8 Ornithology

8. Ornithology

8.1. Introduction

8.1.1. This Chapter of the Environmental Report (ER) considers the potential effects of the Loch Toftingall Battery Energy Storage System (BESS) (the 'Proposed Development') on ornithological features. It summarises the methods used to establish the bird populations within the Site and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the bird populations present. The ways in which birds might be affected (directly or indirectly) by the construction and operation of the Proposed Development are evaluated, prior to, and after, any mitigation measures are considered.

8.1.2. Particular attention has been paid to species of high or moderate Nature Conservation Importance (target species). These include, but are not restricted to, species with national or international protection under the Wildlife and Countryside Act 1981 (and later amendments) and the EU Birds Directive (79/409/EEC).

8.1.3. Birds may be affected by the following phases of the Proposed Development:

- Construction: construction of tracks, BESS compound and temporary construction compound; and
- Operation: including associated maintenance activities.

8.1.4. The potential effects of the Proposed Development on birds are:

- direct habitat loss due to land take by the BESS, access tracks and ancillary structures;
- indirect habitat loss due to the displacement of birds as a result of construction and maintenance activities; and
- disturbance of bird behaviours due to construction and operational activities that do not result in displacement but may result in reduced productivity and/or survival.

8.1.5. This ER is based on information available at the time of writing and is supported by:

- Appendix 8.1: Ornithology Technical Report; and

- Appendix 8.2: Confidential Ornithology.

8.1.6. A detailed description of the Proposed Development is presented in Chapter 4 (Description of the Proposed Development), while the layout of the Proposed Development is illustrated on Figure 4.1.

8.1.7. The ornithology ER was undertaken by Natural Research (Projects) Limited.

8.2. Legislation and Guidance

Legislation

8.2.1. The following legislation has been considered when undertaking this ER:

- The Wildlife and Countryside Act 1981 (as amended) ('WCA').
- The Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations').
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive').
- The Nature Conservation (Scotland) Act 2004 (as amended); and
- The Council Directive on the Conservation of Wild Birds 2009/147/EC (The EU 'Birds Directive').

Guidelines

8.2.2. The following guidance has been consulted while undertaking this ER:

- Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., & Win I. (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114: 723-747.
- European Commission (2020). Natura 2000 Guidance Document: Wind energy developments and EU nature legislation. European Commission, Brussels.
- Scottish Executive Rural Affairs Department (SERAD) (2000). Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and

Fauna and the Conservation of Wild Birds ("the Habitats and Birds Directives"). Revised Guidance Updating Scottish Office Circular No 6/1995.

- Scottish Natural Heritage. (2000b). Natural Heritage Zones.
- SNH (2016a). Assessing connectivity with Special Protection Areas (SPAs). Version 3.
- SNH (2016b). Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees Version 2.
- SNH (2017). Recommended bird survey methods to inform impact assessment of onshore windfarms.
- SNH (2018a). Assessing the cumulative impacts of onshore wind farms on birds. SNH Guidance Note.
- SNH (2018b). Assessing significance of impacts from onshore wind farms on birds out with designated areas. Version 2; and

8.3. Methodology

Study Area

8.3.1. The Study Area was defined with reference to the location of the Proposed Development and encompasses a series of buffers up to 2km in radius. Buffer size varies depending on the sensitivity of the key species, to the potential effects associated with built development (Figures 8.1 & 8.2). The various survey areas, which make up the Study Area, are defined as follows:

- 'Site' refers to the area enclosed by the Proposed Development.
- 'breeding bird survey area', 'winter walkover survey area' or 'core survey area' refers to the Site plus an additional 500m wide strip around the Site, and
- 'raptor survey area' refers to the site area plus an additional 2km wide strip depending on the focal species and presence of contiguous suitable habitat outside of the core survey area.

8.3.2. The Site is primarily comprised of commercial forest.

Desk-based Study

8.3.3. A desk-based study was undertaken to collate existing bird records/data. Distribution and abundance data were collected from published sources (e.g., Gibbons *et al*., 1993 and Forrester *et al*., 2007) and nature conservation organisations including NatureScot, RSPB, Highlands Raptor Study Group (HRSG) in relation to species with a moderate or high nature conservation value (SNH, 2017).

Survey Methodology

8.3.4. Baseline field surveys for the Proposed Development were carried out between April 2017 and April 2019. A detailed methodology for all surveys is provided in Appendix 8.1 of this ER and is briefly summarised below.

- Breeding Birds of Open Ground survey (four visits, April to July 2017; within Site and 500m buffer).
- Scarce Breeding Bird survey (April to July 2017 and 2018; within Site and buffer extending up to 2km depending on species).
- Flight activity (vantage point) surveys (April 2017 to April 2019; within flight activity survey area (FA)).
- Waterfowl survey (April 2017 to April 2019; Loch Toftingall and immediate surrounds).
- Migration Watch Point (MWP) surveys (September to November 2017 and March to May 2018; from three watch points).
- Hen harrier winter roost watches (September and November 2017); and
- Winter walkovers (March 2018 and October 2018 to March 2019; within the Site and 500m buffer).

Survey Limitations

8.3.5. No significant information gaps were identified.

8.4. Embedded Protection Measures

8.4.1. A Bird Protection Plan (BPP), devised in consultation with NatureScot, will be in place prior to the onset of construction activities. The BPP will describe survey methods for the identification of sites used by protected birds and will detail protocols for the prevention, or minimisation, of disturbance to birds as a result of

activities associated with the Proposed Development. The BPP will be overseen by the Ecological Clerk of Works.

8.4.2. The BPP will describe surveys to locate the nests or other key sites (e.g., roosts) of birds listed in Schedules 1 and 1A of the WCA 1981, in advance of construction works progressing within the Site. In the event that an active nest or roost of a Schedule 1 or Schedule 1A species is discovered within distances given by Ruddock & Whitfield (2007) (or within a 500m radius of the nest for Schedule 1 species not listed), a disturbance risk assessment will be prepared under the BPP and any measures considered necessary to safeguard the breeding attempt or roost (e.g., exclusion zones or restrictions on timing of works), will be submitted to NatureScot for agreement before recommencing work.

