Habitat Restoration Opportunities for Cloiche Wind Farm – Site Visit Report

Alba Ecology Ltd.

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Summary

SSE Renewables (SSE) submitted an application for a 36 turbine wind farm at Cloiche south east of Fort Augustus in May 2020. NatureScot objected to the proposal on the basis of carbon-rich soils, deep peat and priority peatland habitat stating that "…*the compensatory restoration proposed is of an insufficient scale to offset the anticipated loss and damage to high quality priority peatland habitat. We consider that restoration on a sufficiently large scale is unlikely to be feasible at this site*."

In light of NatureScot's comments, an additional Option Area for peatland restoration was identified and a Site Visit undertaken in September 2021 to establish the extent of peatland restoration opportunities. Additional opportunities for peatland restoration were also considered within the site boundary.

The site visit identified that the Option Area (ca. 648ha) had vast expanses of exposed bare peat pans which were likely to be actively eroding and were considered highly suitable for peatland restoration.

The impacts of deer pressure were widespread across the Option Area. Success of any peatland restoration is considered likely to be entirely reliant on a substantial and sustained reduction in deer numbers.

On-site opportunities for peatland restoration were identified within the site boundary (within an area c.100-150ha), with networks of erosion features identified as suitable for gully blocking.

Additionally, opportunities to improve the habitat re-instatement along the tracks and around borrow pits in Stronelairg Wind Farm were also identified. Re-applying a seed mix of suitable upland species plus a nurse seed mix of grasses across the redistributed peat would likely increase the success rate.

It is recommended that the information gathered from the site visit is used as the basis for developing a Peatland/Habitat Management Plan for the 29 Turbine Proposed Development, which should commit to a sustained and large-scale reduction in the deer numbers.

Introduction

SSE Renewables (SSE) submitted an application for a 36 turbine wind farm at Cloiche, south east of Fort Augustus in May 2020. NatureScot objected to the proposal in 24th September 2020 on the basis of "*significant adverse impacts on the nationally important carbon-rich soils, deep peat and priority peatland habitat which are present on the site*".

In the Annex to the letter of the 24th September 2020 one of the issues raised in relation to peatlands was "…*the compensatory restoration proposed is of an insufficient scale to offset the anticipated loss and damage to high quality priority peatland habitat. We consider that restoration on a sufficiently large scale is unlikely to be feasible at this site*."

Peatland restoration proposals identified in the Environmental Impact Assessment Report (April 2020) were for the restoration and enhancement of a minimum of 13.92ha of blanket bog within the proposed Cloiche Wind Farm Site (hereafter Cloiche Site). In light of NatureScot's comments, it is considered that a more substantial and ambitious package of peatland restoration and habitat management proposals would be required in order to provide sufficient assurance that adverse construction impacts could be adequately offset and biodiversity enhancement measured offered.

This document reports on the findings of a site visit to establish peatland restoration opportunities within an 'Option Area' approximately 1.5km east of the Cloiche Site as well as additional peatland restoration opportunities within the Cloiche Site.

Aims and Objectives

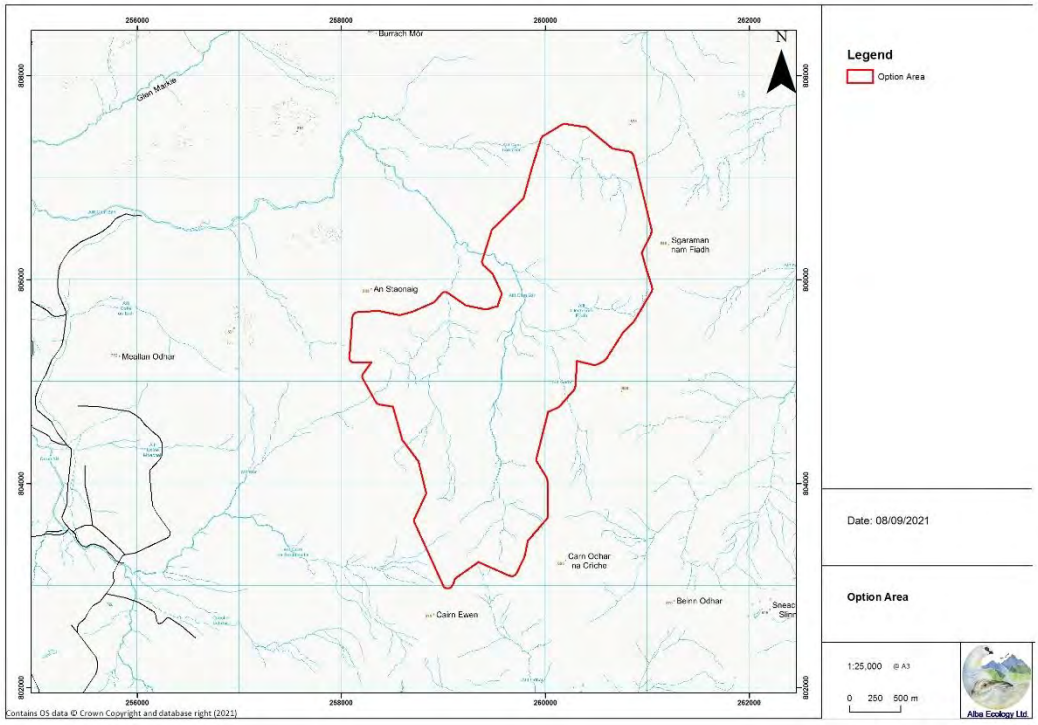
The objectives for this survey and report are:

- Report on the findings of the site visit including the extent, type and status (actively eroding, re-vegetated etc) of peat erosion features across the Option Area;
- Provide a description of the Option Area to determine like-for-likeness with the Cloiche Site and habitats likely to be impacted by the 29 Turbine Proposed Development; and
- Briefly report on the findings of the site visit including the extent, types and status (actively eroding, re-vegetated etc) of peat erosion features within the Cloiche Site to broadly assess if there were likely to be sufficient onsite peatland restoration opportunities.

Option Area

SSE has identified an off-site Search Area for peatland restoration of c.648ha, situated approximately 1.5km to the east of the Cloiche Site (Figure 1).

Figure 1: Search Area



The Search Area is situated within a large, high altitude plateau at c.800m above sea level (asl). It is placed between four hill summits; Carn Odhar na Criche (895m asl) in the south, Carn Donnachaidh Beag (873m asl) in the southwest, Sgaraman nam Fiadh (856m asl) in the northeast and an un-named hill (838m asl) in the west. There is a network of streams, largely draining into Allt Cam Nan Cròc and Allt Cam Ban.

More than 85% of the Search Area is described as 'Class 1' in the Carbon and Peatland Map (2016). 'Class 1' peatlands are considered likely to be:

- Nationally important carbon-rich soils, deep peat and priority peatland habitat; and
- Areas likely to be of high conservation value.

It should be noted that the Carbon and Peatland Map (2016) is a high-level predictive tool which provides an indication of the likely presence of peat and peatland habitat at a coarse scale (NatureScot, 2021).

A section of the southern part of the Search Area is located within the Monadhliath Site of Special Scientific Importance (SSSI) and Special Area of Conservation (SAC) which are designated for blanket bog habitat.

Descriptions and details of the Cloiche Site are provided in the EIA Report (April 2020) and associated Technical Appendixes (e.g. Ramboll, 2019) plus Additional Information (AI) material (Headley, 2021).

Methods

The site visit was conducted in the Search Area, and briefly on the Cloiche Site, by Dr Kate Massey of Alba Ecology and Alastair Miller of Wood E&I UK Ltd on the 2nd and 3rd September 2021.

The Search Area was walked slowly and the extent of peat erosion features identified along with the condition of the peatland to ascertain whether erosion features were likely to be actively eroding, or whether there was evidence of re-vegetation. Consideration was also given to the condition of the peatland habitat based on the Peatland Condition Assessment (PCA) guide (Peatland Action, 2016).

Additional notes were taken on the habitat types and communities present in the Search Area based on the Phase 1 Habitat (JNCC, 2010) and National Vegetation Classification (NVC) (Rodwell, 2006) systems although a formal Phase 1 Habitat or a NVC survey were not undertaken so comments are based on observations and professional judgement.

Nomenclature

Common names only are given in this report. Nomenclature follows Streeter and co-workers (2016) for higher plant species, and Atherton *et al*., (2010) for bryophyte species.

