would be used as required in dry weather. Water monitoring locations at key points downstream of proposed works would be included in the Proposed Development's water quality monitoring programme.

Designated sites with hydrological linkage are considered to be of **very high** sensitivity as a result of their conservation importance. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation,** the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **possible.**

The effect of changes in or contamination of water supply to designated sites from construction works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.1.6 Increased Flood Risk

The Proposed Development infrastructure is not at risk of flooding from any source. However, there is a requirement to prevent exacerbation of flood risk to any areas downstream of the Site.

The drainage installed around long-term infrastructure would be designed to minimise concentration of flows. This would be achieved by the implementation of embedded mitigation measures in line with best practice, including:

- use of cut-off drains to divert runoff around necessary 'hard' infrastructure such as turbine bases and hardstanding areas;
- use of regular cross-drains underneath access tracks. These would be installed in line with natural terrain, making use of low points where runoff would naturally be focused. Cross-drains under existing tracks would be maintained;
- use of a slight gradient on installed 'hard' infrastructure to encourage drainage into a filter drain or swale, for infiltration into vegetated areas and as shallow through-flow;
- long-term drainage would be installed ahead of related construction works or excavations taking place, to ensure that drainage can be controlled appropriately. For tracks, the required trackside drainage would be put in place ahead of access track construction, on a rolling basis as the track development progresses; and
- any areas which must be left unvegetated during the construction phase, such as turbine foundations, hardstanding areas and borrow pits, would have settlement ponds put in place to attenuate flow until vegetation can be re-established at the end of the construction period.

With the appropriate mitigation measures in place, runoff during construction of the Proposed Development would not be greater than natural pre-development runoff. Further details are provided in **Appendix 9.4**.

The receptors, infrastructure and property downstream of the Proposed Development, are considered to be of **very high** sensitivity. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of any increased flood risk is considered to be **negligible**. The likelihood of effect is considered to be **unlikely**.

The effect of increase in flood risk resulting from the construction works is assessed as **negligible** and **not significant**.

9.6.1.7 Modification to Groundwater Flow Paths

Physical changes to the shallow subsurface as a result of all excavation works have the potential to interrupt shallow groundwater flow paths. This would include cut-and-fill track sections, turbine foundations, hardstanding areas, substation, laydown area, construction compounds and cable trenches.

Physical changes to the deeper subsurface (>5m below ground surface) have potential to interrupt deeper groundwater flow paths, where these are present. This would include borrow pit excavations and potentially some turbine foundations.

The bedrock within the Site is noted to be a low productivity aquifer. There is likely to be some limited groundwater flow via weathered zones and fracture networks within the bedrock. Superficial deposits are noted to be predominantly peat which would store some groundwater but contribute very little to groundwater flow.

Groundwater monitoring boreholes would be established within the borrow pit areas prior to any construction work beginning, to a depth at least 1m below the deepest expected excavation. Groundwater level monitoring would be undertaken by the Contractor to determine whether groundwater is present within the proposed borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit areas would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

Excavation of cable trenches could lead to groundwater flow between catchments if the trenches act as preferential flow paths. This can be avoided by laying cables in disturbed ground adjacent to access tracks.

In areas where cable routes cross up or down notable slopes, clay bunds or an alternative impermeable barrier would be placed for every 0.5m change in elevation along the length of the trench to minimise in-trench groundwater flow.

The groundwater receptor is considered to be of **moderate** sensitivity. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **likely**.

The effect of modification to groundwater flow paths from construction works is assessed as **minor**, long-term, adverse and **not significant**.

9.6.1.8 Soil Erosion and Compaction

Proposed construction activity, particularly plant and vehicle movements, soil stripping and stockpiling, would affect the nature of the soils within the Site. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport and stockpiling of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation.

All traffic routes would be clearly demarcated, and vehicles would not be permitted access outwith these areas. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground. Where possible, existing tracks have been incorporated into the Proposed Development, and use of these would help to keep additional soil disturbance to a minimum.

Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstriped ground adjacent to the specific working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging.

The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design and use of floating road construction on areas of deeper peat.

Limited smoothing or 'blading' of stockpiled soils and catotelmic peat would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Bunds on notably sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. Stockpiles would be located on flat or nearly flat ground where possible.

Excavated soil and peat would be used for restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the Proposed Development. Some of the excavated peat would be reserved for peatland restoration in parts of the Site. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turves and to retain the soil structure.

