Scottish & Southern Electricity Networks

TRANSMISSION

Creag Dhubh to Inveraray 275 kV Connection Environmental Impact Assessment

Volume 4 | Appendix 11.2

Groundwater Dependent Terrestrial Ecosystem (GWDTE) Assessment

June 2022

Scottish & Southern Electricity Networks
TRANSMISSION

CONTENTS

List of Abbreviations

BGS	British Geological Survey
CAR	The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)
DTM	Digital Terrain Model
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GWDTE	Groundwater Dependent Terrestrial Ecosystems
NGR	National Grid Reference
NVC	National Vegetation Classification
OHL	Overhead Line
OS	Ordnance Survey
SEPA	Scottish Environment Protection Agency
WEWS Act	Water Environment and Water Services (Scotland) Act 2003
WFD	Water Framework Directive

1 INTRODUCTION

1.1 The Proposals

1.1.1 This Appendix presents information relevant to the Creag Dhubh to Inveraray 275 kV Connection. It should be read in conjunction with **Volume 2** of the **EIA Report** for full details of the Proposed Development.

1.1.2 Scottish Hydro Electric Transmission plc (the Applicant) who, operating and known as Scottish and Southern Electricity Networks Transmission (SSEN Transmission), own, operate and develop the high voltage electricity transmission system in the north of Scotland and remote islands.

1.1.3 Due to the growth in renewable electricity generation in the north and north east of Scotland, upgrade of the transmission network is required in order to provide the necessary increase in transmission capacity.

1.1.4 The Applicant is proposing to apply for consent under Section 37 of the Electricity Act 1989 to construct and operate a 9 km double circuit 275 kV OHL, supported by steel lattice towers between a proposed substation at Creag Dhubh and the recently constructed Inveraray-Crossaig 275 kV capable OHL circuit, in Argyll, Scotland (the 'Proposed Development'). The Proposed Development is shown in **Figure 2.1: Proposed Development (EIAR Volume 3a).**

1.2 The Regulations

1.2.1 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, hereafter referred to as the 'EIA Regulations', contain two schedules. Schedule 1 lists projects where an Environmental Impact Assessment (EIA) is mandatory. Schedule 2 lists projects where EIA may be required "where proposed development is considered likely to give rise to significant effects on the environment by virtue of factors such as its nature, size or location".

1.2.2 The Proposed Development falls within Schedule 1 of the EIA Regulations, as it meets criteria of paragraph (3) of Schedule 1[1]. An EIA is therefore mandatory and an Environmental Impact Assessment Report (EIA Report) will accompany the Section 37 application.

1.2.3 Principal legislation regarding the water environment is provided by the EU Water Framework Directive (WFD[2]) which aims to protect and enhance the quality of surface freshwater (including lakes, rivers, and streams), groundwater, Groundwater Dependent Terrestrial Ecosystems (GWDTEs), estuaries and coastal waters.

1.2.4 The key objectives of the WFD relevant to this assessment are:

- To prevent deterioration and enhance aquatic ecosystems; and
- To establish a framework for protection of surface freshwater and groundwater.

1.2.5 The WFD resulted in the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act[3]), which gives Scottish Ministers powers to introduce regulatory controls over water activities to protect, improve and promote sustainable use of Scotland's water environment.

1.2.6 The protection of GWDTEs in Scotland is regulated within the Water Environment (Controlled Activities) (Scotland) Regulations 2011[4] (as amended) (CAR).

[1] https://www.legislation.gov.uk/ssi/2017/101/schedule/1/made
[2] https://ec.europa.eu/environment/water/water-framework/index_en.html
[3] https://www.legislation.gov.uk/asp/2003/3/contents
[4] https://www.legislation.gov.uk/ssi/2011/209/contents/made

1.3 Purpose of this Baseline Report

1.3.1 This report provides a summary of the GWDTEs that may be affected by the Proposed Development. It provides a description of the bedrock and superficial geology and considers National Vegetation Classification (NVC) and peat surveys that have been completed. It then presents a hydrogeological assessment of the potential GWDTEs, initially identified through habitat surveying that does not take into account underlying geological conditions or connectivity to surface water contribution.

