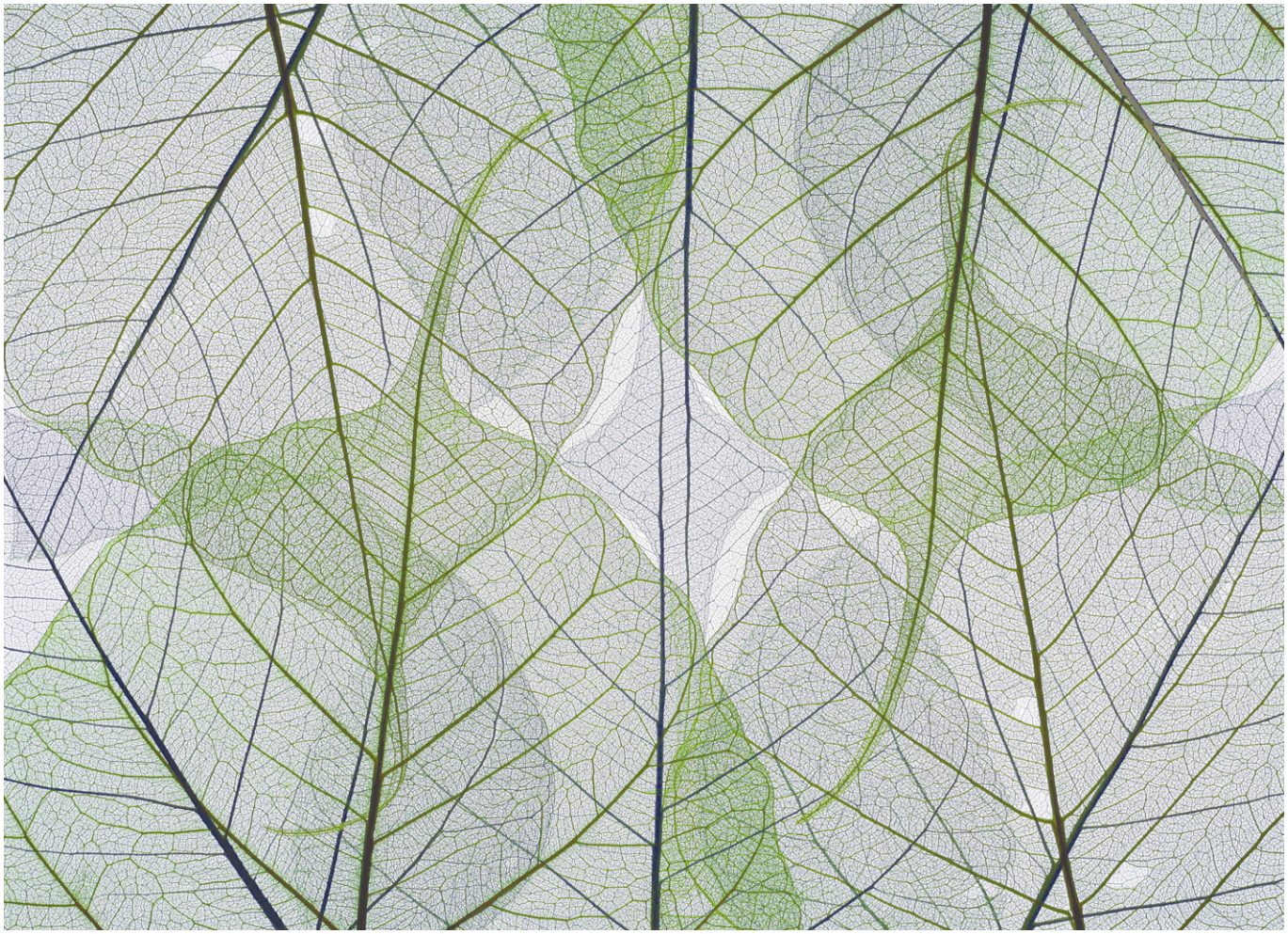

ESB Asset Development UK Limited

# Chleansaid Wind Farm: Groundwater-Dependent Terrestrial Ecosystems Assessment

Technical Appendix 10.4

655007-P10.4 (00)

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# RSK GENERAL NOTES

**Project No.:** 655007-P10.4 (00)

**Title:** Chleansaid Wind Farm: Groundwater-Dependent Terrestrial Ecosystems Assessment

**Client:** ESB Asset Development UK Limited

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| Date: | 18/03/2022 |

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**FIGURES**

# 1 INTRODUCTION

1.1 This report provides a Groundwater-Dependent Terrestrial Ecosystem (GWDTE) Assessment for the Proposed Development and associated development infrastructure.

1.2 The report forms a Technical Appendix to the Environmental Impact Assessment (EIA) Report for the Proposed Development and should be read in conjunction with this document. It has been produced in response to concerns over development in areas with, or that have potential to affect, sensitive groundwater-dependent habitats raised by NatureScot (formerly SNH) and the Scottish Environment Protection Agency (SEPA).

1.3 GWDTE are protected under the Water Framework Directive and are potentially sensitive receptors to the impacts of development. This report identifies the potentially groundwater-dependent habitats present at the site and identifies and assesses the potential impacts of the Proposed Development on these habitats. Design and mitigation methods to avoid or minimise these risks are set out, along with good construction practices that would be employed during all site works.

