

Technical Appendix 6.7: Habitat Management Plan

The Habitat Management Plan is set out overleaf.

Barnesmore Windfarm Repowering

Habitat Management Plan

December 2019

Version 1



CONTENTS

1	INTRODUCTION	1
2	LAND OWNERSHIP	1
3	SITE LOCATION AND HMP AREA.....	1
4	ORNITHOLOGY OVERVIEW.....	2
5	HABITAT CONDITION.....	2
6	AIMS AND OBJECTIVES.....	3
7	HABITAT MANAGEMENT MEASURES.....	9
8	MONITORING PROPOSALS.....	12
	APPENDIX A: WAVE DAMMING SUMMARY	14

List of Figures and Maps

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

Map 1: Site overview

Map 2: Turbary rights

Map 3: Management measures

1 Introduction

The overall purpose of the Barnesmore Windfarm Repowering Habitat Management Plan (“the HMP”) is to implement positive land management for the benefit of landscape and nature conservation which will mitigate any adverse impacts that the Windfarm may have had. In addition to purely mitigating against any adverse impacts, ScottishPower Renewables is also committed to enhancing the nature conservation and landscape value of the Windfarm site. The HMP defines the Aims and Objectives of the land management that will be implemented on site to achieve this overall purpose.

1.1 Background

Barnesmore Windfarm Repowering comprises the removal of the existing Operational Barnesmore Windfarm turbines and replacing them with 13 new, larger turbines (Map 1).

This HMP was developed to describe how potential impacts the development may have on the surrounding habitat and ornithology will be mitigated for during the operational lifetime of the project. The focus of the mitigation measures is the restoration of active blanket bog habitat which is extensive across the site.

The HMP includes the following:

1. Appropriate assessment and description of pre-construction, baseline habitat conditions;
2. Appropriate maps, clearly identifying habitat management areas;
3. Clear Aims and Objectives of proposed habitat management;
4. Detailed methodology and prescriptions of habitat management measures, including timescales and defined criteria for the success of these measures;
5. Details of regular monitoring of habitat management measures using fixed quadrat locations and contingency measures should monitoring reveal unfavourable results;

2 Land Ownership

The land encompassed within this HMP is owned wholly by SPR (“the Land Ownership Boundary” - Map 1), although there are existing turbarry rights in place within the land boundary (Map 2).

3 Site Location and HMP area

The Barnesmore Windfarm Repowering site boundary is located approximately 9km north east of Donegal and sits within the Barnesmore Bog Natural Heritage Area (“NHA”). The NHA comprises predominantly upland blanket bog and heath habitat and is in generally favourable condition, although some areas have been degraded because of human activities, including peat cutting, drainage and commercial forestry. The existing Operational Barnesmore Windfarm infrastructure along with a 3m buffer was excluded from the NHA boundary when the NHA was designated.

The proposed Habitat Management Area (“the HMA”) lies within the NHA boundary and surrounds the Barnesmore Windfarm Repowering infrastructure and encompasses a range of habitats. The HMA is comprised of predominantly peatland and heathland habitat, although there are some localised areas of grassland habitat, and scrub habitat located along riparian corridors. The HMA covers a total area of 152.85ha of predominantly peatland habitat, which is considered adequate to compensate for the 4.37ha of Annex 1 habitats (Blanket Bog, Alpine and Boreal Heath and Wet Heath) predicted to be lost as part of the project (Barnesmore Windfarm Repowering Environmental Impact Assessment Report). The HMA comprises seven individual units (Map 3), the area breakdown of each is shown in Table 1.

Table 1: Breakdown of HMA per unit

Name	Area (ha)
Unit A	27.89
Unit B	103.04
Unit C	0.16
Unit D	11.63
Unit E	1.21
Unit F	1.22
Unit G	7.68
Total	152.85

4 Ornithology overview

Two years of bird surveys were carried out to inform the Environmental Impact Assessment Report identified the usage of the site by a range of bird species. It is anticipated that the management measures outlined below will benefit most ornithological receptors but focus on providing mitigation through habitat improvement for snipe, hen harrier and golden plover (see Section 7.1 for a breakdown of management measures that will benefit each species).

4.1 Snipe

Surveys identified that there were between 19 – 28 snipe territories utilising the area with 500m of the Barnesmore Windfarm Repowering infrastructure. Snipe require a mosaic of habitats for nesting, feeding and chick rearing, including wet areas and pools which provide a source of insects.

4.2 Hen harrier

There are two pairs of hen harrier with territories just overlapping the Site Boundary. Hen harrier require open habitat such as moorland for foraging and nesting.

4.3 Golden plover

Surveys recorded both breeding and overwintering golden plover using the site and habitat management measures have been included within the HMP to provide benefit to them, due to their red listed conservation status. Golden plover require a mosaic of habitats, including open moorland for foraging and nesting.