The receptor, soils and peat within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described above and in **Section 9.7 Mitigation**, the magnitude of effect is considered to be **slight**. The likelihood is considered to be **likely**.

The effect of soil erosion and compaction from construction works is considered to be **minor**, temporary, adverse and **not significant**.

9.6.1.9 Peat Instability

Construction activity on peat can affect the natural stability of the peat deposits in areas near to or associated with construction works. Particular risk areas are associated with works at or near breaks-in-slope, areas where natural peat instability has been recorded, and locations where the peat has degraded through, for example, erosion processes, drying out or overgrazing.

A detailed PSRA has been undertaken for the Proposed Development and is provided in **Appendix 9.1**. The key effects assessment findings are provided below.

The PSRA found that the majority of the Site has a negligible or low risk of natural or induced peat landslide. Seven areas were identified as potentially having moderate or high risk of peat instability. These areas were appraised in greater detail, taking into account location-specific details including information gathered from site surveys. Mitigation measures have been recommended to control peat landslide hazard. For these areas, the peat landslide hazard can be controlled by use of good construction practice and micrositing.

The receptors for peat landslide hazard are the peat soil, peatland habitat, the water environment including surface water and groundwater, Proposed Development infrastructure and construction personnel.

The peat soil, peatland habitat, water environment and Proposed Development infrastructure receptors are considered to be of **high** sensitivity. Construction personnel are considered to be a **very high** sensitivity receptor.

With appropriate design constraints and mitigation measures in place, as described in **Appendix 9.1**, the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **unlikely**.

For all receptors, the effect of peat instability is assessed as **minor**, long-term, adverse and **not significant**.

9.6.2 Operation

During operation, activities with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- surface water drainage, including treatment and discharge of surface runoff;
- maintenance of tracks and trackside drainage;
- long-term drainage around permanent infrastructure; and
- additional extraction and processing of rock for necessary maintenance.

The elements assessed are as follows:

- physical changes to overland drainage and surface water flows;
- water contamination from particulates and suspended solids;
- water contamination from fuels, oils, concrete and suspended solids;
- changes in or contamination of water supply to vulnerable receptors;
- increased flood risk;
- modification to groundwater flow paths;
- soil erosion and compaction; and
- peat instability.

9.6.2.1 Physical Changes to Overland Drainage and Surface Water Flows

No additional changes to overland drainage and surface water flows are anticipated during the operational phase of the Proposed Development. Trackside and infrastructure drainage would remain in place during operation. A monitoring and maintenance programme would be put in place for the drainage infrastructure, to include regular visual inspection of drainage ditches, crossing structures and cross-drains to check for blockages, debris or damage that might impede water flow. Any identified blockage, including build-up of sediment that may lead to future blockage, or damage to structures would be remediated immediately. Where practicable, routine maintenance would be undertaken during dry weather; where this is not practicable, additional sediment control measures may need to be established to manage silty water arising from the work.

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **negligible**. The likelihood of effect is considered to be **unlikely**.

The effect of physical changes to overland drainage from operational works is assessed as **negligible** and **not significant**.

9.6.2.2 Water Contamination from Particulates and Suspended Solids

The main operational phase work of the Proposed Development would involve track and hardstanding maintenance and repair. Regular monitoring of the track and hardstanding condition would be undertaken, particularly following periods of heavy or prolonged rainfall and after snowfall and clearance, if relevant. Any sections of the track showing signs of excessive wear would be repaired as necessary with suitable rock from on-Site borrow pits or external sources.

The drainage network would also be subject to regular monitoring to ensure that it remains fully operational, as water build-up can cause considerable damage to unbound track construction.

All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. These splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **slight**. The likelihood of effect is considered to be **possible**.

The effect of water contamination from particulates or suspended solids from operational works is assessed as **minor**, temporary, adverse and **not significant**.

9.6.2.3 Water Contamination from Fuels, Oils or Foul Drainage

The risk of water contamination from fuels or oils is considerably lower during operation of the Proposed Development than during construction, as there are significantly decreased levels of activity on-Site. The majority of potential pollutants would no longer be present on-Site. Lubricants for turbine gearboxes, transformer oils and maintenance vehicle fuels would remain present in small quantities. There are no plans for herbicide use during operation; physical cutting of vegetation would be the preferred form of management, where required.