## Site location

1.4 The Proposed Development is located on the Dalnessie Estate, approximately 13 km to the north-east of Lairg in the Scottish Highlands, near the A836–A838 junction. The Proposed Development falls within The Highland Council (THC) area, in the North, West and Central Sutherland ward. The land is currently used as a shooting estate and for sheep grazing. Surrounding land uses include commercial forestry, sporting and recreational uses.

1.5 The turbine area covers rough moorland and rough grazing with boggy areas and is bounded to the west and south-west by commercial forestry some of which has been recently felled. The eastern side is bounded by the River Brora and the north-eastern side by the pronounced ridge of Leathad Chleansaid. The turbine area is underlain by nationally important carbon-rich soils, including areas of deep peat and some priority peatland habitat (NatureScot, 2016).

## Development proposals

1.6 The Proposed Development infrastructure would include:

- Up to 16 wind turbines, of approximately 6 MW each, 12 with a maximum tip height of 200 m and four with a maximum tip height of 180 m;
- Hardstanding areas at the base of each turbine, with a permanent area of approximately 2156 $m^2$;
- One permanent meteorological mast and hardstanding areas for up to two permanent Lidar masts;
- Total length of access tracks is 17,002 m, of which 11,121 m is new access track with associated watercourse crossings and 5,881 m is existing access track and watercourse crossings which will need to be upgraded;
- An operations control building with parking and welfare facilities;

- A substation compound;
- An energy storage facility;
- Telecommunications equipment;
- Up to four temporary construction compounds;
- Two borrow pits, to provide suitable rock for access tracks, turbine bases and hardstandings; and
- Underground cabling linking the turbines with the substation.

1.7 Full details of the Proposed Development design are provided in **Chapter 2** of the EIA Report.

## Aims

1.8 This report aims to undertake a review of relevant baseline information, including all habitat and vegetation data and hydrogeological details, in order to provide an assessment of the risk to groundwater-dependent habitats. Recommendations will be made for mitigation measures and construction methods that should be implemented to minimise the risk of disturbance or damage to sensitive habitats during construction works and ongoing development operations.

## Assessment method

1.9 This assessment has involved the following stages:

- Desk study;
- Vegetation mapping;
- Hydrogeological assessment;
- Detailed assessment of sensitive habitats;
- Identification of protection and mitigation measures.

# 2 DESK STUDY

## Information sources

2.1 The desk study involved a review of available relevant information sources on the ground conditions at the Proposed Development. Information sources included:

- Ordnance Survey topographical mapping, current and historical;
- British Geological Survey geological mapping, superficial and bedrock;
- British Geological Survey online borehole database;
- Centre for Ecology and Hydrology Flood Estimation Handbook Web Service;
- Scottish Water service records;
- Highland Council private water supplies records;
- Scotland's Soils mapping; and
- Scottish Environment Protection Agency's *A functional wetland typology for Scotland.*

## Climate and topography

2.1.1 The Proposed Development is located within the UK Meteorological (Met) Office's Northern Scotland regional climatic area. Much of northern Scotland is exposed to the rain-bearing westerly winds, particularly along the west coast. As the Proposed Development is centrally located, it is afforded some protection from the prevailing wet weather by the higher ground to the west. The highest average annual rainfall in the region occurs over the higher, west-facing slopes. The western half of the climatic region receives an average annual rainfall of at least 1,700 mm. The wettest part of the region is immediately north-west of Fort William on the west coast, which receives over 4,000 mm per year.

2.1.2 Average annual rainfall for the climate monitoring station at Altnaharra Stand Alone Weather Station (SAWS), located approximately 17 km north-north-west of the site, is 1,196 mm. Average annual rainfall for the climate monitoring station at Kinbrace, approximately 25 km north-east of the Proposed Development, is 971 mm (Met Office, 2021).

2.1.3 The turbine area lies on the south-western slope of Leathad Chleansaid, a prominent ridge extending south-east from the higher ground of Creag Riabhach na Greighe. The highest point within the turbine area is immediately south of the summit at Sròn Leathad Chleansaid, where the application boundary reaches an elevation of 335 m above Ordnance Datum (AOD). From the ridge crest, the ground slopes south-east towards the Allt nan Con-uisge and east towards the River Brora. The lowest ground is located along the Allt nan Con-uisge in the south-eastern part of the turbine area, at 195 m AOD. The access area to the west falls to an elevation of 140 m AOD when it joins the A836 adjacent to the River Tirry.

## Geology

2.1.4 Geological information is derived from the BGS GeoIndex online geological mapping and the Geological Survey of Scotland, 1:50,000 geological map series (BGS, 2000; 2004; 2021). Additional information has been derived from Johnstone & Mykura (1989) and Trewin (2002).

### Bedrock geology

2.2 The majority of the site and the immediate surrounding area is underlain by the Loch Coire Formation of the Moine Supergroup, comprising metasedimentary bedrock of Neoproterozoic age. This bedrock is made up of migmatitic psammite with migmatitic semipelite, sedimentary rocks that have undergone moderate-grade metamorphism. An intrusion of the Loch Coire Granite rocks of Ordovician age runs the extent of the north-eastern edge of the Site forming the higher ground of Leathad Chleansaid and the hills immediately north. This is a silica-rich igneous intrusion comprising foliated leucogranite that has undergone partial metamorphism and shearing.

2.3 Two small amphibolite dykes of Neoproterozoic age are located just outside the application boundary; both are small in footprint.

