



Kirkton Energy Park

Candidate World Heritage Site Assessment of Impacts

October 2023

Kirkton Wind Farm Ltd.

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1 Introduction and background

This document carries out an ecological impact assessment of the impacts of Kirkton Energy Park (the proposed development) on the candidate Flow Country World Heritage Site (the 'cWHS').

The baseline conditions on the proposed development site are not described here, unless they directly relate to the cWHS; this document should therefore be read in conjunction with EIA and SEI Reports Chapter 8: Ecology and Chapter 9: Ornithology, as well as supporting Technical Appendices.

The cWHS nomination was submitted to UNESCO in February 2023, three months after the submission of the Section 36 application for the proposed development (November 2022). The proposed development had taken account of the presence of the Caithness and Sutherland Peatlands Special Protection Area (SPA), Ramsar and Special Area for Conservation (SAC) as well as the underlying Sites of Special Scientific Interest (SSSIs) during the design process. However the uncertainty around the extent of the cWHS, the boundaries for which do not match area designated as the SAC/SPA meant there was much less opportunity for design to take account of the cWHS.

In response to the 2022 application, the Ecology Officer for the Highland Council (THC) objected due to adverse effects upon the cWHS. THC have adopted a Planning Policy Statement in regard to the cWHS noting that "Any complex and/or national/major Development proposals with the potential to effect the Site and its Outstanding Universal Values (OUVs) that are at pre-application stage as of February 2023 will be considered in this context".

Despite the fact that this proposed development does not fall within the scope of the adopted Planning Policy Statement, application having been made 9th November 2022, this document has been prepared to assess the impacts on the Outstanding Universal Values (OUVs) of the cWHS by the proposed development. The Applicant does not accept that the position adopted by the THC is correct, but this assessment is provided for completeness.

This assessment is supported by the following figures:

- Figure 1 Flow Country Candidate World Heritage Site
- Figure 2 Flow Country cWHS in relation to the Proposed Development
- Figure 3 NVC survey results in relation to the cWHS

1.1 Candidate World Heritage Site

The nomination for the cWHS was submitted in February 2023, three months after the application for the proposed development was made. The adopted Planning Policy The site is considered for WHS status due to the Flow Country being considered the most outstanding example of a blanket bog ecosystem in the world; if accepted it would become the first WHS to be designated in Scotland for ecological/natural features.

Figure 1 shows the cWHS boundary.

WHS's are designated because of the recognition of their Outstanding Universal Value (OUV). For natural sites, OUVs have three pillars:

- Criteria – the factors for which the WHS is globally outstanding; there are six cultural and four natural heritage criteria under which a site can be nominated;
- Integrity – the ‘wholeness’ or completeness of the Site; an expression of whether all of the component parts of what is being described are present in good condition within the boundary area; and
- Protection and management – the extent to which the area proposed for inscription can be protected and managed effectively.

The cWHS is nominated under two of the criteria for which WHS can be nominated:

- (ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- (x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

Appendix A reproduces the Statement of Outstanding Universal Value from the Draft Management Plan for the cWHS (Flow Country Candidate World Heritage Site Steering Group, 2022).

Table 1 provides the features/attributes, which provide more detail about the criteria for OUV, for the cWHS.

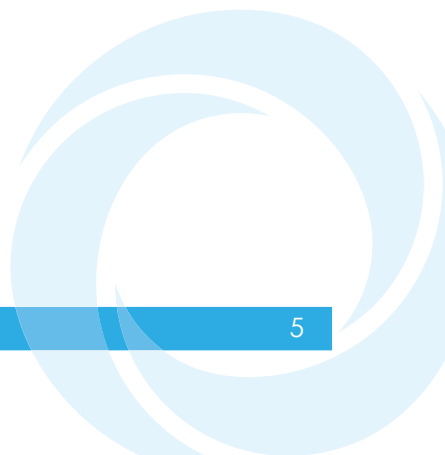
Table 1: List and description of candidate World Heritage Site Attributes (Flow Country Candidate World Heritage Site Steering Group, 2022)

Attribute	Description
Criterion ix.- outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals	
a) most extensive near continuous example of natural actively accumulating blanket bog ecosystem found globally	Persistent rain fed wetness and low rates of evaporation across the Flow Country led to widespread, year-round waterlogged ground conditions which are ideal for the growth and preservation of peat forming plants. This ongoing process (paludification) began around 9,000 years ago and is key in the formation of blanket bog. Unlike other bog types, which are confined by topography, this allows blanket bog to mantle entire landscapes. The Flow Country is one of only a few locations globally where conditions exist that are conducive to blanket bog formation, and combines a quality, extent and connectivity of this habitat exceeding that of any other known blanket bog.
b) climatic and topographic gradients, and geological diversity: bog macroform diversity	The scale of the site, alongside the gradients in climate and topography, and the diversity of the underlying geology, provide the setting for subtle variations in processes which result in a wide diversity in the character of the blanket bog. These factors control the development of complex systems of hummocks, moss lawns, hollows and pools, and the associated plant species, which produce surface patterning that has been classified into 15 site-types. No other

Attribute	Description
	blanket bog in the world contains, or is reported to contain, such a diverse collection of surface patterning within a single area.
c) archive it stores (4 th dimension)	Delving deeper, the peat, which has been forming for over 9,000 years, reaches thicknesses of over 8 m, providing an exceptional archive and a 4th dimension to the Flow Country blanket bog. The processes responsible for the development of the blanket bog system and the ecosystems it supports can be scrutinised back through time across the vast area it covers using pollen records; plant fossils (e.g. hazelnuts, pine cones, pine stumps); lake sediment records (midge and diatom (alga) remains); tephra (ash) layers blown south from Icelandic volcanoes; charcoal (indicating in situ burning).
d) natural laboratory – ongoing scientific and educational use	The exceptional nature of the Flow Country makes it the 'type site' for blanket bog study and it continues to be used as a 'test bed' for peatland research globally. The diversity of features related to altitudinal and climatic gradients across the region and the depth of archive provides significant scope for research. Furthermore, the breadth of existing studies provides a fantastic foundation for future research.
e) carbon sequestration and storage	Globally peatlands are the largest natural terrestrial carbon store. Covering only 3% of the world's land area, they hold nearly 30% of all the carbon stored on land. In blanket bog, year-round waterlogged conditions slow the process of plant decomposition such that the dead plants accumulate to form peat, and thereby sequester carbon from the atmosphere. Over thousands of years this plant material builds up and becomes several metres thick creating a valuable carbon store. The Flow Country provides a superb example of ongoing sequestration, alongside carbon storage demonstrated by peat thicknesses which reaching over 8 metres.
f) water filtration and the impact on the water quality of associated riverine habitats	The catchments draining the Flow Country sustain exceptional water quality, resulting from the natural filtration of rainwater as it slowly seeps through these vast peatlands. The superb water quality is critically important in sustaining globally important populations of the freshwater pearl mussel in rivers which drain from the Flow Country. The European eel (classed by the IUCN as Critically Endangered) is also recorded from these catchments. Furthermore, the rivers of the Flow Country maintain strong populations of Atlantic salmon which is in global decline.
Criterion x. contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation	

Attribute	Description
a) species associations	The diverse range of habitats that The Flow Country contains supports an exceptional and specialised blanket bog biodiversity and holds biological associations unlike any other blanket bog found globally. This is a consequence of the overlapping distributions of species typical of both arctic and temperate climatic zones and is further influenced by altitudinal and climatic gradients and the geological diversity found across the site. Furthermore, the scale and connectivity of the site provides resilience to species it contains.
a.i) birds	The diversity of environments within the blanket bog of The Flow Country, and the patchwork of connected landscape elements within the wider setting (farmland, coastal, etc.), supports a distinctively special assemblage of birds. The precise combination of species, with arctic-alpine and temperate and continental elements is not found anywhere else in the world and includes; red-throated diver, black-throated diver, common scoter, Eurasian wigeon, golden plover, Eurasian greenshank, dunlin, wood sandpiper, golden eagle, merlin, hen harrier and short-eared owl.
a.ii) plants	The floristic composition of the Flow Country blanket bogs, and associated wet heath, is not found anywhere else globally, and represents a highly Atlantic influence on plant distribution and development. Key plants of importance are dwarf birch, alpine bearberry, bogbean, bog hair-grass, water lobelia, bog orchid, marsh saxifrage and 29 species of Sphagnum (over 10% of global Sphagnum flora).
a.iii) genetic diversity	The Flow Country occupies a position at the western extreme of the Eurasian landmass. As such it is a haven of locally adapted genetic diversity. Many species here are isolated from their continental relatives, which means that local lineages have developed. Whilst small, isolated populations frequently suffer from inbreeding depression, the large size of the Flow Country means that this not a significant issue here. Furthermore, many species operate as metapopulations: groups of smaller populations between which individuals can move. Not only does this mean that genes can flow between populations, it also means that individuals can recolonise sites in the event of short-term localised extinction, as has been demonstrated with newts. Given models that suggest droughts will increase in both frequency and intensity in the north of Scotland, the large number of waterbodies in the Flow Country will greatly reduce the likelihood of population loss. This makes it a valuable refuge for wildlife of many

Attribute	Description
	species at both a population and a genetic level.

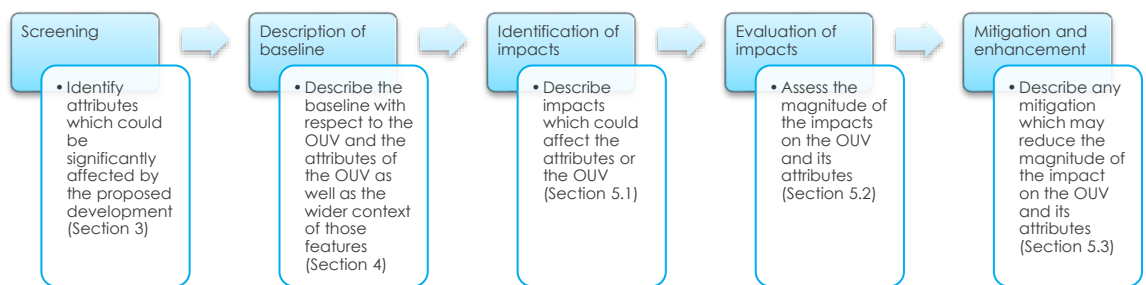


2 Methodology

The methodology used in this process is based upon that for Ecological Impact assessment (CIEEM, 2022), but taking account of specific guidance produced for the assessment of impacts on World Heritage Sites (UNESCO/ICCROM/ICOMOS/IUCN, 2022).

The structure of the assessment is shown in Chart 1 and described in more detail below.