8.5. Baseline Conditions

Designated Sites

8.5.1. The Site is not located within or adjacent to any statutory sites designated for ornithological interest. Statutory designated sites for ornithological interest within 20km of the Site are listed in Table 8.1 and shown in Appendix 8.1: Figure 8.1.

Table 8.1 Designated sites within 20km of the Proposed Development

Name	Designation	Designated for	Distance from Site Boundary
Caithness and Sutherland Peatlands	SPA	Black-throated diver Red-throated diver Common scoter Wigeon Golden eagle Hen harrier Merlin Short-eared owl Golden plover Wood sandpiper Greenshank Dunlin	1.7km south-east

Name	Designation	Designated for	Distance from Site Boundary
Caithness and Sutherland Peatlands	Ramsar	Under Ramsar Criterion 2: Red-throated diver Black-throated diver Golden plover Wood sandpiper Dunlin Under Ramsar Criterion 4: Wigeon Common scoter Greenshank	1.7km south-east
Shielton Peatlands	SSSI	Breeding bird assemblage	1.7km south-east
Caithness Lochs	SPA	Whooper swan Greenland white-fronted goose Greylag goose	5.3 km north-east
Caithness Lochs	Ramsar	Under Ramsar Criterion 6: Whooper swan Greenland white-fronted goose Greylag goose	5.3 km north-east
Loch Watten	SSSI	Non-breeding greylag goose	5.3 km north-east

8.5.2. The European Directive which is currently relevant in the context of SPAs is the Council Directive 2009/147/EC on the Conservation of Wild Birds (the Birds Directive). In Scotland the Birds Directive has been transposed into the domestic legislation through the Habitats Regulations. Guidance for the implementation of the Habitats Regulations in Scotland is provided in Scottish Office Circular No. 6/1995 (revised by the Scottish Executive in June 2000) (SERAD 2000), and in the context of the protection of the Ramsar sites, the Scottish Government guidance published on 22 January 2019.

8.5.3. Whilst the Habitats Regulations provide that an assessment of the likely effects of a proposed development on an SPA is the responsibility of the competent authority – in this instance, the Highland Council, this section provides a summary

examination of the relevant issues to enable the competent authority to undertake the appropriate assessments in respect of the Caithness and Sutherland Peatlands Special Protection Area (SPA) and Ramsar site and the Caithness Lochs SPA and Ramsar site in light of each site's conservation objectives. Information to inform the appropriate assessments is contained within this Chapter, and the associated Appendices 8.1 and 8.2, and so is not repeated at length here.

8.5.4. Regulation 63 of the Habitats Regulations refers to three assessment steps; the outcome of the first two steps determining whether or not the third needs to be implemented. The three steps, set out below as questions, are:

Step 1: Is the proposal directly connected with or necessary to the management of the site?

Step 2: Is the proposal, alone or in combination, likely to have a significant effect on the site? If a significant effect is likely, then an appropriate assessment is necessary; and

Step 3: Can it be demonstrated in light of the conservation objectives that the proposal will not adversely affect the integrity of the site?

8.5.5. In respect of the Proposed Development, the following comments are made in light of the three steps referred to above, to assist the Highland Council with undertaking the appropriate assessment:

Step 1. The construction and operation of the Proposed Development is not directly connected with or necessary for the management of the above-named SPAs, and therefore the next step needs to be considered.

Step 2. Caithness and Sutherland Peatlands Special Protection Area (SPA) and Ramsar site.

8.5.6. Baseline studies recorded the following qualifying species; black-throated diver, red-throated diver, wigeon, hen harrier, merlin, golden plover and greenshank. Although these species were present, they were recorded infrequently, and in relatively small numbers (Appendix 8.1). No qualifying species of this SPA and Ramsar site were recorded as breeding within 2km of the Proposed Development. Hence, their reliance on habitats (e.g., for breeding or foraging) and airspace within the Site was clearly very low, and the Proposed Development will have negligible effects on relevant SPA/Ramsar populations of these species. Consequently, given the favourable condition of each species within the SPA, there is considered to be no potential for any negative effect on these SPA/Ramsar populations as a result of construction or operational activities. Despite a link between the proposal's effects and the qualifying species of the SPA, likely significant effects

are considered trivial or inconsequential and an appropriate assessment is therefore not required.

Step 2. Caithness Lochs Special Protection Area (SPA) and Ramsar site.

8.5.7. The distance of the Caithness Lochs SPA from the Proposed Development (5km) intrinsically lowers the likelihood that the Proposed Development would have a potential impact on the SPA interest, as does survey information which highlights that the two relevant species' activities (i.e., non-breeding greylag goose and whooper swan: Greenland white-fronted goose was not recorded) were centred on Loch Toftingall (Appendix 8.1), which is not a component of the SPA. These considerations in combination with the negligible population effects of any predicted mortality may suggest to the competent authority that the Proposed Development is not likely to have a significant effect under Step 2 of the assessment process.

8.5.8. It follows, therefore, that there will be no detrimental effects on the respective SSSI designations that underpin the SPA and Ramsar designations.

Field Survey

Divers

8.5.9. Black-throated diver was recorded in June and July 2017 with observations of a single bird on Loch Toftingall and four flights involving a total of five birds. Two black-throated diver flights were recorded for a total duration of 231 seconds within 500m of the Proposed Development. No observations were made during the 2018 breeding season. There was no evidence of breeding within the study area during baseline surveys (Appendix 8.1).

8.5.10. Despite black-throated diver being a species of high Nature Conservation Importance, due to the low numbers, very low level of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect black-throated diver populations; therefore black-throated diver is not considered further in this Chapter of the ER.

8.5.11. Red-throated diver was recorded regularly throughout the 2017 and 2018 breeding seasons, and in March 2019, with all observations being of birds either on Loch Toftingall or commuting to and from here. Seven red-throated diver flights were recorded, involving nine birds, for a total duration of 1,542 seconds of flight within 500m of the Proposed Development. There was no evidence of breeding within the study area during baseline surveys (Appendix 8.1).

8.5.12. Despite red-throated diver being a species of high Nature Conservation Importance, due to the low numbers, low level of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect red-throated diver populations; therefore red-throated diver is not considered further in this Chapter of the ER.