2 METHODOLOGY

2.1 Desk Study

2.1.1 The baseline hydrology and hydrogeology of the Site has been characterised in **Chapter 11: Water Environment (EIAR Volume 2)** and sections relevant to the GWDTE assessment are summarised in this document.

2.1.2 The assessment utilised the following opensource datasets:

- Ordnance Survey (OS) 1:10,000 scale mapping;
- Ordnance Survey OS Terrain 5 Digital Terrain Modelling (DTM);
- British Geological Survey (BGS) Geology of Britain Viewer[5] for superficial and bedrock;
- BGS Hydrogeological and Groundwater Vulnerability Maps of Scotland (1:625,000); and
- SEPA Water Environment Hub[6].

2.1.3 Analysis of the hydrological regime of the Study Area (which includes the Field Survey Area of 250 m on either side of the Proposed Development and the Desk Study Area which includes catchment areas that interact with the Proposed Development) was carried out through the use of the ESRI ArcGIS Pro hydrological toolset. This tool provides methods for describing the physical components of a surface, allowing identification of sinks (areas where surface water could pond), determination of likely flow direction and routes where flow accumulation would occur, delineation of watersheds, and mapping of stream networks (see **Figure 11.6: Groundwater Dependent Terrestrial Ecosystems based on NVC Survey, EIAR Volume 3a**).

2.1.4 The methodology for assessing the potential disruption to GWDTEs is outlined in the Scottish Environmental Protection Agency (SEPA) Land Use Planning System Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[7].

2.2 Field Survey

2.2.1 NVC surveys of the field survey area were completed by Ramboll ecologists between the 9 and 11 March 2022. The NVC surveys followed the methodology described in best practice guidance[8], with five 2 m² quadrats surveyed within each habitat, and the species composition analysed.

2.2.2 Ecological surveying was supplemented by hydrological surveying. The Site walkover was conducted by two Ramboll hydrologists on the 7 and 8 March 2022. Briony McIntosh has over five years' experience surveying and is a qualified River Habitat Surveyor, and was accompanied by Hannah Otton who has more than three years survey experience. All data was captured electronically using tablets. Weather conditions on both days were dry and clear. Ground conditions were relatively dry and river levels low to normal.

2.3 Limitations and Assumptions

2.3.1 This assessment relies on datasets provided by parties other than Ramboll and it is assumed these are datasets are accurate and reliable.

[5] https://mapapps.bgs.ac.uk/geologyofbritain/home.html
[6] https://www.sepa.org.uk/data-visualisation/water-environment-hub/
[7] https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf
[8] Rodwell, J.S. (2006), *National Vegetation Classification: User's Handbook*. Peterborough: JNCC.

2.3.2 The habitat and faunal surveys provide a snapshot of ecological conditions and do not record plants or animals that may be present in the field survey area at different times of the year. The absence of a particular species cannot definitely be confirmed by a lack of field signs and only concludes that an indication of its presence was not located during the survey effort.

2.3.3 Hydrological surveying provided assessment of surface water features within the Field Study Area (at accessible locations) and indicative review of hydrological conditions across the Field Study Area, surveying did not include Site-specific assessment of potential GWDTE areas.

3 RESULTS

3.1 Desk Study

Surface Water Baseline

3.1.1 The Proposed Development is located wholly within the catchment of the River Aray. The River Aray flows in a southerly direction from the proposed Creag Dhubh Substation, eventually discharging into Loch Fyne approximately 3 km south of the Inveraray - Crossaig connection point.

3.1.2 The proposed Creag Dhubh Substation is located in the source area of the River Aray. The Proposed Development runs in a southerly direction to the west of the River Aray but does not cross it. The Proposed Development does however cross a large number of tributaries that flow in an easterly direction into the River Aray. The Erallich Water is the largest tributary crossed with the remaining watercourses unnamed burns typically <1 m in width and <0.5 m in depth.