2.4 There are no mapped faults within the site. However, the wider region has been subject to extensive faulting, mainly by compression (thrust) faults associated with the continental collision and mountain building episode known as the Caledonian Orogeny in the Cambrian and Ordovician periods. A branch of the regionally important Naver Thrust Fault crosses the proposed access route approximately 3 km from the public road and continues to the north-west and east-south-east.

### Superficial geology

2.5 The site is mainly covered by peat deposits, with these indicated to blanket the flatter and lower-lying areas of the turbine area and much of the surrounding region.

2.6 Much of the higher ground on the top and steeper slopes of Leathad Chleansaid have no superficial deposits. Other parts of the turbine area and most of the access area are underlain by undifferentiated till and moraine deposits consisting of diamicton, sand and gravel. Diamicton is a very variable glacial sediment deposited in the Pleistocene consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand.

2.7 Alluvium is also present within the site, principally located within and adjacent to river channels. Alluvium is a mixture of clay, silt, sand and gravel deposited by a watercourse in the Holocene.

## Soils and peat

2.8 The Soil Survey of Scotland digital soils mapping shows site soils mainly consist of peat, peaty gleys and peaty podzols (James Hutton Institute, 1981). The Soil Survey mapping does not identify extensive blanket peat within the site, although blanket peat is identified adjacent to and near the turbine area to the west, north and north-east.

2.9 Three phases of peat depth surveying have been undertaken by RSK across the land within the application boundary; details are provided in Technical Appendix 10.1.

2.10 The site is underlain by nationally important carbon-rich soil, deep peat and priority peatland habitat according to the Carbon and Peatland 2016 map (NatureScot, 2016). The peat in the turbine area has been assigned carbon and peatland Classes 1 and 2. Class 1 indicates areas likely to be of high conservation value; Class 2 indicates areas of potentially high conservation value and restoration potential. Class 1 peat is located primarily in the western half of the turbine area, indicating that the peat in the western half of the turbine area is in better condition than the peat in the eastern half of the turbine area.

## Hydrogeology

2.11 The region is underlain by the Moine Supergroup low productivity aquifer, with small amounts of groundwater in the near-surface weathered zone and secondary fractures. The Loch Coire granite, in the north-eastern section of the site, is also classed as a low productivity aquifer with small amounts of groundwater in the near-surface weathered zone and secondary fractures, with rare springs (Scottish Government, 2021).

2.12 The superficial deposits covering the site have a range of potential permeabilities, and their productivity will depend on their composition and connectivity locally, with pockets of sand and gravel having high permeability and clay and silt having low permeability. Alluvial deposits may contain significant groundwater, but its value would be restricted by the small size of the deposits.

2.13 The peat bodies will also hold some groundwater, although peaty gleys are known to have poorly drained characteristics. Flow within peat is known to be extremely slow, although it can contribute some limited baseflow to local burns.

2.14 Regional groundwater flow will tend to mimic the natural topography, flowing mainly south and west towards the Allt nan Con-uisge.

2.15 No springs or seepage lines were identified within the site.

## Hydrology

2.16 The Proposed Development lies across two main watercourse catchments: the River Brora and the River Tirry catchments.

### River Brora catchment

2.17 The River Brora catchment has a total area of approximately 67.48 km$^2$ and drains 86% of the site.

2.17.1 The Allt nan Con-uisge provides the main drainage for the turbine area. It is located within the broad valley south-west of Leathad Chleansaid and drains south-east into the River Brora approximately 800 m upstream of Dalnessie. A number of minor tributaries and drainage ditches drain into the Allt nan Con-uisge from the slopes of Leathad Chleansaid and the low, poorly defined hills to the south-west of the main channel.

2.17.2 The River Brora provides the drainage for the eastern end of the turbine area, including the lower slopes of Sròn Leathad Chleansaid. The River Brora heads mainly south-east, to reach the North Sea at Brora.

### River Tirry catchment

2.17.3 The River Tirry catchment has a total area of 163.41 $km^2$ and drains 14% of the site.

2.17.4 The Abhainn Sgeamhaidh drains the northernmost part of the turbine area, around A' Chleansaid and the slopes below Creag Dhubh. It flows mainly south-west to join the River Tirry west of the A836 before it reaches Loch Shin.

2.17.5 The Fèidh Osdail provides the drainage for the access area. This watercourse drains west and joins the River Tirry near the access route junction off the A836.

2.17.6 The Brora and Tirry catchments are not entirely independent. The weir at Dalnessie and associated artificial channel provide a cross-link from the River Brora into the River Tirry catchment via the Fèidh Osdail. This was established to support the hydro-electric scheme downstream of Loch Shin during periods of high flow in the River Brora.

### Catchment statistics

2.18 The catchment wetness index (PROPWET) for the River Brora and River Tirry catchments are 0.59 and 0.70 respectively, indicating the site is wet for 59-70% of the time.

2.19 The site has a mid-low range of values for baseflow index (BFI HOST), indicative of the relatively impermeable geology with flow dominated by surface water inputs rather than a significant baseflow component.

2.20 The standard percentage runoff (SPR HOST) is 54.62-55.44%, indicating that around 55% of site rainfall is converted into surface runoff from rainfall events. This gives a comparatively high runoff risk as site soils would have a limited capacity to store rainfall and/or they have a relatively slow infiltration rate. As a result, soils with a high SPR tend to saturate quickly, leading to rapid runoff and 'flashy' watercourses that rise and fall in level quickly.