Wildfowl

8.5.13. Whooper swans were recorded regularly during baseline surveys with flocks of between one and 27 individuals. Most observations were of birds on or commuting to and from Loch Toftingall during the non-breeding period. Six flights by whooper swan were recorded, involving a total of 58 birds, within 500m of the Proposed Development. One flight (2 birds) recorded during migration watches passed within 500m of the Proposed Development. A maximum of three birds were present between May and August 2017, but no breeding behaviour was recorded during baseline surveys (Appendix 8.1).

8.5.14. Whooper swan is a species of high Nature Conservation Importance. Due to the low numbers, low level of flight activity and no evidence of breeding within the survey buffers there is no possibility that any potential effects will significantly affect whooper swan populations; therefore, whooper swan is not considered further in this Chapter of the ER.

8.5.15. Two flocks of greylag geese, consisting of two and seven birds, were recorded on Loch Toftingall with all other birds recorded being in flight. Birds were recorded in all months except July and August with the majority recorded during the non-breeding period. Seventeen flights, involving 433 birds, recorded during VP watches passed within 500m of the Proposed Development. Three flights (24 birds) recorded during migration watches passed within 500m of the Proposed Development. There was no evidence of breeding within the study area during baseline surveys (Appendix 8.1).

8.5.16. Despite greylag goose being a qualifying feature of the Caithness Lochs SPA and a species of moderate Nature Conservation Importance, due to the low numbers, very low level of flight activity and no evidence of breeding within the survey buffers there is no possibility that any potential effects will significantly affect greylag goose populations; therefore, greylag goose is not considered further in this Chapter of the ER.

8.5.17. All observations of pink-footed goose were of birds in flight with no birds observed feeding or roosting within the study area. Six flights by pink-footed geese, involving 388 birds, passed within 500m of the Proposed Development (Appendix 8.1).

8.5.18. Despite pink-footed goose being a species of moderate Nature Conservation Importance, due to the low numbers and low level of flight activity recorded within the survey buffers there is no possibility that any potential effects will significantly affect pink-footed goose populations; therefore, pink-footed goose is not considered further in this Chapter of the ER.

8.5.19. Wigeon is a qualifying feature of the Caithness and Sutherland Peatlands SPA during the breeding season but as this species was only recorded once during the non-breeding season (Appendix 8.1) there is no possibility that any potential effects will significantly affect wigeon populations; therefore, wigeon is not considered further in this Chapter of the ER.

Raptors and Owls

8.5.20. Hen harrier was recorded during both non-breeding seasons and both breeding seasons, although the majority of observations were made during the non-breeding season with only five observations in July and none in June. No flights by hen harrier were recorded within 500 m of the Proposed Development during VP watches. No breeding behaviour was observed within the 2 km study area. Roosting birds (or birds exhibiting pre-roosting behaviour) were observed on eight occasions within the study area during September, October, November, December and January (Appendices 8.1 and 8.2).

8.5.21. Despite hen harrier being a species of high Nature Conservation Importance, due to the low numbers, lack of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect hen harrier populations; therefore, hen harrier is not considered further in this Chapter of the ER.

8.5.22. Single wintering rough-legged buzzards were recorded within the study area in April 2017 and then regularly in both non-breeding periods. No flights were recorded within 500m of the Proposed Development during VP watches (Appendix 8.1).

8.5.23. Rough-legged buzzard is considered an irregular winter visitor to Scotland and due to the lack of flight activity recorded within the survey buffers there is no possibility that any potential effects will be significant therefore rough-legged buzzard is not considered further in this Chapter of the ER.

8.5.24. Peregrine was recorded on three occasions in the non-breeding period. No evidence of breeding behaviour was recorded within the study area and no flights by peregrine were recorded within 500 m of the Proposed Development during VP watches (Appendix 8.1).

8.5.25. Despite peregrine being a species of high Nature Conservation Importance, due to the low numbers, lack of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect peregrine populations; therefore, peregrine is not considered further in this Chapter of the ER.

8.5.26. Merlin was recorded infrequently throughout the survey period. No evidence of breeding behaviour was recorded within the study area and one flight by a single merlin was recorded within 500m of the Proposed Development during GVP watches for a total duration of 170 seconds (Appendix 8.1).

8.5.27. Despite merlin being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect merlin populations; therefore, merlin is not considered further in this Chapter of the ER.

8.5.28. Osprey was regularly recorded during both breeding periods with birds regularly recorded fishing at Loch Toftingall and recorded commuting to and from the loch. Fifteen flights by osprey were recorded within 500m of the Proposed Development during VP watches for a total duration of 3,417 seconds. A nest site was located outside the 2km study area (Appendices 8.1 and 8.2).

8.5.29. Despite osprey being a species of high Nature Conservation Importance, due to the low numbers, low levels of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect osprey populations; therefore, osprey is not considered further in this Chapter of the ER.

8.5.30. A single juvenile white-tailed eagle was recorded flying over Loch Toftingall in November 2017. No flights by white-tailed eagle were recorded within 500m of the Proposed Development during VP watches (Appendix 8.1).

8.5.31. Despite white-tailed eagle being a species of high Nature Conservation Importance, due to the low numbers, a lack of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect white-tailed eagle populations; therefore, white-tailed eagle is not considered further in this Chapter of the ER.

8.5.32. A barn owl nest was located in a ruined building over 2km from the Proposed Development. No flights by barn owl were recorded during GVP watches (Appendices 8.1 and 8.2).

8.5.33. Despite barn owl being a species of high Nature Conservation Importance, it is also very tolerant of human activities and so potential for disturbance impact during construction, operation and decommissioning is intrinsically low. A nest site was located, however, the nest site (and associated foraging ranges: Bunn *et al*., 1982) is not within a distance at which any substantive disturbance could occur as a result of the Proposed Development, regardless of any habitat modifications connected with the Proposed Development. Due to the low numbers and lack of flight activity within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect barn owl populations; therefore, barn owl is not considered further in this Chapter of the ER.

Waders

8.5.34. Small numbers of curlew were present in the breeding season (with records in March, April, May, June and July). No flights were recorded within 500m of the Proposed Development during VP watches. Although three breeding territories were recorded within the study area no territories were found within 500m of the Proposed Development (Appendix 8.1)

8.5.35. Despite curlew being a species of moderate Nature Conservation Importance, due to the low numbers and lack of flight activity within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect curlew populations; therefore, curlew is not considered further in this Chapter of the ER.