The pollution prevention plan and spillage and emergency procedures, as set out above, would remain in force throughout the operational phase of the Proposed Development. There would be no concrete batching on-Site during operation.

It is anticipated that welfare facilities would be located at the substation control building and would use one of: a suitably sized holding tank; a waste treatment package plant; or waterless composting toilet facilities, as discussed in **Section 9..6.1.4: Water Contamination from Fuels, Oils or Foul Drainage.**

All relevant water environmental authorisations would be put in place should there be any requirement for these.

The receptor, surface watercourses within the Application Boundary, is considered to be of **high** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **negligible**. The likelihood of effect is considered to be **unlikely**.

The effect of water contamination from fuels or oils from operational works is assessed as **negligible** and **not significant**.

9.6.2.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

Only minor works would take place within the Site during the operational phase, to allow necessary maintenance activities to be undertaken. Additional works affecting PWS, GWDTE and designated sites would be of very minor scale.

PWS and designated sites are considered to be of **very high** sensitivity.

The potential GWDTE identified are considered to be of **high** sensitivity.

With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **negligible**. The likelihood of effect is considered to be **unlikely**.

The effect of changes in or contamination of water supply to vulnerable receptors is assessed as **negligible** and **not significant**.

9.6.2.5 Increased Flood Risk

Infrastructure drainage would remain in place during the operational phase. A regular monitoring and maintenance programme for all drainage infrastructure would be implemented to ensure that it remains fully operational and in good condition. Where practicable, routine maintenance would be undertaken during dry weather, to help ensure that drainage operation during wet weather is fully functional.

Post-development runoff would be designed such that there is no change from natural pre-development runoff.

The receptors, infrastructure and property downstream of the Proposed Development, are considered to be of **very high** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **negligible**. The likelihood of effect is considered to be **unlikely**.

The effect of increase in flood risk resulting from operational works is assessed as **negligible** and **not significant**.

9.6.2.6 Modification to Groundwater Flow Paths

There would be a minor ongoing requirement for additional rock extraction at the borrow pit sites during operation, for track and hardstanding maintenance. These operations would be very limited in nature.

The groundwater receptor is considered to be of **moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **negligible**. The likelihood of effect is assessed as **possible**.

The effect of modification to groundwater flow paths from operational works is assessed as **negligible** and **not significant**.

9.6.2.7 Soil Erosion and Compaction

There are no soil stripping or stockpiling activities planned for the operational phase of the Proposed Development.

Ongoing monitoring and maintenance work at the Proposed Development would require vehicle activity on-Site. This would be much reduced from the construction phase and would mostly involve significantly lighter vehicles than the heavy construction plant. The ongoing vehicle activity would have some effect on soil and peat compaction below access tracks, although at a significantly lower level than during construction.

The receptor, soils and peat within the Application Boundary, is considered to be of **high** sensitivity. The magnitude of effect is considered to be **negligible**. The likelihood of effect is considered to be **possible**.

The effect of soil erosion and compaction from operational works is considered to be **negligible** and **not significant**.

9.6.2.8 Peat Instability

No changes to the proposed infrastructure are anticipated during the operational phase of works.

The peat soil, peatland habitat, water environment and Proposed Development infrastructure receptors are considered to be of **high** sensitivity. Operation personnel are considered to be a **very high** sensitivity receptor.

With appropriate design constraints and mitigation measures in place, as described in **Technical Appendix 9.1**, the magnitude of effect is considered to be **no change**. The likelihood of effect is considered to be **unlikely**.

For all receptors, the effect of peat instability is assessed as **no change** and **not significant**.

9.6.3 Decommissioning

Potential effects of decommissioning the Proposed Development would be similar to those encountered in the construction phase, although generally with lower magnitude as the level of activity at the Proposed Development would be lower.

Discussions would be held with the Applicant and the appropriate regulatory authorities prior to decommissioning to agree an appropriate decommissioning strategy.

9.7 Mitigation

The importance of geology, hydrogeology, hydrology and peat has been recognised throughout the Proposed Development design process. Key features that have had an influence on design are:

- peatland and peat depth;
- watercourses and waterbodies;
- potential GWDTE;
- PWS; and
- designated sites.

This section provides a detailed summary of the mitigation that would be adopted for the Proposed Development.

9.7.1 Mitigation by Design

All excavation works requiring removal of bedrock or superficial deposits have been kept to a practical minimum by good site design.