5 Habitat Condition

5.1 Overview

Prior to developing the HMP SPR commissioned a Phase 1 habitat survey to classify habitat type. Additional information was gathered on habitat condition and usage through additional field surveys and desk-based surveys of satellite imagery.

5.2 Peatland habitat status

The habitats within the Land Ownership Boundary predominantly comprised of mosaic of blanket bog, alpine and boreal heath and wet heath and form part of the Barnesmore Bog Natural Heritage Area. The NHA Site Synopsis states the NHA is in a generally favourable condition. However, there are extensive areas of peat cutting across, some of which is historical and was carried out by hand, and some of which has been cut more recently using machinery. There are also drainage ditches and areas

of low density self-seeded conifers. The HMA lies wholly within SPRs wider Land Ownership Boundary and has been split into Units for the purposes of the HMP accounting for the varying habitat condition across the site. This will influence the management measures undertaken in each Unit which are briefly described below with more detail provided in Section 7:

- Unit A has approximately 1540m of agricultural drains present within the area which will exert draw-down of water within the adjacent peat mass.
- Unit B comprises an area of blanket bog and heathland habitat which covers an area of 103.04ha. Self-seeded regeneration conifers are found throughout the area, having spread from the adjacent forestry.
- Unit C is a small 0.16ha area of conifer plantation which was planted on peatland habitat in the middle of the NHA.
- Unit D is in the south of the site and comprises two areas of land totalling 11.63ha which lie out with the turbary rights boundary, but where peat cutting has been carried out.
- Unit E is 1.21ha in size and covers 10 small areas where peat cutting has recently been carried out using machinery. Due to the cutting and extraction method the surface remains bare (no turves have been replaced) leaving the peat exposed and susceptible to oxidation.
- Unit F comprises the turbines and roads from the existing Operational Barnesmore Windfarm infrastructure (1.22ha) which will be restored to blanket bog habitat following decommissioning. As these areas are surrounded by good quality blanket bog habitat they are expected to return to a functional hydrological unit.

5.3 Other habitat status

Unit G comprises four areas totalling 7.68ha of non-peatland habitat along riparian corridors.

6 Aims and Objectives

6.1 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 applied to each Objective within this HMP is shown in Figure 1. 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.