8.5.36. Golden plover was present through much of the year, with records in January, February, March, April, May, August, September, October and November. No flights were recorded within 500m of the Proposed Development during VP watches and no breeding activity was recorded within the study area (Appendix 8.1).

8.5.37. Despite golden plover being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding within the survey buffers coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect golden plover populations; therefore, golden plover is not considered further in this Chapter of the ER.

8.5.38. Migrant greenshank were observed on three occasions between August and October, no flights were recorded within 500m of the Proposed Development

during VP watches and no breeding activity was recorded within the study area (Appendix 8.1).

8.5.39. Despite greenshank being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect greenshank populations; therefore, greenshank is not considered further in this Chapter of the ER.

8.5.40. A single whimbrel was observed in August, no flights were recorded within 500m of the Proposed Development during VP watches and no breeding activity was recorded within the study area (Appendix 8.1).

8.5.41. Despite whimbrel being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect whimbrel populations; therefore, whimbrel is not considered further in this Chapter of the ER.

Skuas

8.5.42. Arctic skua was recorded in flight once in May 2017 and three times in July 2018. No flights passed within 500m of the Proposed Development. There was no evidence of breeding within the study area during baseline surveys (Appendix 8.1).

8.5.43. Despite arctic skua being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect arctic skua populations; therefore, arctic skua is not considered further in this Chapter of the ER.

8.5.44. Great skua was recorded in flight once in June 2017 and once in August 2018. One flight involving a single bird passed within 500m of the Proposed Development. There was no evidence of breeding within the study area during baseline surveys (Appendix 8.1).

8.5.45. Despite great skua being a species of high Nature Conservation Importance, due to the low numbers, very low levels of flight activity and no evidence of breeding coupled with measures set out in the BPP (see Embedded Protection Measures) there is no possibility that any potential effects will significantly affect great skua populations; therefore, great skua is not considered further in this Chapter of the ER.

Other species

8.5.46. All of the open-ground passerine species are regionally widespread and common. The changes induced by the Proposed Development will be largely immaterial in terms of the regional effects on the conservation status of passerine birds. In view of their local numbers relative to wider abundance, and the low sensitivity of such passerines to the impacts of built development coupled with measures set out in the BPP (see Embedded Protection Measures), these species are not considered further in this Chapter of the ER.

8.6. Consideration of Potential Effects

Effects Scoped Out

8.6.1. On the basis of the desk study and field survey work undertaken, the professional judgement of the ornithology team, experience from other relevant projects, consultations and taking account of policy guidance, the following topic areas have been scoped out of further consideration:

- Effects on internationally and nationally designated sites: the distance to the nearest SPAs and SSSIs and/or the species' ecology and biology of the qualifying interests are such that no species cited in the designations for these areas will be affected by the Proposed Development.
- Effects on the following bird populations: black-throated diver, red-throated diver, whooper swan, greylag goose, pink-footed goose, waders, white-tailed eagle, rough-legged buzzard, osprey, peregrine, hen harrier, merlin, barn owl, Arctic skua, great skua and passerines. Baseline field studies recorded very infrequent use of the area near the Proposed Development site by these species or species groups. Although these species or species groups were present, they were recorded infrequently, and in relatively small numbers (Appendix 8.1). Hence, their reliance on habitats (e.g., for breeding, roosting or foraging) and airspace in the vicinity of the Proposed Development was clearly very low, and the Proposed Development will have negligible effects on relevant populations of these species or species groups. Consequently, given regional abundance and/or behavioural sensitivity there is considered to be no potential for any adverse effect on regional populations as a result of construction, operational or decommissioning activities (see Baseline Conditions).
- Effects on all bird species classified as of low Nature Conservation Importance.

Potential Construction Impacts

Disturbance of Breeding Birds

8.6.2. Construction of the Proposed Development is anticipated to last for approximately 9 months. Disturbance from construction will therefore potentially affect one bird-breeding season (March-August). Construction activity could result in unpredictable disturbance by personnel and machinery to specific areas of the Site. The result may be a reduction in breeding success, changes in range use or temporary or permanent displacement of individual birds.

8.6.3. When the baseline data are evaluated, it has been demonstrated that there is no requirement for any further consideration of effects due to so few records and no breeding sites located for any species recorded.

8.6.4. It is concluded that disturbance to breeding birds due to the construction of the Proposed Development will have no adverse effects on all bird species.

Disturbance to Foraging Birds

8.6.5. Foraging birds will potentially be displaced from localised areas around the construction site; however, there is no evidence to suggest that the localised areas around the construction site are critical to the performance of any species. Furthermore, species of high Nature Conservation Importance, will be essentially behaviourally insensitive to the potential adverse effects of construction activities that are intrinsically short term, and so the magnitude of spatial effects will be negligible, at worst.

8.6.6. When the baseline data are evaluated, it has been demonstrated that there is no requirement for any further consideration due to so few records and no breeding sites located for any species recorded.

8.6.7. It is concluded that disturbance to foraging birds due to the construction of the Proposed Development will have no adverse effects on all bird species.

Direct Habitat Loss

8.6.8. As set out in Chapter 4: Description of the Proposed Development, the construction of the Proposed Development will result in a permanent direct loss of approximately 1.05 ha of habitat. This habitat loss is very small and considered of negligible ornithological significance at the scale of the Peatlands of Caithness and Sutherland NHZ. The effect of this habitat loss is spatially negligible in relation to the home range requirements of all potentially affected species. Hence, there will be no change in the conservation status of potentially affected species as a result

of habitat loss and the effects of direct habitat loss on all ornithological interests are deemed negligible.

8.6.9. It is concluded that direct habitat loss due to the construction of the Proposed Development will have no adverse effects on all bird species.

Potential Operational Impacts

Displacement

8.6.10. No species of moderate or high Nature Conservation Importance were recorded as breeding at distances at which operational displacement could potentially constitute an adverse effect. Furthermore, the Proposed Development is clearly not critical to the requirements of foraging for species of moderate or high Nature Conservation Importance. Even if operational displacement of foraging birds from a small area does occur, it will have minimal local adverse effects on the profitability of foraging and indiscernible effects on regional populations. The magnitude of operational disturbance effects on these species of moderate or high Nature Conservation Importance is considered to be negligible.