2.21 Catchment statistics are derived from the Flood Estimation Handbook Web Service (CEH, 2021).

## Private water supplies

2.22 The properties at Dalnessie make use of a groundwater abstraction via a borehole at NGR NC 6309 1524. The borehole is housed in an enclosed building with fully protected headworks.

2.23 There are no other properties within 5 km of the Proposed Development and no other private water supplies were identified by THC following an information request. It remains possible that some properties take water from the River Brora or the River Tirry downstream of the Proposed Development.

# 3 VEGETATION AND GROUNDWATER DEPENDENCY

3.1 Groundwater-dependent terrestrial ecosystems (GWDTE) are defined by the UKTAG (2004) as:

> *"A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in 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 of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body."*

3.2 In line with the guidance provided in UKTAG (2004), a dual ecological and hydrogeological approach to identifying GWDTE has been used. This involves a detailed study of vegetation communities in order to determine the potential level of groundwater dependency, combined with a detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is therefore able to provide a source of water to terrestrial ecosystems.

3.3 Determining groundwater dependency is complex as most water-dependent terrestrial ecosystems rely on a combination of groundwater, surface water and rainwater, and many vegetation communities will use whatever source of water is available. In some topographical and hydrogeological conditions, a particular ecosystem can be groundwater-dependent whereas in others the same ecosystem is surface water-dependent. Seasonal patterns of water availability influence water use, providing an additional level of complexity; groundwater reliance is typically greater in the summer when rainfall and surface water are less available (Isherwood, 2013).

### Vegetation mapping

3.4 The site vegetation has been surveyed using a combined Phase 1 habitat and National Vegetation Classification (NVC) survey method and is reported in full in **Chapter 8** Ecology with mapping provided in **Figure 8.3**. The key findings relating to groundwater dependency are summarised below.

3.5 NVC communities identified by SEPA as likely to be highly or moderately groundwater dependent, depending on the hydrogeological setting, are listed in SEPA's publication *"Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems"* (SEPA, 2017). Within the site, the potentially groundwater-dependent NVC communities identified are:

- M15 - *Scirpus cespitosus* - *Erica tetralix* wet heath;
- M23 - *Juncus effusus/acutiflorus* - *Galium palustre* rush-pasture; and
- M25 - *Molinia caerulea* - *Potentilla erecta* mire.

3.6 The list of NVC communities provided in SEPA's (2017) Appendix 4 indicates that M23 is potentially highly groundwater-dependent and M15 and M25 are potentially moderately groundwater-dependent in Scottish situations. The UKTAG updated Annex 1 (UKTAG, 2009) identifies M15 and M23 as potentially moderate and M25 as potentially low groundwater dependency in Scottish situations.

# 4 DETAILED ASSESSMENT

4.1 The study area, which consists of the application boundary and a 250 m buffer zone around this, has been reviewed to identify areas of M15, M23 and M25 habitats that require assessment.

4.2 Detailed consideration is required for sensitive habitats that lie within 100 m of access tracks which will typically have excavations less than 1 m in depth or within 250 m of excavations deeper than 1 m such as turbine foundations and borrow pits (SEPA, 2017). The combined infrastructure buffer is provided as a green dashed line in the figures provided, for reference purposes. An overview map of the site showing the areas of potentially groundwater-dependent communities is provided in **Figure 10.4.1**.

### Conceptual Site Model

4.3 SEPA (2017) identifies M15 as a community *"… likely to be … moderately groundwater dependent … depending on the hydrogeological setting"*. The updated UKTAG Annex 1 table (UKTAG, 2009) identified M15 as class 2 (moderate), where class 1 is high groundwater-dependency and class 3 is low groundwater-dependency.

4.4 SEPA (2017) identifies M23 as *"… likely to be … highly groundwater dependent … depending on the hydrogeological setting"*. The updated UKTAG Annex 1 table (UKTAG, 2009) identified M23 as class 2 (moderate) in Scottish settings.

4.5 SEPA (2017) identifies M25 as *"… likely to be … moderately groundwater dependent … depending on the hydrogeological setting"*. The updated UKTAG Annex 1 table (UKTAG, 2009) identified M25 as class 3 (low).

4.6 In this sense, M23 would be considered to be potentially more sensitive than M15, and M15 would potentially be more sensitive than M25.

*Habitats on peat*

4.7 A significant proportion of the NVC habitats within the turbine area are on areas of confirmed peat over 0.5 m in depth. As noted above, water flow through peat does occur but is very slow except in areas with peat pipes or conduits to allow focused flow.

4.8 Blanket peat, such as is present at the site, is generally considered to be ombrotrophic (JNCC, 2021) and receives all of its nutrients from rainwater. Localised flushing can occur adjacent to watercourses but is rarely extensive away from the watercourse channel. It is recognised that the peat present within the turbine area has a wide range of depths, with the south-western section of the turbine area having a more developed peat profile than the north-eastern section. However, it remains likely that the dominant water source for the entire turbine area, irrelevant of peat depth, is rainwater with shallow through-flow within the uppermost vegetated layer.

4.9 In some areas, eroded peat exposes superficial deposits below; this material is likely to be the undifferentiated till and morainic deposits or alluvium identified on BGS geological mapping. The variability in these deposits can have different effects on the vertical movement of groundwater. Finer grained clay/silt accumulations will form a barrier to groundwater flow, while sands and gravels can act as a preferential pathway for groundwater flow. Within the peat survey, it was noted that the base was predominantly

firm or hard, indicating a high presence of clay within the superficial deposits. The clay material would provide an impermeable barrier layer between the peat deposit and the bedrock, effectively preventing any existing groundwater from the bedrock from reaching the ground surface.