3.1.3 A number of ephemeral streams were observed during the walkover, particularly across the open grazed land between Stromnagachan and North Tullich. These features are not considered to represent formal watercourses. They do not have a defined channel and are preferential drainage routes during periods of high surface water runoff.

3.1.4 One spring was identified at Ordnance Survey National Grid Reference (OS NGR) NN 08967 16797. It is considered a sensitive GWDTE habitat and is located within 100 m of Tower T12 and the proposed temporary and permanent access tracks

3.1.5 Surface water features are shown in **Figure 11.1: Surface Water Features, EIAR Volume 3a.**

Geology and Hydrogeology Baseline

3.1.6 According to the BGS bedrock geology mapping, the northern end of the Proposed Development is underlain by unnamed extrusive rocks (mafic lava and mafic tuff). The remainder of the Proposed Development is underlain by the Argyll Group consisting of psammite, semipelite and pelite (see **Figure 11.3: Bedrock Geology, EIAR Volume 3a**).

3.1.7 The BGS superficial geology mapping indicates the glacial till deposits (diamicton) are present in the northernmost and southernmost areas of the Proposed Development (see **Figure 11.4: Superficial Geology, EIAR Volume 3a**).

3.1.8 According to BGS 1:625,000 scale hydrogeological mapping the whole Proposed Development is underlain by aquifers of a Low Productivity (**Figure 11.5: Hydrogeology, EIAR Volume 3a**), in which flow is virtually all through fractures and other discontinuities. Aquifers underlying the Proposed Development are considered unlikely to support public water supplies, or to have the potential to do so.

3.2 Field Survey

National Vegetation Classification

3.2.1 NVC surveys were carried out by Ramboll between the 9 and 11 March 2022. These surveys identified habitats with a potential to be Highly or Moderately groundwater dependent (**Figure 11.6: Groundwater Dependent Terrestrial Ecosystems based on NVC Survey, EIAR Volume 3a**).

3.3 Groundwater Dependent Terrestrial Ecosystems

3.3.1 Excavation of soil and bedrock during the construction phase of the Proposed Development may cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow could potentially reduce the supply of groundwater to GWDTEs, thereby causing an alteration or change in the quality and / or quantity of groundwater, and / or a change in the physical or biological characteristics of the GWDTE. Contamination of groundwater may also cause physical or chemical contamination to the GWDTE.

3.3.2 Following identification of potential GWDTEs from NVC mapping, hydrological and hydrogeological desktop study information has been used to qualitatively determine the potential dependence of each habitat on groundwater.

3.3.3 The potential for a habitat to be groundwater dependent, and therefore the sensitivity of each potential GWDTE habitat, has been based upon classifications provided within the SEPA guidance document LUPS-GN31.

3.3.4 **Table 3.1** sets out the predominant NVC communities encountered across the Site with the potential to be GWDTE following the detailed NVC survey carried out in March 2022. The GWDTE classification of each GWDTE receptor (i.e. Highly / Moderately groundwater dependent habitat) has been classified in accordance with SEPAs guidance LUPS-GN31. The SEPA classification is modified from UKTAG (2008)[9] list of NVC communities, which provides the full list for all communities. The relevant UKTAG classification is also provided.

Table 3.1: NVC Communities Present and their Potential Groundwater Dependency according to SEPA NVC Classification

NVC Community Present	Initial Potential GWDTE Classification
M6c	High
M15c	Moderate

3.4 Groundwater Dependency

Introduction

3.4.1 UKTAG guidance (2004) recognises that most "*water dependent terrestrial ecosystems lie along a continuum between always only groundwater dependent and always only surface water dependent […]. The source of water supply for some wetlands does not appear to be critical, therefore the task of identifying dependence upon groundwater is sometimes complex*".

