

Carrick Windfarm

Outline Habitat Management Plan

December 2021

Version 1.0

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Image 1: Process for monitoring and management to achieve habitat restoration.

Figure 7.6.1: Outline Habitat Management Plan Area Location

1 Introduction

The overall purpose of the Carrick Windfarm Outline Habitat Management Plan ('the OHMP') is to implement positive land management for the benefit of landscape and nature conservation which will mitigate adverse impacts that the windfarm may have had, particularly in relation to peatland habitats. In addition to purely mitigating against any adverse impacts, ScottishPower Renewables (hereafter referred to as 'the Applicant') is also committed to enhancing the nature conservation and landscape value of the Site. As well as delivering benefits for blanket bog habitats the OHMP is also likely to benefit a range of other associated species. The OHMP defines the Aims and Objectives of the land management that will be implemented on Site to achieve this overall purpose.

The Applicant has been at the forefront of blanket bog restoration, developing new techniques to restore these habitats which are effective and scalable to meet the challenges of biodiversity, climate change, water quality and natural flood management. Between 2010 and 2019, the Applicant has implemented 1500 hectares (ha) of peatland restoration from commercial forestry across our projects. This work transcends windfarms, with the techniques now being adopted by other organisations including Forestry and Land Scotland (FLS), the Royal Society for the Protection of Birds (RSPB) and NatureScot¹ to assist with their own restoration ambitions and objectives. In 2017, the Applicant was invited by the International Union for Conservation of Nature (IUCN) to act as lead authors of a new technical report for their Commission of Inquiry into Peatlands which was published in 2019. This report² describes the historical work done by the Applicant and other organisations to restore blanket bog from forestry, the methods which have been developed and their efficacy at achieving restoration objectives.

1.1 Background

Carrick Windfarm (the 'Proposed Development') will comprise up to 13 wind turbines, associated infrastructure and an Energy Storage Facility (i.e. battery) subject to landowner agreement. The OHMP was developed to describe how potential impacts the Proposed Development may have on the surrounding habitat will be mitigated during the operational phase. Mitigation measures are focussed on the restoration of blanket bog habitat.

The OHMP includes the following:

- a description of baseline (pre-construction) habitat conditions;
- the identification of habitat management areas including maps;
- clear Aims and Objectives;
- detailed methodology and prescriptions of habitat management measures, including timescales with defined criteria for the success of the proposed measures;
- details of regular monitoring of habitat management measures using fixed quadrat locations and contingency measures should monitoring reveal unfavourable results; and
- details of the production of regular monitoring reports to be submitted to the Planning Authority at agreed intervals.

¹ Formerly Scottish Natural Heritage (SNH).

² <https://www.iucn-uk-peatlandprogramme.org/resources/commission-inquiry/commission-inquiry-peatlands-update-2017-20>

2 Land Ownership

The land covered by the Habitat Management Plan (HMP) is owned by the Scottish Government and managed by FLS. It will be leased to the Applicant for the duration of the proposed windfarm development. The lease agreements will include a provision to enable the Applicant to implement management works within the Site.

3 Site Location and HMP Area

The Proposed Development is located in South Ayrshire approximately 14km east of Girvan and 6km south of Straiton. The OHMP area lies within the Site Boundary and encompasses a total area of 28 ha. This area is entirely comprised of peatland habitat (of varying depth) and the restoration of this area is considered to compensate for the estimated 9.36ha of peatland habitat predicted to be directly and indirectly permanently lost as part of the Proposed Development as well as resulting in a net gain of approximately 18.64ha of peatland habitat (Carrick Windfarm Environmental Impact Assessment Report (EIAR)). The restoration of bog habitat may in turn be expected to result in additional biodiversity benefits such as the provision of habitat for aquatic and terrestrial invertebrates, common amphibians and ground nesting birds.

The HMP area was selected following a detailed review process which considered a range of factors including topography, peat depth, connectivity to adjacent mesotopes and features visible on aerial photography. The final selected area was considered to be the most appropriate largely due to the presence of deep peat (up to 5m) and connectivity to an area of relatively unmodified bog which is situated within the OHMP.

