Appendix 9G
Habitat Loss and Disturbance Calculations

1. Introduction

1.1 Background

1.1.1 This appendix details the approach, assumptions and results of the process adopted to quantify habitat loss and disturbance/degradation as a result of the construction of the Proposed Development for the ecological impact assessment presented in **Chapter 9: Ecology**.

1.1.2 Habitat loss, disturbance and potential degradation have been estimated using the Phase 1 habitat survey results and the layout of the Proposed Development. Where there is uncertainty in design layout (dimensions, extent etc.) various assumptions have been made regarding the construction methodology to arrive at realistic "worst case" estimates.

1.1.3 National Vegetation Classification (NVC) data were used to inform vegetation sensitivity classification mapping (**Appendix 9F: Vegetation Sensitivity Classification**); however, they could not be accurately used to determine land take and temporary disturbance areas owing to the fact that distribution maps were prepared by mapping vegetation polygons as primary, secondary or tertiary components (given the transitional nature of communities). As a result of which, distribution maps would regularly overlap for many similar communities, leading to double counting of habitat loss or disturbance.

1.1.4 Habitat loss calculations also consider direct loss of coniferous plantation woodland as a result of planned forestry removal to allow sufficient clearance from turbine blades and other infrastructure.

1.2 Approach

Estimating Habitat Loss / Potential Change

1.2.1 Direct habitat loss would occur as a result of the construction of the permanent elements of the wind farm infrastructure such as the wind turbine bases, internal wind farm tracks, crane pads and grid connection infrastructure (including up to 3 substations and battery storage facilities).

1.2.2 In addition to which, direct loss of coniferous plantation woodland would result from the removal of forestry within a clearance buffer around turbine locations (comprising turbine blade length - Max 156m or Max 180m+10%) and a 10m clearance buffer around access tracks and other infrastructure.

1.2.3 Access tracks would be floated normally where the peat depth is greater than 1m, otherwise the tracks would be excavated and backfilled. Submerged drainage pipes would be installed across excavated tracks where hydrological sensitivities are present. Further details are provided in **Chapter 4: Project Description**.

1.2.4 Excavated tracks are expected to extend along 13.2km. These can have a greater impact on terrestrial habitats because of the associated earthworks, in particular where the track runs across a slope requiring a cutting and embankment to be created. Cut tracks also normally require drainage ditches.

1.2.4 Floated tracks are expected to extend along 15.5km. Whilst these have the benefit of avoiding peat excavation, the extent of direct habitat loss will be generally similar to excavated tracks whilst the indirect effects on habitats (principally hydrological) are likely to extend over a smaller area.

1.2.5 The dimensions assumed for the estimates of direct habitat loss for each of the built elements of the Proposed Development are provided in **Table 9G.1** below.

Zone of Influence for Temporary Habitat Disturbance

Construction Disturbance

1.2.6 As well as direct habitat losses there will be an area of ground surrounding built infrastructure which will be subject to physical disturbance (comprising plant traffic and excavations, drainage ditches, cable trenches, banked cut faces/batters etc.). For the purposes of the temporary habitat disturbance estimates a 50m construction buffer has been applied around turbine bases; and a 10m construction buffer has been applied around access tracks.

Hydrological Change

1.2.7 Potential impacts on the hydrology of surface waters are addressed in detail in **Chapter 11: Hydrology, Hydrogeology and Geology**. This chapter focuses on terrestrial habitats that are considered to be particularly sensitive to changes to surface water or groundwater hydrology resulting from construction activities associated with wind farm development, focusing on blanket bog pool systems, flushes and groundwater dependent terrestrial ecosystems (GWDTEs).

1.2.8 Some habitats adjacent to the zone of physical construction disturbance, particularly those sensitive to changes in surface hydrology such as blanket bog, will be indirectly affected due to hydrological changes associated with excavations for turbine foundations, borrow pits and access tracks etc. The habitats which are considered particularly sensitive to damage during construction works include blanket bog (particularly areas of hollows and pool systems), along with wet heath, marshy grassland and acid flush which all contain potential GWDTEs.

1.2.13 The hydrological zone of influence for sensitive habitats on the Development Site is assessed to be within 250m from such areas of excavation.

1.2.9 In addition, blanket bog and acid flushes can be affected through changes in hydrology related to the disturbance of soil and peat structure. The result of these changes can be the loss of plant species adapted to the hydrological regime present within these habitats.

1.2.10 Hydrological changes can occur through the excavation of soil and bedrock during the construction of roads/access tracks, foundations, trenches and borrow pits, where localised disruption to groundwater flow can occur. This can impact on associated groundwater abstractions (especially shallow sources, i.e. springs and wells) or on potential GWDTEs. Discharge of groundwater/surface water contaminated during excavation may cause physical or chemical contamination to terrestrial habitats and nearby watercourses. An example of this is when blanket bog has new drainage ditches created adjacent to it resulting in a lowering in the water level and losses of bog specialist plant species being replaced by species that can tolerate drier conditions. This change over time is regarded as an indirect loss or degradation of habitat.

