Creag Dhubh to Inveraray 275 kV Connection Environmental Impact Assessment

Volume 4 | Appendix 11.4

Forestry Hydrology Assessment

June 2022

CONTENTS

List of Abbreviations

DTM	Digital Terrain Model
DWPA	Drinking Water Protected Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FEH	Flood Estimation Handbook
NVZ	Nitrate Vulnerable Zone
OHL	Overhead Line
SEPA	Scottish Environment Protection Agency
SSEN	Scottish and Southern Electricity Transmission

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.

The Applicant is proposing to apply for consent under Section 37 of the Electricity Act 1989 to construct and operate 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 The UK Forestry Standards Guidelines (UKFSG) (5th Ed)[2] sets out that, with regard to acidification of downstream watercourses, "*research shows that the effects of harvesting on surface water acidity are difficult to discern when 20% or less of a catchment is felled within any three-year period. Consequently, where the rate of felling exceeds this figure, it may be necessary to carry out a site impact assessment to determine if the watercourse is at risk; this includes felling for habitat restoration or windfarm developments*".

1.2.4 Similarly, Guideline 34 of the UKFSG sets out that clear-felling of more than 20% of the catchment of a public water supply should be avoided within any three-year period.

1.2.5 It is also noted that "*Estuarine and coastal waters are less influenced by forestry due to dilution and other factors, but some water bodies are very sensitive to disturbance, such as designated shellfish waters in shallow marine lochs. Shellfish could be adversely affected by increased sediment and nutrient inputs associated with larger-scale forestry operations*". The 20% threshold is also advised in Guideline 42 with regard to waterbodies are sensitive to nutrient enrichment, including shallow coastal lochs designated for shellfish; i.e. limit any clear-felling to less than 20% of the catchment in any three year period.

[1] https://www.legislation.gov.uk/ssi/2017/101/schedule/1/made

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf

1.2.6 The key receptors with regard to potential impacts from extensive forestry felling are:

- Public drinking water supplies;
- Shellfish Water Protected Areas[3];
- Flood Risk Areas;
- Catchments Sensitive to Acidification; and
- Nitrate Sensitive Catchment.

1.3 Purpose of this Technical Appendix

1.3.1 This assessment takes account of the felling requirements for the construction and operation of the Proposed Development, as well as the additional 'management felling' required to achieve windfirm edges. It assesses the how felling may impact key receptors (listed in **Section 3.1**) in relation to the 20% threshold and supports **Chapter 11: Water Environment (EIAR Volume 2)**. Further details on Forestry can be found in **Chapter 14: Forestry (EIAR Volume 2)**.

[3] Shellfish water protected areas are areas designated for the protection of shellfish growth and production.

2 METHODOLOGY

2.1 Desk Study

2.1.1 The baseline hydrology and hydrogeology of the Proposed Development has been characterised as part of the EIA and, where relevant, is 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);
- BGS 1:625,000 Geological Mapping;
- SEPA River Basin Management Plan;
- SEPA Flood Maps[4]; and
- OS Open Rivers watercourse map.

2.1.3 Analysis of the hydrological regime of the Study Area 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 for 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. The flow paths and subsequent watershed delineation were used to identify the principal catchment area through which the proposed OHL passes. The catchment area has been verified using the Flood Estimation Handbook (FEH) web service[5].

2.1.4 The catchment along the Proposed Development was then assessed to determine the potential for connectivity with downstream sensitivities, as listed in **Section 1.3**.

2.2 Limitations and Assumptions

2.2.1 Data collected by parties other than Ramboll is relied upon and assessment derived from these data sets is based on the assumption that surveying has been carried out following best practice guidelines, in line with those employed by Ramboll.

2.2.2 Felling plans for Ladyfield Forestry, and potential felling associated with the proposed Ladyfield Wind Farm are unknown. However, it is unlikely the felling would result in more than 20% of the River Aray catchment being felling within a 3 year period.