Chart 1 Structure of Assessment



The CEEM Guidelines (CIEEM, 2022) form the basis of the impact assessment presented in this document. These guidelines set out a process of identifying the value of each ecological/ornithological receptor and then characterising the impacts that are predicted, before discussing the effects on the integrity or conservation status of the receptor, proposed mitigation and significance of effects of any residual impacts predicted. In this case, the valuation of the ecological/ornithological receptors is not carried out; the assessment is focussed on the OUV and its attributes and as such, these are recognised to be internationally important. However, identifying what receptors, detected on and around the proposed development, form part of the attributes of the OUV and thus whether impact should be assessed on them, would form part of the early stage evaluation.

The following definitions of the terms 'impact' and 'effect' are used in this assessment:

- impact – actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow.
- effect – outcome to an ecological feature from an impact. For example, the effects on a dormouse population from loss of a hedgerow.

The initial action for any Ecological Impact Assessment (EIA) is to determine which features should be subject to detailed assessment. In this case, it is determining which of the attributes of the OUV apply for the purposes of this assessment as not all attributes may be affected by the proposed development. The guidance (UNESCO/ICCROM/ICOMOS/IUCN, 2022) does not describe in detail how this should be done, but it is considered similar to the approach used for assessing 'likely significant effect' in Habitats Regulations Appraisals; that is a relatively cautious examination of potential impacts for which there is a pathway for the effect of the impact to be great enough to be significant. As such the approach used is that used for Habitats Regulations Appraisal (SNH, 2015) for deciding which impacts could affect the OUVs of the cWHS.

The zone of influence for a project is defined here as the area over which the OUV and its attributes may be affected by biophysical changes as a result of the proposed

development and associated activities. The zone of influence is likely to extend beyond the site, for example where there are ecological or hydrological links beyond the site boundary. The zone of influence will also vary for different receptors, depending on their sensitivity to environmental change. Consideration of the zone of influence ensures that impacts on the 'wider setting' (defined as the immediate and extended environment that is part of, or contributes to, [the cWHS']) significance and distinctive character (UNESCO/ICCROM/ICOMOS/IUCN, 2022 p14) will also be assessed. Since it is proposed that the cWHS be designated for its biodiversity and ecological importance the setting will therefore relate to the wider ecology and environment and therefore impacts on this will also need consideration.

2.1 Impacts and Effects

The CIEEM guidelines suggest that the process of predicting ecological impacts and effects should take account of relevant ecosystem structure and function such as:

- available resources – e.g. territory, food and water;
- environmental process – e.g. flooding, erosion, eutrophication, deposition and climate change;
- ecological processes and relationships – e.g. population dynamics, vegetation dynamics and predator / prey relationships;
- human influences – e.g. animal husbandry, burning, pollution, disturbance from public access; and
- historical context – e.g. natural range of variation, historical human influences and geomorphological evolution.

In accordance with the CIEEM guidelines, when describing impacts and effects, reference is made to the following, where appropriate:

- confidence in predictions – the level of certainty that an impact will occur as predicted, based on professional judgement and where possible evidence from other schemes – this is based on a four point scale: certain / near certain; probable; unlikely; and extremely unlikely;
- magnitude – the size of an impact in quantitative terms where possible;
- extent – the area over which an impact occurs;
- duration – the time for which an impact is expected to last;
- reversibility – a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. A temporary impact is one from which a spontaneous recovery is possible; and
- timing and frequency – i.e. whether impacts occur during critical life stages or seasons.

Both direct and indirect impacts are considered: direct impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or receptor, e.g. external sourcing of stone for road surfaces may cause growth of plant species not generally found in that area of the application site.

2.2 Magnitude of impact

For the purposes of EclA, the CIEEM guidelines define a significant effect as “an effect that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general”. Significant effects can be either positive or negative and are qualified with reference to an appropriate geographic scale, from international to local, however, it should be noted that the scale of significance of an effect may not be the same as the geographic context in which the feature is considered important. For example, an effect on a species which appears on a national list of species of principal importance for biodiversity may not have an effect on its national population.

The WHS guidance defines four categories of impact which can be either positive or negative. They are defined as (UNESCO/ICCROM/ICOMOS/IUCN, 2022):

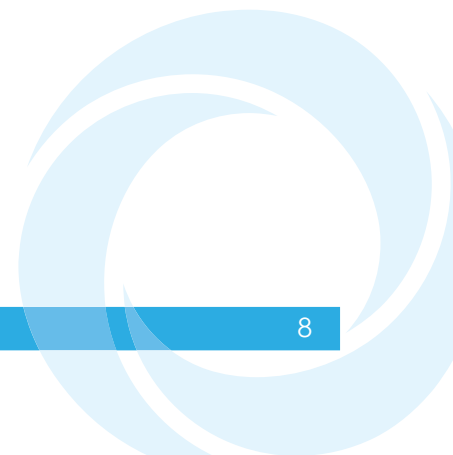
- Neutral: Research into the potential impact reveals that no change would occur to the attribute;
- Minor: Research into the potential impact shows that the change would be negligible;
- Moderate: Research into the potential impact shows that there would be some change to the attribute; and
- Major: Research into the potential impact shows that there would be large change to the attribute.

For the purposes of this assessment, impacts which are minor or neutral would not be considered to have an adverse effect on the OUV and its attributes because an impact categorised at this level would have no or a negligible effect on the OUV and its attributes. Moderate or major negative effects would be considered to have an adverse effect on the OUV; in EIA terms they would be deemed 'significant'.

2.3 Mitigation, Compensation and Enhancement

It is important as part of any Environmental Impact Assessment to clearly differentiate between mitigation, compensation and enhancement and these terms are defined here as follows:

- Mitigation is used to refer to measures to avoid, reduce or remedy a specific negative impact *in situ*. Mitigation is only required for negative impacts assessed as being significant or where required to ensure compliance with legislation.
- Compensation is used to refer to measures proposed in relation to specific negative impacts but where it is not possible to fully mitigate for negative impacts *in situ*. Compensation is only required for negative impacts assessed as being significant or where required to ensure compliance with legislation.
- Enhancement is used to refer to measures that will result in positive ecological impacts but which do not relate to either specific significant negative impacts or where measures are required to ensure legal compliance.



3 Screening

Table 2 assesses each of the attributes of the OUV to determine if there is a potential significant effect as a result of the proposed development.

Table 2: Assessment of the Attributes of the OUVs

Attribute	Description	Comment
Criterion ix.- outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals		
a) most extensive near continuous example of natural actively accumulating blanket bog ecosystem found globally	Persistent rain fed wetness and low rates of evaporation across the Flow Country led to widespread, year-round waterlogged ground conditions which are ideal for the growth and preservation of peat forming plants. This ongoing process (paludification) began around 9,000 years ago and is key in the formation of blanket bog. Unlike other bog types, which are confined by topography, this allows blanket bog to mantle entire landscapes. The Flow Country is one of only a few locations globally where conditions exist that are conducive to blanket bog formation, and combines a quality, extent and connectivity of this habitat exceeding that of any other known blanket bog.	The proposed development would not have a significant effect on this attribute; the proposed development is a small area on the boundary of the cWHS and the scale of this development is too small to have a significant effect on this attribute. No further assessment is required.
b) climatic and topographic gradients, and geological diversity: bog macroform diversity	The scale of the site, alongside the gradients in climate and topography, and the diversity of the underlying geology, provide the setting for subtle variations in processes which result in a wide diversity in the character of the blanket bog. These factors control the development of complex systems of hummocks, moss lawns, hollows and pools, and the associated plant species, which produce surface patterning that has been classified into 15 site-types. No other blanket bog in the world contains, or is reported to contain, such a diverse collection of surface patterning within a single area.	The proposed development will not affect the climate or the topographic gradients or geological diversity which cause such a wide diversity of bog macroform diversity to form. No further assessment is required.
c) archive it stores (4th dimension)	Delving deeper, the peat, which has been forming for over 9,000 years, reaches thicknesses of over 8 m, providing an exceptional archive and a 4th dimension to the Flow Country blanket bog. The processes responsible for the development of the blanket bog system and the ecosystems it supports can be scrutinised back through time across the vast area it covers using pollen records; plant fossils (e.g. hazelnuts, pine cones, pine stumps); lake sediment records (midge and diatom (alga) remains); tephra (ash) layers blown	The proposed development would not affect the historical record stored in the peat of the Flow Country. No further assessment required

Attribute	Description	Comment
	south from Icelandic volcanoes; charcoal (indicating in situ burning).	
d) natural laboratory – ongoing scientific and educational use	The exceptional nature of the Flow Country makes it the 'type site' for blanket bog study and it continues to be used as a 'test bed' for peatland research globally. The diversity of features related to altitudinal and climatic gradients across the region and the depth of archive provides significant scope for research. Furthermore, the breadth of existing studies provides a fantastic foundation for future research.	Research would be unaffected by the proposed development. No further assessment is required.
e) carbon sequestration and storage	Globally peatlands are the largest natural terrestrial carbon store. Covering only 3% of the world's land area, they hold nearly 30% of all the carbon stored on land. In blanket bog, year-round waterlogged conditions slow the process of plant decomposition such that the dead plants accumulate to form peat, and thereby sequester carbon from the atmosphere. Over thousands of years this plant material builds up and becomes several metres thick creating a valuable carbon store. The Flow Country provides a superb example of ongoing sequestration, alongside carbon storage demonstrated by peat thicknesses which reaching over 8 metres.	The proposed development would not affect the ability of the Flow Country to continue to sequester carbon. Technical Appendix 15.1 details the results of the carbon calculator showing that although some carbon will be released as a result of the proposed development, overall there would be a net carbon benefit associated with the proposed development. No further assessment is required.
f) water filtration and the impact on the water quality of associated riverine habitats	The catchments draining the Flow Country sustain exceptional water quality, resulting from the natural filtration of rainwater as it slowly seeps through these vast peatlands. The superb water quality is critically important in sustaining globally important populations of the freshwater pearl mussel in rivers which drain from the Flow Country. The European eel (classed by the IUCN as Critically Endangered) is also recorded from these catchments. Furthermore, the rivers of the Flow Country maintain strong populations of Atlantic salmon which is in global decline.	Two watercourses cross the proposed development, both of which in stretches form the boundary of the cWHS. With the mitigation identified in the EIAR, there would be no adverse impact on water quality and as such, there would be no adverse impact on this attribute. No further assessment is required.
Criterion x. contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation		
a) species associations	The diverse range of habitats that The Flow Country contains supports an exceptional and specialised blanket bog biodiversity and holds biological associations unlike any other blanket bog found globally. This is a consequence of the overlapping distributions of species typical of both arctic and temperate climatic zones and is further influenced by altitudinal and climatic gradients and the geological	Consideration of the sub-categories has shown that additional assessment is required on this attribute for a (i) and a(ii).