Limitations

While every effort was made to provide a detailed assessment of conditions and description of the Search Area and Cloiche Site, it is unlikely that one site visit can achieve full characterisation.

A formal Phase 1 Habitat, NVC, and PCA surveys was not undertaken during the site visit, instead professional judgement was used during a walkover, by two highly experienced upland habitat ecologists.

Habitat categories and the 'condition' of these categories are human (or artificial) constructs and, therefore, to a degree are subjective and a matter of professional judgement. Furthermore, different conditions can co-exist in an area of habitat (e.g. through drainage, preferential grazing, trampling etc.) and so it is not appropriate to assume an entire area of habitat is in one condition or another. Under these circumstances, it is usually reported that the habitat is approaching a particular condition. Consequently, it is not always possible to be unequivocal when making judgements such as whether a particular habitat is classified under one condition or another.

The limitations were minimised by conducting the field survey within the optimal survey period (between April and October).

It is important to note that measuring peat depth was outside the scope of the site visit. Apparent peat depth as discussed in this report is estimated based on visual vegetation assessments and through estimating peat depth from available features such as haggs and ditches and through occasionally pushing a walking pole into the peat.

Results

The results presented are based on the site visit conducted on 2nd and 3rd September 2021. A list of Target Notes with illustrative photos are provided in Appendix 1 and Target Note locations are provided in Figure 2 and Figure 3.

Option Area

The Search Area was walked on Thursday 2nd September in very good weather conditions (clear and warm) and on Friday 3rd September 2021 in relatively poor weather conditions (low cloud/reduced visibility).

Overview

Across the Search Area there were vast expanses of exposed bare peat pans which were considered to be largely actively eroding. Common cottongrass was colonising across many of the pans but it was not providing complete cover, and often there was little to no colonisation. Many of the edges of the pans were expanding, evidenced by eroding hagg faces or tussocks of remnant bog habitats surrounded by bare peat.

Deer hoof prints were common across the bare peat areas and were demonstrably causing and exacerbating erosion.

Photo 1: View of an extensive bare peat pans.

The vegetation between bare peat pans including montane heath, montane grassland and blanket bog vegetation in various stages of degradation.

Bare peat pans

Bare peat pans formed large expanses within the Search Area. They were dark brown and highly conspicuous, the large scale and extent of which was quite unexpected and exceptional. The pans varied in size from 10's of meters to 100's of meters and were often linked with less degraded areas. Occasionally there were remnant islands of peat within the pan c.1m-1.5m in height with dry bog vegetation on the top. Many of the bare peat pans appeared to have deep peat (>1m) remaining below the surface demonstrating a large resource of carbon that

was exposed, eroding and being lost. Although some patches had rocks showing through where erosion had resulted in bedrocks and/or mineral soil being exposed.

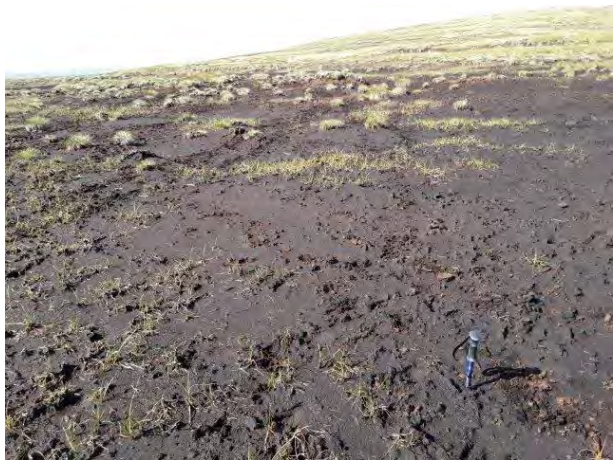


Photo 2: An area of bare peat which was likely >1m in depth with a little common cottongrass colonisation but active erosion clearly evident.

There was varying degrees of natural re-colonisation on the bare peat pans which was exclusively by common cottongrass wherever peat remained. Common cottongrass sometimes formed cover of up to ca. 70% of the ground surface with a network of roots helping to stabilise the peat, but often there was much less than this, perhaps only 5% or less cover. Where erosion had exposed mineral soil within the bare peat pan mat grass, wavy hair-grass and mosses such as woolly fringe moss had also colonised.

There were clear signs of active erosion in the peat pans, in the form of deer hoof prints, wind erosion and runs or small gullies of water within the bare peat pan.

Types of erosion at the edge of bare peat pans

Around the edges of the bare peat pans there were two main types of erosion: erosion hagg faces and tussocks of remaining bog vegetation surrounded by bare peat.

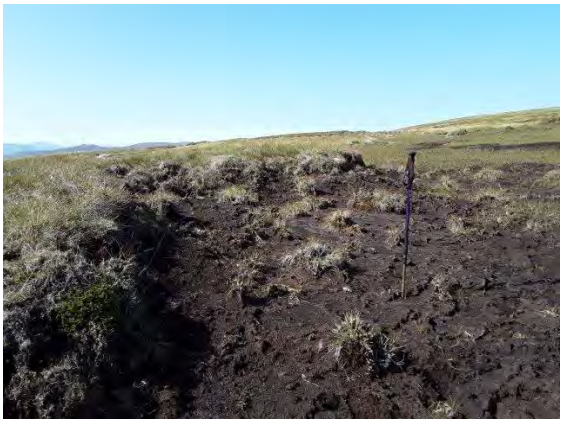


Photo 3 and 4: Examples of erosion at the edge of the bare peat pans. Photo on the left is an example of an erosion faces around the edge of bare peat pan. The photo on the right is an example of tussocks of hare's-tail cottongrass with bare peat surrounding them. This was on a gentle slope on the edge of a peat pan.

Erosion faces at the edge of the bare peat pan was generally between c.0.5m and 1.5m high with little vegetation cover and appeared to be actively eroding, causing the bare peat pans to expand. On gentler slopes, often at the transition to fragments of blanket bog habitat there were tussocks, appearing to be held in places by the roots of either hare's-tail cottongrass or deergrass, surrounded by bare peat that was eroding. There were often other species associated with blanket bog present in these tussocks including woolly fringe moss, lichens and blaeberry. These areas were clearly actively eroding and expanding into the fragments of remnant blanket bog.

Fragments of remaining blanket bog habitat

Between the bare peat pans there were fragments of remnant blanket bog habitat. Occasionally these areas were of high quality blanket bog, with hummocks and hollows present and carpets of bog-mosses. For example, towards the south of the Search Area (OS Grid Reference NH 59260 04415) there was an area of ca. 50m by 100m where bog-moss cover was good forming a near complete carpet of red bog-moss and papillose bog-moss. There were bog pools with feathery bog-moss (NVC community M2). The vegetation was open with a mixture of deergrass, cowberry, hare's-tail cottongrass, crowberry and a little heather (NVC community M17a). There were also occasional hummocks of rusty bog-moss. However, the scale of this high quality blanket bog was very small in comparison to the scale of bare peat pans. Nevertheless, such remnant patches likely indicate what was once probably widespread and also what restoration could aspire to reach in terms of blanket bog habitat condition in some areas.


Photo 5 and 6: A fragment of blanket bog vegetation with bog pools and hummocks of rusty bog-moss.

There were several examples in the centre and north of the Search Area where the fragments of remnant bog were very small (e.g. 10m x 30m) (NVC communities M19 and M20). In these fragments there were hummocks of rusty bog-moss very close to bare peat pans.

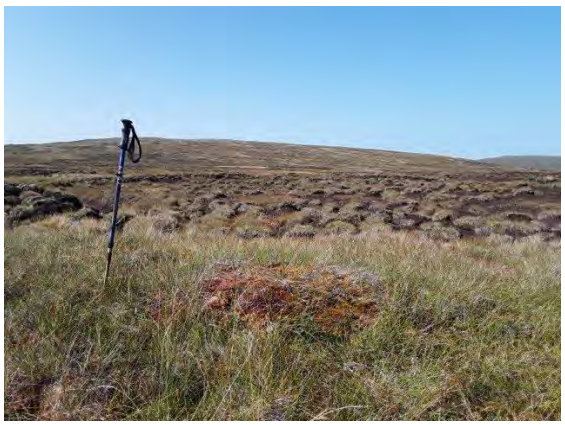
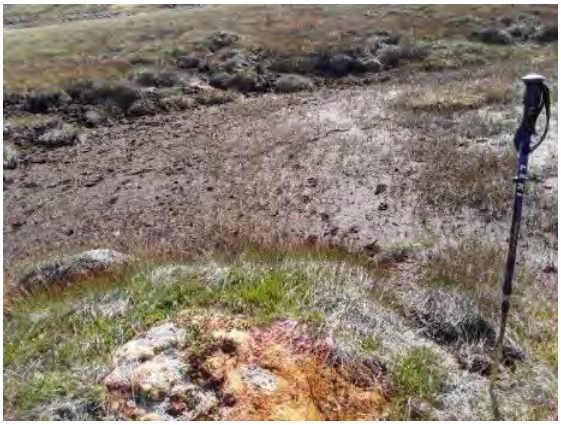



Photo 7 and 8: Rusty bog-moss hummocks within a few meters of extensive bare peat pans.