8.6.11. It is concluded the operation of the Proposed Development will have no adverse effects on all bird species.

Assessment of Cumulative Effects

8.6.12. In considering cumulative effects, it is necessary to identify any effects that are minor (or greater) in isolation but that may be major cumulatively.

8.6.13. “Target” species were taken to be those species of high Nature Conservation Importance for which there was some indication of a potential effect as a result of the Proposed Development, which may be exacerbated cumulatively. However, no significant effects of the Proposed Development were identified, and all effects on all bird species were deemed to be of negligible significance. As such, the predicted in-isolation effects of the Proposed Development are considered to have no potential to contribute to cumulative effects and are therefore negligible across all species.

8.6.14. In conclusion, for all bird species, the cumulative effects of the Proposed Development in-combination with other projects in the NHZ are likely to be negligible.

8.7. Mitigation Measures

8.7.1. As there will be no significant effects on bird species mitigation is not required.

8.8. Residual Effects

8.8.1. As there was no requirement for mitigation, no significant residual effects have been identified.

8.9. Enhancement Measures

8.9.1. The Outline Habitat Management Plan (oHMP) for the Site (Appendix 7.2) recognises the requirement of National Planning Framework 4 (NPF4) Policy 3 that "*development proposals will contribute to the enhancement of biodiversity, including where relevant, restoring degraded habitats*". The HMP area, as it currently exists, has been heavily modified as a result of commercial forestry operations which has created a monoculture habitat which, at present, offers limited benefit for biodiversity.

8.9.2. The proposed habitat enhancement of the HMP area would have additional benefits for many bird species. The change from a monoculture coniferous plantation woodland to a more natural peatland bog system will enhance the area for notable scarce bird species such as hen harrier and upland wading birds, such as golden plover. Native tree and scrub planting will provide foraging, nesting and sheltering opportunities for a variety of species of conservation interest such linnet, lesser redpoll and yellowhammer and provide an additional winter food resource for wintering thrushes. The HMP objectives will effectively create new opportunities for a wider range of avian species of conservation interest.

8.9.3. Additionally, the change from forestry to bog habitat, and the restoration of peatland, would, over time, have benefits in terms of general biodiversity. The diversity of flora and fauna would improve, and the area is likely to become ecologically richer.

8.10. Summary

8.10.1. It is concluded, overall, that the likely effects of the Proposed Development on all bird species are likely to be negligible.

8.11. References

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9 Cultural Heritage

9. Cultural Heritage

9.1. Introduction

9.1.1. This Chapter of the Environmental Report evaluates the effects of the Proposed Development on cultural heritage and was undertaken by Headland Archaeology (UK) Ltd. Baseline information supporting the assessment is presented in Appendix 9.1: Archaeological Desk-based Assessment, with an accompanying gazetteer (Annex 1).

Scope of Assessment

9.1.2. The scope of this Chapter was agreed through screening and scoping responses for previous iterations of the Proposed Development received from The Highland Council (THC) and Historic Environment Scotland (HES).

9.1.3. The assessment concentrates on potential direct and indirect (physical) effects of the Proposed Development upon heritage assets, including the potential for previously unrecorded heritage assets to be discovered during construction (also known as the 'archaeological potential' of the Site).

9.1.4. Consideration of effects during decommissioning of the Proposed Development on heritage assets is scoped out of the assessment. Assuming that all land-take for the decommissioning works, including the access track, lies within the same footprint as the construction works any adverse effects would be fully mitigated during construction (as applicable) with no remaining archaeological potential. Consideration of the setting of heritage assets in the wider area during construction and operation is scoped out of the assessment. Due to the nature and anticipated limited visibility of the Proposed Development, and the receiving environment, no adverse setting effects are anticipated.

Objectives

9.1.5. The objectives of this assessment are therefore to:

- Describe the cultural significance, importance, location, nature and extent of any known heritage assets or areas of archaeological potential which may be affected by the Proposed Development;
- Determine any adverse effects of the Proposed Development upon cultural heritage;
- Outline suitable mitigation measures to avoid, reduce or offset adverse effects; and

- Provide an assessment of any residual effects remaining after mitigation.

9.2. Legislation, Policy and Guidance

9.2.1. The assessment has been undertaken with reference to relevant legislation, policy and guidance relating to the historic environment, the context of which is presented in Appendix 9.1: Archaeological Desk-based Assessment (Section 2), including:

Statutory Protection

- The Ancient Monuments and Archaeological Areas Act 1979.
- The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997.
- The Historic Environment Scotland Act 2014.

National Planning Policy

- National Planning Policy (NPF) 4.
- Historic Environment Policy for Scotland (HEPS).

Local Planning Policy

- The Highland Council (THC) Highland Wide Local Development Plan (HWLDP) (adopted April 2012): Policy 57 Natural, Built and Cultural Heritage.

Guidance

- Environmental Impact Assessment Handbook (v5 NatureScot & HES 2018).
- 'Managing Change in the Historic Environment' (MCHE) (HES).
- Designation Policy and Selection Guidance (DPSG, 2019) to accompany HEPS.
- Planning Advice Note (PAN) 2/2011.
- The Chartered Institute for Archaeologists (CIfA) 'Code of Conduct' (2022).
- Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment' (CIfA 2020).
- Standard and guidance for historic environment desk-based assessment (CIfA 2020).
- 'Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC and CIfA July 2021).

9.3. Methodology

Definition of Baseline Conditions

Desk-based Assessment and Field Reconnaissance Survey

9.3.1. Heritage assets within the Study Area are shown on Figure 9.1 with detailed descriptions compiled in Appendix 9.1: Archaeological Desk-based Assessment (and Annex 1).

9.3.2. Designated heritage assets are labelled with the reference number assigned to them by HES; non-designated assets are labelled with the reference number in the HER (prefixed MHG) or the NRHE. A single asset number can refer to a group of related features, which may be recorded separately in the HER and other data sources.

Study Areas

9.3.3. Site Boundary: corresponds with the Proposed Development Site.

9.3.4. Study Area: heritage assets within 1.0km of the Site Boundary are considered to inform the assessment of the Proposed Development Site's archaeological potential.