[4] https://map.sepa.org.uk/floodmaps/FloodRisk/PostCode

[5] Flood Estimation Handbook Web Service https://fehweb.ceh.ac.uk/GB/map

3 RESULTS

3.1 Desk Study

Catchment Areas

3.1.1 The Proposed Development is located entirely within the River Aray catchment. The catchment area of the River Aray is approximately 63 km^2 and has been delineated using the ArcGIS Pro hydrological toolset (**Figure 11.4.1, Annex A**). The River Aray discharges into Loch Fyne and the catchment contains a number of smaller watercourses which discharge into the River Array, the catchment areas of which the Proposed Development passes through.

Receptor Sensitivities

Public Drinking Water Supplies

3.1.2 The Scottish Government has published mapping[6] of Drinking Water Protected Areas (DWPAs). The Proposed Development is not located within, or within 500 m of a DWPA.

3.1.3 There is however a DWPA within the wider River Aray catchment at Am Buachaille approximately 4.5 km south of the Proposed Development (**Figure 11.4.2, Annex A**).

Shellfish Water Protected Areas

3.1.4 The River Aray discharges into Loch Fyne which is designated as a Shellfish Water as presented in **Figure 11.4.3, Annex A**.

Flood Risk Areas

3.1.5 Any catchments which exceed 3 km^2 in area would be expected to be associated with downstream fluvial flood risk areas

3.1.6 A review of the SEPA Flood Maps indicates the Proposed Development is not considered at risk of flooding as areas indicated to be at a High likelihood (1 in 10 year, or 10% annual probability) of flooding are confined to low lying areas in close proximity to the River Aray, Erallich Water and an unnamed watercourse at Drimfern. Further details are provided in **Chapter 11: Water Environment (EIAR Volume 2)**.

3.1.7 Downstream of the Proposed Development and on the eastern floodplain of the River Aray the SEPA Flood Maps indicate more extensive flood outlines where the topography is shallow. Although these flood risk areas currently appear to be limited to undeveloped greenfield land, changes in the flood risk due to forestry felling could increase the extent of flooding and introduce new receptors to a potential flood risk, or lead to an increase in the frequency, depth and hazard where a flood risk already exists.

Catchments Sensitive to Acidification

3.1.8 Mapping of catchments vulnerable to acidification is presented by Forest Research[7], a research agency of the Forestry Commission. No catchments in the vicinity of the site are shown to be vulnerable to acidification. Therefore, this sensitivity has not been considered further in this assessment.

[6] https://www.gov.scot/publications/drinking-water-protected-areas-scotland-river-basin-district-maps/

[7] https://forestry.maps.arcgis.com/apps/View/index.html?appid=0f618ca9de8640d0862ad113387b9704

Nitrate Sensitive Catchments

3.1.9 There are five Nitrate Vulnerable Zones (NVZs) in Scotland as set out by the Agricultural and Rural Economy Directorate[8] and none of these are downstream of the Proposed Development. Therefore, this sensitivity has not been considered further in this assessment.

Summary of Catchment Sensitivities

3.1.10 The catchment sensitivity is summarised in **Table 3.1**.

Table 3.1: Catchment Sensitivity

Catchment Name	OHL Towers	Total Catchment Area (km2)	Sensitivity
River Aray	All (Tower T1 – T34)	63	Discharges to Loch Fyne (coastal waterbody) at Inveraray a Shellfish Waters Protected Area & Downstream Areas of Flood Risk

Felling

3.1.11 Felling associated with the Proposed Development is summarised in **Table 3.2** and shown in **Figure 11.4.4, Annex A**.

Table 3.2: Catchment Felling associated with the Proposed Development

Catchment Name	Proposed Felling within the Operational Corridor (km^2)	Proposed Management Felling Outwith OHL Buffer (km^2)	Proposed Access Track Felling (km^2)	Long Term Retention to be Felled (km^2)	Maximum Total Proposed Felling (km^2)	Maximum Proposed Total Felling (% of total catchment)
River Aray	0.19	0.15	0.02	0.06	0.42	0.66

3.1.12 Felling associated with the Long Term Felling Plans (LTFP) and the Creag Dhubh to Dalmally OHL which links into the proposed Creag Dhubh substation, both of which fall within the River Aray catchment is summarised in **Table 3.3** and shown in **Figure 11.4.4, Annex A**.