Attribute	Description	Comment
	diversity found across the site. Furthermore, the scale and connectivity of the site provides resilience to species it contains.	
a.i) birds	The diversity of environments within the blanket bog of The Flow Country, and the patchwork of connected landscape elements within the wider setting (farmland, coastal, etc.), supports a distinctively special assemblage of birds. The precise combination of species, with arctic-alpine and temperate and continental elements is not found anywhere else in the world and includes; red-throated diver, black-throated diver, common scoter, Eurasian wigeon, golden plover, Eurasian greenshank, dunlin, wood sandpiper, golden eagle, merlin, hen harrier and short-eared owl.	A number of species listed have occurred on or in the vicinity of the proposed development. Given adverse impacts on birds from wind farm developments are known there is the potential for significant effects to occur on this aspect of the attribute and further assessment is required.
a.ii) plants	The floristic composition of the Flow Country blanket bogs, and associated wet heath, is not found anywhere else globally, and represents a highly Atlantic influence on plant distribution and development. Key plants of importance are dwarf birch, alpine bearberry, bogbean, bog hair-grass, water lobelia, bog orchid, marsh saxifrage and 29 species of Sphagnum (over 10% of global Sphagnum flora).	A number of species listed, or habitats they could be found in, have occurred on or in the vicinity of the proposed development. As such, there could be significant effects on those plant species so further assessment is required.
a.iii) genetic diversity	The Flow Country occupies a position at the western extreme of the Eurasian landmass. As such it is a haven of locally adapted genetic diversity. Many species here are isolated from their continental relatives, which means that local lineages have developed. Whilst small, isolated populations frequently suffer from inbreeding depression, the large size of the Flow Country means that this not a significant issue here. Furthermore, many species operate as metapopulations: groups of smaller populations between which individuals can move. Not only does this mean that genes can flow between populations, it also means that individuals can recolonise sites in the event of short-term localised extinction, as has been demonstrated with newts. Given models that suggest droughts will increase in both frequency and intensity in the north of Scotland, the large number of waterbodies in the Flow Country will greatly reduce the likelihood of population loss. This makes it a valuable refuge for wildlife of many species at both a population and a genetic level.	The proposed development would not have an effect on the genetic diversity of the cWHS or its ability to allow genes to flow between populations or act as a refuge in the event of an environmental catastrophe. No further assessment is required.

3.1 Landscape Impacts

As detailed above, the criterion for which the cWHS has been nominated are aspects of biodiversity and ecological importance. The attributes of those proposed OUVs do not relate to landscape character, scenic quality, important views, or visual relationships of the cWHS. The draft of 'Management Plan for the Proposed Flow Country World Heritage Site' (December 2022) notes on page 25 that there is no explicit link between OUV and important views, visual relationships or natural beauty. As such, any landscape and visual impact that might arise from the proposed development would not have an adverse impact on the OUVs for which the cWHS is nominated. There would be no risk to the integrity of the OUVs and cWHS from impacts of this nature. Landscape and visual impact is therefore screened out of this OUV Assessment.

4 Baseline

Figure 2 shows the cWHS boundary in relation to the infrastructure of the proposed development.

4.1 Ornithology Receptors

EIA and SEI Reports Chapter 9: Ornithology and Technical Appendix 9.1 describes the ornithological baseline of the proposed development in detail. The baseline description has been based on the two years of survey carried out on and in the vicinity of the proposed development, consisting of a number of different surveys detailed in Technical Appendix 9.1. The occurrence of species which are named in the attributes of the OUV are detailed here. These species are also qualifying species for the Caithness and Sutherland Peatlands SPA and impacts on those species have already been assessed due to their importance in that regard.

4.1.1 Red-throated diver

Seventeen flights of Red-throated diver *Gavia stellata* were observed during focal diver surveys, all to the west of the proposed development. There was no flight activity recorded over the proposed development.

Two territories were recorded in 2020 and 2021, also to the west of the proposed development. There were no breeding territories within the proposed development.

4.1.2 Black-throated diver

There were four flights of Black-throated diver *Gavia arctica* recorded during VPs; these all occurred to the west of the proposed development. Similarly there was one pair of Black-throated diver observed on a lochan to the west of the proposed development during breeding surveys. The species was not observed on or over the proposed development.

4.1.3 Common scoter

Common scoter *Melanitta nigra* was not recorded during surveys. Additionally, EIA Report Technical Appendix 9.3: Common Scoter Assessment was produced to assess potential impacts on this species in more detail and found it was highly unlikely that this species would occur on or over the proposed development.

4.1.4 Wigeon

Wigeon *Anas penelope* was not recorded during surveys for the proposed development.

4.1.5 Golden plover

In total, six Golden plover *Pluvialis apricaria* were identified during the two years of survey. In 2020, there was one probable territory in the western part of the survey buffer, and one probable territory within the proposed development site. In 2021, there were two probable territories around turbine five and two possible territories identified, both to the south-west of the proposed development site, one within the survey boundary and one beyond it.

Table 3 shows the flight activity recorded for Golden plover. All records came from the breeding season.

Table 3: Vantage point results for Golden plover

Species	Survey Season	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Golden Plover	September 2019 – February 2020					
	March 2020 – August 2020	1	11	24	515	165
	September 2020 – February 2021					
	March 2021 – August 2021	1	3	43	666	97

4.1.6 Greenshank

Two Greenshank *Tringa nebularia* flights were observed in 2020. There was one bird sighted during breeding bird surveys in 2020. This was the only activity for this species during the two years of surveys; there was no evidence for breeding.

4.1.7 Dunlin

Three territories were identified for Dunlin *Calidris alpina*; in 2020 one probable territory was identified in the survey buffer to the west of the proposed development and in 2021 a probable territory was identified in the survey buffer to the west and a possible territory was identified in the proposed development to the east of turbines 5 and 6. A small amount of flight activity was associated with these territories (Table 4).

Table 4: Results of VP surveys for Dunlin

Species	Survey Season	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Dunlin	September 2019 – February 2020					
	March 2020 – August 2020	1	23	4	255	230
	September 2020 – February 2021					
	March 2021 – August 2021	1	1	1	4	0

4.1.8 Wood sandpiper

Wood sandpiper *Tringa glareola* was not recorded during surveys for the proposed development.

4.1.9 Golden eagle

There were four flights of Golden eagle *Aquila chrysaetos* recorded in the first year of survey and no other observations of the species. There was no evidence of breeding activity recorded.

4.1.10 Merlin

Table 5 shows the occurrence of Merlin *Falco columbarius* during VP surveys. Most records occurred during the breeding season, with only one flight outside this period. There was no evidence for breeding observed during the surveys.

Table 5: Results of VP surveys for Merlin

Species	Survey Season	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Merlin	September 2019 – February 2020					
	March 2020 – August 2020	1	1	4	30	0
	September 2020 – February 2021	1	1	1	12	0
	March 2021 – August 2021	1	1	3	113	0

4.1.11 Hen harrier

Table 6 shows the flight activity for Hen harrier *Circus cyaneus* recorded during vantage point surveys. Most activity was observed in the 2020 breeding season; however, there was no evidence for breeding on or in the vicinity of the proposed development.

Table 6: Results of VP surveys for Hen harrier

Species	Survey Season	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Hen Harrier	September 2019 – February 2020	1	1	1	70	0
	March 2020 – August 2020	1	1	11	1,256	43
	September 2020 –	1	1	4	867	0

Species	Survey Season	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
	February 2021					
	March 2021 – August 2021	1	1	2	53	33

4.1.12 Short-eared owl

Short-eared owl *Asio flammeus* was not recorded during surveys carried out for the Proposed Development.

4.1.13 Summary for ornithology receptors

With a number of species not recorded during surveys, Table 7 provides a summary of whether further assessment is required for each species named in the attribute of the OUV.

Table 7: Review of ornithology receptors

Species	Further assessment?	Comment
Red-throated diver	Yes	Although species was only recorded to the west of the site, there is potential for disturbance to breeding birds outside the proposed development. As such, displacement effects on this species should be considered
Black-throated diver	No	The species was only recorded to the west of the proposed development and due to the distance from the proposed development, there could be no displacement effects on this species.
Common scoter	No	Species was not recorded during surveys. Technical Appendix 9.3 demonstrated that it was unlikely the species would be recorded and as such, there is no pathway for impact on this species
Wigeon	No	Species was not recorded during surveys
Golden plover	Yes	Breeding territories present on and adjacent to the proposed development; potential for displacement to occur. There was also sufficient flight activity that increased mortality as a result of collision risk needs to be assessed
Greenshank	No	Two flights were observed in 2020; this was the only activity

Species	Further assessment?	Comment
		recorded for this species. There was no breeding recorded. Activity was too low and sporadic for there to be adverse effects on this species
Dunlin	Yes	Breeding territories present on and adjacent to the proposed development; potential for displacement to occur
Wood sandpiper	No	Species was not recorded during surveys
Golden eagle	No	There was no evidence for breeding. While Golden eagle can be displaced by turbines, the very infrequent use of the proposed development site (four flights in two years of survey) demonstrate that the proposed development site does not support Golden eagles.
Merlin	Yes	While no breeding was recorded, the species was recorded several times in each breeding season. As such, there is potential for displacement to occur
Hen harrier	Yes	While no breeding was recorded, the species was recorded several times in each breeding season. As such, there is potential for displacement to occur
Short-eared owl	No	Species was not recorded during surveys

4.2 Ecology receptors

EIA and SEI Reports Chapter 8: Ecology and Technical Appendices (TA) 8.1: Habitat Surveys, 8.2: Bat Survey, 8.3: Protected Mammal Surveys, and 8.4: Fish Habitat Survey details the results of the baseline surveys and impact assessment of the proposed development on non-avian ecological receptors.

TA 8.5: Outline Habitat Management Plan (HMP) details the proposed methodology to enhance the habitats on site for described ecological receptors, particularly hen harriers and blanket bog habitats, to be achieved through a programme of habitat management and enhancement with the aim of improving semi-natural habitats on site.

TA 8.6: Deer Management Statement assesses impacts of the proposed development, including successful implementation of the HMP, on the local deer population.

As a result of the design amendments to the original submitted application (Supplementary Environmental Information document refers), the Infrastructure Buffers¹ have changed and the resulting amendments presented on Figure 3. NVC communities recorded as present within the Infrastructure Buffers are listed, together with their extent, in Table 8.

Table 8: NVC Communities Recorded Within infrastructure Buffers

NVC Community	Extent (ha) within Infrastructure Buffers (% of total)
Discrete stands of classifiable NVC communities	
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire, sub-community a	0.48 (0.17)
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire, sub-community c	0.33 (0.12)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	23.00 (8.02)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath, sub-community b	5.36 (1.87)
M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire	3.13 (1.090)
M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire, sub-community b	38.68 (13.49)
M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	2.98 (1.04)
M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire, sub-community a	6.75 (2.35)
M23 <i>Juncus effusus</i> / <i>acutiflorus</i> – <i>Galium palustre</i> rush pasture	0.48 (0.17)
MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	1.06 (0.37)
U2 <i>Deschampsia flexuosa</i> grassland	0.40 (0.14)
U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	3.96 (1.38)
U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community, sub-community a	2.74 (0.95)
W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland	2.85 (0.99)
W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland, sub-community c	0.92 (0.32)
W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland	3.25 (1.13)
W23 <i>Ulex europaeus</i> – <i>Rubus fruticosus</i> scrub	0.50 (0.17)

¹ The assessment area for vegetation has been defined here as an area which extends 250m from borrow pits or structures requiring foundations and 100 m out from all infrastructure, i.e. areas which are considered to be potentially impacted upon by the development footprint. These distances are based on guidance by SEPA (2017), with respect to the suggested buffers in which GWDTE should be identified. The vegetation assessment area will hereafter be referred to as the Infrastructure Buffers.