Data Sources

9.3.5. The baseline for the assessment has been informed by Appendix 9.1: Archaeological Desk-based Assessment. The following sources of information were referred to:

- Designation data downloaded from Historic Environment Scotland in April 2023.
- Historic Environment Record (HER) data, digital extract received from Highlands Council in March 2022.
- The National Record of the Historic Environment (NRHE), including the Canmore database and associated photographs, prints/drawings and manuscripts held by HES.
- Historic Landscape Assessment data, viewed through the HLAMap website.
- The National Collection of Aerial Photography (NCAP).
- Geological data available online from the British Geological Survey.
- Historic maps held by the National Library of Scotland.

- Unpublished maps and plans held by the National Records of Scotland.
- Relevant internet resources, including Google Maps, Google Earth, and PastMap.
- Readily available published sources and unpublished archaeological reports.

9.3.6. A field reconnaissance survey was undertaken on 28th April 2022 in clear weather conditions.

Potential for Unknown Heritage Assets in the Site

9.3.7. The likelihood that undiscovered heritage assets may be present within the Site Boundary is referred to as archaeological potential. Overall levels of potential can be assigned to different areas of the Site, while recognising that the archaeological potential of any area will relate to particular historical periods and types of evidence. The following factors are considered in assessing archaeological potential:

- The distribution and character of known heritage assets in the vicinity, based principally on an appraisal of data in the HER;
- The history of archaeological fieldwork and research in the surrounding area, which may give an indication of the reliability and completeness of existing records;
- Environmental factors such as geology, topography and soil quality, which would have influenced land-use in the past and can therefore be used to predict the distribution of potential archaeological remains;
- Land-use factors affecting the survival of archaeological remains, such as ploughing or commercial forestry planting; and
- Factors affecting the visibility of archaeological remains, which may relate to both environment and land-use, such as soils and geology (which may be more or less conducive to formation of cropmarks), arable cultivation (which has potential to show cropmarks and create surface artefact scatters), vegetation, which can conceal upstanding features, and superficial deposits such as peat and alluvium which can mask archaeological features.

9.3.8. In the Archaeological Potential section of this assessment (see para 9.5.4 of this Chapter for summary, and Appendix 9.1: Archaeological Desk-based Assessment for detailed assessment), the likelihood that the Site may contain undiscovered heritage assets, their likely location and potential density, and their likely level of importance is assessed, described, and justified.

Importance of Heritage Assets

9.3.9. The importance of a heritage asset is the overall value assigned to it based on its cultural significance, reflecting its statutory designation or, in the case of non-designated assets, the professional judgement of the assessor (Table 9.1).

9.3.10. Heritage assets are defined as "Features, buildings or places that provide physical evidence of past human activity identified as being of sufficient value to this and future generations to merit consideration in the planning system" (NatureScot & HES 2018, Environmental Impact Assessment Handbook, v5, p.122). Thus, any feature which does not merit consideration in planning decisions due to its cultural significance may be said to have negligible importance.

9.3.11. Heritage assets for which a level of importance cannot be defined based on current information are defined as 'uncertain' importance.

Table 9.1 Criteria for Assessing the Importance of Heritage Assets

Importance	Criteria
Very High (International)	World Heritage Sites and other assets of equal international importance, that contribute to international research objectives
High (National)	Inventory Gardens and Designed Landscapes, Scheduled Monuments, Protected Wreck Sites, Inventory Historic Battlefields, Category A Listed Buildings, Historic Marine Protected Areas, and other assets of equivalent importance that contribute to national research objectives
Medium (Regional)	Conservation Areas, Category B Listed Buildings, non-designated assets of regional importance except where their particular characteristics merit a higher level of importance, and other assets that contribute to regional research objectives
Low (Local)	Category C Listed Buildings and locally listed (non-designated) heritage assets, except where their particular characteristics merit a higher level of importance. Non-designated heritage assets of Local importance, including assets that may already be partially damaged

Limitations to Assessment

9.3.12. Information held by public data sources is generally considered to be reliable; however, the following general points are noted:

- There is no LIDAR data available for the Site Boundary on the Scottish Remote Sensing Portal;

- HER records can be limited because opportunities for research, fieldwork and discovery depend on the volume and frequency of commercial development and occasional research projects, rather than the result of a more structured research framework. A lack of data within the HER records does not necessarily equal an absence of archaeological potential;
- Documentary sources are rare before the medieval period;
- Wherever such documentary sources are used in assessing archaeological potential professional judgment is used in their interpretation;
- Where heritage assets have been identified solely from aerial imagery without confirmation from archaeological excavation or supporting evidence in the form of find-spots for example, it is possible the interpretation may be revised in the light of further investigation;
- The significance of sites can be difficult to identify from HER records, depending on the accuracy and reliability of the original source;
- There can often be a lack of dating evidence for archaeological sites; and
- Any cultural heritage field reconnaissance survey has inherent limitations, primarily because archaeological remains below ground level may have no surface indicators.

9.4. Design and Mitigation

Mitigation

9.4.1. Assessment of impacts is an iterative part of the design process. For any identified effect, the preferred mitigation option is always to avoid or reduce adverse effects through design, or through precautionary measures such as fencing off heritage assets during construction works to avoid accidental direct physical effects. Effects which cannot be eliminated in these ways will lead to residual effects.

9.4.2. It is possible to mitigate residual adverse direct or indirect physical effects by an appropriate level of survey, excavation and recording during or in advance of construction, and subsequent analyses and publication of the results, in accordance with a written scheme of investigation (NPF4 Policy 7.o and PAN2/2011 sections 25-27).

9.5. Effects

Baseline Environment

9.5.1. For a full discussion of the Baseline Environment of the Site see Appendix 9.1: Archaeological Desk-based Assessment.

Geology and Geomorphology

9.5.2. The bedrock geology within the Site is sedimentary, comprising Spital Flagstone Formation - Siltstone, Mudstone and Sandstone. Superficial deposits are recorded as Peat (http://mapapps.bgs.ac.uk/geologyofbritain/home.html). The National Soil Map of Scotland records this as Dystrophic blanket peat (https://map.environment.gov.scot/Soil_maps/).