1.2.11 Almost the entire Study Area is covered by blanket peat, usually at least one metre deep, supporting several recognisable NVC blanket bog vegetation communities. There were just a few areas without any blanket bog at all. The majority of this Annex I habitat was considered to be in good condition with good cover values of typical species and was usually clearly classifiable in NVC terms. Plants characteristic to these habitats are adapted to low nutrient, acidic and wet conditions, and therefore the maintenance of a high water table is critical to the long-term maintenance of these species. Artificial drainage of peat can cause the loss of such species; particularly bog mosses (*Sphagnum* spp.). In extreme cases this may result in enough loss of vegetation cover and structure to cause the eventual erosion of exposed peat.

1.3 Footprint Calculations

1.3.1 The dimensions and extents of the various infrastructure elements for the Proposed Development are provided in **Table 9G.1** below.

Table 9G.1 Dimensions and Extents of the Proposed Development as provided in Chapter 4

Infrastructure	Number or Length (km)	Maximum Dimensions assumed (m)	Total footprint area (ha)
Turbine foundations and crane pad hardstandings	35	For each wind turbine: Crane pad hardstanding 35 @ 50m by 25m) = **4.38ha** (0.125ha per turbine Turbine foundations[1]: 35 @ 11.5m radius = **1.47ha** (0.042ha per turbine);	5.85
Access tracks	28.7km	5m running surface Temporary passing places (up to 33m x 4m) would be provided every 500m	15.12
Borrow pit search areas	5	Estimated dimensions to acquire the required quantity of stone	10.48
Central / Main substation (grid connection location)	1	150m x 80m	1.20
Construction compound	1	150m x 80m	1.20
Secondary substation	2	80m x 80m	1.28
Storage / laydown areas	3	100m x 100m	3.00
TOTAL AREA			**38.13**

1.3.2 The total footprint (that is the area subject to direct habitat loss and which could not be restored for at least the lifetime of the wind farm) has therefore been calculated as **38.13 ha.**

1.3.3 Additional to the Proposed Development footprint relating to the infrastructure elements is the Forestry Removal footprint (**Figure 9G.1**) based on required forestry clearance from turbine blades and access roads etc. This footprint would contribute direct habitat loss relating to coniferous plantation woodland and secondarily the indirect disturbance relating the harvesting/removal operations which may cause trampling to some modified bog habitat.

[1] Calculations regarding the dimensions of each wind turbine are based on an indicative hardstanding layout provided on 8 February 2018. The final scheme design is likely to comprise: 11 turbines @ 11.5m radius; 16 turbines @ 6.5m radius; and 8 turbines @ 5m radius. However, it is not currently known where each turbine type will be sited, therefore for the purpose of this assessment we have adopted a precautionary approach in assuming that all turbine foundations would be 11.5 m radius.

1.4 Results

Direct Habitat Loss

1.4.1 **Table 9G.2** provides the total estimated direct habitat loss from the construction of the proposed wind farm divided across different Phase 1 habitat types without considering any indirect impacts.

1.4.2 **Table 9G.3** provides the total estimated direct habitat loss from the construction of the proposed wind farm divided across sensitive vegetation communities (based on the classification of NVC communities presented in **Appendix 9F: Vegetation Sensitivity Classification**).

1.4.4 **Table 9G.4** provides the total estimated loss of existing coniferous planting within the Development Site. The total direct loss of coniferous plantation woodland relating to forestry removal is approximately 41.4ha. This is an overall figure for habitat loss, which would include the 5.18ha lost to the infrastructure elements of the scheme (See **Table 9G.2**).

Temporary Habitat Disturbance

1.4.5 **Table 9G.5** provides the extent of temporary habitat loss or disturbance to Phase 1 habitat types for each element of wind farm infrastructure.

1.4.6 **Table 9G.6** provides the extent of temporary habitat loss or disturbance to sensitive vegetation communities (based on the sensitivity classification of NVC communities presented in **Appendix 9F: Vegetation sensitivity and approach to avoidance of blanket bog**).

1.4.7 These losses and potential changes are fully considered within the ecological impact assessment reported in **Chapter 9: Ecology** (**Section 9.12 – 9.16**).