NVC Community	Extent (ha) within Infrastructure Buffers (% of total)
Mosaics	
H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath with planted broad-leaved trees	3.95 (1.38)
H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath, sub-community a with planted broad-leaved trees	2.46 (0.86)
H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath / U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	2.40 (0.84)
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire, mosaic of sub-communities a and b / U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland / H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath	2.67 (0.93)
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire, sub-community c / H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath / U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	3.15 (1.10)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath / <i>Juncus</i> pasture	12.19 (4.25)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath / H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath	1.54 (0.54)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath / U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland	12.31 (4.29)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath / M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	3.71 (1.29)
M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire, mosaic of sub-communities a and b	57.27 (19.97)
M23 <i>Juncus effusus</i> / <i>acutiflorus</i> – <i>Galium palustre</i> rush-pasture / U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	0.65 (0.23)
M28 <i>Iris pseudacorus</i> – <i>Filipendula ulmaria</i> mire / U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	0.89 (0.31)
U2 <i>Deschampsia flexuosa</i> grassland / M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire, sub-community c	13.84 (4.83)
U2 <i>Deschampsia flexuosa</i> grassland / M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	6.40 (2.23)
U2 <i>Deschampsia flexuosa</i> grassland / U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	2.03 (0.71)
U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland / <i>Juncus</i> pasture	3.88 (1.35)
Unclassified Habitat	
Improved grassland	11.69 (4.07)
<i>Juncus</i> pasture	27.68 (9.65)
Low woodland	1.40 (0.48)

NVC Community	Extent (ha) within Infrastructure Buffers (% of total)
Mixed woodland	1.33 (0.46)
Coniferous plantation woodland	16.89 (5.89)
Pasture	1.60 (0.6)
Total	286.79 (100)

Table 9 shows the potential groundwater dependence (from SEPA, 2017) and nature conservation status for NVC categories (or Phase 1 habitats where NVC categorisation is absent) within the Infrastructure Buffers.

Table 9: Potential Groundwater Dependence and Nature Conservation Designations of Phase 1 Habitats / NVC communities within the Infrastructure Buffers

Phase 1 Habitat / NVC Community	Potential Groundwater Dependence	Nature Conservation Status
H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath	None	European dry heaths (Annex 1) Alpine and Boreal heaths (Annex 1) Upland heathland (SBL)
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire	High	Upland flushes, fens and swamps (SBL)
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	Moderate (dependent on the hydrogeological setting)	Northern Atlantic wet heaths with <i>Erica tetralix</i> (Annex 1) Alpine and boreal heaths (Annex 1) Degraded raised bogs still capable of natural regeneration (Annex 1) Blanket bogs (Annex 1) Blanket bog (SBL) Upland flushes, fens and swamps (SBL) Upland heathland (SBL)
M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire	None	Blanket bogs (Annex 1) Depressions on peat substrates of the <i>Rhynchosporion</i> (Annex 1) Blanket bog (SBL) Upland heathland (SBL)
M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	None	Active raised bogs (Annex 1) Blanket bogs (Annex 1) Depressions on peat substrates of the <i>Rhynchosporion</i> (Annex 1) Blanket bog (SBL) Upland heathland (SBL)
M23 <i>Juncus effusus</i> / <i>acutiflorus</i> – <i>Galium palustre</i> rush-pasture	High	Purple moor-grass and rush pastures (SBL) Upland flushes, fens and swamps (SBL)
M28 <i>Iris pseudacorus</i> – <i>Filipendula ulmaria</i> mire	Moderate (dependent on the hydrogeological setting)	Blanket bog (SBL) Upland flushes, fens and swamps (SBL)
U2 <i>Deschampsia flexuosa</i> grassland	None	Upland flushes, fens and swamps (SBL) Upland heathland (SBL) <i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland (SBL)

Phase 1 Habitat / NVC Community	Potential Groundwater Dependence	Nature Conservation Status
		<i>Nardus stricta</i> – <i>Galium saxatile</i> grassland (SBL)
U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland	None	Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (Annex 1) Upland heathland (SBL) <i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland (SBL) <i>Nardus stricta</i> – <i>Galium saxatile</i> grassland (SBL)
U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	None	
MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	None	
W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland	High	Caledonian forest (Annex 1) Bog woodland (Annex 1) Upland birchwoods (SBL) Wet woodland (SBL)
W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland	None	Old sessile oakwoods (Annex 1) Caledonian forest (Annex 1) Upland birchwoods (SBL) Wet woodland (SBL)
W23 <i>Ulex europaeus</i> – <i>Rubus fruticosus</i> scrub	None	
Coniferous plantation woodland	None	
Deciduous low woodland	None	
Mixed woodland	None	
Improved grassland	None	
<i>Juncus</i> pasture	None	Purple moor-grass and rush pastures (SBL)

Definitions

Annex 1 - Annex 1 of the Habitats Directive (92/43/EEC)

SBL - Scottish Biodiversity List

Table 10 shows the value given for each habitat identified within the Infrastructure Buffers. Wherever possible, the NVC categories have been used as the basis of the evaluation because they more directly relate to SEPA (2017) GWDTE classification as well as Annex 1 and SBL habitat categories.

Table 10: Evaluation of Habitats / NVC Communities within the Infrastructure Buffers

Phase 1 Habitat / Community	Reason for Evaluation	Evaluation
H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath	Listed on the SBL, with floristic variations listed on Annex 1. Low level of cover within the Infrastructure Buffers in mosaic with planted deciduous trees, U20, M15, M6 and U4, and M6 and U20 at 5.65%.	Less than local

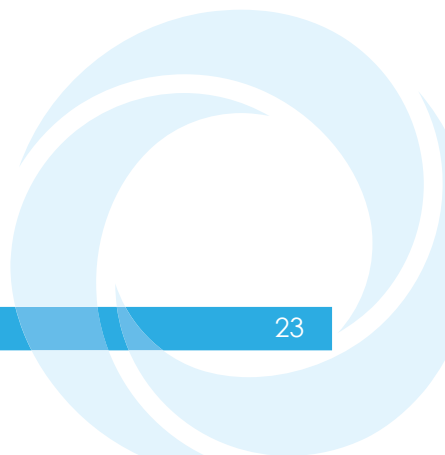
Phase 1 Habitat / Community	Reason for Evaluation	Evaluation
M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire	Listed on the SBL. Very low level of cover within the Infrastructure Buffers as a discrete stand (0.29%). Also present in mosaic with U4 and H10, H10 and U20, and U2 equating to 6.86%. High potential for groundwater dependence.	Local
M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	Listed on the SBL, with floristic variations listed on Annex 1. Moderate level of cover within the Infrastructure Buffers as a discrete stand at 9.89%, with additional coverage as a mosaic with <i>Juncus</i> pasture, H10, U4, M19, and U2 (12.60%). Moderate potential for groundwater dependence.	Local
M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire	Listed on the SBL, with floristic variations listed on Annex 1. Moderate level of cover within Infrastructure Buffers at 34.55%.	Local
M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	Listed on the SBL, with floristic variations listed on Annex 1. Low level of cover within Infrastructure Buffers as a discrete stand (3.39%), and in mosaic with M15 (1.29%).	Less than local
M23 <i>Juncus effusus</i> / <i>acutiflorus</i> – <i>Galium palustre</i> rush-pasture	Listed on the SBL. Very low level of cover within the Infrastructure Buffers as a discrete stand (0.17%), and in mosaic with U20 (0.23%). High potential for groundwater dependence.	Less than local
M28 <i>Iris pseudacorus</i> – <i>Filipendula ulmaria</i> mire	Listed on the SBL. Very low level of cover within the Infrastructure Buffers in mosaic with U20 at 0.31%. Moderate potential for groundwater dependence.	Less than local
U2 <i>Deschampsia flexuosa</i> grassland	Listed on the SBL. Very low level of cover within the Infrastructure Buffers as a discrete stand (0.14%), and in mosaic with M15, M6, and U20 (7.77%).	Less than local
U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland	Listed on the SBL. Low level of cover within the Infrastructure Buffers in mosaic with <i>Juncus</i> pasture, M15, and M6 and H10 (6.57%).	Less than local
U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	Low level of cover within the Infrastructure Buffers as a discrete stand (2.40%), and in mosaic with H10, M23, M28, M6 and H10, and U2 (3.19%).	Less than local
MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	Very low level of cover within the Infrastructure Buffers at 0.37%.	Less than local
W4 <i>Betula pubescens</i> / <i>Molinia caerulea</i> woodland	Listed on the SBL, with floristic variations listed on Annex 1. Very low level of cover within the Infrastructure Buffers as a discrete stand (1.31%). High potential for groundwater dependence.	Less than local
W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland	Listed on the SBL, with floristic variations listed on Annex 1. Very low level of cover within the Infrastructure Buffers at 1.13%.	Less than local
W23 <i>Ulex europaeus</i> – <i>Rubus fruticosus</i> scrub	Very low level of cover within the Infrastructure Buffers at 0.17%.	Less than local
Coniferous plantation woodland	Low level of cover within the Infrastructure Buffers at 5.89%.	Less than local
Deciduous low woodland	Very low level of cover within the Infrastructure Buffers at 0.48%.	Less than local
Mixed woodland	Very low level of cover within the Infrastructure Buffers at 0.46%.	Less than local

Phase 1 Habitat / Community	Reason for Evaluation	Evaluation
Improved grassland	Low level of cover within the Infrastructure Buffers at 4.07%.	Less than local
<i>Juncus</i> pasture	Listed on the SBL. Moderate level of cover within Infrastructure Buffers as a discrete stand (9.65%), and in mosaic with M15 and U4 (5.60%).	Less than local

4.2.1 Ecological Features Brought Forward for Assessment

Table 1 (Section 1.1 refers) lists the ornithological and terrestrial ecological features that contribute to the criterion under which the cWHS has been nominated, namely criterion x, section a.i birds and a.ii plants. No reference is made to non-avian mammal ecological receptors.

The features listed under criterion x, section a.ii include blanket bogs and associated wet heath. In the absence of a more detailed definition, and for the purposes of this assessment, it is assumed that the phrase “*blanket bogs*” applies to NVC communities M17 and M19, and “*associated wet heath*” to NVC community M15.