3.4.2 SNIFFER (2007) guidance[10] states that the dependence of wetlands on groundwater bodies is a result of hydrological connectivity. The degree of dependency will vary depending on whether the wetland is underlain by a low productivity or high productivity aquifer and whether there is a hydrological linkage mechanism between groundwater and the surface wetland. Likelihood of dependency is based upon the following:

- High Likelihood: characterised by intergranular, high productivity drift aquifer and dominantly intergranular, highly productive aquifer;

[9] Guidance within GN31 is adapted from 'UK Technical Advisory Group list of NVC communities and associated groundwater dependency scores (2008)
[10] SNIFFER (2007) WFD66 – Wetland Hydrogeomorphic Classification for Scotland. Edinburgh: SNIFFER.

- Moderate Likelihood: characterised by intergranular, moderate productivity drift aquifer and fractured, very low productivity aquifer; and
- Low Likelihood: characterised by intergranular, very low productivity drift aquifer and fractured, very low productivity aquifer.

3.4.3 Following the initial identification of habitats with the potential to be GWDTEs from NVC mapping (**Figure 11.6: Groundwater Dependent Terrestrial Ecosystems based on NVC Survey, EIAR Volume 3a**), Ramboll hydrologists assessed the Site-specific conditions and hydrological context of potential GWDTEs. Hydrological and hydrogeological desktop study information, supported by field survey observations, were used to qualitatively determine the groundwater dependency of potential GWDTE.

3.4.4 The assessment included consideration of:

- The direct hydrological connection of a potential GWDTE to surface water sources;
- Underlying geological conditions including the productivity of bedrock and superficial geology, the presence of peat souls and permeability of upgradient geology;
- Topography and the presence of rill or runnels indicative of surface runoff;
- The presence of indicative 'flush' patterns of vegetation communities; and
- Land use.

3.4.5 Where GWDTE features are found to be in direct connectivity to surface water features they are considered to have a lower likelihood of groundwater dependency.

Terrain

3.4.6 The GWDTE habitats dominate the section of the Proposed Development which traverses the open rough, grazed pasture. The topography in this area is steep with the land falling to the east towards the River Aray (see **Figure 6.2: Topography, EIAR Volume 3a**).

3.4.7 The terrain therefore dictates that a high level of surface water runoff will be flowing downslope across the route of the Proposed Development. This was confirmed during the Site visit when a number of ephemeral watercourses and drainage features were observed coming down off the steep hillside and is supported by the ESRI ArcGIS Pro hydrological toolset stream network modelling (see next section).

Hydrological Analysis

3.4.8 Based on Digital Terrain Model (DTM) surface terrain data, a flow accumulation tool was to generate likely surface water runoff flow paths based on the predicted flow direction of surface waters. Combined with the OS 1:10,000 scale mapping of watercourses, the hydrological analysis predicts that the majority of the potentially High and Moderate GWDTE habitats are either adjacent to watercourses or likely surface water flow/accumulation paths (see **Figure 11.7, EIAR Volume 3a**).

3.4.9 This indicates that the topography of the Site is such that there are areas where surface waters would accumulate and these often correlate with the areas of habitat which were initially indicated to have a potential to be GWDTEs; it is considered that these surface water flows are likely to present a greater source of water input to the habitat than groundwater. On this basis, the majority of the potentially High and Moderate GWDTEs are not considered to be dependent on groundwater.

Geology and Hydrogeology

3.4.10 The underlying bedrock aquifer is assessed by the BGS to be of Low productivity with limited groundwater in the near surface weathered zone and secondary fractures. Therefore, it is it is considered likely that the majority of the potential GWDTEs within the Site are not fed by a groundwater aquifer, based on the underlying hydrogeology. This is supported by the observed presence of GWDTEs being in direct connection to overland flows and the assessment of local topography which predicts surface water run-off downslope towards the River Aray.