Careful and informed infrastructure design forms a key measure for prevention of induced instability in peat. The collated peat depth information has been used to inform the proposed infrastructure layout throughout the design process. Incursion into areas of deeper peat has been kept to a practical minimum by careful design and would be further reduced by local micrositing, in order to minimise disruption to peatland ecosystems and hydrology, and to avoid the risk of induced peat instability. Where incursion into deeper peat has been required along the Site Access, floating road construction has been proposed.

Access tracks are anticipated to be constructed using established cut-and-fill and floating road construction methods. Any peat present along the route would be excavated and stored for use in reinstatement of elements of project infrastructure where appropriate.

9.7.2 Mitigation Commitments

9.7.2.1 Soil and Peat

Soil stripping would be undertaken by the Contractor with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate bunds for separate soil types in order to preserve the soil quality.

For work within areas of peat, acrotelmic peat (the uppermost 0.5m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging.

The underlying catotelmic peat would be stored in bunds up to 1m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Areas proposed for peat stockpiles are shown in **Figure 9.2.1**. Excavation of catotelmic peat has been limited by careful infrastructure design and use of floating road construction on an area of deeper peat.

Limited smoothing or ‘blading’ of stockpiled soils and catotelmic peat would be undertaken by the principal Contractor to help shed rainwater and prevent ponding of water on the stockpile. Bunds on notably sloping ground would have sediment control measures installed near the base, on the downslope side to collect and retain any sediment mobilised by rainfall. Stockpiles would be located on flat or nearly flat ground where possible.

Excavated soil and peat would be used in reinstatement and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase. Some of the excavated peat would be reserved for peatland restoration in areas to the north of the Site. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turves and to retain the soil structure.

Construction work would make use of the current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and

maintained at all stages of the Proposed Development and developed as part of the post-consent detailed design works, and would be updated as new information becomes available.

Micrositing would be used to avoid possible problem areas identified during ground investigation or other detailed design works. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows.

Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20m of a watercourse or within areas of identified deep peat. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works.

Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered if necessary, in specific areas.

During construction, members of the construction staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice should any peat landslide indicators be identified.

Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected.

9.7.2.2 Surface Watercourses and Groundwater

Silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into, or towards, any watercourse within the Application Boundary. Additional measures such as cut-off drains, filter drains and bunds would be installed to capture overland runoff and divert water into treatment systems.

All engineering works adjacent to watercourses, including access tracks and watercourse crossing structures, would have appropriate sediment control measures established prior to any groundworks.

Vegetation would be retained along watercourse banks to act as additional protection to the watercourses.

Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details would be agreed with SEPA, but are anticipated to include at least the following:

- visual checks for entrained sediment; and
- in-situ measurements of pH, temperature and specific conductivity.

In-situ measurement of turbidity and dissolved oxygen may be recommended by SEPA or the ECoW for locations with particular sensitivity, such as upstream of PWS intakes or designated sites, if relevant.

Pre-construction monitoring would be undertaken by the Contractor on a monthly basis for a minimum period of three months prior to any work taking place.

During construction, the monitoring would be undertaken by the ECoW or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations upstream of the Proposed Development are intended to help differentiate between incidents arising from, and those unrelated to, the Proposed Development. It has only been possible to select one control location for the Proposed Development (WQM5) as the Site is located in the headwaters of the River Lonan, Allt Nathais and Lusragan Burn, meaning that there are limited water quality monitoring points upstream of the Proposed Development.

Recommended frequency of monitoring for the different locations are provided in **Table 9.13**. Proposed monitoring locations are shown in **Figure 9.8**.