5 Assessment

5.1 Identification of Potential Impacts

5.1.1 Ornithology attributes

In Table 7, each species named in the attributes for OUV was reviewed to identify those species for which further assessment was required. This identified a number of ornithology receptors and potential impacts which could affect the receptors. As a result, the following impacts on the following species have been identified:

- Construction disturbance and displacement and operational displacement on Red-throated diver;
- Construction and operational displacement on Golden plover;
- Increased mortality as a result of collision risk on Golden plover;
- Construction and operational displacement on Dunlin;
- Construction and operational displacement on Merlin; and
- Construction and operational displacement on Hen harrier.

5.1.2 Ecology attributes

The following impacts on the ecological qualifying features of the cWHS, specifically NVC communities M15, M17 and M19, have been identified:

- Construction
 - habitat loss or damage (permanent and temporary);
 - possible changes to groundwater flows affecting GWDTEs; and
 - sedimentation or other pollution of watercourses from construction activities and vehicular traffic.
- Operational
- Decommission

5.2 Evaluation of Impacts on OUV and Attributes

5.2.1 Ornithology attributes

It should be noted that impacts on these attributes have already been assessed as they are all qualifying features of the Caithness and Sutherland Peatlands SPA. No adverse impacts were identified in that assessment. Nevertheless there are subtle differences (e.g. some Golden plover territories were outwith the SPA but are within the cWHS). These are unlikely to cause a change in outcome of assessment of effects upon those species, since as well as being assessed as qualifying features of the SPA have also been assessed in their own right as sensitive receptors and no significant effects were identified. However, given the sensitivity of the cWHS then additional assessment has been required.

Red-throated diver

Due to reasons of sensitive species protection, exact locations are not referred to, but are provided in Confidential Technical Appendix 9.2.

Red-throated diver were observed breeding within the survey area, although the territory which was present was outwith the area of the published disturbance distance (Ruddock, 2007) (Goodship & Furness, 2022). Breeding may not be limited to just this locale in the future, so there is potential for disturbance during the breeding season during construction and displacement of the territory during construction and operation.

Lochans in the immediate vicinity of the proposed development are not currently in use (confirmed by survey and by NatureScot response to the S36 application (NatureScot, 2023)) although there has been historic use. That does mean they could return to use during the construction phase which means there could be temporary disturbance on any divers breeding on that or other lochs used for breeding within 750 m of the infrastructure or working areas of the proposed development site.

However, Red-throated diver are also legally protected from disturbance and measures outlined in Section 5.3 would mean there would be no disturbance to breeding birds during construction. As such, there would be no disturbance effects on breeding Red-throated diver, resulting in a neutral effect.

It is unlikely that potentially breeding birds are displaced as a result of the construction activity. It is not considered plausible that a breeding attempt on the historically used, but currently disused lochan would be made and then immediately displaced as a result of the construction activity. Given the recent history of disuse, there would be no reason to expect this to reverse in the year when construction is due to commence when nothing else has changed to enhance the suitability of the lochan. This is not therefore considered an adverse impact on the OUV and confidence in this prediction is certain/near certain.

Following construction, displacement impacts could also occur on the historic location, which is currently unused.

Red-throated diver have been recorded continuing to breed at Burger Hill on Orkney (Orkney Wind , 2019) where breeding territories continued in a loch adjacent to a wind farm and at Carraig Gheal wind farm where breeding persisted in the vicinity of the wind farm following construction and operation (RPS, 2021) but not at Smølla wind farm, Norway (Halley, 2007), where nests surrounded by turbines did not persist once the wind farm was constructed. The situation on this lochan is more akin to Burger Hill and Carraig Gheal where the lochan is in proximity to, rather than surrounded by turbines.

There is no current evidence of Red-throated diver breeding on the lochan in question, and the evidence is that breeding can and does persist in proximity to turbines. As a result, in the event that the lochan was considered suitable for breeding (and it is possible that felling associated with the development could improve the suitability), it would remain available as a breeding lochan for divers, and the proposed development would not operate a displacement effect. This would therefore be considered a neutral effect and there would be no impact on the OUV. Confidence in this prediction is near certain/certain.

Golden plover

The review of potential impacts identified construction and operational displacement as requiring assessment.

The evidence for the effects of wind farms on golden plover is contradictory. One study found a displacement effect within the turbine array extending out to 400 m from turbines during the operation phase which persisted into the construction phase (Samson, 2016).

A longer-term study on another wind farm found no such effect (Fielding & Haworth, 2013).

Of the territories identified, all but one of which are within the cWHS, there is one within 400 m of turbines. The presence of the turbines may also displace breeding Golden plover from the area within 400 m of the turbines although the effect of this is not certain, given the contradictory results from different wind farms. From a precautionary viewpoint, it has been assumed to occur.

The density of Golden plover is relatively low in the survey area and this will be driven by habitat suitability. As such, the number of potential affected territories is low. The effect may be long term, although this is uncertain since the study which identified the displacement only continued for a short period following operation commencing. The location of the turbines is very close to the boundary of the cWHS, such that areas affected will also be outwith the cWHS. While there is no estimate on the Golden plover population of the cWHS, the Caithness and Sutherlands Peatlands Special Protection Area offers an approximate estimate since it lies within the cWHS; the most recent estimate is of 1,922 pairs (unpublished NatureScot data, based on Site Condition Monitoring from 2009). The population of the cWHS is likely to be greater than this since it includes areas not included within the SPA.

As such, the number of territories potentially affected by this is likely to be within the annual variation for the population, and is therefore not considered to be any greater than a minor impact. This would not be considered an adverse effect on the OUV. Confidence in this prediction is near certain/certain.

The annual estimate of collision risk on this species was 0.008 birds per year, equating to less than one bird lost over the lifetime of the proposed development. This indicates that there was little flight activity over or through the proposed development, which underlines the findings of the surveys of little evidence of feeding on the proposed development. It also shows there would be very little or no additional mortality as a result of the proposed development. This therefore would be a neutral impact which would not be an adverse impact on the OUV. Confidence in this prediction is near certain/certain.

Dunlin

Over the two years of survey, there were two Dunlin territories recorded within the cWHS; one per year. Flight activity is likely to be associated with territory holding birds, but it may include movements from non-territorial birds as well.

There is no evidence that Dunlin are adversely affected by wind farms. In a multi-species analysis Pearce-Higgins (Pearce-Higgins J. S., 2012) found no significant effects on breeding Dunlin from wind farms. As a result, and given the low numbers present, while some short term disturbance/displacement could occur during construction, once construction is over, there would be expected to be no effect of the proposed development on the distribution of Dunlin. As such, the impact would be assessed as neutral and there would be no adverse impact on the OUV. Confidence in this prediction is near certain/certain.

Merlin

No Merlin were recorded breeding. Because disturbance to this species is unlawful while it is breeding, mitigation described in section 5.3 would be put in place to protect any

breeding Merlin identified in areas where disturbance could occur. As such, construction disturbance would be neutral and there would be no adverse impact on the OUV. Confidence in this prediction is certain/near certain.

The evidence of flight activity suggests that use of the proposed development is limited. While there is limited evidence of the impacts of wind turbines on merlin, they can tolerate human infrastructure (Ruddock, 2007), and the limited use of the proposed development would mean that if any displacement were to occur, the effects of it would be very limited and not rise to a level which could be considered anything more than a minor impact. This means there would be no adverse effect on the OUV. Confidence in this prediction is certain/near certain.

Hen harrier

There was no evidence of breeding recorded for hen harrier, but they are occasionally observed over the proposed development.

Mitigation is identified in Section 5.3 which protects breeding Hen harrier from disturbance during the construction phase. This means there would be no construction disturbance effects in the unlikely event that breeding Hen harrier are found on or close to the proposed development.

A displacement effect of flight activity within 500 m of turbines was identified in a multi-species, multi-site study (Pearce-Higgins J. S., 2009) but more evidence of this effect in long term monitoring programmes has not been observed (e.g. (Fielding A. &, 2015) Instead there seems to be little further evidence for an adverse effect (Haworth, 2013).

Given that and the very limited use of the proposed development by hen harrier, any effect of the proposed development would be so low as to be essentially neutral. This means there would be no adverse impact on the OUV of the cWHS. Confidence in this prediction is certain/near certain.

With respect to potential collision risk, because the flight activity is low, collision risk is also estimated to be low, with an annual estimate of 0.001 per year. This results in an estimated loss of 0.03 birds across the lifespan of the wind farm. As a result, the level of additional mortality would not impact the cWHS population and that means the impact is neutral and there would be no adverse effect on the cWHS population. Confidence in this prediction is near certain/certain.

5.2.2 Ecology attributes

Construction Phase Impacts

The potential impacts are addressed for each habitat brought forward to assessment in turn.

EIA Report Chapter 3: Description of Development includes the proposed dimensions of all permanent and temporary features of the proposed development. Permanent features of the proposed development consist of turbines, turbine foundations, crane hardstandings, access tracks, an abnormal load turning area, and substation / battery compound. Temporary features of the proposed development consist of the construction compound and borrow pit(s).

The impacts are categorised as follows:

- Direct habitat loss: this includes habitats present under the footprint of the proposed development, including access tracks, turbine bases, crane hardstandings, substation, compound and borrow pit(s).
- Indirect habitat disturbance: this has only been calculated for peatland habitats which lie within 5m of the permanent infrastructure. The allowance of 5m is to account for degradation due to drainage and cable laying, and is considered likely to produce a conservative estimate for habitat loss as drainage effects will depend on topology, so not all areas included are likely to be affected.

The total area of wet dwarf shrub heath (M15 *Trichophorum germanicum* – *Erica tetralix* wet heath) and blanket bog (M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire, and M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire) amounts to approximately 177.03ha (61.72%). This includes 36.15ha (12.6%) of M15 *Trichophorum germanicum* – *Erica tetralix* wet heath which is in mosaic with *Juncus* pasture, H10 *Calluna vulgaris* – *Erica cinerea* heath, U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland, M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire, and U2 *Deschampsia flexuosa* grassland; 57.27ha (19.97%) of M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire, sub-communities a and b; and 3.71ha (1.29%) of M19 blanket mire in mosaic with M15 wet heath.

M15 *Trichophorum germanicum* – *Erica tetralix* wet heath

A total of 64.51ha of M15 vegetation communities (including sub-communities) are present within the Infrastructure Buffers, representing 22.49% cover. Over half of this total (36.15ha) is made up of M15 communities which are in mosaic with *Juncus* pasture, H10 dry heath, U4 grassland, M19 blanket mire, and U2 grassland communities and so this should be regarded as a worst-case scenario.

A total of 4.53ha (0.92ha of M15 / *Juncus* pasture, M15 / U4, M15 – M19, and U2 / M15 mosaics, and 3.61ha of discrete M15) will be permanently lost to the Proposed Development. The loss of 1.58% M15 communities (0.32% *Juncus* pasture / M15, M15 / U4, M15 – M19, and U2 / M15 mosaics, and 1.26% discrete M15) within the Infrastructure Buffers leaves 98.42% of this vegetation community still present in the Infrastructure Buffers following construction.