4 Habitat Condition

4.1 Overview

Detailed National Vegetation Classification (NVC) surveys have been undertaken within the Proposed Development Area and a surrounding buffer of up to 250m (i.e. the NVC Survey Area) to support the EIAR. Further surveys were carried out to inform condition and provide more detailed information on peat depth, vegetation composition and the underlying site hydrology. Peat depth varies across the OHMP area, with the maximum depth recorded circa. 5m. The OHMP area has mostly been planted with commercial forestry crop, however, it is clear that many trees are exhibiting poor and stunted growth most likely as a result of deep peat and waterlogged conditions. There is an area of unplanted bog within the OHMP area (approximately 3ha) which has not been directly affected by forestry practices, but indirect effects such as the growth of self-seeded conifers is apparent.

4.2 Peatland habitat status

Peatland habitat within and around the Proposed Development Area is generally in a degraded condition as a result of extensive historical cultivation for commercial forestry. A complete description of the impacts of forestry on peatland habitats can be found at <https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Resources/COI%20Forestry%20briefing.pdf>.

Surviving forms of peatland habitats within the NVC Survey Area are dominated by modified forms of the NVC bog-type communities M18 *Erica tetralix*–*Sphagnum papillosum* raised and blanket mire, M19 *Calluna vulgaris*- *Eriophorum vaginatum* blanket mire and M25 *Molinia caerulea*-*Potentilla erecta* mire.

5 Aims and Objectives

5.1 Delivery Process

The delivery of an HMP is based on achieving the various Aims, which are assessed by measuring the extent to which clearly defined Objectives and their associated condition indicators have been met. The definition of each Objective is therefore a key requirement for an HMP to allow progress to be assessed in a quantified, objective way which has clear implications for whether the overall Aims are likely to be met and any management measures which need to be put in place or amended.

A summary of the stages is shown in Image 1 which has been applied to each Objective within this OHMP. For Objectives where the required management is not obvious, or the processes not well enough understood to allow them to be defined in detail, a programme of trials is advocated to allow the methods, costs, rates and effects of management measures to be assessed before being implemented more widely.

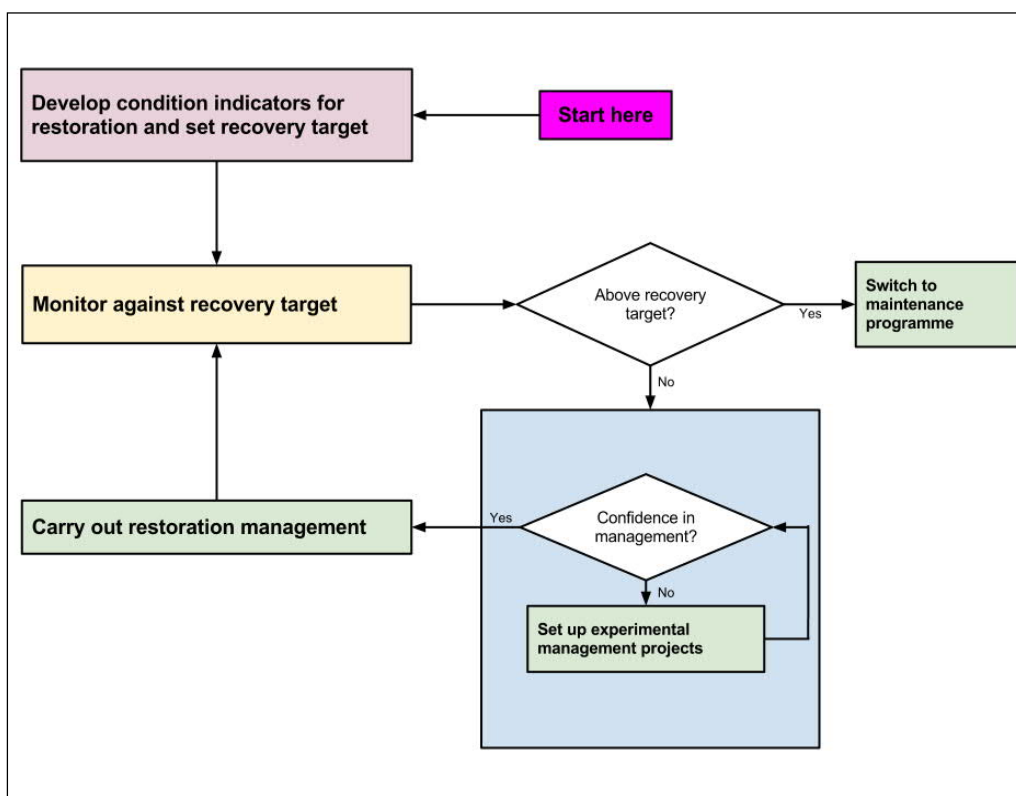


Image 1: Process for monitoring and management to achieve habitat restoration, redrawn from Hurford and Schneider (2007)³