TABLE 9.13: PROPOSED WATER QUALITY MONITORING LOCATIONS AND RECOMMENDED MONITORING FREQUENCY

ID	LOCATION	GRID REFERENCE	MONITORING SCHEDULE
WQM1	Eas na Làraich Mòire, just south of the site entrance	NM 9729 3234	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at borrow pit BP2 and on the Site access between the Site entrance and watercourse crossing WC7; otherwise, monthly
WQM2	Allt an Taillir, approx. 2km south of the Site entrance	NM 9725 3034	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at borrow pit BP1 and on the Site access between BP2 and watercourse crossing WC6; otherwise, monthly
WQM3	Unnamed tributary to Eas nam Meirleach, north of turbine T5	NM 9487 3059	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at the compound area, the substation, turbines T6 and T5, and associated access tracks; otherwise, monthly
WQM4	Eas nam Meirleach, north of track to turbine T3	NM 9458 3061	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at turbine T4 and T3 and associated access tracks; otherwise, monthly
WQM5 (control)	Unnamed tributary to Eas nam Meirleach, east of turbine T4	NM 9458 2977	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at turbine T4 and T3 and associated access tracks; otherwise, monthly
WQM6	Unnamed tributary to Allt an t-Sean-achaidh, north of access track to turbines T1 and T2	NM 9359 3023	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at turbine T1 and associated access tracks; otherwise, monthly
WQM7	Allt Fròga ch, south-west of turbine T2	NM 9327 2904	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work at turbine T2 and associated access tracks; otherwise, monthly

Groundwater monitoring boreholes would be established by the Contractor within the two proposed borrow pit areas prior to any construction work commencing, to a depth at least 1m below the deepest expected excavation. Groundwater level monitoring would be undertaken by the Contractor to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within a borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

All works through and adjacent to wetland areas would be supervised by the ECoW.

9.7.2.3 Drainage Infrastructure

Trackside drainage would be no longer or deeper than necessary to provide the required track drainage.

Cross-drains under tracks would be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows.

All drainage infrastructure would be designed with a capacity suitable for a rainfall intensity of a 1-in-200-year storm event plus allowance for climate change.

Where track sections cross wetland or bog areas, cross-drainage would be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely spaced drainage pipes, or both as appropriate. These would be determined on a case-by-case basis to suit each individual area.

All required licences for watercourse crossings and construction works would be in place prior to construction commencing.

All long-term and temporary drainage infrastructure would be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. Where possible, trackside drainage would be laid up to 100m ahead of track construction works on a running basis.

Temporary water control measures would be implemented as necessary adjacent to larger areas of excavation. These would include borrow pit sites and may also include turbine base excavations and hardstanding areas. These measures would take the form of temporary settlement ponds, filter drains or proprietary treatment measures such as Siltbusters. Detail would be provided within the Pollution Prevention Plan(s) prepared for the Construction Runoff Permit and suitability would be determined following appropriate on-Site soil tests.

All earthmoving activity would be restricted during periods of wet weather, particularly for work occurring within 20m of a watercourse, to minimise mobilisation of sediment in heavy rainfall. The ‘stop’ conditions provided in **Table 9.12** are recommended to guide all earthmoving activity at all stages of the Proposed Development.

Long-term drainage infrastructure would have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow. Remediation would be undertaken immediately by the Contractor. Routine maintenance would be scheduled where possible for dry weather.

9.7.2.4 Excavations

Any water collecting within excavations would be pumped out prior to further work within the excavation. The water is likely to require treatment to remove suspended solids prior to discharge to ground.

Cable trenches would be laid in disturbed trackside material. In areas where cable routes cross up or down steep slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5m change in elevation along the length of the trench to minimise in-trench groundwater flow.

Vegetation cover would be re-established as quickly as possible on all areas of stripped ground, once activity involving these areas is complete. This would include track verges, screening bunds, cut slopes and much of the Site during decommissioning and restoration works. Where possible this would be achieved using excavated peat acrotelm. Additional measures including hydroseeding and/or use of a biodegradable geotextile would be considered if insufficient peat turf is available and for areas of particular sensitivity that require immediate protection.

Rock testing would be undertaken by the Contractor on appropriate samples from the borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to

determine likely degradation patterns during the lifespan of the Proposed Development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

Any unused or remaining unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and capped with soil or turf to promote re-establishment of natural vegetation cover.

9.7.2.5 Proposed Development Traffic

Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

Tracks and hardstanding areas would be monitored on a regular basis by the Contractor, particularly following periods of heavy or prolonged rainfall or after snow clearance. Any sections of track or hardstanding showing signs of excessive wear would be repaired as necessary with suitable rock from the borrow pits or external sources.

The bridge structures at watercourse crossings would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourses from vehicle movements. The splash controls would be monitored regularly by the Contractor to ensure they remain effective and have not become damaged in any way.

Routine monitoring checks of project infrastructure, including track and hardstanding surfaces and all drainage infrastructure, would be undertaken by the Contractor on a quarterly basis throughout project operation. Monitoring would involve visiting all aspects of the infrastructure and undertaking a visual inspection to identify the following:

- areas where track surfaces or hardstanding areas were showing evidence of erosion or surface damage;
- any areas where surface water was ponding or collecting on tracks or hardstanding areas; and
- any areas where drainage infrastructure was damaged, blocked or inadequate.