Ecological effects on M15 communities as a result of direct impacts associated with construction activities are considered to be minor and would not have an adverse impact on OUV attributes. Confidence in this prediction is near certain.

A total of 3.41ha M15 communities (1.66ha of discrete M15, and 1.75ha in mosaic with *Juncus* pasture, U4 grassland, M19 blanket mire, and U2 grassland) are present within 5m of permanent infrastructure, representing 1.19% of the total within the Infrastructure Buffers. Therefore, there is potential for indirect impacts and temporary loss associated with the construction zones around infrastructure. With the mitigation measures detailed in Section 5.3 including the requirement for ECoW and the requirement for pollution control during construction (to be taken forward within the proposed development CEMP) along with measures detailed within the PMP (EIA Report Technical Appendix 10.2), effects on M15 vegetation communities as a result of indirect impacts will not result in loss of structure and function.

Ecological effects on M15 communities as a result of indirect impacts associated with construction activities are considered to be minor and there would be no impact on OUV attributes. Confidence in this prediction is near certain.

M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire

A total of 99.08ha of M17 vegetation communities (including sub-communities) are present within the Infrastructure Buffers, representing 34.55% cover.

A total of 3.34ha of M17 vegetation communities will be permanently lost to the Proposed Development. The loss of 1.16% M17 communities within the Infrastructure Buffers leaves 98.84% of this vegetation community still present in the Infrastructure Buffers following construction.

Ecological effects on M17 communities as a result of direct impacts associated with construction activities are considered to be minor and there would be no impact on OUV attributes. Confidence in this prediction is near certain.

A total of 2.34ha M17 communities are present within 5m of permanent infrastructure, representing 0.81% of the total within the Infrastructure Buffers. Therefore, there is potential for indirect impacts and temporary loss associated with the construction zones around infrastructure. With the mitigation measures detailed in Section 5.3 including the requirement for ECoW and the requirement for pollution control during construction (to be taken forward within the Proposed Development CEMP) along with measures detailed within the PMP (EIA Report Technical Appendix 10.2), effects on M17 vegetation communities as a result of indirect impacts will not result in loss of structure and function.

Ecological effects on M17 communities as a result of indirect impacts associated with construction activities are considered to be minor and there would be no impacts on OUV attributes. Confidence in this prediction is near certain.

M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire

A total of 13.44ha of M19 vegetation communities (including sub-communities) are present within the Infrastructure Buffers, representing 4.69% cover. This includes discrete stands (2.98ha of M19 and 6.75ha of M19a), and M19 communities in mosaic with M15 (3.71ha), and so should be regarded as a worst-case scenario.

A total of 0.09ha (0.06ha of M19a, and 0.03ha of a mosaic of M15 – M19) will be permanently lost to the Proposed Development. The loss of 0.03% M19 communities (0.02% of M19a, and 0.01% of a mosaic of M15 – M19) within the Infrastructure Buffers leaves 99.97% of this vegetation community still present in the Infrastructure Buffers following construction.

Ecological effects on M19 communities as a result of direct impacts associated with construction activities are considered to be minor and there would be no impacts on OUV attributes. Confidence in this prediction is near certain.

A total of 0.18ha M19 communities (0.13ha of M19a, and 0.05ha of a mosaic of M15 – M19) are present within 5m of permanent infrastructure, representing 0.06% of the total within the Infrastructure Buffers. Therefore, there is potential for indirect impacts and temporary loss associated with the construction zones around infrastructure. With the mitigation measures detailed in Section 5.3 including the requirement for ECoW and the requirement for pollution control during construction (to be taken forward within the Proposed Development CEMP) along with measures detailed within the PMP (EIA Report Technical Appendix 10.2), effects on M19 vegetation communities as a result of indirect impacts will not result in loss of structure and function.

Ecological effects on M19 communities as a result of indirect impacts associated with construction activities are considered to be minor and there would be no adverse impacts on OUV attributes. Confidence in this prediction is near certain.

Operational Phase Impacts

During the operational phase, only service vehicles will be present on the site and will be confined to site access tracks, with the potential for incidents and spillages affecting sensitive habitats being very low (see EIA Report Chapter 10: Hydrology, Hydrogeology, Geology and Soils). Therefore, impacts are assessed as neutral on wet dwarf shrub heath and blanket bog (qualifying habitats of the cWHS) are predicted. There would therefore be no impact on OUV attributes. Confidence in this prediction is near certain.

The HMP, provided in outline in EIA Report Technical Appendix 8.5, includes aims to restore blanket bog habitats affected by historic drainage and planting of coniferous woodland, resulting in a beneficial operational effect. This has been assessed as a conservative minor level due to the fact that the felling would be outwith the cWHS but would impact on the zone of influence. Confidence in this prediction is near certain.

Decommission Phase Impacts

It is difficult to predict impacts which would arise from decommissioning and the confidence in all predictions is therefore considered to be uncertain due to the length of the operational period (30 years). It is assumed, however, that impacts are likely to be similar in nature to the construction phase but of lower magnitude, because infrastructure will be in place, allowing access to the site.

Vegetation clearance will be limited and the land associated with the following components of the proposed development will be reinstated: turbine bases, some access tracks and substation.

Updated surveys will be required before the decommissioning phase begins, and appropriate mitigation measures will consequently be put in place to reduce likely effects to an acceptable level. In addition, appropriate screening and biosecurity measures will be established for materials used in habitat re-instatement if not sourced from the site itself. Therefore, impacts would be minor and would not impact adversely or beneficially on the OUV attributes for any important habitats as a result of decommissioning.

5.3 Mitigation and Enhancement

In line with current CIEEM guidelines, the impact assessment is carried out on the basis that mitigation measures will be in place during construction and operation. The following mitigation measures and good practice measures will be applied to the project during construction and operation to ensure that effects on the ornithological and ecological qualifying features of the cWHS are reduced.

5.3.1 Ornithology

Construction Phase

Details of construction mitigation measures will be provided in a Construction Environmental Management Plan (CEMP). The CEMP will be submitted to THC for

approval, in consultation with NatureScot and SEPA, post-consent but prior to development commencing. The CEMP will include information on the following ecological related activities:

- Construction works will require a Construction Method Statement (CMS) to be prepared post-determination and in advance of the commencement of construction on site; and
- Construction works will be overseen by an Ecological Clerk of Works (ECoW) and their role and responsibilities will be detailed in a CEMP.

Wherever possible, vegetation clearance will take place outside the bird breeding season (i.e. September – mid-March). Should this not be possible, then the vegetation to be removed will be searched by a suitably qualified ecologist no more than 24 hours before clearance commences.

Nests of non-Schedule 1 or Annex I species present will be marked with a buffer (likely to be 5m, but can be less with ECoW oversight) to prevent damage to the nest. This buffer can only be removed with ECoW approval once the nest is no longer in use.

In the 12 months before construction commences, breeding raptor surveys should be undertaken (and should also be carried out during construction if construction falls within a breeding season) with the aim of identifying the presence of any Annex 1 or Schedule 1 species which may be disturbed by the construction work.

A tool box talk should also be provided during the induction process, detailing that there may be sensitive species on the proposed development site during the construction period and that care should be taken to avoid disturbing these birds if present and that sightings should be reported to the ECoW for further investigation. These actions should be particularly targeted at hen harrier, merlin and golden eagle.

Should the nest (or where applicable the roost) of an Annex 1 or Schedule 1 species be present, then disturbance buffers based on Goodship and Furness (2022) should be established around the nest and no construction activity should be allowed within this area. The ECoW should carry out a risk assessment if access roads are within the buffer distance of the nest to establish if they can be used safely.

Operational Phase

A Habitat Management Plan (HMP) will be established. This will aim to monitor the occurrence of sensitive species on the proposed development site with a view to identifying habitat management measures to support species which appear to be declining.

The HMP has been provided in outline (EIA Report Technical Appendix 8.5) and the finalised version will be submitted to THC for approval, in consultation with NatureScot, before construction commences. The HMP aims to particularly improve the quality of peatland habitats on the proposed development site.

Post construction monitoring would be undertaken in years 1, 2, 3, 5, 10, 15 and 25 years following operation commencing.

The aim of monitoring would be to monitor bird populations within the proposed development site to ensure that the wind turbines are not having unpredicted adverse effects on the bird populations present, and to ensure that the HMP is effective in supporting the bird populations on the proposed development site.

Although the detailed scope of the monitoring would be agreed with THC, NatureScot and RSPB Scotland, the following surveys would be carried out in each of the designated years:

- Breeding bird surveys (using a Brown and Shepherd approach (Brown, A. F. and Shepherd, K. B., 1993)) to allow breeding waders to be monitored across the proposed development site; and
- Breeding raptor surveys within the proposed development site boundary and where access permits to a distance of 2km from the proposed development site boundary.

5.3.2 Ecology

Design Mitigation

Turbines have been sited at least 50m from watercourses and a distance of at least 50m between turbine blade tip and the nearest woodland has been maintained as per current bat guidance (SNH, 2019).

A Peat Management Plan (PMP) has been produced (EIA Report Technical Appendix 10.2 refers) which describes measures taken to minimise the amount of peat excavated at the design stage. Measures include siting of turbines and site infrastructure in areas of shallower peat wherever possible and selecting consistent peat depths of 1.0-1.5m as a threshold above which tracks would be floated.

The design sought to minimise the take of potential GWDTEs through taking account of NVC information, along with other site constraints, in layout iterations.

Construction Phase

Full details of construction mitigation measures will be provided in a Construction Environmental Management Plan (CEMP) to be agreed with THC, in consultation with relevant stakeholders, post-consent but prior to development commencing.

The PMP (EIA Report Technical Appendix 10.2) describes measures to be taken when excavating peat during construction such as appropriate storage and handling methods. The PMP also describes where peat will be re-used and restoration methods.

General:

- construction works will require a Construction Method Statement (CMS) to be prepared post-determination and in advance of the commencement of works on site; and
- works will be overseen by an Environmental / Ecological Clerk of Works (EnvCoW / ECoW) and their role and responsibilities will be detailed in the CEMP. In outline, this role will include ongoing monitoring of environmental / ecological constraints, review and audit of the appointed contractors environmental performance, delivery of toolbox talks, and supervision of construction works.

Protected Species:

- a pre-construction survey focussing on otter will be undertaken, covering suitable habitat within 250m from construction areas. This survey will be undertaken by a suitably qualified ecologist. The survey will aim to identify if otter activity levels have continued as identified in the baseline surveys. In addition, the surveys will establish if there is a water vole population present within the site given the suitable habitat recorded during baseline surveys and the dynamic nature of water vole populations.