³ Hurlford, C. and Schneider, M. (2007). Monitoring nature conservation in cultural habitats: A practical guide and case studies. Springer Netherlands.

5.2 Quantifying restoration outcomes

Some Objectives are considered to be more fundamental than others to achieve in order for habitats to be restored and have therefore been weighted accordingly (see individual Objectives within each Aim for the weighting). This allows an overall weighted average score for the entire OHMP area to be produced out of 100 and compared with Table 7.6.1 below, with 100 demonstrating each Objective is met at every sample location. This method allows an overall assessment of restoration progress to be made.

Condition Class	Weighted Average Score
Very poor	<60.0
Poor	60.01-70.0
Acceptable	70.01-80.0
Good	80.01-90.0
Excellent	90.01-100

Table 7.6.1 Scoring System for HMP Targets

Table 7.6.2 shows the breakdown of each individual Objective along with the weighting which is based on the relative importance for the overall Aim being achieved. The highest weighting is given to bog water table as a good hydrological regime is critical to the function of healthy bog habitat. Higher weighting is also given to the Sphagnum moss Objectives as these are the constants of blanket bog habitat and also indicate the basic hydrology is intact.

Aim	Group	Objective	Short Description	Weighting
Aim 1: Underlying Conditions	Bog Water Table	1.1	Water table in drought: <20 cm	20 %
		1.2	Water table in drought: <10 cm	15 %
		1.3	Water table in drought: 0 cm	5 %
	Tree regeneration	1.4	Absence of trees	5 %
		1.5	Tree height	5 %
Aim 2: Conservation Status and Quality	Sphagnum and Peat	2.1	Sphagnum present	10 %
		2.2	Thick branched Sphagnum present	5 %
		2.3	Sphagnum cover >30 %	10 %
		2.4	Sphagnum trampling absent	2.5 %
		2.5	Bare peat cover <1 %	5 %
	Higher Plants	2.6	Eriophorum spp. present	5 %
		2.7	Calluna present	5 %
		2.8	Calluna >20 cm and <20 % browsed	2.5 %
		2.9	True grass cover <5 %	2.5 %
		2.10	Key plant cover <75 %	2.5 %

Table 7.6.2: Weighted Score Given to Each Objective

The score for a treated area is therefore calculated as follows:

Weighted Average Score for each habitat grouping (example for blanket mire) = Sum (% Samples which meet Obj. 1.1 * 0.20, % Samples which meet Obj. 1.2 * 0.10..., % Samples which meet Obj. 3.10 * 0.025).

Proposed management measures for each area are described in Section 6 and a description of monitoring methods is included in Section 7.

Aim 1: Restore Conditions for Blanket Mire Habitat

Definition and Distribution

The definition of blanket mire habitat covered by Aim 1 is defined as all areas within the OHMP area with peat depths >0.5m. This covers a total area of approximately 28ha. Where trees are present these areas will be felled during construction of the windfarm (Phase 1) as per the Windfarm Felling Plan (Appendix 13.1 Forestry of the EIAR).

Background

The condition of the majority of bog habitat within the OHMP area is poor due to cultivation for commercial forestry. In order to create the underlying conditions required for the establishment of typical bog species, restoration works will need to be carried out to reverse the negative effects of historical management activities and prevent further habitat degradation.

Condition Requirements

The primary condition required to support blanket bog habitat is a water table depth which is close to the surface throughout the year, including the drought period (typically April – June). Based on this requirement, a set of Objectives have been defined which will allow restoration progress to be monitored.

Objectives

Based on the requirements specified above a set of Objectives have been defined which will allow progress to be monitored (Table 7.6.3). An Objective is considered to be met when at least 70% of sample plots meet the specified criteria.