Any areas of track or hardstanding surface showing signs of damage, erosion or excessive wear would be repaired as necessary. Drainage features would be repaired, reinstated or replaced as necessary to ensure continued efficient operation.

Site-specific mitigation, including track drainage segregation to avoid ‘flushing’ from excavation works, and micrositing to avoid specific higher sensitivity areas, would be identified and established where appropriate.

All traffic routes would be clearly demarcated, and vehicles would not be permitted access outwith these areas.

9.7.2.6 Pollution Prevention

Oil and fuel storage and handling on-Site would be undertaken by the Contractor in compliance with SEPA’s Guidance for Pollution Prevention – Above ground oil storage tanks (GPP 2[28]) and with the Water Environment (Controlled Activities) (Scotland) Regulations 2011[29].

Risk assessments would be undertaken by the Contractor and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored within the Site would be identified. Hazardous

28 NetRegs (2021). Above ground oil storage tanks. Available at: https://www.netregs.org.uk/media/1890/guidance-for-pollution-prevention-2-2022-update.pdf, accessed September 2024.
29 Scottish Government (2011). The Water Environment (Controlled Activities) (Scotland) Regulations. Available at: https://www.legislation.gov.uk/ssi/2011/209/contents, accessed September 2024.

substances likely to be within the Site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used within the Site.

All deliveries of oils and fuels would be supervised by the Contractor.

All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater.

Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area.

Waste oil would not be stored within the Application Boundary but would be removed to dedicated storage or disposal facilities.

Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.

Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.

Refuelling and servicing would be undertaken by the Contractor in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants.

Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.

The access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions.

As described above in **Section 9.6.1.4: Water Contamination from Fuels, Oils or Foul Drainage**, it is anticipated that construction phase welfare facilities would be located at the construction compound and operation phase welfare facilities would be located at the substation control building, and would use one of: a suitably sized holding tank; a waste treatment package plant; or waterless composting toilet facilities. All relevant water environmental authorisations would be put in place should there be any requirement for these.

The Site Spillage and Emergency Procedures would be prominently displayed at the Site office and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available within the Site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials;
- sand bags would also be readily available for use to prevent spread of spillages and create dams if appropriate;
- where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the Site by a licensed waste carrier to a suitable landfill facility;
- the emergency contact telephone number of a specialist oil pollution control company would be displayed within the Site; and

- sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Site.

SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident and its resolution would be forwarded to SEPA no later than 14 days after the incident.

All works through and adjacent to wetland areas would be supervised by the ECoW.

9.8 Residual Effects

The above assessment is based on a Site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, to the geological, hydrogeological, hydrological and peat regime have been considered.

9.8.1 Construction

A summary of the residual effects associated with the construction phase of the Proposed Development, taking into account the embedded and additional mitigation proposed, can be found in **Table 9.14**.

TABLE 9.14: SUMMARY OF RESIDUAL EFFECTS DURING CONSTRUCTION OF THE PROPOSED DEVELOPMENT

EFFECT	ASSESSMENT CONSEQUENCE	EFFECT SIGNIFICANCE
Physical changes to overland drainage and surface water flows	Minor, long-term and adverse	Not significant
Water contamination from particulates and suspended soils	Minor, temporary and adverse	Not significant
Water contamination from fuels, oils or foul drainage	Minor, temporary and adverse	Not significant
Changes in or contamination of water supply to vulnerable receptors	Minor, temporary and adverse	Not significant
Increased flood risk	Negligible	Not significant
Modification to groundwater flow paths	Minor, long-term and adverse	Not significant
Soil erosion and compaction	Minor, temporary and adverse	Not significant
Peat instability	Minor, temporary and adverse	Not significant

9.8.2 Operation

A summary of the residual effects associated with the operation phase of the Proposed Development, taking into account the embedded and additional mitigation proposed, can be found in **Table 9.15**.