Known Heritage Assets

9.5.3. There are no known heritage assets recorded on the HER/NRHE within the Site Boundary. Assessment for this chapter has identified no heritage assets.

Archaeological Potential

9.5.4. In general, the Site is of negligible archaeological potential. It is acknowledged that in areas of deep peat, there is potential for previously unrecorded assets to survive below-ground and obscured by the masking effect of peat cover.

Construction Effects

9.5.5. Development activities within the Site have the potential to truncate or remove any hitherto unknown buried archaeological remains, resulting in an adverse effect on these assets. Direct physical effects may occur during construction as a result of intrusive groundworks. Indirect effects describe secondary processes, triggered by the development, that lead to the degradation or preservation of heritage assets. For example, changes to hydrology may affect archaeological preservation within waterlogged deposits.

9.5.6. A description of the Proposed Development is presented in Chapter 4. Proposed ground works with the potential to impact upon archaeological remains include:

- Formation of the construction compound (potential future augmentation area) immediately to the east of the main BESS compound.
- Construction of new access track from the existing Halsary Wind Farm track into the Loch Toftingall site.
- Levelling and preparation of the main BESS platform.

- Preparation of battery unit and other foundation footings within the compound.
- Trenching and laying of cables within the compound.
- Preparation of landscaping areas and formation of attenuation pond.

9.5.7. There are no known heritage assets located within the Site. There are no known heritage assets located in the Study Area that are likely to be indirectly physically impacted through works within the Site. No adverse direct or indirect physical effects are therefore anticipated.

9.5.8. As a moorland bog, the Site is of generally negligible archaeological potential. The potential for hitherto unknown archaeological remains is further reduced by the establishment of commercial forestry across the Site and associated deep-ploughing which would have largely destroyed any remains which may have been present. It is acknowledged that in areas of deep peat, there is potential for previously unrecorded assets to survive below-ground and obscured by the masking effect of peat cover. Direct adverse physical construction effects on previously unknown heritage assets in the Site are therefore unlikely but possible. Based on the assessment of archaeological potential, any currently unknown remains are unlikely to be of more than medium importance. If such remains are present and discovered during construction phase groundworks, they may be fully removed. Given the potential for adverse direct physical effects upon hitherto unknown heritage assets of up to medium importance within the Site, archaeological mitigation is proposed.

Mitigation Measures During Construction

9.5.9. No adverse direct or indirect physical effects are anticipated upon known heritage assets during construction as there are none within the Site. Direct physical construction effects may however occur upon previously unknown heritage assets in the Site in areas of deep peat, where there is potential for previously unrecorded assets to survive below-ground and obscured by the masking effect of peat cover.

9.5.10. A programme of archaeological monitoring ('watching brief') is proposed during construction in areas where known or suspected peat deposits are proposed for removal as part of the construction of the Proposed Development. Archaeological monitoring will identify any archaeological remains and allows for effects upon them to be mitigated, by avoidance and preservation *in situ* where possible, or otherwise by advance excavation and recording. Where construction effects are unavoidable, these will be offset by excavation and recording of the remains in accordance with NPF4 Policy 7.o, PAN2/2011 sections 25-27, and THC HWLDP Policy 57: Natural, Built and Cultural Heritage. The scope and nature of any mitigation, should it be required, will be outlined in a written scheme of investigation (WSI) and agreed with THC in advance of construction.

9.6. Concluding Statement

9.6.1. The scope for this Chapter was agreed through screening and scoping responses for previous iterations of the Proposed Development received from the Highland Council (THC) and Historic Environment Scotland (HES).

9.6.2. The assessment concentrates on potential direct and indirect (physical) effects of the Proposed Development upon heritage assets, including upon the potential for previously unrecorded heritage assets to be discovered during construction (also known as the 'archaeological potential' of the Site).

9.6.3. Consideration of effects during decommissioning of the Proposed Development on heritage assets is scoped out of the assessment. Consideration of the setting of heritage assets in the wider area during construction and operation is scoped out of the assessment.

9.6.4. There are no known heritage assets within the Site Boundary. It is acknowledged however that in areas of deep peat, there is potential for previously unrecorded assets to survive below-ground and obscured by the masking effect of peat cover. Direct physical construction effects on previously unknown heritage assets in the Site is therefore unlikely but possible.

9.6.5. A programme of mitigation is proposed to offset any potential direct physical effects on previously unknown heritage assets which may exist within the Site, to include potential impacts upon or beneath peat.

9.6.6. Following implementation of the proposed mitigation measures for identified possible adverse direct physical construction effects upon archaeological potential, there will be no residual effects.

9.6.7. The scope and nature of any mitigation should it be required will be outlined in a written scheme of investigation (WSI) and agreed with THC in advance of construction, in accordance with NPF4 Policy 7.o, PAN2/2011 sections 25-27, and THC HWLDP Policy 57: Natural, Built and Cultural Heritage.

10. Geology and Peat

10. Geology and Peat

10.1. Introduction

10.1.1. This Chapter of the Environmental Report (ER) examines the effects of Loch Toftingall BESS (the Proposed Development) on the geology and peat resource and provides a preliminary geological assessment of the baseline conditions while considering peat instability and management. As stated in Chapter 4: Description of the Proposed Development, the Proposed Development will be permanent; therefore, decommissioning will not be assessed as part of this Chapter.

10.1.2. This Chapter of the ER is supported by the following Appendix documents provided in Volume 3 Technical Appendices:

- Appendix 10.1: Peat Slide Risk Assessment (PSRA); and
- Appendix 10.2: Outline Peat Management Plan (oPMP).

10.1.3. This Chapter is supported by the following figures:

- Figure 10.1: Superficial Soils;
- Figure 10.2: Solid Geology;
- Figure 10.3: National Soils Map of Scotland;
- Figure 10.4: Extract from Carbon and Peatland Map 2016; and
- Figure 10.5: Interpolated Peat Depths.