3.1.13 There are four phases of felling associated with Three Bridges LTFP. Only Phase 1 will coincide with the Proposed Development and therefore within the three year assessment period. Therefore, only these areas of felling are included in **Table 3.3**.

Table 3.3: Wider Catchment Felling

Type of Fell	Area of Fell (km^2)	Maximum Proposed Total Felling (% of total catchment)
Creag Dhubh to Dalmally OHL felling	0.05	0.08
Creag Dhubh to Dalmally management felling	0.18	0.29

[8] https://www.gov.scot/policies/agriculture-and-the-environment/nvz/

Three Bridges Phase 1 Felling	1.27	2.02
Three Bridges Phase 1 Felling (for Blarghour Wind Farm)	0.80	1.27
TOTAL	**2.3**	**3.66**

3.1.14 The combined felling (**Table 3.2** and **Table 3.3**) within the River Aray catchment is 4.32% and therefore under the 20% threshold for potential impacts to water quality.

4 ASSESSMENT

4.1.1 Analysis of the hydrological regime of the Study Area was carried out through the use of the ESRI ArcGIS Pro hydrological toolset and the resultant River Aray catchment has been assessed with regard to its sensitivity to the key factors listed in the UK Forestry Standards Guidelines (UKFSG) (5th Ed):

- Public Drinking Water Supplies
- Shellfish Water Protected Areas
- Flood Risk
- Catchments Sensitive to Acidification
- Nitrate Sensitive Catchments

4.1.2 One DWPA is located within the River Aray catchment approximately 4.5 km south of the Proposed Development. This DWPA falls within a sub-catchment (Allt Riabhachan) of the River Aray and no felling associated with the Proposed Development is within this catchment. Therefore as <5% of Allt Riabhachan catchment, as well as the overall River Aray catchment is to be felled, it is considered that proposed felling would not impact on public drinking water supplies.

4.1.3 The River Aray discharges into Loch Fyne which is designated as a Shellfish Water. However, the proposed felling within the River Aray catchment represents less than 5% of the overall catchment. On this basis, it is considered that the proposed felling would not impact on a Shellfish Water Protected Area.

4.1.4 The SEPA flood maps indicate the River Aray and its tributaries are indicated to be at risk of fluvial flooding. Flood extents for the River Aray are indicated to be more extensive on the low lying, greenfield, active floodplain areas downstream of the Proposed Development. Changes in flood risk due to forestry felling could increase the extent of flooding and introduce new receptors to potential flood risk, or lead to an increase in the frequency, depth and hazard where flood risk already exists. However, the proposed felling within the River Aray catchment is less than 5% of the catchment and it is not therefore considered that felling would have an impact on flood risk.

4.1.5 No catchments in the vicinity of the Site are shown to be vulnerable to acidification and none of the five NVZs in Scotland are downstream of the Proposed Development. Therefore, there is no potential for impacts to these receptors.

5 CONCLUSION

5.1.1 UK Forestry Standards Guidelines (UKFSG) (5th Ed) dictate that felling of more than 20% of the total catchment area has the potential to impact sensitive receptors including:

- Public Drinking Water Supplies
- Shellfish Water Protected Areas
- Flood Risk
- Catchments Sensitive to Acidification
- Nitrate Sensitive Catchments

5.1.2 The Proposed Development falls entirely within the River Aray catchment which has an area of approximately 63 km^2.