On the tops of eroded peat haggs and on the edge of erosion features, the vegetation was largely characterised by woolly fringe moss and lichens with deergrass (NVC community M15c/M17b). There were occasionally areas of blanket bog with small erosion gully systems forming. These were usually at a transition point between bare peat pans and other habitat types, including blanket bog, montane heath and montane grassland.

Montane habitats

There were several other habitat types in the Search Area, there were largely montane grassland and montane heathlands, and included species such as mat grass, stiff sedge, woolly fringe moss, heath rush, The grassland had abundant deergrass with tormentil, mat grass, heath rush, alpine bearberry, cowberry and crowberry, woolly fringe moss and lichens.

Evidence of deer

There was widespread evidence of deer across the Search Area. This included hoof marks and deer trails clearly visible in the bare peat. Deer were regularly seen during the Site Visit including a large dispersed herd of up to 350 head of red deer seen on the lower slopes of Carn Odhar na Criche. It was considered highly likely that impacts from deer were the causal factor of the widespread erosion within the Search Area. Combined with the cold climate and short growing season associated with the high altitude of the Search Area natural re-colonisation and the ability of the blanket bog to recover from the impacts of deer at these densities are likely to be severely limited.

Photo 9: Ca. 350 deer on the slopes of Carn Odhar na Criche.

Photo 10: A recent deer trail in bare peat between tussocks of hare's-tail cottongrass.

Photo 11: Hoof prints clearly visible on bare peat – common across the Search Area.

Restoration potential

There was considered to be a great deal of peatland restoration potential and opportunity in the Search Area. Peatland restoration is not just good for carbon storage and reducing climate change, but it also improves water quality, stops peat erosion, may help reduce the risk of wildfire, help reduce downstream flooding (with restored bogs holding back more water in the upper catchment for longer than would otherwise be the case in a degraded bog system) and increase the abundance of insects such as crane flies, which are a vital food source for upland waders, such as snipe, golden plover, dunlin and greenshank. Peatland restoration in the Search Area would likely make a substantial contribution to improving the overall ecology of the area, reducing carbon emissions, stabilising bare peat surfaces and potentially re-establishing active blanket bog.

For example, in the south of the Search Area, within the Monadhliath SAC, there were large expanses of bare peat that were clearly actively eroding. In some areas there was deep peat, demonstrating a large carbon store which is currently eroding. The Monadhliath SAC blanket bog is of international importance and restoration of these bare peat areas in the upper catchment of the Allt Mór and Allt Cam Ban would reduce the erosion of the internationally important peatland, prevent the expansion of eroded areas within the internationally important blanket bog, reduce particulate matter entering these watercourses and slow the movement of water into the lower catchments.

Photo 12: A bare peat pan suitable for peatland restoration which forms part of the Monadhliath SAC internationally important blanket bog.

A further example of restoration potential and opportunity was in the north of the Search Area in the upper catchment of the Allt Cam nan Croc where there was considered great potential to revert the eroded areas back to wet and potentially active blanket bog. This area had many small (ca. 10x 30m) fragments of bog habitat with bog-mosses present, including hummocks of rusty bog-moss, within a wide expanse of bare peat (ca. 500m x 500m) which appeared deep. The topography was generally flat with slopes rising around it. If deer pressure was substantially reduced, a suitable seed source provided and drainage routes blocked it was considered that this area would likely re-wet and support high quality blanket bog, probably with little other intervention.

Photo 13: View of an area with high restoration potential in the north of the Search Area.

Cloiche Site

A small section of the Cloiche Site was walked on the afternoon of Friday 3rd September 2021. The section was to the north and west of Turbine 4 of the operational Stronelairg Wind Farm.

There were numerous erosion gullies through fairly dry blanket bog habitat within this section of the Cloiche Site. These erosion gullies were ca. 1m deep and 1-2m wide and formed a network of actively eroding peat on gently sloping ground. The blanket bog was largely made up of heather, deergrass, common cottongrass and hare's-tail cottongrass with conspicuous and abundant lichens and woolly fringe moss. The detrimental impacts of deer were evident in the form of hoof prints and deer tracks, including within the bare peat at the base of erosion gullies. These erosion gullies appeared to be highly suitable for peatland restoration. The erosion gullies could be blocked with peat or wood dams, which would prevent further erosion and raise the water table re-wetting the surrounding blanket bog. Effective and sustained deer management would be required to allow successful restoration.

This type of eroded habitat was characteristic of much of the habitat that was driven through during the site visit and around Stronelairg Wind Farm and so it is considered likely that large areas (c.100 – 150ha) could be suitable for peatland restoration.

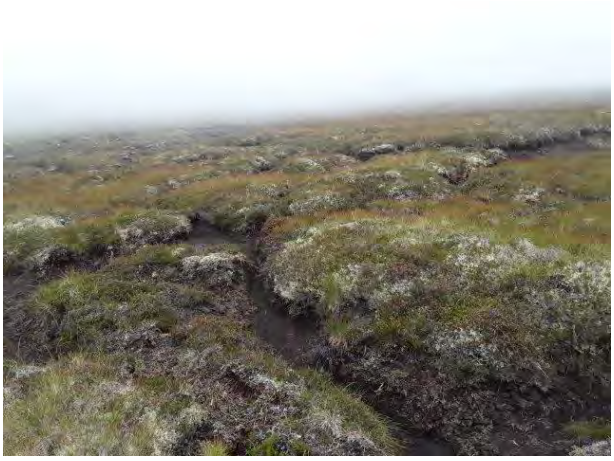


Photo 14: A network of erosion gullies within the blanket bog habitat.

The blanket bog vegetation was made up of deergrass, heather and patches of red bog-moss and papillose bog-moss and some remnant hummocks of rusty bog-moss. There were occasional dried out pools within some areas of more intact blanket bog. If the water table was raised these pools would likely restore naturally.

Photo 15: Dried out pool within the blanket bog vegetation.

Notably, there was a large former lochan present (at OS grid reference NH 47906 04673) which, at the time of the walkover site visit had a bare peat surface, with deer prints across it. On the OS map it was mapped as a lochan, but the lochan wall had eroded at a single breach point and the water had drained away. Blocking and securing the breach point would likely result in the lochan re-wetting. Several other smaller lochans within the immediate vicinity were also identified at risk of being lost through erosion of lochan walls (including one at OS grid reference NH 47936 04581). Peatland restoration around these lochans would ensure they remained.

Photo 16: A former lochan with a breach in the lochan wall.

Stronelairg Bare Peat Re-instatement

In the Annex to the letter from NatureScot of the 24th September 2020 it was noted that there was variable success of habitat restoration at the nearby Stronelairg Wind Farm:

"*Due to the challenges of successful habitat restoration in construction projects of this type in this environment, reflected in the variable success rate at Stronelairg, we advise that the predicted temporary losses should in fact be considered as permanent*".

Whilst driving the track through the operational Stronelairg Wind Farm the variability of restoration on the redistributed peat beside the track and beside borrow pits was noted.

In some areas the nurse seeds, of variable grass species, had resulted in near completed cover of the peat surface, whereas in other areas, often near to or adjacent to successful areas, the redistributed peat was bare, with little evidence of colonisation.

Photo 17 and 18: Redistributed peat with little evidence of colonisation (on the left) and better cover of vegetation (on the right).

The success or failure may, in part, be due to the slow growth at high altitude, but there were areas where re-seeding was clearly successful/partly successful. Therefore, the quantity/quality/timing of seed application may have also played a role in the areas that were not successful. Additionally, the detrimental impact of deer is clearly high and may also have had a role to play in the limited success of the re-instatement. Re-applying a seed mix of suitable upland species (e.g. deergrass, common cottongrass and heather), plus a nurse seed mix of grasses across the redistributed peat should increase the success rate, especially if deer pressure is widely and effectively reduced.