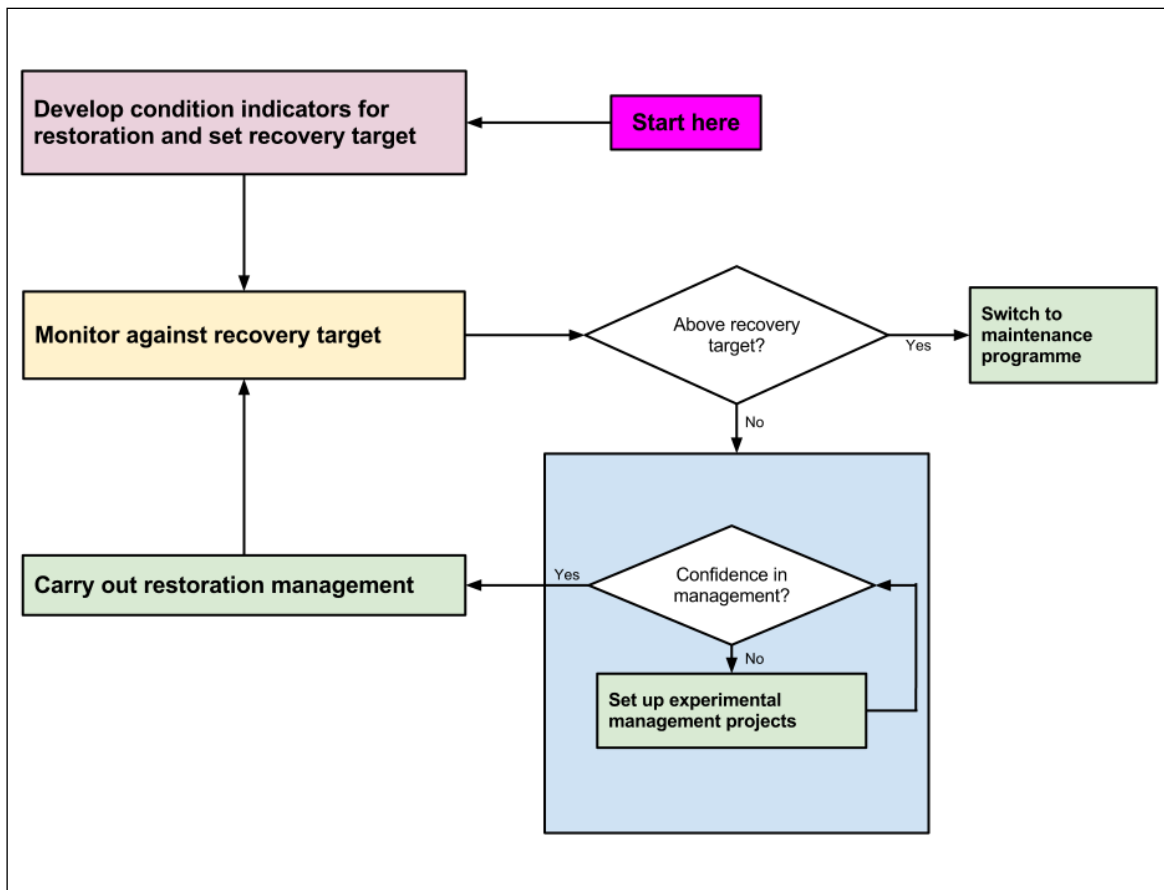


Figure 1: Process for monitoring and management to achieve habitat restoration, redrawn from Hurford and Schneider (2007).

6.2 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 Objectives have been weighted accordingly (see individual Objectives within each Aim for the weighting). This allows an overall weighted average score for the entire site to be produced out of 100 and compared against with Table 2 below, with 100 demonstrating each Objective is met at every sample location. This method allows an overall assessment of restoration progress to be made.

Table 2: Scoring system for HMP targets

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

Table 3 shows the breakdown of each individual Objective along with its weighting which is based on the relative importance for bog functioning. The highest weighting is given to bog water table as good hydrology is critical to the function of a 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.

Table 3: Weighted score given to each objective

Aim	Group	Objective	Short Description	Weighting
Aim 1: Underlying Conditions	Bog Water Table	1.1	WT in drought: <20cm	20%
		1.2	WT in drought: <10cm	15%
		1.3	WT in drought: 0cm	5%
	Tree Regeneration	1.4	Trees should be absent	5%
		1.5	Trees should be <1m if present	5%
Aim 2: Conservation Status	Sphagnum & Peat	2.1	Sph. present on plots	10%
		2.2	Thick sph. present on plots	5%
		2.3	Sph. cover >30% on plots	10%
		2.4	Sph. trampling absent on plots	2.5%
		2.5	Bare peat cover <1% on plots	5%
	Higher Plants	2.6	Eri. present on plots	5%
		2.7	Cal. present on plots	5%
		2.8	Cal. >20cm & <20% browsed	2.5%
		2.9	True grass cover <5% on plots	2.5%
		2.10	Key plant cover <75%	2.5%

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

Weighted Average Score = Sum (% Samples which meet Obj. 1.1 * 0.20, % Samples which meet Obj. 1.2 * 0.15..., % Samples which meet Obj. 2.10 * 0.025)

Aims and Objectives are described for the areas of modified blanket bog below. The management measures for each area are described in Section 7, and a description of the monitoring is included in Section 8.

Aim 1: Restore conditions for modified blanket bog habitat

Definition and Distribution

The habitats within the HMA are predominantly blanket bog, alpine and boreal heath and wet heath, and are generally in favourable condition. Although there are localised patches of heathland, Units A, B, C, D, E, and F are comprised of mostly blanket bog habitat which has been modified and degraded as a result of human activity. Management works in these Units will have overarching benefits for both snipe and golden plover providing wetter areas for foraging and the removal of self-seeded conifers from open habitat will additionally have benefits for hen harrier.

Background

The condition of the bog habitat across the HMA is generally good, with the exception of Units A, B, C, D, E, and F. In order to create the underlying conditions required for the establishment of typical bog species, works will need to be carried out to reverse the negative historical management activities and prevent further degradation.

Condition Requirements

The conditions required for blanket bog within these areas are defined as follows:

- Water table depth must be close to the surface, including the drought period April - July
- Regenerating trees must be absent

Based on these requirements a set of Objectives have been defined which will allow progress to be monitored.

Objectives

The Objectives for blanket bog conditions are shown in the table below along with its weighting. An Objective is considered to be met when at least 70% of sample plots meet the 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 on site 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%

Aim 2: Improve quality of modified blanket bog habitat

Definition and Distribution

The habitats within the HMA are predominantly blanket bog, alpine and boreal heath and wet heath, and are generally in favourable condition. Although there are localised patches of heathland, Units A, B, C, D, E, and F are comprised of mostly blanket bog habitat which has been modified and degraded as a result of human activity. Management works in these Units will have overarching benefits for both snipe and golden plover providing wetter areas for foraging and open habitat free of regenerating conifers for nesting.