4.10 Bedrock at the site is classed as low productivity aquifers; it is therefore unlikely that the small amount of potential groundwater present within the bedrock is accessible to surface habitats.

4.11 It is concluded, therefore, that occurrences of M15, M23 and M25 habitats on peat preclude them from being groundwater-dependent as there is no groundwater source available to them.

*Habitats not on peat*

4.12 Some areas of M15, M23 and M25 habitats are located in areas with no identified peat, or where peat coverage is sparse and patchy. In these areas, the nature of the underlying substrate requires assessment.

4.13 Much of the remaining M15, M23 and M25 habitats away from peatland are in areas lacking superficial deposits or on superficial deposits comprising mostly diamicton till and moraine deposits, which are naturally variable materials.

4.14 The peak and hillsides of Sròn Leathad Chleansaid and along the ridge are largely without superficial deposits.

4.15 Within the site exposures of superficial deposits were rare; however, Photograph 10.4.1 shows one exposure that was identified during site surveys.

**Photograph 10.4.1: Exposed diamcton till and morainic deposits underlying surface peat, NGR NC 6164 1844. Peat in this location is approximately 1.5 m in thickness.**

4.16 No springs or seepage features were identified within the Proposed Development or immediate surroundings and no springs are indicated on topographical mapping within the surrounding 2 km buffer zone.

4.17 It is concluded that none of the habitats within the Proposed Development can truly be described as groundwater-dependent as there is no reliably available source of groundwater on which they are able to depend. They are likely to rely on a combination of rainfall and surface runoff, with some direct surface water in areas adjacent to watercourses and waterbodies.

4.18 Nevertheless, these habitats are considered to be sensitive and a level of protection is required to minimise and, if necessary, mitigate any impacts that may occur. As the areas of M15 wet heath and M25 mire are both widespread and interfingered across much of the turbine area, the assessment has treated each of the three habitat types individually but looking at the turbine area as a whole rather than trying to employ arbitrary boundaries.

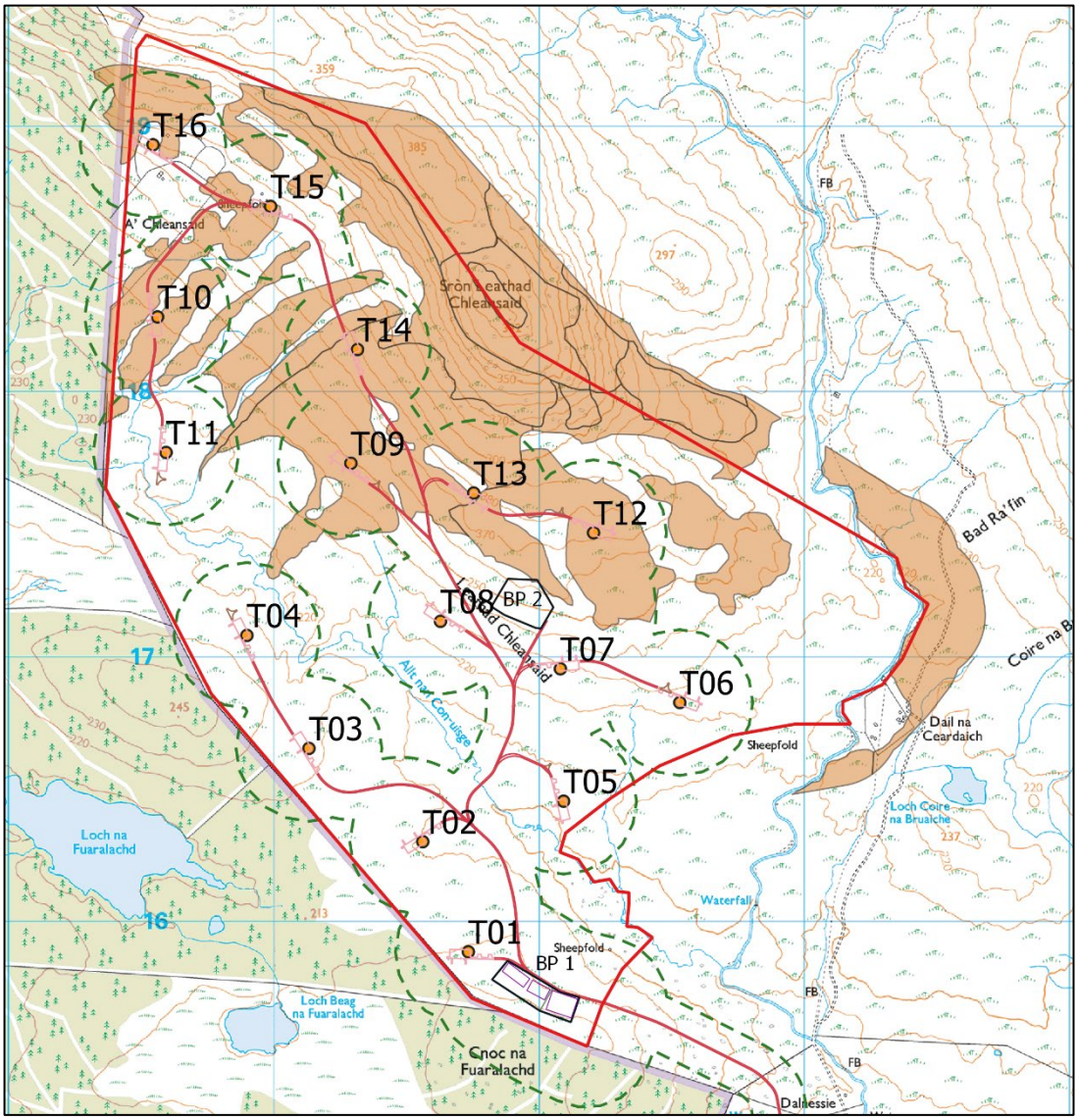
4.19 In the maps below, M15 habitat areas are coloured orange, M23 habitat areas are coloured purple and M25 habitats are coloured blue. The infrastructure buffer is shown as a green dashed line.