Discussion and Recommendations

The habitats and vegetation within the Search Area was broadly similar to that of the Cloiche Site (Ramboll, 2019; Headley, 2021). The habitats were made up of fragments of blanket bog, wet and dry modified bog, montane heath and montane grassland, and included a similar array of NVC communities (e.g. M2, M3, M15, M17, M19, U5, U7). However, the scale and type of erosion features present within the Option Area was different to that of the Cloiche Site. Across the Option Area there were vast expanses of exposed bare peat pans which were considered to be largely actively eroding and expanding and suitable for peatland restoration. Many of the areas contained deep peat that without intervention would likely be lost.

Table 1 shows the current direction of vegetation change within the Search Area. From the remnant fragment of blanket bog to bare peat pan which is currently either eroding to mineral soil, or partially re-colonised by common cottongrass. With intervention through established peatland restoration techniques, this direction of change would be halted or reversed.

Current direction of change →				
High quality habitat	Deterioriating habitat	Degraded habitat	Very degraded habitat	Re-coloisation
				
Good quality blanket bog vegetation with hummocks and hollows.	Blanket bog vegetation degraded with bare peat patches.	Tussocks of vegetation remaining with actively eroding bare peat surrounding tussocks.	Bare peat actively eroding	Either common cottongrass colonising the bare peat or mineral soil/bedrock exposed.

Table 1: Demonstrating the direction of change of the blanket bog habitat within the Search Area from blanket bog habitat to bare peat pans.

Peatland restoration techniques, including deer control, seeding, mulching, blocking drains and re-profiling edges were all considered to be suitable for the Search Area. The aim of any peatland restoration is likely to range from stabilising exposed peat in the upper catchments of several watercourses including the Allt Cam Ban, Allt Cam nan Croc and Allt Mor to prevent further erosion in some areas, to re-establishing active blanket bog in other area. Although the high altitude of the Search Area is likely to result in the timeframe for success to be longer than that of more lowland sites.

Success of any peatland restoration is considered likely to be entirely reliant on a substantial and sustained reduction in deer numbers. Currently the pressure on the peatland from deer in the Search Area is such that deer prints are widespread and notable, and they are likely to be the causal factor of the widespread peat erosion. If deer numbers are not substantially reduced then peatland restoration will likely fail and the current situation will continue and so deteriorate further with exposed peat eroding and the bare peat areas expanding into the small remaining fragments of blanket bog habitat that remain.

Opportunities for peatland restoration were identified within the Cloiche Site, with networks of erosion features identified as suitable for blocking. It was considered that there were areas that would be highly suitable for gully blocking, and re-profiling. Although the whole of the Cloiche Site was not walked, it appeared that networks of gullies were widespread and that frequent dams in the gullies would reduce/cease peat erosion and raise the water table. This assessment is supported by the EIA Report (April 2020) and subsequent AI data (e.g. Headley, 2021).

A relatively large former lochan was located within the Cloiche Site. A breach was identified in the lochan wall. Blocking this breach and allowing the area to re-wet would likely re-instate this former lochan. Again, the success of restoration will be dependent on a substantial and sustained reduction in deer pressure.

Opportunities to improve the habitat re-instatement along the tracks and around borrow pits in Stronelairg were also identified. Re-applying a seed mix of suitable upland plus a nurse seed mix of grasses across the redistributed peat should increase the success rate.

It is recommended that the information gathered from the site visit is used as the basis for developing a Peatland/Habitat Management Plan for the 29 Turbine Proposed Development, which should commit to a sustained reduction in deer pressure, such that habitat restoration measures are successful.

References

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Figure 2: Search Area Target Notes

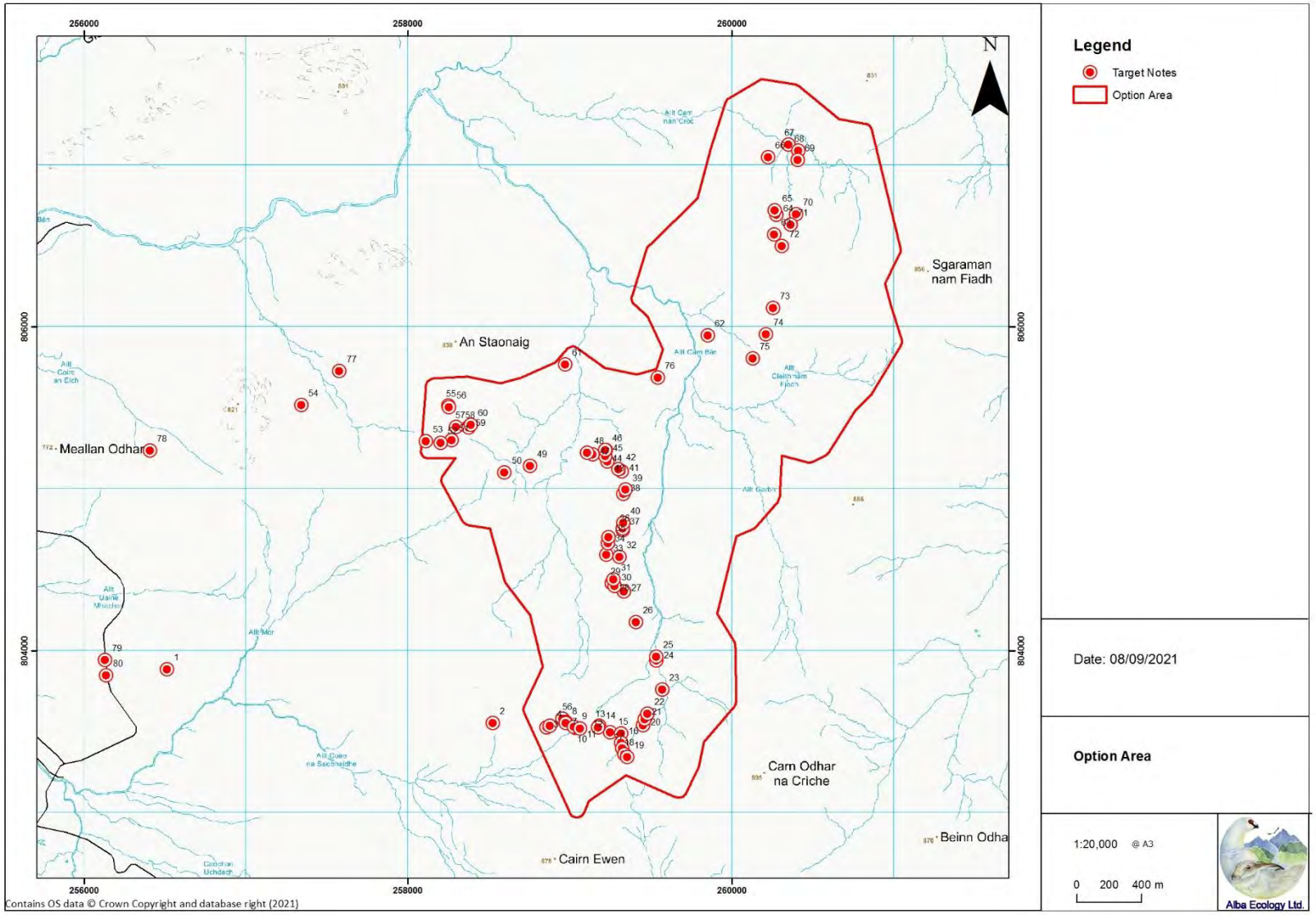
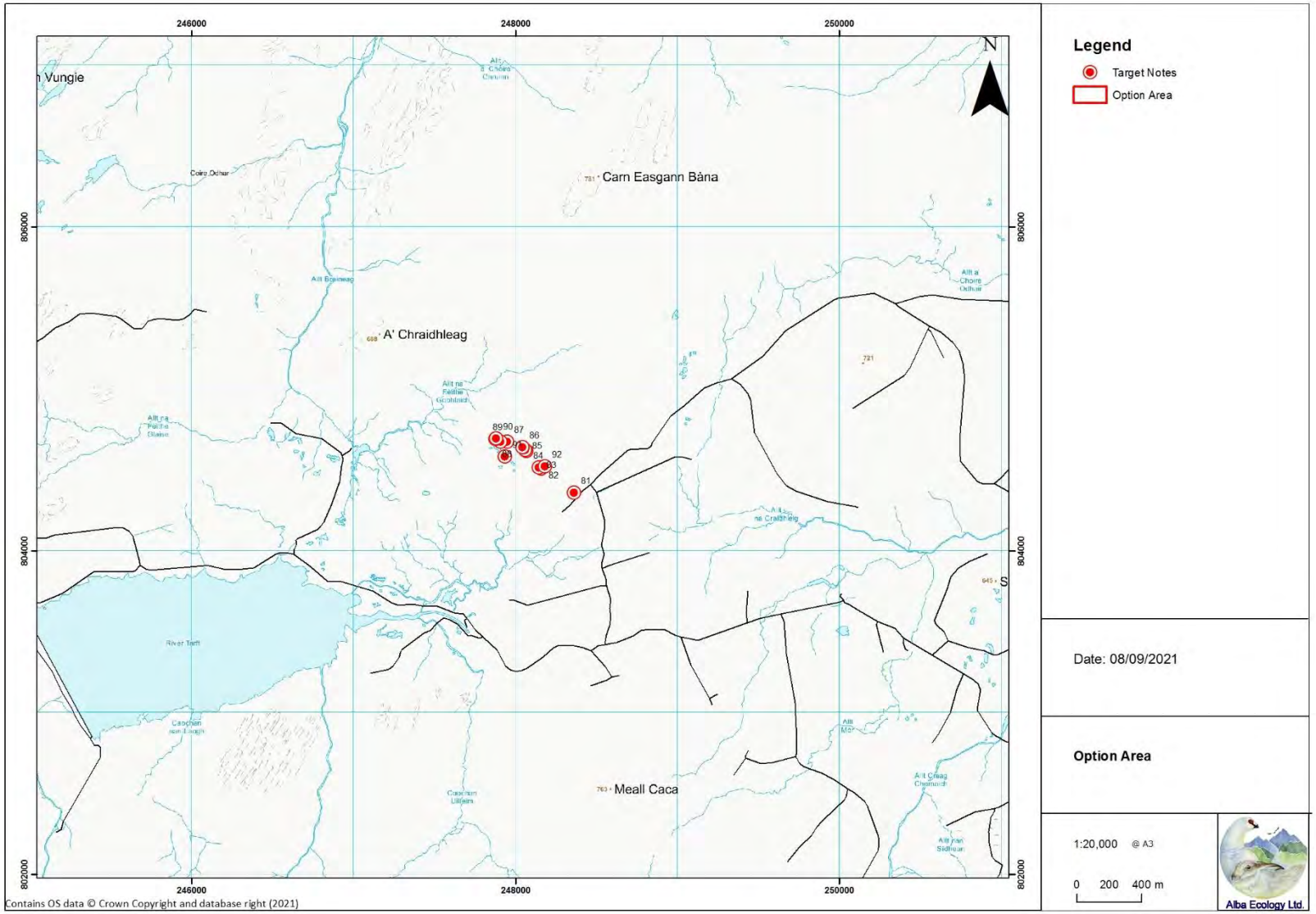
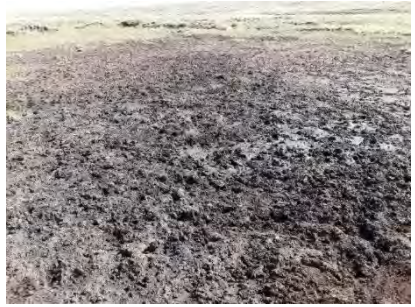