Background

The long-term aspiration (>5 years) is to restore the habitat to high quality blanket bog. However, the precise vegetation assemblage which would be expected is difficult to define and variation is expected due to localised conditions (e.g. slope, aspect, mesotope position). The response of a set of common indicators of blanket bog quality will therefore be monitored which will ultimately help to gauge success. These common indicators have been incorporated into Objectives below.

Objectives

A number of indicators have been used to formulate Objectives which reflect different aspects of blanket bog quality over time. An Objective is considered to be met when at least 70% of sample plots meet the criteria.

	Objective	Description	Weighting
Sphagnum and peat	2.1	At least one species of Sphagnum should be present (predicted community M17, 18 or 19) on each sampled plot.	10%
	2.2	<i>Sphagnum papillosum</i> or <i>S. magellanicum</i> should be present (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	5%
Higher plants	2.6	<i>Eriophorum</i> spp. should be present on each sampled plot.	5%
	2.7	<i>Calluna vulgaris</i> should be present on each sampled plot.	5%
	2.8	<i>Calluna vulgaris</i> of at least 20cm 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 <i>Calluna vulgaris</i> , <i>Eriophorum</i> spp. and <i>Tricophorum cespitosum</i> should account for no more than 75% of foliar cover on each sampled plot.	2.5%

Aim 3: Establish and maintain riparian woodland habitat

Definition and Distribution

The definition of riparian woodland habitat covered by Aim 3 is defined as areas adjacent to watercourses with suitable soils for tree planting (peat depth <30cm) and covers an area of approximately 7.68 ha (Map 3).

Background

In order to provide additional benefit for hen harrier through the creation of linear features which will enhance foraging habitat, new riparian woodland habitat will be created on suitable soils along watercourses within SPRs Land Ownership Boundary where woodland could be expected to establish naturally. In some of the areas that have been identified as suitable there are a few mature trees already present, and additional planting will increase the riparian woodland extent. The distribution of proposed riparian woodland is shown on Map 3. Following the initial planting works, a monitoring and maintenance programme will be executed until trees are considered established, achieving the criteria set out in the below Objectives.

Objective	Description	Weighting
3.1	Achieve target density of 1250 stems/ ha	55%
3.2	Achieve mean height of >1m after 10 years	30%
3.3	Achieve mean height of >1.8m after 15 years	10%
3.4	Invasive species should be absent from all plots	5%

7 Habitat Management Measures

The management approaches taken by SPR reflect the different requirements of the variable site conditions. Management units are split according to treatment type and underlying habitat.

7.1 Management Units

Management units have been defined according to areas which require different types of active management, as shown in the table below.

Unit	Habitat	Size (ha)	Species benefitted
Unit A	Drained bog	27.89	Snipe, golden plover
Unit B	Removal of regenerating conifers	103.04	Hen harrier, snipe, golden plover
Unit C	Removal of conifers	0.16	Hen harrier, snipe, golden plover
Unit D	Cut peat	11.63	Snipe, golden plover
Unit E	Cut peat	1.21	Snipe, golden plover
Unit F	Infrastructure restored to peatland habitat	1.22	Snipe, golden plover
Unit G	Riparian planting	7.68	Hen harrier
Total		152.85	

7.2 Physical Interventions on degraded bog habitat

Physical interventions are defined as measures which comprise mechanical treatment to an area of land.

7.2.1 Unit A: Drain damming

There are approximately 1541m of drains within Unit A which would benefit from being dammed in order to prevent further damage to the hydrological regime of the peatland habitat. SPR has developed a technique to successfully restore drained blanket bog, termed “wave damming” which has proven successful on a number of similar sites in Scotland (Photos 1 & 2). The method rapidly creates dams within existing drains to prevent water flow, which helps stabilize the hydrology and support bog forming species such as *Sphagnum* mosses. SPR initially tested this method at Black Law windfarm where a comprehensive monitoring programme was set up to verify the technique. The results proved the method to be successful in raising the water table and showed that the pools quickly occluded with bog vegetation. SPR have now treated approximately 192km of drains at sites including Black Law and Whitelee windfarms and have found the technique to be consistently effective across different sites. Throughout the development of peatland restoration techniques, SPR have engaged stakeholders including Scottish Natural Heritage, Peatland Action and the Royal Society for the Protection of Birds, by demonstrating techniques and sharing the results of monitoring. Peatland Action has now adopted the wave damming technique for use on a number of sites¹. A further description of the wave damming technique is provided in Appendix A.

¹ http://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/file_attach/Session%208%20Combined%20Workshop%20Presentation.pdf



Photos 1 & 2: Area of wave damming at Black Law windfarm immediately following treatment (left) and two years post treatment (right)

7.2.2 Units B & C: Removal of conifers

There are two proposed methods for dealing with regenerating conifers across the site. In areas where additional ground-treatment works are required the conifers can be dealt with by excavators concurrently. The operators can use the excavator buckets to crush the trees and bury them into the peat mass as part of a ground-smoothing process. The second technique is conventional hand clearance using brush-cutters or chainsaws on low density areas. This requires the contractor to ensure that the tree is cut below the lowest whorl of branches to ensure that no side branches remain or regrow.