### M15 wet heath

4.20 The areas of M15 wet heath (Map 10.4.1) cover large sections of the turbine area, particularly the north, north-east and eastern sections, covering the ridge crest of Leathad Chleansaid and much of the south-western slope.

4.21 Turbines T9, T10, T12, T13, T14 and T15 are located on M15 habitats, with Turbine T16 bordering the northernmost habitat area. Turbine T11 is approximately 116 m from the nearest M15 habitat. The access track crosses a substantial amount of land covered in M15 habitats, and the turbine hard standings will also be constructed on the habitats.

4.22 The bedrock, forming the south-west facing slopes of Leathad Chleansaid, is Loch Coire Granite. This is a low productivity aquifer, which may have small amounts of groundwater in near-surface weathered zones and secondary fractures (BGS, 2021) although springs are rare. Due to the blanket peat covering in parts of the area, water flow would be naturally impeded. It is therefore likely that the primary source of water is rainwater with some shallow through-flow in the vegetated layer. Due to both the underlying bedrock and the presence of peat, the M15 wet heath is unlikely to be groundwater-dependent at this site.




**Map 10.4.1: Map showing the coverage of M15 habitat**

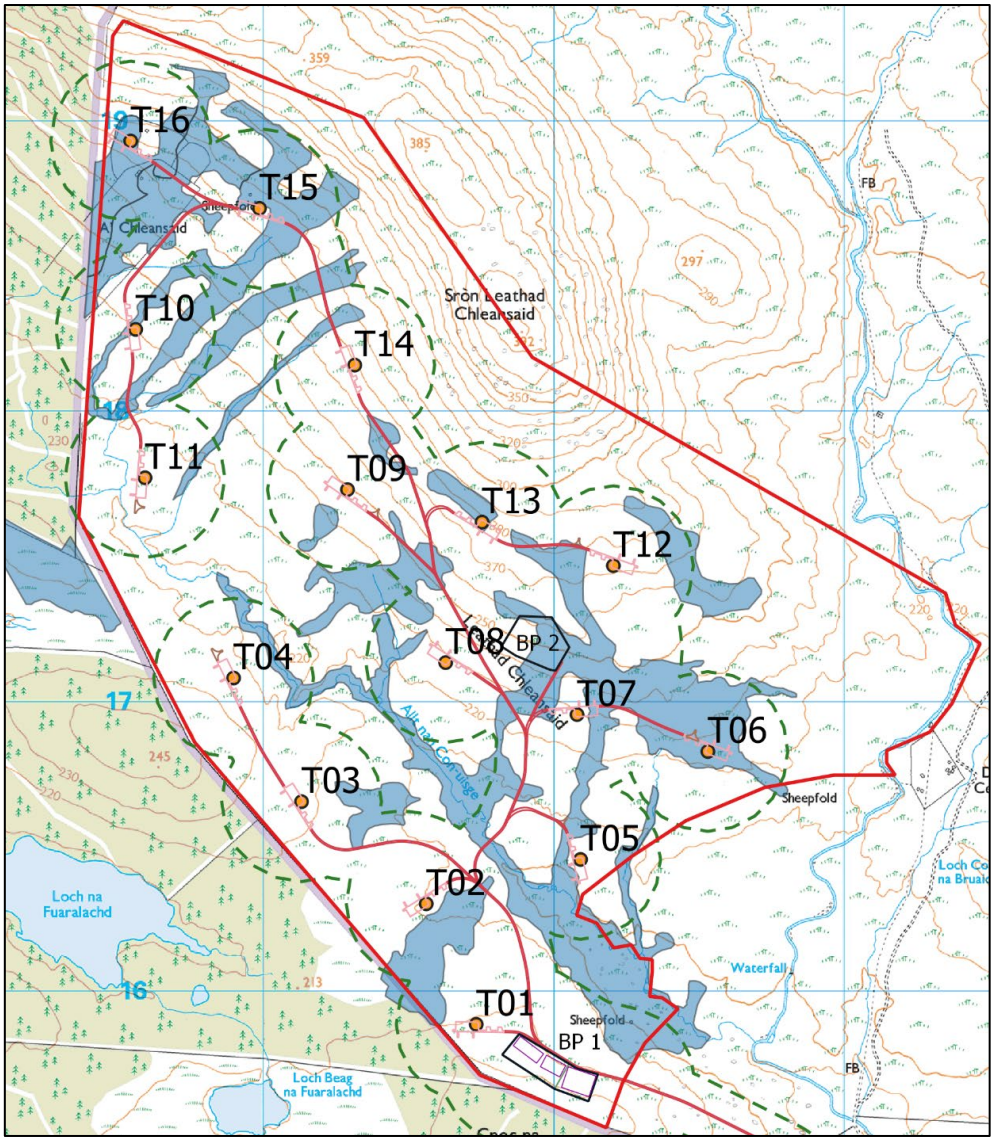
### M25 mire

4.23 This habitat is relatively complex as the M25 mire interlaces with the areas of M15 along the northern Leathad Chleansaid slopes. The M25 areas also extends further down the slope, with elongated sections alongside drainage channels and natural watercourses throughout the turbine area.