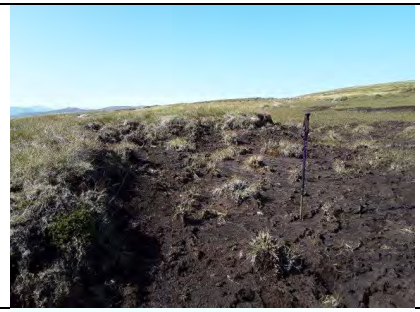
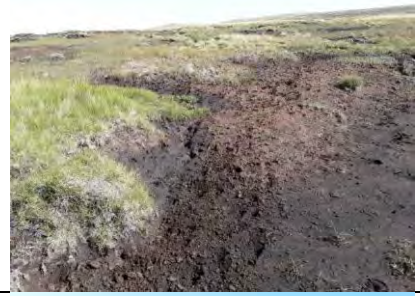
Figure 3: Cloiche Site Target Notes

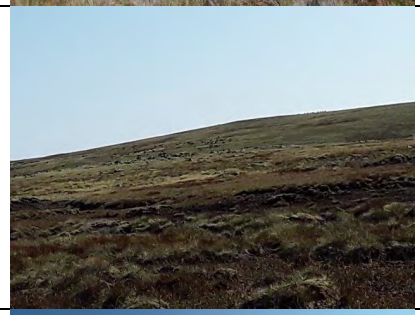


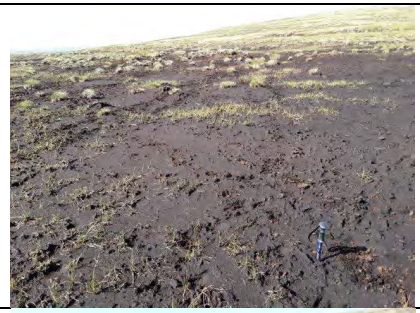
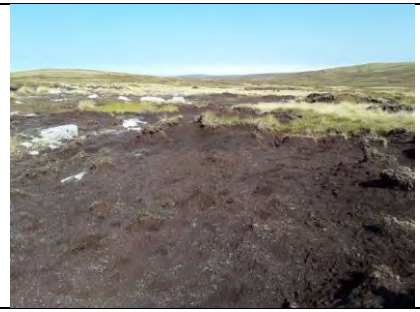
Appendix 1: Target Notes

TG	Grid	Note	Comment	Photos
1	NH 56513 03884	View and borrow pit.	View of Stronelairg Wind Farm. There was bare redistributed peat and soil, ca. 50cm deep, around a borrow pit from the construction of Stronelairg Wind Farm. This could be re-seeded. Many detrimental signs of red deer obvious in the bare peat and soil.	  
2	NH 58526 03552	Deer.	Ca. 30 deer in the distance on the shoulder of a hill.	

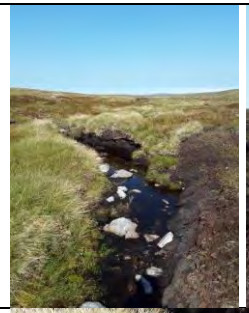
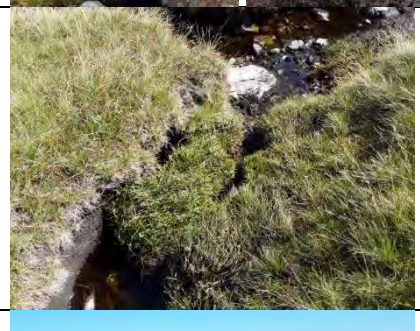
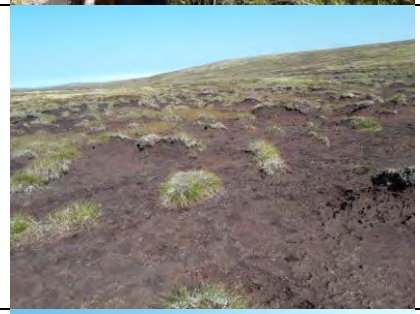
TG	Grid	Note	Comment	Photos
3	NH 58856 03525n	Bare peat pan.	There were many deer prints in the bare peat. These were probably the prints of the deer seen previously in TG2. This demonstrates that deer are causing and/or exacerbating the erosion of the peat surface over large areas.	
4	NH 58878 03534	Bare peat pan.	There was an area of bare peat, partially stabilised with common cottongrass. There were small active erosion gullies within the bare peat pan, caused by water flow demonstrating active erosion.	 
5	NH 58955 03581	Bare peat partly recolonised.	Large bare peat pan ca. 100m x 120m. Some natural re-colonisation (ca. 70% cover) but it was restricted to common cottongrass. The re-colonisation was not uniform, with patches showing clear sign of active erosion. There was ca. >1m of peat below the pan, demonstrating a large resource of peat that was exposed and eroding. Recommend: Reduce grazing pressure hugely. Mulch and re-seeding. Re-profile edges of pan to prevent it further expanding.	  