7.2.3 Units D & E: Peat cutting remediation

Units D and E are currently predominantly bare peat (with no basal vegetation) as a result of mechanical peat cutting practices. It is expected that natural succession will lead to typical bog species, such as *Eriophorum angustifolium* (a recognised pioneer species of saturated bare peat), establishing on the area in the future. SPR propose to monitor these areas and will consider the need for further intervention (e.g. brash/ seed spreading) in the event that the Objectives are not being met.

Turbary rights exist on certain parts of the site which permit peat cutting to satisfy fuel requirements of the associated dwelling house (Map 2). Peat cutting is not permitted outwith these areas, and SPR will take steps to ensure that it is prevented by monitoring peat cutting activities and regulating site entry.

7.2.4 Unit F: Infrastructure restoration

SPR will reuse as much of the existing infrastructure as possible for the repowering project, and any tracks or turbine pads that will not be reused will be decommissioned. The roads and turbines to be decommissioned are located within areas of high quality blanket bog habitat and so will be restored to functioning bog habitat (Photo 3). This will involve the removal of between 100cm – 150cm of material (to be reused in the repowering infrastructure), and infilling the void with peat excavated from the Barnesmore Windfarm Repowering infrastructure.

Further details of the reinstatement process will be developed following site investigation work and the appointment of a civil engineering contractor. Factors which require consideration include the following:

1. Gradient of the area reinstated
2. Physical properties of the peat being deposited and whether any compartmentalisation is required
3. Depth of existing granular fill and depth to which the permanent water table exists including the potential for any residual granular fill to act as a drain
4. Adjacent habitat type and topography

Areas of steeper gradient and/or with adjacent shallow peat habitats will have much shallower depths of peat deposited or no peat deposited and will target heathland habitat restoration.



Photo 3: Road leading to T21 proposed to be decommissioned and restored

7.2.5 Units G: Riparian planting

Prior to planting, a soil survey will be carried out to determine appropriate locations for tree planting along the watercourses outlined in Map 3. Trees will be staked and tubed to protect against deer and vole damage. Exact species composition will be determined following the soil survey but will likely include species such as birch and willow.

7.2.6 HMA: Grazing management

Habitat quality across the wider HMA is in generally favourable condition and the NHA is not currently being negatively impacted by grazing of wild deer or livestock. Habitat monitoring will be carried out through the Operational phase of the windfarm to inform the Objectives for habitat condition and will therefore identify whether there is an impact from overgrazing in the future.

8 Monitoring Proposals

Vegetation monitoring

SPR has developed a protocol to monitor vegetation in relation to the Objectives set out within this Habitat Management Plan based on extensive experience monitoring similar habitats across Scotland.

Monitoring will be undertaken on a set of n=30 permanent 1m radial samples in Units A, B, D and E (n=120 total). Unit F will be monitored using fixed point photography only as it is linear in nature.

At each 1m radial sample the following information is collected for species relevant to the Objectives (target species):

1. Presence/absence of target species
2. By eye cover targets of key metrics (see 2a below)
3. Height and offtake of *Calluna*
4. Depth to water table (using fixed dipwell)
5. 3 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.

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Method	Long	Short	Long	Short	Long		Short		Long

Field protocol

1. 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, rarer species are assessed in larger units.

2. General Cover Assessment

- a) 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)
 - iv) is the combined cover of *Calluna*, *Eriophorum* and *Tricophorum* < 75% (if unsure record higher)

3. *Calluna* height and offtake

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

4. 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. On a quality bog the water table should remain within 20cm of the surface of the peat mass throughout the year.

5. 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, litter or bare peat that it hits directly below. Both basal layer and higher vegetation are to be recorded.

Tree establishment monitoring

SPR will monitor tree condition and stature of trees planting for Aim 3 on a regular basis until trees are considered to be established. Monitoring will be carried out between June and September using the following methodology:

- Locating each sample point
- Attaching a 5.64m length rope to the centre point
- Counting the number of trees in each plot
 - o Each tree will be assessed for health, species, height and condition
 - o Any damage or disease will be noted

Appendix A: Wave damming summary

The process

1. Identify the drain. The excavator has tracked down the drain, flattening the vegetation and exposing the oxidised peat slope either side of the cut channel. The excavator will straddle the drain, facing upslope. The operator will begin working at the top of the slope, building the dams as they move downhill.