TABLE 9.15: SUMMARY OF RESIDUAL EFFECTS DURING OPERATION OF THE PROPOSED DEVELOPMENT

EFFECT	ASSESSMENT CONSEQUENCE	EFFECT SIGNIFICANCE
Physical changes to overland drainage and surface water flows	Negligible	Not significant
Water contamination from particulates and suspended soils	Minor, temporary and adverse	Not significant
Water contamination from fuels, oils or foul drainage	Negligible	Not significant
Changes in or contamination of water supply to vulnerable receptors	Negligible	Not significant
Increased flood risk	Negligible	Not significant
Modification to groundwater flow paths	Negligible	Not significant
Soil erosion and compaction	Negligible	Not significant
Peat instability	Negligible	Not significant

9.8.3 Decommissioning

Levels of activity within the Application Boundary would be similar to the construction phase, although lower. Therefore, residual effects during the decommissioning phase of the Proposed Development would be the same as or less than those related to the construction phase.

9.9 Cumulative Assessment

The potential for the Proposed Development to contribute to cumulative effects in relation to other projects within 5km was assessed. Operational projects within 5km of the Application Boundary are not considered for cumulative effects as these are already taken into consideration as part of the existing baseline. Projects at scoping stage were not considered. Proposals in scoping (or that have been screened for EIA purposes) may not proceed to application with the same design scoped and may not become applications before the Proposed Development is determined and therefore, it is unlikely that there would be any overlap between their construction and the construction stage of the Proposed Development. No projects within 5km of the Application Boundary were identified that would have the potential for cumulative effects in relation to the Proposed development.

9.10 Enhancement

Peatland restoration, habitat management and habitat enhancement proposals for the Proposed Development are discussed in detail in **Appendix 10.5** of the EIA Report. The key points with relation to peat and hydrology are summarised below.

Peat restoration would take place within the Application Boundary and would focus on blocking of natural or artificial drainage channels to encourage re-wetting and regrowth of Sphagnum species; removal of trees and tree roots; reprofiling of gully sides and replacement of vegetation; and exclusion of grazers through fencing and livestock management where required.

Due to limited opportunities for enhancement on-Site, two off-Site areas, part of the wider landholding of the Proposed Development's Landowner are also being considered for enhancement. An Option is in place

which will allow the Applicant to have control over the off-Site areas for enhancement opportunities. Enhancement measures would focus on ditch-blocking and scrub removal to improve water retention, and grazing management where required. Further information can be found in **Appendix 10.5** – **outline Habitat Management**

The peat soil, peatland habitat and water environment receptors within the Application Boundary and within the two off-Site areas are of **high** sensitivity. The magnitude of the effect is considered to be **substantial**. The likelihood of the effect is considered to be **likely**. For all receptors, the effect of enhancement activities is considered to be **major**, **beneficial** and **significant**.

9.11 Summary

This Proposed Development has been assessed in relation to the potential impacts on geology, hydrogeology, hydrology and soils during the construction, operational and decommissioning phases. Information on the Study Area was compiled using data gathered within a desk study and verified by an extensive fieldwork programme.

The assessment considered the sensitivity of the receptors, their proximity to the Application Boundary and any primary mitigation measures which have been incorporated into the Proposed Development design. Where particularly sensitive receptors were identified, additional mitigation measures were outlined. PWS, potential GWDTE and designated sites which are within, near or have hydraulic linkage to the Site have been assessed individually and appropriate mitigation measures have been set out where linkages have been identified.

A detailed programme of peat depth and condition surveying has been completed, and the results have been used to inform the design. A PSRA and Outline PMP have been produced for the Proposed Development, which show that areas of deep peat can be avoided and peat resources can be safeguarded.

A Drainage Impact Assessment has been produced for the Proposed Development which includes an Outline Drainage Strategy. Sustainable drainage systems have been proposed to ensure that the rate of runoff from the Proposed Development post-development is not greater than that prior to development. The proposed sustainable drainage systems allow water quality to be managed at source, prior to any discharge, thereby helping to prevent any reduction in water quality in watercourses downstream of the Application Boundary.

A Borrow Pit Assessment (BPA) has been produced to address the aggregate need for the Proposed Development construction and operational maintenance. The BPA considers potential landscape, visual, hydrological and hydrogeological impacts from the excavations as well as potential impacts arising from noise, dust and vibrations. Where impacts are identified, mitigation measures have been proposed.

Mitigation measures have been identified for all potential impacts, either through design process or in accordance with good practice guidance. It has been shown, as a consequence of the Proposed Development design and embedded mitigation that no significant impacts on geology, hydrogeology, hydrology and soils would arise as a result of the Proposed Development.

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