TG	Grid	Note	Comment	Photos
6	NH 58956 03581	Erosion hagg.	Erosion faces around the bare peat pan. This one was less than 1m high. These could be re-profile to prevent further expansion of the bare peat pan.	
7	NH 58974 03560	Deer prints in bare peat.	Clear evidence of active erosion from deer prints in this bare peat pan which was ca. 10m x 10m in size.	
8	NH 58974 03551	Re-colonisation.	This large bare peat pan (ca. 30m x 30m) was colonised by common cottongrass. Deer prints were evident throughout the pan.	 
9	NH 59034 03523	Bare peat pan.	Common cottongrass partially re-vegetated over an area of bare peat (ca. 10m x 30m). There was ca. 70% cover of common cottongrass. Rocks showing through in some places but clearly deep peat in other location. Many deer prints evident in the bare peat.	

TG	Grid	Note	Comment	Photos
10	NH 59027 03530	Montane grassland.	Montane grassland dominated by mat grass and stiff sedge with lichens (NVC community U7).	
11	NH 59064 03518	Deer.	There were up to 350 red deer visible on hill slope.	 
12	NH 59249 03495	Deer.	There were up to 350 deer visible on the hillside. Peatland restoration would only be successful if deer numbers are substantially reduced.	  

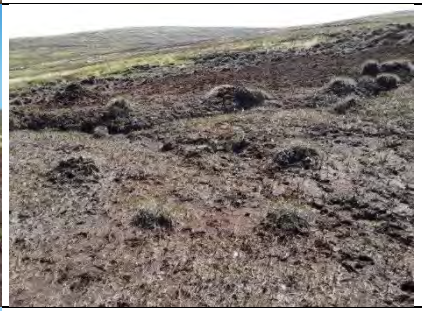
TG	Grid	Note	Comment	Photos
13	NH 59180 03536	Bare peat.	The very large bare peat pan was partially vegetated with common cottongrass, but there were smaller patches within it that were 98% bare peat, with just a little common cottongrass. The bare peat pan was estimated to be over deep peat (>1m deep). Deer prints were frequent across the pan. It was considered to be actively eroding. This area was located within the SAC.	
14	NH 59176 03526	Erosion hagg.	Erosion face at the edge of the bare peat pan was ca. 1.5m high. It was an active eroding edge, causing the pan to expand. There were occasional islands of remaining peat in the pan, but they were actively eroding. The vegetation at the top of the erosion features was largely woolly fringe moss with wavy hair-grass, blaeberry and lichens.	  
15	NH 59318 03489	Bare peat to mineral soil.	The bare peat pan had reached mineral soil. It was estimated there was a loss of ca. 1m of peat to expose the mineral soil. Recommend: Reduce deer pressure substantially and effectively. Re-profile edges to prevent expansion of pan. Seed and mulch the bare peat to reduce further loss.	

TG	Grid	Note	Comment	Photos
16	NH 59318 03431	Re-colonisation.	On the peat surface, where re-colonisation was seen, it was exclusively common cottongrass. Where there was mineral soil mat grass, stiff sedge, crowberry and mosses such as woolly fringe moss were seen to colonise.	
17	NH 59324 03397	Bare peat.	A ca. 20m x 10m of patch of near complete bare peat in a larger bare peat pan with common cottongrass colonising. Clearly actively eroding.	
18	NH 59338 03361	Evidence of expanding bare peat pan.	There was a large bare peat pan which appeared to be expanding in size, through erosion at the edge. The slope here had remaining tussocks of vegetation at the uppermost slope, with no vegetation lower down. The blanket bog vegetation is being lost through active erosion. Recommend: reduce grazing pressure substantially, re-profile, re-seed and mulch.	
19	NH 59354 03343	Evidence of active erosion.	These tussocks are remains of blanket bog vegetation, including hare's-tail cottongrass and woolly fringe moss. The bare peat was spreading around the root bases and deer paths between the tussocks could be seen. Recommend: flatten, seed and mulch.	

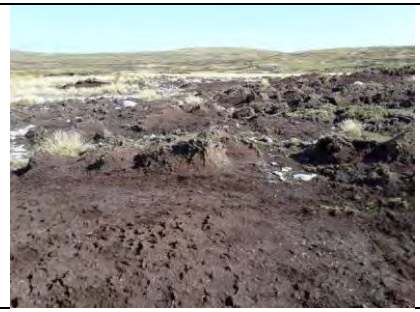
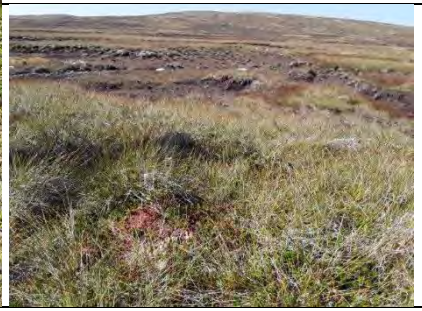
TG	Grid	Note	Comment	Photos
20	NH 59453 03538	Evidence of active erosion.	The water in the small stream was stained brown with peat particles seen in the water demonstrating active erosion.	 
21	NH 59461 03577	Evidence of active erosion.	Large peat particles were deposited on the vegetation around this stream. Clear evidence of active erosion in higher water flows.	
22	NH 59478 03611	Evidence of active erosion.	Tussocks of deergrass and hare's-tail cottongrass surrounded by bare peat. Active erosion. It was estimated this was on deep peat (>1m).	
23	NH 59571 03760	Large bare peat pan.	There was a large bare peat pan ca. 50m x 100m. There were deer prints frequently across it. There was little to no re-colonisation. It was estimated this was on deep peat (>1m). Active erosion.	 

TG	Grid	Note	Comment	Photos
24	NH 59535 03939	Evidence of active erosion.	Large areas of bare peat with tussocks of hare's-tail cottongrass demonstrating active erosion and loss of blanket bog habitat.	
25	NH 59534 03961	Hare's-tail cottongrass tussocks.	These hare's-tail cottongrass tussocks demonstrate that active blanket bog was once present, but it has been heavily degraded. Deer prints were surrounding the remaining tussocks. Recommend putting heather brash and seed between the tussocks, with coir bails to hold it in place.	
26	NH 59408 04175	Vast bare peat pan.	Bare peat pan ca. 450m x 150m, with a little common cottongrass. Large tracks with hare's-tail cottongrass hummocks with bare peat around them. The scale of degradation is extensive.	 
27	NH 59335 04365	Bare peat pan.	A smaller bare peat pan, (ca. 30m x 70m). With evidence of active erosion. Would require re-profiling the edges mulching and seeding the bare peat.	

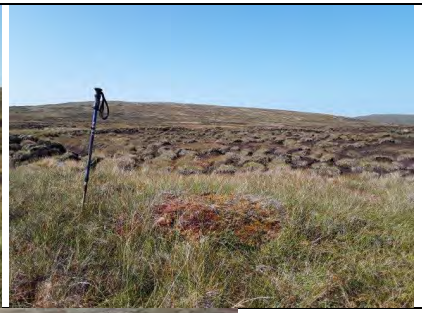
TG	Grid	Note	Comment	Photos
28	NH 59260 04415	M17a with M2 pools.	An area ca. 50m x 100m where bog-moss cover was good forming a near carpet. There were two M2 bog pools with feathery bog-moss. The vegetation was NVC community M17a with mostly deergrass, hare's-tail cottongrass, red bog-moss, papillose bog-moss and crowberry growing through it. There was also cowberry and little heather. This was a fragment or remnant of blanket bog in good condition.	  
29	NH 59260 04415	Rusty bog-moss.	Rusty bog-moss was in a hummock that was ca.60cm wide and 15cm deep. Cloudberry, woolly fringe moss and blaeberry were within the hummock. The hummock was within the M17a community.	
30	NH 59275 04400	Evidence of active erosion.	There was erosion of the edge of the area containing the M17a blanket bog and M2 pools. It was next to a bare peat pan, which showed evidence of erosion. This demonstrates that the remaining, remnant blanket bog was under threat from erosion.	

TG	Grid	Note	Comment	Photos
31	NH 59271 04441	Deer damage in good bog.	There were deer prints in the M17a blanket bog fragment.	
32	NH 59307 04580	Remnant peat island.	There was a ca. 1.5m high peat island in a large bare peat pan. There was a little re-colonisation by common cottongrass.	 
33	NH 59225 04593	View.	A view of a typical large peat pan.	
34	NH 59235 04663	Montane grasslands.	The grassland had abundant deergrass with tormentil, mat grass, heath rush, alpine bearberry, cowberry and crowberry. Woolly fringe moss was abundant (NVC community U5e).	 