2. The operator will start work on one side of the dam, on the oxidised peat slope. The operator uses the bucket to cut into the peat mass circa. 800mm depth. The bucket is then used to pull the peat towards the excavator, thrusting material upwards. Care should be taken to ensure that the operator does not flip the peat during this process, and the vegetated surface remains on top.



3. Using the back of the bucket, the operator pushes the back of cut peat towards the machine so that it is compressed into place with a ramped face.



4. The operator will repeat this action a second time, in the middle of the drain.



5. The operator will then repeat this action a third time on the other side of the drain, on the oxidised peat slope. The dam is now three bucket widths wide, although additional width can be achieved using additional bucket widths.



6. The operator then uses the bucket to flatten and compress the top of the dam.



7. The operator then uses the bucket to flatten the edge of the cut face behind the dam. This will enable any livestock a way to climb out of the dam.



8. The finished process.



About wave damming

Timing

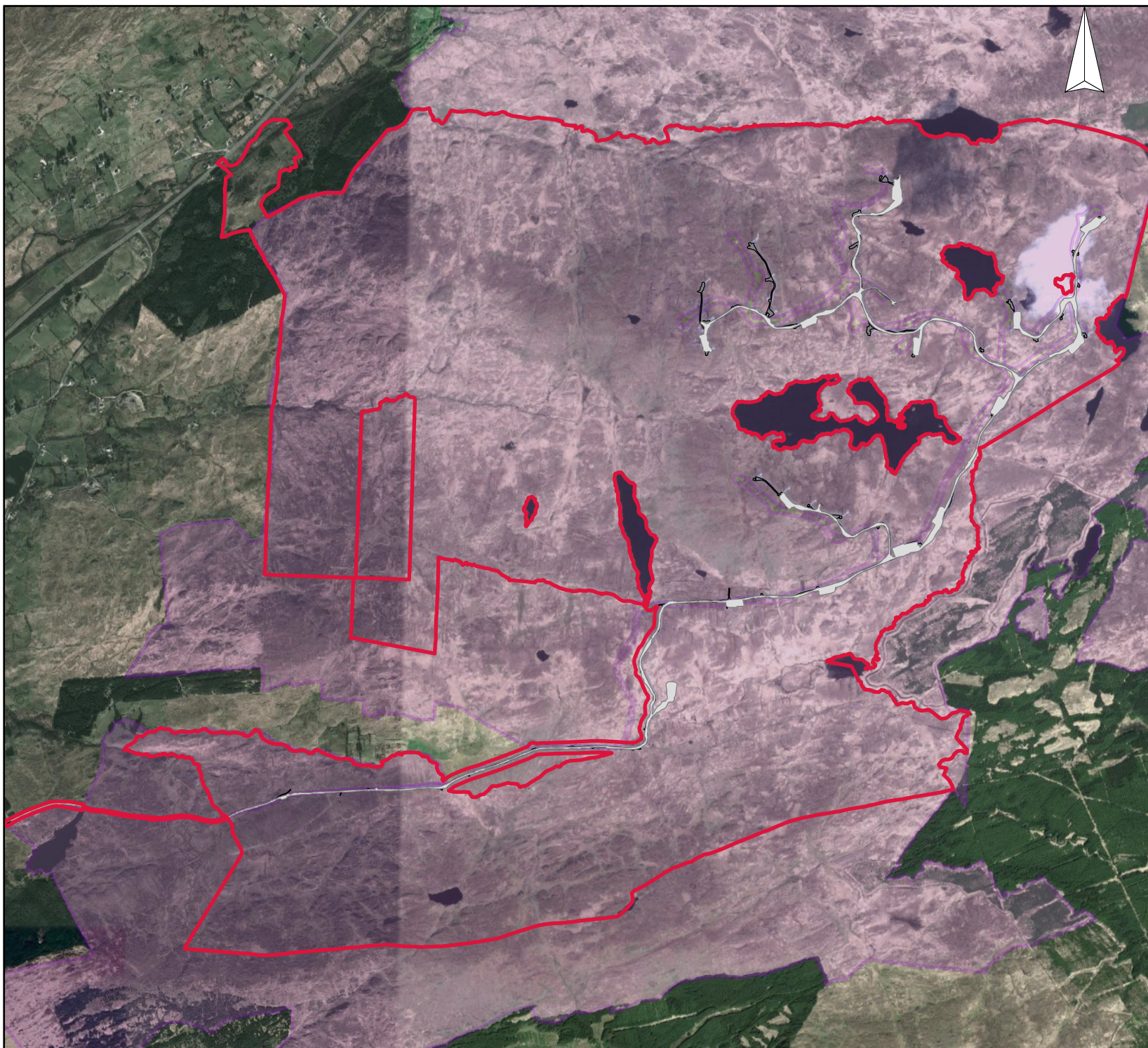
The time taken to build a wave dam is on average about 1minute; significantly faster than traditional dams which take over ten minutes to build.