Table 9G.2 Predicted Direct Loss of Phase 1 Habitat Types

Phase 1 habitat type	Permanent habitat loss			Total area of habitat affected (ha)	Total areas of habitat in development site (ha)	Percentage of total habitat in footprint affected by construction (%)
	Turbines bases (ha)	Access tracks (ha)	Associated permanent infrastructure (crane pads, borrow pits, substations etc) (ha)			
Planted coniferous plantation woodland	0.031	1.3	3.8	**5.18**	166.45	3.1%
Marshy grassland	0	0.03	0	**0.03**	17.85	0.2%
Semi-improved acid grassland	0	0.05	0	**0.05**	19.41	0.3%
Wet heath	0	0.22	2.18	**2.4**	31.93	7.5%
Blanket bog	0.56	14.73	14.06	**29.34**	1358.85	2.2%
Wet modified bog	0.02	0.11	1.45	**1.58**	43.75	3.6%
Bare ground	0	0	0.02	**0.02**	0.19	10.5%

Table 9G.3 Predicted Direct Loss of Sensitive Vegetation Communities

Habitat classification	Permanent habitat loss			Total area of habitat affected (ha)	Total areas of habitat in development site (ha)	Percentage of total habitat in Footprint affected by construction
	Turbines bases (ha)	Access tracks (ha)	Associated permanent infrastructure (crane pads, borrow pits, substations etc) (ha)			
Red (high sensitivity)	0.03	0.75	0.6	1.4	182	0.8%
Amber (medium sensitivity)	0.45	11.57	12.27	24.3	1,007	2.4%
Yellow (medium sensitivity)	0.06	11.57	1.58	4.2	184	2.3%
Green (low sensitivity)	0.06	1.69	5.8	7.6	295	2.6

Table 9G.4 Predicted Direct Loss of Existing and Planned New Coniferous Planting

Forestry type	Permanent habitat loss			Total area of habitat affected (ha)	Total areas of habitat in development site (ha)	Percentage of total habitat in footprint affected by construction
	Turbines bases (including turbine blade clearance +10%) (ha)	Access tracks (including 10m clearance) (ha)	Associated permanent infrastructure (crane pads, borrow pits, substations etc) (including 10m clearance (ha)			
Existing plantation	Combined areas			41.4	211.11	19.6 %

Table 9G.5 Predicted Temporary Disturbance of Phase 1 Habitats

Phase 1 habitat type	Temporary/indirect habitat loss			Total area of habitat affected (ha)	Total areas of habitat in development site (ha)	Percentage of total habitat in footprint affected by construction (%)
	50m construction buffer from turbine bases (ha)	10m construction buffer around access tracks (ha)	Associated temporary infrastructure (compounds, met masts etc) (ha)			
Marshy grassland	0	0.14	0	**0.14**	17.85	0.8%
Semi-improved acid grassland	0	0.22	0.0002	**0.22**	19.41	1.1%
Wet heath	0.067	0.87	0.4	**1.3**	31.93	4.1%
Blanket bog	5.86	62.5	8.4	**76.8**	1358.85	5.7%
Wet bog	0.33	0.6	0	**0.9**	43.75	2.1%

Table 9G.6 Predicted Temporary Disturbance of Sensitive Vegetation Communities

Phase 1 habitat type	Temporary/indirect habitat loss			Total area of habitat affected (ha)	Total areas of habitat in development site (ha)	Percentage of total habitat in footprint affected by construction
	25m construction buffer from turbine bases (ha)	10m construction buffer around access tracks (ha)	Associated temporary infrastructure (compounds, met masts etc) (ha)			
Red (high sensitivity)	0.53	3.33	0	3.86	182	2.1%
Amber (medium sensitivity)	2.23	48.9	4.9	56.1	1,007	5.57%
Yellow (medium sensitivity)	0.68	10.9	1.23	12.8	184	6.96%
Green (low sensitivity)	1.15	7.23	0.76	9.14	295	3.1%

134000 135000 136000 137000 138000 139000 140000

936000 935000 934000 933000 932000 931000

Key

- Development site boundary
- Survey area
- Turbine 180m to blade tip
- Turbine 156m to blade tip
- Cranepad hardstanding
- Site roads
- Bridge
- Culvert
- Burrow pit
- Beinn Grideag turbines
- Central / Main substation (grid connection location) 150m x 80m
- Construction Compound 150m x 80m
- Secondary substation 80m x 80m
- Storage / Laydown Areas
- Felling area
- Area of Existing Trees
- Potential habitat enhancement search area

0 250 500 750 1,000 m

Scale at A3: 1:22,500

Client

Lewis Wind Power
Cumhachd Gaothe

Stornoway Wind Farm
EIA Report

Figure 9G.1
Forestry removal areas

April 2019

wood.

F:\GWM\DATA\PROJECT\40001 Stornoway Optimisation Feasibility Study\D040 Design\GIS\mxd\40001-Gos393b.mxd Originator: gwenda.pannu