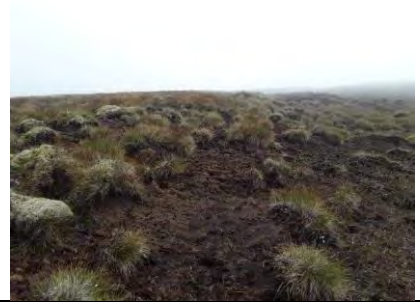
TG	Grid	Note	Comment	Photos
35	NH 59238 04701	Montane grasslands.	Mat grass dominant with heath rush and stiff sedge. The ground flora included little shaggy moss, red-stemmed feather-moss and woolly fringe moss (NVC community U7a).	
36	NH 59326 04746	View.	View looking southeast showing extensive erosion.	
37	NH 59327 04753	Views.	View looking north showing extensive erosion (1st photo). View looking east showing extensive erosion (2nd photo).	 
38	NH 59330 04968	Vast bare peat pan.	Erosion exposed the bedrock/substrate below. There were erosion faces at the edge of the pan, demonstrating expansion of a bare peat pan.	 

TG	Grid	Note	Comment	Photos
39	NH 59343 04995	Bare peat.	Some places here appeared to have lost nearly all the peat. Recommend using species that are naturally colonising, to prevent further erosion of remaining peat. These include wavy hair-grass, deergrass, stiff sedge and mat grass. There were some areas that still supported ca. 1.5m deep peat which was un-vegetated and likely to erode away. Deer hoof prints were evident.	
40	NH 59330 04787	Evidence of active erosion.	The ripples in the bare peat (>1m deep) demonstrate active wind erosion.	
41	NH 59321 05106	Hagg erosion face.	There was a ca. 2m high erosion hagg which could be re-profiled to prevent further erosion. There was deergrass and woolly fringe moss on top of the erosion hagg.	
42	NH 59301 05119	Blanket bog vegetation.	Hare's-tail cottongrass was abundant growing through a mixture of low dwarf shrubs including crowberry, blaeberry and alpine bearberry. There was a layer of lichens over red bog-moss and woolly fringe moss (NVC community M20b).	 

TG	Grid	Note	Comment	Photos
43	NH 59231 05168	Pool.	There was a large pool (ca. 10m x 10m). The bog vegetation surrounding the pool was dry. The water in the pool was ca. 50cm below the surface of the surrounding bog. The pool was murky with algae and a little feathery bog-moss.	
44	NH 59217 05200	Bottle sedge.	This area was in a topographically low and may once have been a fen. Bottle sedge was poking through the blanket bog vegetation which included red bog-moss and papillose bog-moss. There was hare's-tail cottongrass, common cottongrass, deergrass, mat grass and heath rush with a little sub-shrubs (NVC community M17c).	
45	NH 59221 05240	Rusty bog-moss.	Two hummocks of rusty bog-moss. One was ca. 70cm wide 20cm high the second was ca. 1m wide and 50cm high. There was red bog-moss mixed in with the rusty bog-moss.	  

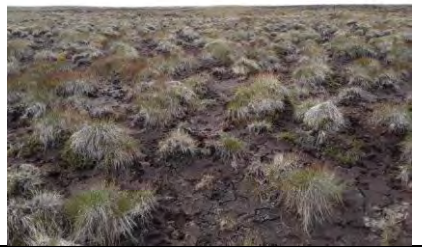
TG	Grid	Note	Comment	Photos
46	NH 59219 05240	Rusty bog-moss beside hagg system.	The rusty bog-moss hummock at this location was within 2m of an extensive erosion feature. It is a relic, in a fragment of blanket bog.	 
47	NH 59141 05213	Rusty bog-moss.	The hummock of rusty bog-moss was in poor condition, with about 50% dried out. It was beside a bare peat pan.	 
48	NH 59106 05221	Bare peat pan.	Very large area of bare peat. There was some common cottongrass colonisation but large areas were actively eroding.	
49	NH 58755 05139	Bare peat pan.	There was ca. 100m x 100m of bare eroding peat. There was ca. 10% common cottongrass but the area appeared to be expanding.	 

TG	Grid	Note	Comment	Photos
50	NH 58597 05101	M2 pool in open blanket bog.	There was an M2 pool with feathery bog-moss in open bog, with hare's-tail cottongrass and deer grass. There was a good cover of bog-moss (NVC community M17a). There was also occasional bottle sedge. There was little or no heather in this patch and in the whole of the Option Area.	 
51	NH 58272 05299	Bare peat around tussocks.	The peat appeared deep (>1m). The area was not yet a bare peat pan, but tussocks of hare's-tail cottongrass and deergrass with woolly fringe moss were present between the bare peat.	
52	NH 58202 05282	Pools.	There was a species poor pool system (M3). There were no bog-mosses present. The area was surrounding by a species poor M17a blanket bog with bog-moss and bottle sedge.	 
53	NH 58111 05293	View of deer.	There were ca. 40 deer seen on the hill slope in the distance.	

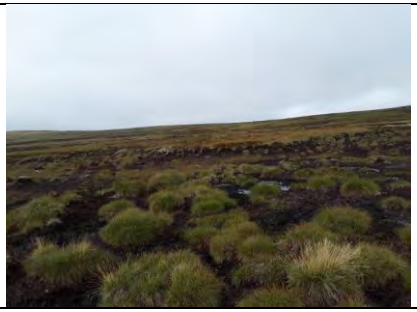
TG	Grid	Note	Comment	Photos
54	NH 57341 05518	Dwarf birch.	Dwarf birch was present in a transition point from montane heath to small patch of blanket bog, then into modified bog. The dwarf birch was amongst woolly fringe moss, hare's-tail cottongrass, crowberry, red bog-moss and deergrass. There was a hummock of rusty bog-moss.	 
55	NH 58250 05514	Bare peat pan.	Very large bare peat pan ca. 100m x 150m. The erosion faces were ca. 1.5m high. There were occasional remnant islands ca. 1m high. To the east the pan had eroded to a rocky substrate. To the west the peat surface was actively eroding.	 
56	NH 58255 05503	Hole in peat.	There were several ca. 50cm diameter holes in the peat to underground pipes. The holes were ca. >1m deep with water flowing underneath.	
57	NH 58298 05382	Bog being lost.	Where blanket bog vegetation was actively being lost, there was often tussocks of hare's-tail cottongrass or deergrass, the roots holding the vegetation in place, but bare peat around the tussocks. These areas were located at the edge of peat pans, where they met intact fragments of bog habitat. It demonstrates that blanket bog vegetation is currently being lost and bare peat areas are expanding.	

TG	Grid	Note	Comment	Photos
58	NH 58377 05381	Common cottongrass colonisation.	Common cottongrass was colonising bare peat surface. In some areas colonisation was quite extensive, in others it was very occasional.	
59	NH 58374 05379	Evidence of active eroding peat.	Bare peat was actively eroding, exacerbated by numerous deer prints. Areas with colonisation, areas of active erosion, and erosion of blanket bog vegetation can be in close proximity to each other. All three were within 20m at this location.	 
60	NH 58389 05395	Blanket bog vegetation being lost.	Hummocks of papillose bog-moss, hare's-tail cottongrass, crowberry, bearberry and deergrass were present as M20b blanket bog which was being degraded and lost through deer prints creating bare patches.	
61	NH 58971 05766	Erosion gullies.	There were multiple erosion gullies (ca. 1m depth) within modified blanket bog, with woolly fringe moss as the edges of the erosion features. These gullies could be blocked to raise the water table and prevent further erosion.	

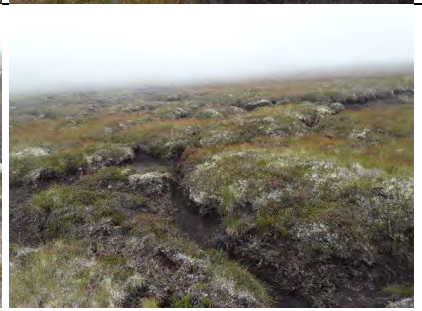
TG	Grid	Note	Comment	Photos
62	NH 59852 05947	Bare peat pan and tussocks of hare's-tail cottongrass.	There was deep peat (>1m deep) with a bare surface and some remaining tussocks of hare's-tail cottongrass. All this peat will be lost if there is no management intervention.	
63	NH 60260 06570	Vast bare peat pan.	Ca. 250m wide and extensive bare peat pan. It was mainly bare peat with some colonising of common cottongrass and mat grass in places.	
64	NH 60274 06691	View.	View of extensive bare peat pan. Slopes have all eroded with very little remaining bog as just small stripes. There were occasional patches in the centre of the bare peat pan which were deergrass and common cottongrass dominated.	
65	NH 60266 06720	Remnant bog.	Remains of blanket bog habitat. The patches were ca. 30m x 10m in size. They included red bog-moss, papillose bog-moss, hare's-tail cottongrass, crowberry, bilberry, alpine bearberry and deergrass. At the edges it breaks up into tussocks surrounded by bare peat, then it goes into the bare peat surface.	 