Spacing





The wave dams are installed close together, roughly every 3-4m. This spacing was specified so that there was not more than a 10cm drop in ground level between each dam location so that water stored behind the dam can re-wet the intermediate drain space and adjacent ground. The spacing of dams is also dependent on local gradient.

Width

The width of the dam ensures that not only the ditch itself is blocked, but also the collapsed oxidised slopes on either side of the channel. This reduces the likelihood of a new hydrological flow around the side of the dam, and encourages the water to spread out and rewet the wider bog.



Legend

-  **SPR landownership**
-  **Barnesmore NHA**
-  **Existing layout**
-  **Repowering layout**

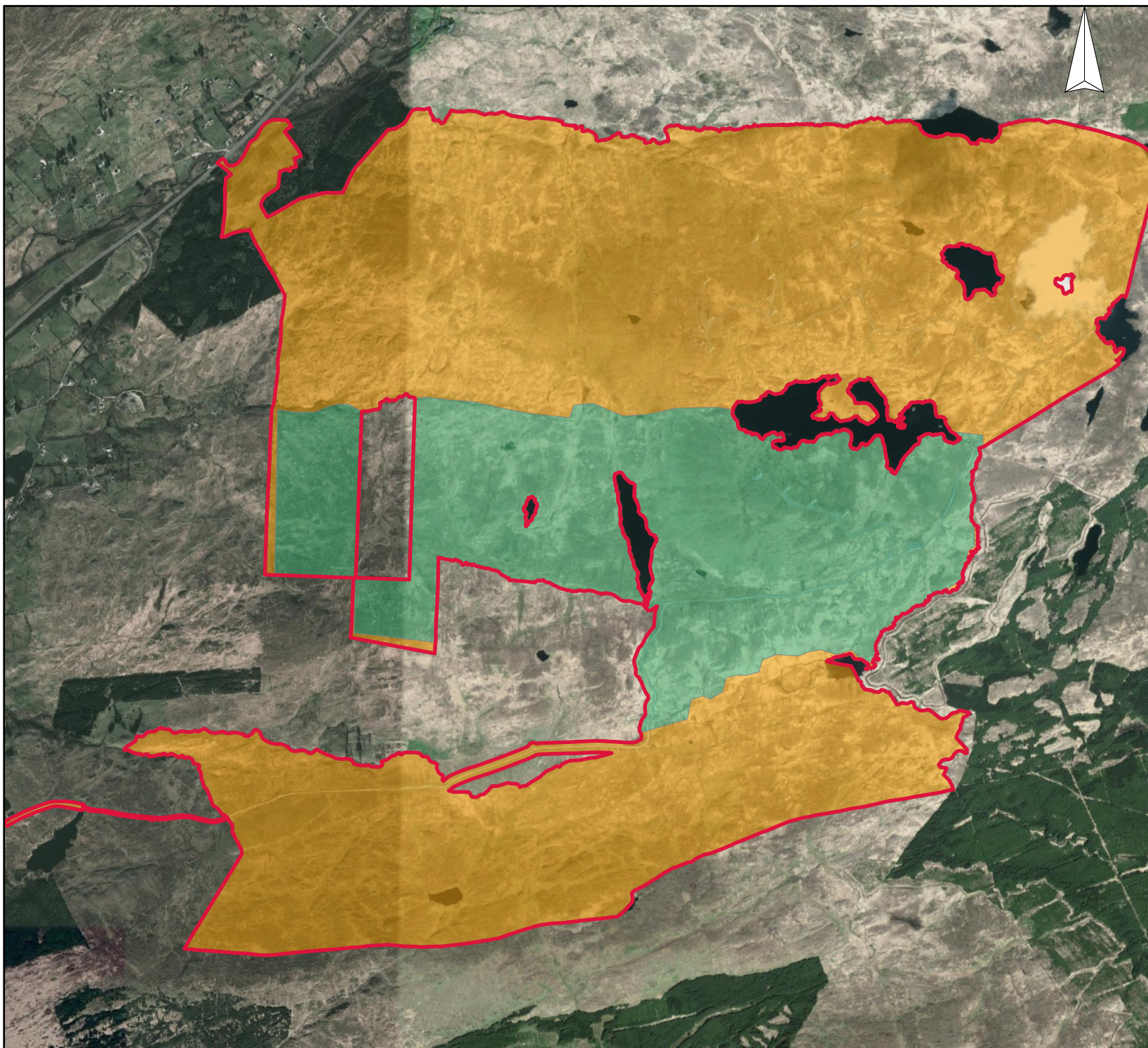
Scale: 1:41000 @ A4

Status:	Date:	Dr.:	Ch.:	App.:
FINAL	Dec 2019	SR	CB	PR




Site overview

Barnesmore repowering
Version 1.0

Map 1



Legend

-  **SPR landownership**
-  **Turbary rights**
No turbarry
-  **Turbary rights**
Turbary rights