3.4.11 The areas of potential Moderate GWDTE are recorded on areas of shallower peat overlying bedrock with low permeability. It is therefore considered likely that the potential GWDTE areas would be ombrogenous (rain fed) with the habitats forming as a result of saturation following rainfall, and not supported by a groundwater feed.

3.4.12 The potential High GWDTE areas are recorded on areas of deeper peat (up to approximately 1.0 m) which are towards the base of the slope where the combination of the topography shallowing and the water retention of the peaty soils would again support the assumption that the GWDTE habitats are not groundwater dependent, but fed by near surface flows.

Land Use

3.4.13 The majority of the potential GWDTEs are located in areas of open, rough grazed land. These are areas characterised by habitats where the flora, and drainage patterns, have been altered over time by grazing and potentially burning. The habitats are not considered to have formed due to a significant groundwater contribution, supported by the classification of the underlying geology as being of Low Productivity. Therefore, these habitats are not considered to be GWDTE.

3.4.14 A strip of Moderate potential GWDTEs is located in the forestry ride south of the proposed Creag Dhubh substation. Commercial forestry significantly alters drainage patterns, with this area being waterlogged from forestry drainage channels being directed into the ride. The habitats are not therefore considered groundwater dependent but reliant on surface water accumulation in the comparatively more open land adjacent to the forest rills.

Springs

3.4.15 One spring was identified at OS NGR NN 08967 16797 where a contribution from shallow groundwater cannot be discounted. It lies within an area mapped as a Moderate GWDTE and this is the only habitat which this assessment concludes may be groundwater dependent.

3.5 Sensitivity of Groundwater Dependent Habitats

3.5.1 The UKTAG (2004) guidance provides criteria for identification and inclusion of GWDTEs in the risk assessment process, based on complementary ecological and hydrogeological assessments. These criteria have been used to produce the following matrix (**Table 3.2**), which provides an identification of sensitive and potentially sensitive GWDTEs that require a qualitative assessment to ascertain the significance of the risks the Proposed Development poses to them.

Table 3.2: Matric for Identification of Sensitive GWDTEs from Ecological and Hydrogeological Assessments

		Hydrogeological Assessment Groundwater Dependency Level		
		High Likelihood	**Moderate Likelihood**	**Low Likelihood**
Ecological Assessment of NVC Communities	**High groundwater dependent**	Sensitive GWDTE	Potentially sensitive GWDTE	Potentially sensitive GWDTE
	Moderately groundwater dependent	Potentially sensitive GWDTE	Potentially sensitive GWDTE	Not sensitive
	Not groundwater dependent	Potentially sensitive GWDTE	Not sensitive	Not sensitive

3.5.2 The hydrogeological assessment of groundwater dependency based on the NVC survey concluded that the likelihood of groundwater dependency is considered to be low for all potential GWDTEs across the Site (**Figure 11.7: Hydrological Assessment of Groundwater Dependent Terrestrial Ecosystems, EIAR Volume 3a**). This is in line with the topography; land use; hydrological; and hydrogeological conditions. Therefore, according to the matrix in **Table 3.2**, the areas indicated to be of High groundwater dependency based on the NVC survey are potentially sensitive, and the Moderate groundwater dependent habitats based on the NVC survey are not sensitive.

3.5.3 The exception to this is the habitat at the spring identified at OS NGR NN 08967 16797 which falls within the Moderate GWDTE classification based on the NVC survey, and is likely to be at least in part groundwater dependent and is therefore potentially sensitive.