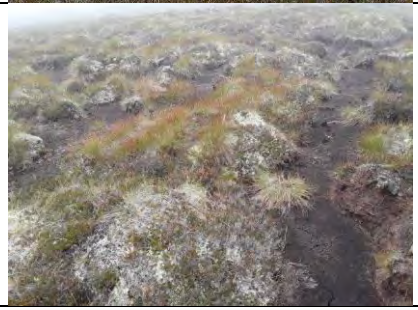
TG	Grid	Note	Comment	Photos
66	NH 60224 07046	Flat bare peat pan.	Given the conditions this whole area would revert to blanket bog, due to the deep peat below and the topography of a wide, flat area with slopes rising around it.	
67	NH 60351 07125	Rusty bog-moss and bare peat.	There was a tiny patch of blanket bog habitat in a vast expanse of bare peat. The fragment of remnant bog was ca. 10m x 10m. Rusty bog-moss was present in several hummock.	  
68	NH 60412 07086	Tussocks surrounded by bare peat.	Tussocks with woolly fringe moss, deergrass, crowberry, alpine bearberry, and red bog-moss.	 

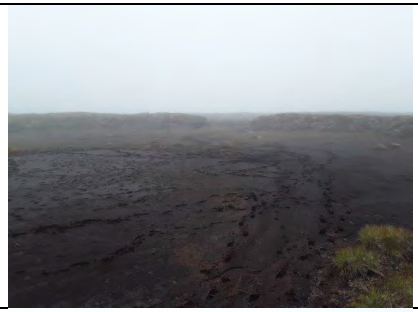
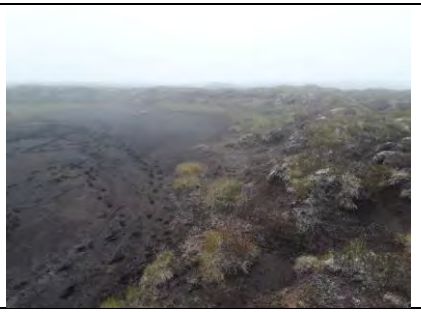
TG	Grid	Note	Comment	Photos
69	NH 60406 07029	Rusty bog-moss.	Rusty bog-moss beside bare peat.	
70	NH 60397 06695	View.	View of extensive area of bare peat, with some remnant bog.	
71	NH 60364 06630	View.	View of an area in north of Option Area. It is a large flat area suitable for restoration. The light area is the tussocks surrounded by bare peat. The orange areas are remnant bog with deergrass. Large areas of exposed deep peat are seen as the dark brown colour in this and other photos..	
72	NH 60310 06500	Erosion face.	The erosion faces (haggs) around the outside of the bare peat pan were ca. 1m to 1.5m in height. Recommend re-profiling them to prevent expansion of bare peat area.	

TG	Grid	Note	Comment	Photos
73	NH 60255 06117	Deer tracks.	There were many recent deer tracks between the tussocks of hare's-tail cottongrass. It was clear that the erosion and bare peat was caused by these deer.	  
74	NH 60212 05953	Evidence of active erosion.	This area had a slope with erosion at the top and bog habitat at the bottom. The area at the top of the slope had some remaining peat but was down to bedrock in some places. Recommend stopping the loss of the remaining peat. Prevent further loss of bog habitat by placing coir bunds between the tussocks and re-seeding.	 
75	NH 60129 05805	Stream.	Low flows in drained peat can lead to the release of iron ochre and occasionally to dense growths of iron bacteria. This occurs when the water table lowers to below the acid influence of the peat, and acidic water with high concentrations of dissolved iron meets less acidic mineralized water which causes the iron to precipitate out of solution, which in turn can cause and be exacerbated by growths of iron depositing bacteria. This appeared to be the case here.	

TG	Grid	Note	Comment	Photos
76	NH 59543 05685	View.	Extensive area of bare peat in the background.	
77	NH 57578 05727	Example of an erosion gully with vegetation.	Example of a revegetating gully. It was outside the Option Area. No revegetating gullies were seen within the Option Area. This gully was ca. 1.2m deep and was vegetated with wet heath vegetation including deergrass and heather.	
78	NH 56407 05235	Dwarf birch.	Dwarf birch in a patch of hare's-tail cottongrass with heather and red bog-moss (NVC community M19).	
79	NH 56130 03943	Stronelairg failed re-instatement.	Beside the track there was a 10m to 15m wide area of bare redistributed peat from construction of Stronelairg Wind Farm. There were occasional very small tussocks of deergrass, heather, blaeberry, but it was mostly bare peat. There were occasional tiny patches of bog-mosses present. This is a failed attempt to cover the bare peat surfaces with a nurse crop.	 

TG	Grid	Note	Comment	Photos
80	NH 56137 03848	Stronelairg re-instatement.	There was ca. 80% to 90% cover of vegetation on this redistributed peat beside the Stronelairg Wind Farm track. There were some patches of common cottongrass, heather and bog-mosses developing. Deergrass and crowberry were also present. It was establishing and the bare peat surface was largely covered with the nurse crop (including bent grasses, mat grass and wavy hair-grass). The re-instatement of vegetation was working better in some places than others.	 
81	NH 48361 04356	Erosion gullies.	West of T4 of Stronelairg Wind Farm there were numerous erosion gullies. This one had a bare peat base. It was ca. 1m deep and 1-2m wide. The bog habitat was on a gentle slope. Blocking the erosion gullies would reduce erosion and raise the water table.	 
82	NH 48159 04507	Erosion gullies.	There was a network of small erosion gullies. They were ca. 1m deep and 50cm to 1m wide. The tops of this area had a high cover of lichens. These erosion gullies could be blocked.	 
83	NH 48146 04515	Deer prints.	Detrimental deer impacts were evident. There were deer tracks on the bare peat within the erosion gullies exacerbating them.	

TG	Grid	Note	Comment	Photos
84	NH 48066 04616	Erosion gullies.	This erosion gully was ca. 1m wide and 1m deep. The blanket bog habitat was characterised by woolly fringe moss and lichens.	
85	NH 48060 04621	Rusty bog-moss.	Rusty bog-moss was present with woolly fringe moss on edge of an erosion hagg.	
86	NH 48042 04638	Pools.	There were some dried out pools. If the water table was raised these pools would likely restore. They were present in some species poor M17a blanket bog with rusty bog-moss hummocks present.	 
87	NH 47947 04674	Evidence of active erosion.	The erosion was not in the same state as in the Option Area. There was more vegetation present, and there were often erosion gullies which were shallow, ca. 20cm deep. Recommend substantially reducing numbers of deer, and placing in coir bunds between the remnant bog, blocking erosion gullies and re-seeding.	

TG	Grid	Note	Comment	Photos
88	NH 47906 04673	Lost lochan.	Large bare peat area which is recorded on the OS map as a lochan. It was ca. 80m x 40m in size. There was a surrounding wall of peat around the lost lochan ca. 1.5m high. There was a clear breach in the wall and a section which was eroded. There were deer tracks within the bare peat.	 
89	NH 47876 04690	Lost lochan.	The breach point of the lost lochan was ca. 3m wide. If it was blocked, then the lochan would likely refill with water.	
90	NH 47879 04693	Bare peat.	On the far side of the lost lochan there was an area eroded to bedrock.	
91	NH 47936 04581	Lochan.	There was a lochan with water and common cottongrass beside the lost lochan. However, the barrier wall was eroding. It was ca. 2m wide. This lochan could also be lost if action is not taken.	 

TG	Grid	Note	Comment	Photos
92	NH 48181 04519	Lost pool.	The OS map shows this as a pool, but currently it is bare peat with some common cottongrass. There was no clear breach point, but likely requires the water table to be raised to re-wet.