5.1.3 Receptors of relevance to the Proposed Development which are within or are in hydrological connectivity to the River Aray catchment are:

- Public Drinking Water Supplies: there is a Drinking Water Protection Area approximately 4.5 km south of the Proposed Development;
- Shellfish Water Protected Area: the River Aray discharges into Loch Fyne which is a Shellfish Water Protected Area; and
- Flood Risk: SEPA flood maps indicate reaches of the River Area are at high risk (1 in 10 year, or 10% annual probability) of flooding.

5.1.4 Felling associated with the Proposed Development totals 0.42 km^2, and an addition 2.3 km^2 of felling is proposed from cumulative developments. In total, this represents <5% of the total area of the River Aray catchment and therefore no potential impacts on sensitive receptors are anticipated as a result of the Proposed Development.

Scottish & Southern Electricity Networks

TRANSMISSION

Annex A - Figures

Scottish & Southern Electricity Networks
TRANSMISSION

Scale @ A3: 1:60,000
0 0.375 0.75 1.5 2.25 3 3.75 km

Legend

- Proposed Alignment Towers
- Proposed Alignment
- Inveraray - Crossaig Towers
- Inveraray - Crossaig OHL
- Proposed Creag Dhubh Substation (Separate Application)

Temporary Diversions

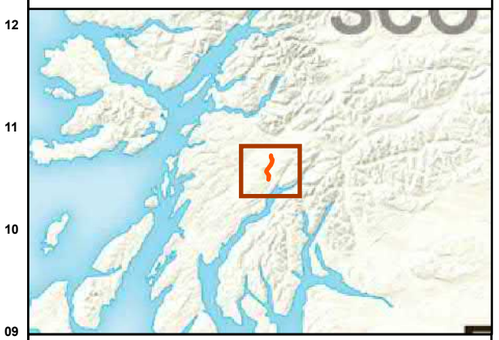
- ITE / ITW 132 kV Diversion Poles
- 275 kV Diversion Towers
- ITE / ITW 132 kV Diversion
- 275 kV Diversion

Access Tracks

- Creag Dhubh Access Track
- Access Tracks - Track To Be Maintained
- Proposed Access Route (Perm)
- Proposed Access Route (Temp)
- Existing Access Tracks Upgrade

Hydrology

- Stream Network
- Watercourse
- River Aray Catchment



Project No:	LT000194
Project:	1620011091
Title:	Creag Dhubh to Inveraray 275 kV Overhead Line Figure 11.4.1: River Aray Catchment Area and Flow Paths
Drawn by:	NJ
Date:	20/09/2022
Drawing:	R162_11091_Fig11_4_1_FHA_Catchment_B

Scottish & Southern Electricity Networks
TRANSMISSION

Scale @ A3: 1:60,000
0 0.375 0.75 1.5 2.25 3 3.75 km

Legend

- Proposed Alignment Towers
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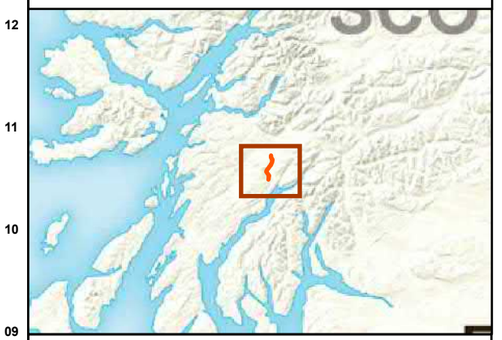
- Creag Dhubh Access Track
- Access Tracks - Track To Be Maintained
- Proposed Access Route (Perm)
- Proposed Access Route (Temp)
- Existing Access Tracks Upgrade

Hydrology

- Stream Network
- Watercourse
- Drinking Water Protected Areas
- River Aray Catchment
- Scottish Water Cladich Water Catchment



Project No: LT000194
Project: 1620011091

Title: Creag Dhubh to Inveraray 275 kV Overhead Line

Figure 11.4.2: Drinking Water Protected Areas

Drawn by: NJ Date: 20/09/2022

Drawing: R162_11091_Fig11_4_2_EIAR_FHA_DWPA_C