	Objective	Description	Weighting
Bog water table	1.1	The bog water table should be no deeper than 20cm from the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions' (defined as the time at which water table levels onsite are considered to be in the lowest 10% of their measured range, and rainfall has been negligible for at least 3 weeks; surveys undertaken any time between 1st April and 31st August).	20 %
	1.2	The bog water table should be no deeper than 10cm below the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	15 %
	1.3	The bog water table should be at or above the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	5 %
Tree regeneration	1.4	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be absent from each sampled plot.	5 %
	1.5	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be < 1m in height if present.	5 %

Table 7.6.3 Bog Water Table and Tree Regeneration Objectives

Aim 2: Improve quality of blanket mire habitat

Definition and Distribution

The definition of blanket mire habitat covered by Aim 1 is defined as all areas within the OHMP area with peat depths >0.5m. This covers a total area of approximately 28ha. Where trees are present these areas will be felled during construction of the windfarm (Phase 1) as per the Windfarm Felling Plan (Appendix 13.1 Forestry of the EIAR).

Background

The majority of blanket mire habitat within the OHMP area has been heavily drained and is of a lower quality than would be expected on intact blanket mire. This is evidenced by the plant assemblages observed within the OHMP area, which is not as diverse as would be expected from a high-quality bog.

The long-term aspiration (>five years) is to restore the blanket mire habitat within the OHMP area to a high quality. Monitoring undertaken by the Applicant on other restoration sites has shown that once the underlying hydrological conditions are restored, typical bog species will start to recolonise the treated areas. The precise vegetation assemblage which would be expected is difficult to define at this stage and variation is also expected between the mesotopes present.

Objectives

A number of indicators have been used to formulate Objectives which reflect different aspects of blanket mire quality over time (Table 7.6.4). These will be compared against suitable reference areas where possible to allow the quality of the restored blanket mire to be assessed in context. An Objective is considered to be met when at least 70 % of sample plots meet the specified criteria.

	Objective	Description	Weighting
Sphagnum and peat	2.1	At least one species of Sphagnum should be present (open range land: predicted community M17, 18 or 19) on each sampled plot.	10 %
	2.2	Sphagnum papillosum or S. magellanicum should be present (open range land where expected type is M17 & 18) on each sampled plot.	5 %
	2.3	Sphagnum spp. should account for at least 30% of basal cover on each sampled plot.	10 %
	2.4	Visible trampling or uprooting impacts of large grazing mammals on Sphagnum hummocks (or lawns) should be absent on each sampled plot.	2.5 %
	2.5	Bare peat should comprise <1 % of 'basal' cover on each sampled plot, in situations where it is arising due to trampling effects or disturbance by machinery (where sites are naturally eroding this target can be modified to suit).	5 %
Higher plants	2.6	Eriophorum spp. should be present on each sampled plot.	5 %
	2.7	Calluna vulgaris should be present on each sampled plot.	5 %
	2.8	Calluna vulgaris of at least 20 cm average canopy height and with < 20% leading shoots browsed by deer/sheep on average, should be present on each sampled plot.	2.5 %
	2.9	'True grasses' foliar cover should be less than 5 % on each sampled plot.	2.5 %
	2.10	The combined cover of Calluna vulgaris, Eriophorum spp. and Tricophorum cespitosum should account for no more than 75 % of foliar cover on each sampled plot.	2.5 %

Table 7.6.4 Sphagnum, Peat and Higher Plant Objectives

6 Habitat Management Measures

The habitat management measures proposed by the Applicant reflect the different requirements of site conditions which are variable.

6.1 Physical Interventions on degraded bog habitat

Physical interventions are defined as measures which comprise mechanical treatment to an area of land. These treatments will be carried out at an appropriate time post-felling (typically >four years after felling).

The Applicant have undertaken several trial projects to investigate types of intervention and associated costs, environmental risks and practical considerations relevant to forest-bog restoration. A description of the work undertaken and results are detailed at <https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Resources/COI%20Forestry%20briefing.pdf> with a summary included in Table 7.6.5 below.