4 MITIGATION MEASURES AND RECOMMENDATIONS

4.1.1 The majority of the GWDTE areas are assessed as not being groundwater dependent, but instead reliant on surface water runoff. Therefore, it is considered that the maintenance of surface water quality and quantity and distribution to these habitats is important. Measures to ensure the continued supply of surface waters and prevent impacts to water quality are provided in **Chapter 11: Water Environment (EIAR Volume 2), and Technical Appendix 2.2: Outline Construction Environmental Management Plan (EIAR Volume 4).**

4.1.2 Drainage measures that will maintain hydrological connectivity and ensure water quality would be implemented via the final Construction Environmental Management Plan (CEMP) for the Site to be developed by the Appointed Contractor. However, mitigation measures may include the following:

- Implementation of Sustainable Drainage System (SuDS) measures to maintain quality of water supply during the construction phase of the Proposed Development;
- Maintenance of flow paths/ redistribution of water where diverted;
- Implementation of pollution control measures; and
- The Appointed Contractor to follow relevant SSEN Transmission's General Environment Management Plans (GEMPs), SEPA best practice guidance, and produce Pollution Prevention Plans (PPPs) prior to works.

4.1.3 The habitat at the spring, which is considered a sensitive GWDTE habitat, is located within 100 m of Tower T12 and the proposed temporary and permanent access tracks. Further mitigation will be required in this area and may include:

- Provision of a detailed risk assessment and Site investigation of works near the spring to be provided by the appointed Contractor to SEPA;
- Avoidance of direct impacts by construction activity on the spring; and
- Demarcation of the spring and monitoring of works in close proximity by the ECoW.

4.1.4 Direct loss of sensitive habitats identified as not being groundwater dependent and / or peatland habitats are assessed in **Chapter 8: Ecology** and **Chapter 10: Geology and Soils (EIAR Volume 2)** respectively.

5 CONCLUSION

5.1.1 Excavation of soil and bedrock during the construction phase of the Proposed Development may cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow could potentially reduce the supply of groundwater to GWDTEs, thereby causing an alteration or change in the quality and / or quantity of groundwater, and / or a change in the physical or biological characteristics of the GWDTE. Contamination of groundwater may also cause physical or chemical contamination to the GWDTE.

5.1.2 NVC surveying carried out in March 2022 by Ramboll ecologists, identified a number of habitats with the potential to be Highly or Moderately groundwater dependent.

5.1.3 Hydrological and hydrogeological desktop study information has been used to qualitatively determine the potential groundwater dependency and sensitivity of each potential GWDTE. The assessment included consideration of:

- The direct hydrological connection of a potential GWDTE to surface water sources;
- Underlying geological conditions including the productivity of bedrock and superficial geology, the presence of peat souls and permeability of upgradient geology;
- Topography and the presence of rill or runnels indicative of surface runoff;
- The presence of indicative 'flush' patterns of vegetation communities; and
- Land use.

5.1.4 The assessment concluded the majority of the GWDTEs identified along the Proposed Development are not considered groundwater dependent and therefore not sensitive habitats because:

- The majority of the habitats are located on or at the base of a steep hillslope where surface water runoff is high. This is indicated by the stream network mapping indicating preferential flow paths and areas of surface water accumulation, and confirmed on the Site visit where a number of ephemeral streams and flow paths were observed.
- The underlying geology is a low productivity aquifer with limited groundwater in the near surface weathered zone and secondary fractures and therefore unlikely to support the GWDTE habitats.
- Land use which includes grazed rough pasture and commercial forestry will have significantly altered the flora and drainage patterns encouraging preferential drainage flow paths to support surface water contribution and the habitats in are not therefore considered to have formed due to a significant groundwater contribution.

5.1.5 For these habitats which are not identified as being groundwater dependent, and therefore not sensitive, standard mitigation will be required to ensure the quality and quantity of surface water to these areas is maintained. These measures will be set out in the final CEMP (including a PPP) to be written by the Appointed Contractor. An Outline CEMP is provided as **Technical Appendix 2.2 (EIAR Volume 4)**.

5.1.6 However, one spring was identified at OS NGR NN 08967 16797 where a contribution from groundwater flow cannot be discounted. This habitat is considered sensitive and is within 100 m of the Proposed Development. Further mitigation will be required including a detailed risk assessment and Site investigation by the Appointed Contractor; avoidance of direct impacts by construction activity; and demarcation of the spring and monitoring of works in close proximity by the ECoW.