The results of the pre-construction surveys will inform whether the CEMP will include further mitigation with regard to protected species. NatureScot will be consulted throughout this process;

- a site speed limit of 15mph will be in place at all times to reduce the risk of collision and protected species mortality associated with construction vehicles;
- excavations will be covered at the end of each working day to minimise the risk of faunal species becoming injured or trapped. Alternatively, a wooden plank or similar means of egress will be placed inside to allow a means of escape for animals should they enter the excavation. Any temporarily exposed open pipe system would be capped in such a way as to prevent wildlife gaining access;
- works will be conducted during daylight hours where possible, avoiding the sensitive periods of dawn and dusk when wildlife is most active;
- to ensure compliance with the Wildlife and Countryside Act 1981, mitigation will be required to reduce the chances of inadvertently killing or injuring individual reptiles during construction works. Given the large spatial scale of the works, fencing and translocation are not considered appropriate. Proposed mitigation therefore involves habitat management and identification of potential refugia and hibernacula if present. Where appropriate and safe to do so, the vegetation of all construction working areas with potentially suitable open habitats for reptiles will initially be cut during the active season for reptiles (April to October). Taking into account ornithological sensitivities (detailed in EIA Report Chapter 9: Ornithology), October is likely to be the optimal month for this task. Mitigation works will be carried out to reduce the height of vegetation (e.g. use of a brush cutter or tractor mounted flail) and make it less attractive for reptile habitation. The works will be carried out under the supervision of the EnvCoW / ECoW. Working areas would then be kept unsuitable for reptiles through regular cutting until construction in that location commences; and
- In the event that a protected species is discovered on site, all work in that area would stop immediately and the EnvCoW / ECoW contacted. Increased buffer areas may be required in these locations. Details of the local police Wildlife Crime Officer, NatureScot Area Officer, and Scottish Society for the Prevention of Cruelty to Animals (SSPCA) relevant Officer would be held in the site emergency procedure documents.

Habitats:

- the loss of plant communities is an unavoidable consequence of the proposed development. However, incidental habitat loss will be avoided by minimising the footprint of construction activities. This will be achieved by operating machinery and storing materials within the footprint of permanent construction features wherever practicable. This will also be achieved through appropriate training of the site staff and by ensuring that vehicles and their operators do not inadvertently stray onto adjacent habitat areas; and
- re-instatement of habitats – best practice techniques for vegetation and habitat reinstatement will be adopted and implemented on areas subject to disturbance, such as the temporary construction compound area, as soon as is practicable.

Pollution Prevention:

- to prevent pollution of watercourses within, and beyond, the site boundary (with particulate matter or other pollutants such as fuel), best practice techniques will be employed as outlined in Chapter 10: Hydrology, Hydrogeology, Geology and Soils.

Further details of pollution prevention control measures will be provided in the CEMP. Measures will include:

- emergency spill kits will be readily available on site to protect against accidental release, leakage or spillage of potentially contaminative substances and materials;
- construction plant to be checked regularly for leakages and will undergo maintenance on a regular basis;
- construction traffic to be limited to allocated areas of the Proposed Development;
- concrete and cement mixing and washing areas will be sited at appropriate distances from any surface watercourses to limit potential pollution of the water environment;
- site drainage measures, including drainage ditches and silt traps, will be provided to collect and treat increased surface run off; and
- assessment of Earthworks Specification, chemical analysis and assessment of imported fill materials.

Operational Phase

A Habitat Management Plan (HMP) will be established. This has been provided in outline (EIA Report Technical Appendix 8.5) and will be agreed in full with THC and NatureScot before construction commences. It aims to improve the quantity and quality of peatland habitats, benefitting site ecology and ornithology, and to monitor the effects of the Proposed Development.

During the operational phase the following mitigation will be in place:

- a site speed limit of 15mph will be in place at all times to reduce the risk of faunal collisions with construction vehicles; and
- a distance of at least 50m between turbine blade tip and the nearest woodland will be maintained as per current bat guidance (SNH, 2019).

Good practice measures designed to protect the hydrological environment, as outlined in EIA Report Chapter 10: Hydrology, Hydrogeology, Geology and Soils will also benefit the ecology of the site.

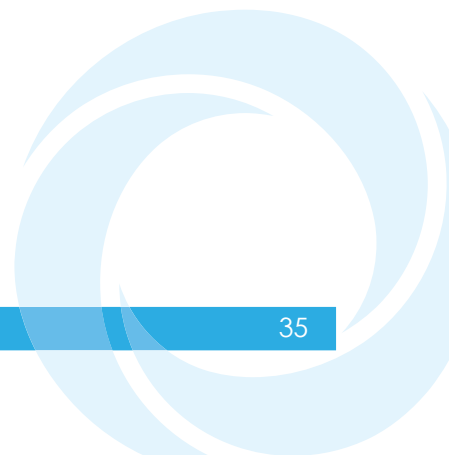
Full Implementation of the mitigation measures contained within the CEMP, HMP and PMP, will ensure that there will be no significant adverse residual effects on qualifying features of the cWHS in terms of the EIA Regulations.

With full implementation of the HMP and establishment of blanket bog habitats associated with the removal of the block of conifer plantation, there will be minor positive residual effects on qualifying features of the cWHS through an increase in the extent of blanket bog habitat (approximately 81.25ha).

5.4 Summary of Assessment

The ornithological and ecological baseline conditions have been described and evaluated in order to identify qualifying features of the cWHS present on site and associated with the proposed development. Proposed mitigation measures have been identified, including those embedded in design, and with reference to the proposed development CEMP, HMP and PMP where applicable.

Potential impacts upon attributes of the cWHS as a result of the proposed development have been identified and the effect of these impacts on those attributes have been assessed in line with current guidance (CIEEM, 2018). No significant residual effects on attributes of the cWHS were identified. There will therefore be no impact on the Outstanding Universal Values of the Candidate World Heritage Site, particularly of attribute 10 a (i) and (ii) and as such the proposed development can proceed with no impact on the cWHS.



6 References

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Appendices

Appendix A. Statement of Outstanding Universal Values (Flow Country Candidate World Heritage Site Steering Group, 2022)

A brief synthesis

The Flow Country property is the most outstanding example of a blanket bog ecosystem in the world. With its intricate network of pools, hummocks and ridges, the bog stretches across some c. 190,000 hectares of northern mainland Scotland, with the property boundary comprising seven discrete, but adjacent areas. The underlying peat has been accumulating for the past 9,000 years and the bog displays a remarkable range of features resulting from the climatic, altitudinal, geological and geomorphological gradients found across the region. Alongside the extensive record of peat accumulation that The Flow Country contains, and the store of carbon this represents, the ecological processes that result in peat formation continue to sequester carbon on a very large scale.

The Flow Country blanket bog also provides a globally significant natural habitat for an internationally important assemblage of specialist biodiversity. The area supports a unique and distinctive assemblage of birds, with a combination of arctic-alpine, temperate and continental species not found anywhere else in the world. This is a result of the site's location and the diversity of blanket bog habitats it contains, combined with the patchwork of connected farming and coastal landscape elements within the wider setting.

Protection for The Flow Country is provided through international and national designations, as well as national and local planning policies, and there is scope for future expansion of the site through restoration of adjacent degraded blanket bog. The area is also considered to be the type-locality for the description of blanket bog and so represents a significant research and educational resource.

Justification of criteria

Criterion (ix)

The Flow Country is the most extensive and diverse example of an actively accumulating blanket bog landscape found globally. Since the glaciers receded from Scotland climatic conditions, in combination with the underlying geology, the resultant topography, and the biogeography have led to the formation of a vast and diverse blanket bog landscape that stretches across the north of Scotland. The persistent precipitation-fed waterlogging of the soil has led to an expanse of peat bog, c. 400,000 hectares, that blankets the landscape, including hills, slopes and hollows, together forming a globally rare and significant peatland ecosystem. Of this, nearly 190,000 hectares is identified as suitable to be included within the property, on the basis of current quality and continuity of habitat.

The Flow Country therefore represents the most extensive, near-continuous, high quality and near-natural blanket bog landscape found globally. The active processes of blanket bog formation have continued uninterrupted for 9,000 years, and the diversity of blanket

bog features is not found anywhere else on Earth. Moreover, the processes of blanket bog formation provide an outstanding example of carbon sequestration and long-term storage on a massive scale.

The blanket bog also provides an incredible record of its formation, preserved as pollen and plant fossils, and telling a story of its past flora, fauna, climate, palaeoecology and human influence. This is also important for helping us understand the future functioning of this and other blanket bogs globally.

Criterion (x)

The Flow Country contains an exceptional example of the biodiversity found within a blanket bog landscape. The geographical position of The Flow Country and the diversity of habitats result in biological associations unlike any other found globally. Furthermore, the scale and connectivity of the property afford resilience to the ecosystem and the species it contains.

The blanket bog of The Flow Country is a globally significant natural habitat for the conservation of biodiversity, not least because of its unique and specialised assemblage of flora and fauna, but also because of the rarity of the ecosystem and the declining condition and extent of comparable ecosystems globally.

The diverse range of blanket bog features that The Flow Country contains, such as pools and hummocks, support an exceptional and specialised blanket bog biodiversity and holds biological associations unlike any other blanket bog found globally. This diversity is a consequence of the overlapping distributions of species typical of both arctic and temperate climatic zones and is further influenced by altitudinal and climatic gradients, and geological diversity found across the site.

The property includes some species that are rare, scarce or threatened, but it is the distinct assemblage of specialised flora and fauna within a high-quality blanket bog that make The Flow Country so significant, along with its pivotal position at the crossroads of bird flyways and migration routes. Furthermore, the scale and connectivity of the property afford resilience to the ecosystem and the species it contains.

Statement of integrity

The Flow Country property comprises seven discrete but adjacent areas totalling around 190,000 hectares, which encompass a large expanse of actively accumulating blanket bog ecosystem. The overwhelming majority of the blanket bog within the property boundary is in near-natural condition. The remainder includes areas of blanket bog that are undergoing restoration, and areas that are expected to be restored in the short to medium term.

The property is of sufficient size to contain all the elements of Outstanding Universal Value (OUV) needed to demonstrate the ecological and biological processes, and the biodiversity that comprise this globally significant ecosystem. These include the blanket bog itself, the wider peatland landscape complex in which it lies and the finer elements, including intricate pool systems, diverse surface patterning, fens, and the range of flora and fauna that all of these systems support. The climatic, altitudinal, geological and geomorphological gradients that occur across The Flow Country all contribute to ensuring that the variety of features that make up blanket bogs are represented.

Furthermore, the boundaries of the nominated property are largely defined on the basis of the hydrological elements that comprise the blanket bog, and therefore ensure ecosystem integrity and coherence.

Large areas of the wider Flow Country peatland have suffered from poor historical management decisions in relation to matters such as drainage and woodland creation, but the boundary has been chosen to include only those areas of deep peat which are in good condition or have the ability to return to a near-natural state within the next 10-25 years.

It is expected that in time, it will be possible to integrate some of the more degraded bog in the wider Flow Country into the property.