4.24 Sections of the access track will cross M25 habitat, and Turbines T6, T10, T13, T15 and T16 are located on or bordering the habitat. Turbines T1, T2, T3, T4, T5, T7, T8 and T11 are all located within the infrastructure buffer zone, as are the planned locations for the compounds.

4.25 These lower slopes around the central section of the turbine area are underlain by bedrock of the Loch Coire Formation and classed as a low productivity aquifer. As for M15 habitat, the ground cover is largely blanket peat, in some areas with depths well in excess of 3 m, therefore the M25 mire present across the slopes is unlikely to be truly

groundwater dependent. The habitat locations alongside drainage and watercourse features indicates that surface water associated with these drainage features provides a key source of water. This is likely to be supplemented by rainwater and shallow throughflow.



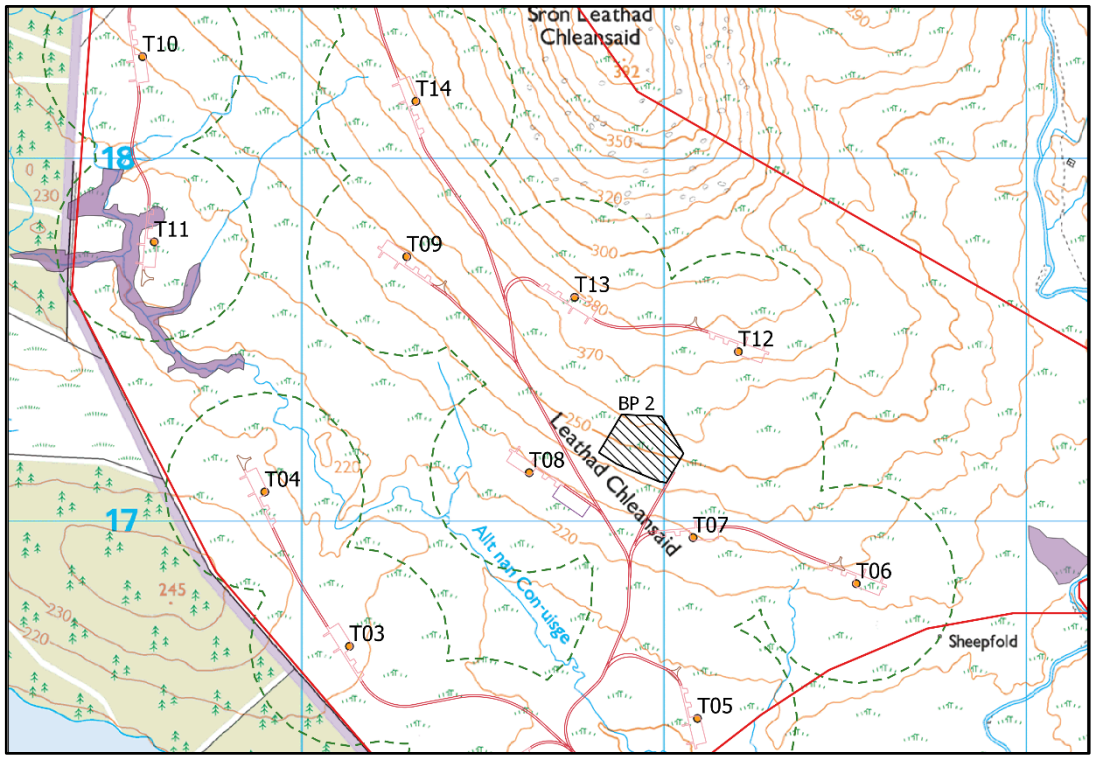

**Map 10.4.2: Map showing the coverage of M25 habitat**

### M23 rush-pasture

4.26 There are two main areas of M23 rush pasture: one located near Turbine T11, with the second just inside the site boundary to the east of Turbine T6. The habitat area near Turbine T11 is entirely associated with drainage channels forming the headwaters of the Allt nan Con-uisge. The area east of Turbine T6 is associated with boggy ground near the River Brora.

4.27 The area east of Turbine T6 lies completely outwith the infrastructure buffer and is not located downstream of any Proposed Development infrastructure. This area is considered not to require any further assessment as a result.

4.28 The M23 rush-pasture near Turbine T11 is closely associated with drainage and watercourse channels (both natural and modified or artificial). In addition, part of this area is underlain by blanket peat, notably the westernmost and southernmost areas. Its location adjacent to watercourses indicates that the most likely source of water is surface water associated with the watercourses, supplemented by rainwater and shallow through-flow.