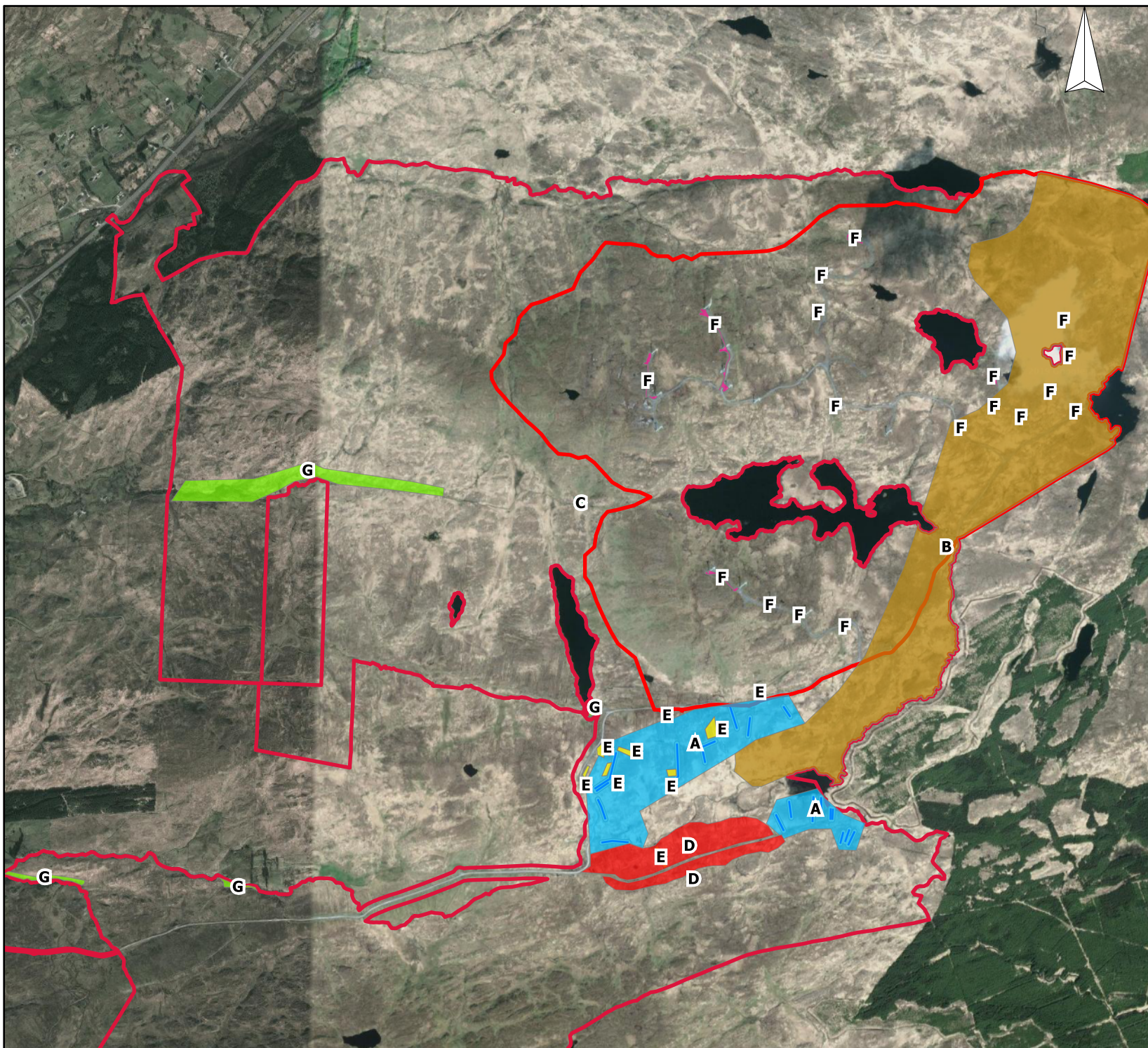
Scale: 1:41000 @ A4

Status:	Date:	Dr.:	Ch.:	App:
FINAL	Dec 2019	SR	CB	PR










Turbary rights

Barnesmore repowering
Version 1.0

Map 2



Legend

-  **SPR landownership**
-  **Drains**
- Habitat Management Units**
-  **A**
-  **B**
-  **C**
-  **D**
-  **E**
-  **F**
-  **G**

Scale: 1:37000 @ A4

Status:	Date:	Dr.:	Ch.:	App:
FINAL	Dec 2019	SR	CB	PR

Management units

Barnesmore Repowering
Version 1.0

Map 3