Technique	Description	Drain/furrow disruption	Conifer regeneration removal
Cross-tracking	Uses a tracked excavator to flatten plough ridges and disrupt drainage pathways and ring-bark conifer regeneration	Yes	Yes
Ground-smoothing	Uses an excavator bucket to upturn stumps and infill furrows and drains and bury conifer regeneration	Yes	Yes
Hand clearance	Hand felling of conifer regeneration using clearing saws or chainsaws	No	Yes (densities <2500/ha)
Wave damming	Creating dams approx. 4m apart within existing drains and double ploughed furrows to stop water flow.	Yes	No
Raking	Uses an excavator to rake conifer regeneration into brush piles	No	Yes

Table 7.6.5 Physical Intervention Methods

The precise areas where each technique will be implemented will be determined when undertaking the detailed planning of restoration work. It is envisaged that a combination of measures will typically be required within each defined area depending on ground conditions, topography and the extent of factors affecting restoration (i.e. conifer regeneration, ploughing method, stump sizes, drain status etc.).

7 Monitoring

The Applicant has developed a protocol to monitor vegetation in relation to the Objectives set out within the OHMP based on extensive experience monitoring similar habitats across Scotland.

Monitoring will be undertaken on a set of permanent 1m radial samples within the OHMP area. At each 1m radial sample point the following information will be collected for species relevant to the Objectives (target species):

1. presence/absence of target species;
2. by eye cover targets of key metrics;
3. height and offtake of Calluna;

4. depth to water table (using fixed dipwell); and
5. three pin hits of foliar and basal vegetation cover equally spaced along a 20m transect (long format only).

There are two monitoring methods used: a long monitoring protocol and short monitoring protocol. The short monitoring protocol only records items 1, 2, 3 and 4. The protocols will be applied according to the programme below. See Annex 1 for further details on the monitoring protocol.

Year*	1	2	3	4	5	7	9	12	15	20	25
Method	Long	Short	Long	Short	Long	Short	Long	Long	Long	Long	Long

* Year after implementation of physical interventions

Annex 1: Field Monitoring Protocol

Frequency Assessment

At each monitoring sample plot a rope demarcated at 0.25m, 0.50m and 1m will be used to form a radial quadrat. Starting with the smallest distance and working up to 1m, the presence of each target species is to be recorded, noting the smallest distance found. This nested unit size allows different sizes of sampling units to be applied to species of differing abundances for trend monitoring i.e. common species are assessed in smaller units and rarer species are assessed in larger units.

General Cover Assessment

Record each by eye cover assessment within each frequency point (1m circle):

- i) is Sphagnum cover > 30 % (if unsure record lower);
- ii) is bare peat cover < 1 % (if unsure record higher);
- iii) is true grass cover (excluding Molinia) < 5 % (if unsure record higher); and
- iv) is the combined cover of Calluna, Eriophorum and Tricophorum < 75 % (if unsure record higher).

Calluna height and offtake

Record the height of a representative Calluna plant within each 1m radial plot. Record Calluna height from the top of the basal layer and the depth of the basal layer to peat surface separately. Record the percentage of Calluna long shoots browsed.

Dipwell protocol

Permanent dipwells will be installed at each monitoring sample plot. During a drought period where there has been no limited rainfall in the preceding 14 days (typically between April and June, although can occur at other times), the dipwells will be measured by measuring from the top of the dipwell to the water table (termed "water depth"), and from the top of the dipwell to the main peat mass surface (termed "peat offset"). By subtracting the peat offset from the water depth it is possible to calculate the true value of the water table within the bog.

Pin hits

At each monitoring sample plot a rope demarcated at 1m, 11m and 19m is set out to the west. At each marker point a laser pointer is stood on the north side of the rope and used to record any living plant species, plant litter or bare peat that it hits directly below. Both basal layer and higher vegetation are to be recorded.

Long and Short Monitoring Methods

The 'long' monitoring method records the following information:

- 1. presence/absence of target species;
- 2. by eye cover targets of key metrics;
- 3. height and offtake of Calluna;
- 4. depth to water table (using fixed dipwell); and
- 5. three pin hits of foliar and basal vegetation cover equally spaced along a 20m transect (long format only).

The 'short' monitoring method is the same as above with the omission of pin hits of foliar and basal vegetation cover.