**Map 10.4.3: Map showing the coverage of M23 habitat**

# 5 PROTECTION AND MITIGATION

## Design and mitigation

5.1 Wetland habitats are known to be sensitive to changes in their water supply, whether this is from groundwater, surface water or rainwater. With this in mind, the following good practice construction methods would be used for all development on or adjacent to wetland or bog areas:

- 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.
- Removing protective layers of soil and superficial deposits makes groundwater vulnerable to pollution from leaks or spills from vehicles or equipment used during construction. Earthworks would be kept to a practical minimum within these areas, to reduce the area of wetland affected by the construction works.
- Trackside drainage would be kept to a practical minimum and would only be installed where required to protect the track from erosion. When excavating new ditches after construction of a floating road, any intercepting ditches should be installed sufficiently far away from the road to minimise any drawdown of the water table below the road and any consequential settlement. This would ensure the load on the peat would not increase (SNH and FCS, 2010).
- All works through and adjacent to wetland areas would be supervised by the Environmental Clerk of Works (ECoW).
- Site-specific mitigation, including drainage segregation to avoid 'flushing' from excavation works, and micrositing to avoid specific higher sensitivity areas, would be identified and established where appropriate. For this development, particular care would be required for works around T11 to protect both the wetland habitat and the surface watercourses in this area.
- Water would not be discharged directly into watercourses. Additional protection, in terms of sediment traps using silt fencing, straw bales or excavated sumps, would be put in place between the water discharge location and watercourses. Sediment trap installation would be overseen by the ECoW.

## Monitoring

5.2 Targeted monitoring would be put in place to provide a check on the identified wetland areas and to ensure that mitigation and protection measures are in place and effective.

5.3 The monitoring programme would include establishment of groundwater monitoring boreholes within the two borrow pit areas to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken 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 the 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.

5.4 Surface water monitoring would be established within the existing watercourse network. Details are provided in Technical Appendix 10.5.

5.5 All areas of sensitive habitat would be visited and assessed prior to any construction work by the ECoW. Assessment would include collection of representative photographs of the areas most likely to be affected by the works. Regular assessment visits would be undertaken throughout the construction period and for a minimum of 12 months after reinstatement to ensure that habitat protection is effective and any restoration and recovery works become established.

5.6 All proposed monitoring would begin at least 6 months prior to construction work, would continue throughout the construction period and for at least 12 months following reinstatement post-construction.

# 6 CONCLUSIONS

6.1 A detailed assessment of the interaction between the proposed works for the Proposed Development and any potentially groundwater-dependent terrestrial ecosystems has been undertaken.

6.2 Three potentially groundwater-dependent NVC communities have been identified within the site: M15 wet heath, M23 rush-pasture and M25 mire. M15 wet heath has potential moderate groundwater dependency in Scottish situations. M23 has potential moderate to high groundwater dependency, M25 has potentially low to moderate groundwater dependency.

6.3 Owing to the distribution of habitats at the Proposed Development, the areas of M15 and M25 habitats have been considered as a whole rather than as smaller sub-areas within the site. One of the two areas of M23 habitat has been considered separately.

6.4 The potentially groundwater-dependent habitats have been assessed specifically within the context of the Proposed Development, taking into account the local bedrock and superficial geology, peat distribution and site observations. The superficial deposits, consisting largely of peat and clay-rich diamicton till, would act to insulate the groundwater in the bedrock from the ground surface in areas where they are present, effectively preventing groundwater discharge at surface. Areas without significant superficial deposits are confined to higher ground, where springs and seepages are unlikely as a result of the topography and lack of recharge potential.

6.5 It is determined as a result that none of the three potentially groundwater-dependent communities within the Proposed Development is actually groundwater-dependent but rely on a mix of surface water, shallow throughflow in surface vegetation and rainwater.

6.6 Impacts to wetland habitats and watercourses would be kept to a practical minimum through use of best practice construction and mitigation measures. Specific mitigation measures, to avoid changes to the watercourse hydrochemistry through ‘flushing’ of excavated material in surface runoff, have been set out and would be adhered to during all site works. Careful construction to ensure suitable continuity of flow across site tracks would help to minimise any potential impacts to the wetland habitats present within the Proposed Development.

# 7 REFERENCES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# 8 FIGURES

257000 258000 259000 260000 261000 262000 263000 264000

919000 918000 917000 916000 915000 914000

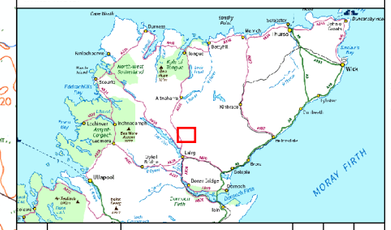
Legend:

- Proposed Turbine Locations
- Permanent Lidar Location
- Permanent Met Mast
- Turning Head
- Hardstanding
- Access Track
- Application Boundary
- Control Building and Substation Compound (100m x 75m)
- Substation Construction Compound and Battery Energy Compound (75m x 45m)
- Main Construction Compound (100m x 40m)
- Additional Construction Compound (100m x 40m)
- Mobilisation Compounds
- Borrow Pit
- GWDTE Infrastructure Buffer

**Potential GWDTE**

- M25
- M23b
- M15

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter




| Rev | Date | Description | Drn | Chk | App |
|---|---|---|---|---|---|
| 00 | 06/12/2021 | First Draft | CM | CI | CI |
| 01 | 20/01/2022 | Update BP1 and Figure No. | CM | CI | CI |
| 02 | 25/01/2022 | Mobilisation Compounds | CM | CI | CI |

**Chleansaid Wind Farm**

TITLE:

Figure 10.4.1:
GWDTE

0 0.5 1
Kilometres
SCALE: 1:25,000 @ A3

REV 02

Document Path: C:\Users\CMcGuire\OneDrive - RSK Group\Documents\655007 Chleansaid Wind Farm\GIS\655007 Chleansaid baseline.aprx