Requirements for the protection and management of the Site

Around 73% of the area within the proposed property boundary has the highest level of statutory protections, with national regulation and policy reflecting their national and international significance, including those originally introduced via the EU Habitats and Birds Directives leading to Special Protection Area (SPA) and Special Area of Conservation (SAC) classification which are now protected through domestic legislation. The majority of the area is also protected through the Ramsar Convention. These instruments provide specific protection for the elements of OUV as set out in the Site's attributes, notably including the processes for the maintenance and formation of blanket bog, and the associated flora and fauna.

Further to the statutory protection, peatlands – particularly those containing peat greater than 50cm in depth – are protected through planning policies, both at Scottish national and local levels. There are specific planning policies at national level in relation to both World Heritage Sites and areas of peatland that afford them effective protection from development proposals that might impact adversely on OUV. Moreover, where the boundary is not coincident with existing environmental designations, protection will again be ensured by national and local planning policy; the Local Authority will have regard to the Management Plan as a material consideration.

The property has no buffer zone. Areas important for the protection of OUV outside of the boundary are protected through a combination of national and local planning policy, and the wider protection afforded by the existing high level designations. Buffer zones also have no basis in Scottish law, so would not add more protection than is already in place.

Management of the Site's OUV will be guided by a single clear Management Plan, developed by a stakeholder partnership comprising key landowners and managers, government agencies, local communities and scientific experts, and also through public consultation. The key management opportunity is bog restoration, and potential threats include commercial forestry and unwanted tree regeneration, inappropriate deer management, water management and drainage, intensive agriculture, inappropriately sited and/or designed wind farms, burning and climate change. A key requirement for the management of this property lies in continued strong and adequately resourced coordination and partnership arrangements focused on the World Heritage property.

Attributes of OUV

Attributes, sometimes called 'features' for natural Sites, provide detail about the criteria for Outstanding Universal Value at a more granular level. In essence, they break down

the reasons why the area is considered to be worthy of World Heritage Site inscription into a straightforward list. The attributes for The Flow Country are set out in Table 11.

Table 11: List and description of candidate World Heritage Site Attributes (Flow Country Candidate World Heritage Site Steering Group, 2022)

Attribute	Description
Criterion ix.- outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals	
a) most extensive near continuous example of natural actively accumulating blanket bog ecosystem found globally	Persistent rain fed wetness and low rates of evaporation across the Flow Country led to widespread, year-round waterlogged ground conditions which are ideal for the growth and preservation of peat forming plants. This ongoing process (paludification) began around 9,000 years ago and is key in the formation of blanket bog. Unlike other bog types, which are confined by topography, this allows blanket bog to mantle entire landscapes. The Flow Country is one of only a few locations globally where conditions exist that are conducive to blanket bog formation, and combines a quality, extent and connectivity of this habitat exceeding that of any other known blanket bog.
b) climatic and topographic gradients, and geological diversity: bog macroform diversity	The scale of the site, alongside the gradients in climate and topography, and the diversity of the underlying geology, provide the setting for subtle variations in processes which result in a wide diversity in the character of the blanket bog. These factors control the development of complex systems of hummocks, moss lawns, hollows and pools, and the associated plant species, which produce surface patterning that has been classified into 15 site-types. No other blanket bog in the world contains, or is reported to contain, such a diverse collection of surface patterning within a single area.
c) archive it stores (4 th dimension)	Delving deeper, the peat, which has been forming for over 9,000 years, reaches thicknesses of over 8 m, providing an exceptional archive and a 4th dimension to the Flow Country blanket bog. The processes responsible for the development of the blanket bog system and the ecosystems it supports can be scrutinised back through time across the vast area it covers using pollen records; plant fossils (e.g. hazelnuts, pine cones, pine stumps); lake sediment records (midge and diatom (alga) remains); tephra (ash) layers blown south from Icelandic volcanoes; charcoal (indicating in situ burning).
d) natural laboratory – ongoing scientific and educational use	The exceptional nature of the Flow Country makes it the 'type site' for blanket bog study and it continues to be used as a 'test bed' for peatland research globally. The diversity of features related to altitudinal and climatic gradients across the region and the depth of

Attribute	Description
	archive provides significant scope for research. Furthermore, the breadth of existing studies provides a fantastic foundation for future research.
e) carbon sequestration and storage	Globally peatlands are the largest natural terrestrial carbon store. Covering only 3% of the world's land area, they hold nearly 30% of all the carbon stored on land. In blanket bog, year-round waterlogged conditions slow the process of plant decomposition such that the dead plants accumulate to form peat, and thereby sequester carbon from the atmosphere. Over thousands of years this plant material builds up and becomes several metres thick creating a valuable carbon store. The Flow Country provides a superb example of ongoing sequestration, alongside carbon storage demonstrated by peat thicknesses which reaching over 8 metres.
f) water filtration and the impact on the water quality of associated riverine habitats	The catchments draining the Flow Country sustain exceptional water quality, resulting from the natural filtration of rainwater as it slowly seeps through these vast peatlands. The superb water quality is critically important in sustaining globally important populations of the freshwater pearl mussel in rivers which drain from the Flow Country. The European eel (classed by the IUCN as Critically Endangered) is also recorded from these catchments. Furthermore, the rivers of the Flow Country maintain strong populations of Atlantic salmon which is in global decline.
Criterion x. contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation	
a) species associations	The diverse range of habitats that The Flow Country contains supports an exceptional and specialised blanket bog biodiversity and holds biological associations unlike any other blanket bog found globally. This is a consequence of the overlapping distributions of species typical of both arctic and temperate climatic zones and is further influenced by altitudinal and climatic gradients and the geological diversity found across the site. Furthermore, the scale and connectivity of the site provides resilience to species it contains.
a.i) birds	The diversity of environments within the blanket bog of The Flow Country, and the patchwork of connected landscape elements within the wider setting (farmland, coastal, etc.), supports a distinctively special assemblage of birds. The precise combination of species, with arctic-alpine and temperate and continental elements is not found anywhere else in the world and includes; red-throated diver, black-throated diver, common scoter, Eurasian wigeon, golden

Attribute	Description
	plover, Eurasian greenshank, dunlin, wood sandpiper, golden eagle, merlin, hen harrier and short-eared owl.
a.ii) plants	The floristic composition of the Flow Country blanket bogs, and associated wet heath, is not found anywhere else globally, and represents a highly Atlantic influence on plant distribution and development. Key plants of importance are dwarf birch, alpine bearberry, bogbean, bog hair-grass, water lobelia, bog orchid, marsh saxifrage and 29 species of Sphagnum (over 10% of global Sphagnum flora).
a.iii) genetic diversity	The Flow Country occupies a position at the western extreme of the Eurasian landmass. As such it is a haven of locally adapted genetic diversity. Many species here are isolated from their continental relatives, which means that local lineages have developed. Whilst small, isolated populations frequently suffer from inbreeding depression, the large size of the Flow Country means that this not a significant issue here. Furthermore, many species operate as metapopulations: groups of smaller populations between which individuals can move. Not only does this mean that genes can flow between populations, it also means that individuals can recolonise sites in the event of short-term localised extinction, as has been demonstrated with newts. Given models that suggest droughts will increase in both frequency and intensity in the north of Scotland, the large number of waterbodies in the Flow Country will greatly reduce the likelihood of population loss. This makes it a valuable refuge for wildlife of many species at both a population and a genetic level.

State of conservation

To support the justification as set out above it is important to assess the current biological condition of the proposed area. Assessing the condition of the proposed WHS is complex due to the vast size and relative isolation of much of the blanket bog.

Around 73% of the proposed Flow Country WHS is notified as a series of Sites of Special Scientific Interest (SSSI) under domestic legislation, and has also been designated as the Caithness and Sutherland Peatlands Special Area of Conservation (SAC) and Special Protection Area (SPA); originally under the EU Habitats and Birds Directives respectively, and now via domestic legislation. The Caithness and Sutherland Peatlands are also listed as a single Site under the International Ramsar Convention on Wetlands, to which the UK is a contracting party. The qualifying features of these protected areas are obliged to be monitored regularly so as to determine their condition, enabling the reporting required by Scottish Government and the Bern Convention.

Blanket bog is the most extensive feature of Caithness and Sutherland Peatlands SAC and Ramsar Site. Wet heath also forms large parts of the SAC. Two other terrestrial SAC

features - 'very wet mires often identified by an unstable quaking surface', and 'depressions on peat substrates' – are found as small areas embedded within the blanket bog and wet heath. All four habitats form an intricate mosaic across the SAC ensuring that they are managed together. The blanket bog and depressions on peat substrates habitats are so intimately related that they are monitored together as one feature, and both are included in the term 'blanket bog' in the rest of this section.

Summary of the condition of the proposed Site in 2022

Based on the best information as of summer 2022, a majority of the features of the Caithness and Sutherland Peatlands SAC, where it overlaps with the proposed WHS, are currently in favourable condition. Those features are: very wet mires often identified by an unstable quaking surface, acid peat-stained lakes and ponds, marsh saxifrage, and, clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels.

Although the blanket bog and wet heath features of the SAC were both assessed in 2017 as being in 'Unfavourable – no change' condition, this was mainly because, although much of the site was showing the benefits of good management, some parts had been damaged by fire and trampling by red deer. Since 2017, there have been notable improvements in the management of the SAC, particularly in places where pressure from deer trampling had previously been a concern.

By October 2021, more than 90% of the blanket bog and wet heath in the SAC was either in favourable condition or under management intended to bring the habitat back into favourable condition. The pressures in the remaining parts of the SAC include burning, deer trampling, drainage and other land disturbance, are being monitored and where possible, interventions are in place to start to move the condition forward to being in more favourable condition.

In addition to the regular habitat monitoring, the SAC is monitored for any fire impact using Sentinel satellite imagery backed up with ground-truthing. By October 2021, there had been fire damage to 6% of the blanket bog and 20% of the wet heath in the SAC since the most recent scheduled monitoring. However, the number of uncontrolled fires has been decreasing in recent years, with none in 2021, and most of the land previously damaged by burning is under management that aims to prevent future fires.

The majority of the bird features of Caithness and Sutherland Peatlands SPA and Ramsar Site were monitored, most recently, in the six years running up to 2018. The others between 2004 -2009. Ten of the twelve qualifying SPA bird species and the one Ramsar bird feature were all in 'favourable condition'. This analysis has enabled us to identify the parts of the SAC where we need to focus efforts to encourage land management that should bring all features into favourable condition before the next monitoring cycle. The main pressures that need to be addressed are burning, trampling by red deer and drainage. Existing initiatives such as the Muirburn Code, Agri-Environment schemes, Deer Management Groups and the Peatland ACTION scheme should help address these pressures both within the SAC/SPA and in the parts of the WHS that lie outwith the SAC/SPA. In addition, the WHS bid itself has raised the profile of the habitats and species of the Flow Country and is encouraging land managers to work in partnership towards their good management.