10.2. Legislation, Policy and Guidance

10.2.1. Consideration was given to the National Planning Framework 4 (NPF4)[1] which sets out the Scottish Government's policy on how nationally important land use matters

[1] Scottish Government, 2023: National Planning Framework 4 (NPF4) [online] available at: National Planning Framework 4 - gov.scot (www.gov.scot) (Accessed 27/06/2023)

should be addressed. Policy 5 within this document details the approach to soils, and includes the following key points relating to developments on peatland:

10.2.2. "Development proposals on peatland, carbon rich soils and priority peatland habitat will only be supported for:

- Essential infrastructure and there is a specific locational need and no other suitable site;
- The generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets;
- Small-scale development directly linked to a rural business, farm or croft;
- Supporting a fragile community in a rural or island area; or
- Restoration of peatland habitats.

10.2.3. Where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify:

- The baseline depth, habitat condition, quality and stability of carbon rich soils;
- The likely effects of the development on peatland, including on soil disturbance; and
- The likely net effects of the development on climate emissions and loss of carbon.

10.2.4. This assessment should inform careful project design and ensure, in accordance with relevant guidance and the mitigation hierarchy, that adverse impacts are first avoided and then minimised through best practice. A peat management plan will be required to demonstrate that this approach has been followed, alongside other appropriate plans required for restoring and/ or enhancing the site into a functioning peatland system capable of achieving carbon sequestration."

10.2.5. In addition to NPF4, guidance relevant to this Chapter includes:

- The Scottish Government (2017) Peat Landslide Hazard and Risk Assessments – Best Practice Guide for Proposed Electricity Generation Developments[2];
- Scottish Government, SNH, SEPA (2017) Peatland Guidance on Development on Peatland, on-line-version-only[3];
- SEPA (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste[4];
- SEPA (2017) Developments on Peat and Off-Site Uses of Waste Peat[5];
- The Scottish Government (2009) The Scottish Soil Framework[6];
- The Scottish Office (1996) Planning Advice Note PAN 50 - Controlling the Environmental Effects of Surface Mineral Workings[7] and
- The Construction Industry Research and Information Association (CIRIA) (2015) Environmental Good Practice on Site (C741)[8].

10.3. Methodology

Scope of Assessment

10.3.1. The key issues for the assessment of potential effects on the geology and peat resource within the Site as a result of the Proposed Development are:

[2] The Scottish Government (2017) Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments Guidance [Online] Available at: http://www.gov.scot/Resource/0051/00517176.pdf (Accessed 27/06/2023)
[3] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only Available at : Guidance+on+developments+on+peatland+-+peatland+survey+-+2017.pdf (www.gov.scot) (Accessed 27/06/2023)
[4] SEPA (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste [Online] Available at: Guidance+on+the+assessment+of+peat+volumes%2C+reuse+of+excavated+peat%2C+and+the+minimisation+of+waste.pdf (www.gov.scot) (Accessed 27/06/2023)
[5] SEPA (2017) Developments on Peat and Off-Site Uses of Waste Peat [Online] Available at: wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf (sepa.org.uk) (Accessed 27/06/2023)
[6] The Scottish Government (2009) The Scottish Soil Framework [Online] Available at: http://www.gov.scot/Publications/2009/05/20145602/0 (Accessed 27/06/2023)
[7] The Scottish Office (1996) Planning Advice Note PAN 50 - Controlling the Environmental Effects of Surface Mineral Workings [Onlline] Available at: 0026467.pdf (www.gov.scot) (Accessed 27/06/2023)
[8] The Construction Industry Research and Information Association (CIRIA) (2015) Environmental Good Practice on Site Guide (C741), CIRIA: London.

- Potential for peat destabilisation and peat slide risk;
- Potential effects relating to peat disturbance and the subsequent effects from excavated peat and peat management;
- Potential for compaction of superficial soils; and
- Potential for loss of important geological materials.

10.3.2. These risks are assessed in the form of:

- A PSRA;
- An oPMP; and
- Assessment of potential effects following the engineering design of Site Layout as detailed in Chapter 4: Description of the Proposed Development.

10.3.3. The key sensitive receptors in the assessment are:

- Soil type and associated land use are highly sensitive (e.g. deep peat, where peat depth is greater than 1.0m and blanket bog);
- Class 1 or 2 priority peatland habitats, carbon-rich and peaty soils cover >20% of the development area;
- Areas containing geological or geomorphological features considered to be of national importance (eg. Geological SSSIs) and
- Areas containing receptors of regionally important economic mineral deposits.

Elements Scoped Out of Assessment

10.3.4. According to the published data mapping by SEPA[9] there are no areas of contaminated land within the Site, therefore no effects are anticipated. Should contaminated land be found to be present during excavations, this would be tested and appropriate action would be taken as per the Environmental Protection Act 1990[10]. As a result of these findings, potential effects of contaminated land have been scoped out of this assessment.

[9] SEPA data publication map [online]: Map | Scotland's environment web (accessed 21/04/2023)
[10] Environmental Protection Act 1990 [online]: https://www.legislation.gov.uk/ukpga/1990/43/contents (accessed 21/04/2023)

10.3.5. Map data published by the Coal Authority[11] shows no former coal mining activity within the Site area; therefore, potential effects relating to mining and disused mining infrastructure have been scoped out of the assessment.

Study Area

10.3.6. The Site is located approximately 2km Southeast of Spittal, Caithness. The Site falls within the administrative area of Highland Council, covering an area of approximately 40.3 hectares (ha). The Site is centred at NGR 317765, 951893 on gently sloping land ranging between approximately 100m Above Ordnance Datum (AOD) near the Site entrance and 75m AOD at the easternmost point of the Site.

10.3.7. The Site Area is the land within the red line boundary and the focus of field surveys. A wider area defined as 'land under control of the applicant' is considered later in this chapter and associated technical appendices, habitat management and peat management related measures.

10.3.8. The Site is situated approximately 400m west of the Loch of Toftingall, its tributary "Allt Eireannaich" flows within the Site before flowing into the loch to the east, this watercourse forms part of the Wick River basin. The Site is in a rural area, with a landscape consisting largely of forestry plantations as well as some deforested land in the south of the Site.

Design Parameters

10.3.9. The design parameters that will influence the assessment of geology and peat in relation to effects resulting from the Proposed Development have been based on the layout of the Proposed Development, including the location of the BESS and associated infrastructure. Aside from those detailed in Chapter 4: Description of the Proposed Development, no additional design parameters will be required in the assessment presented in this Chapter. As outlined in Chapter 4: Description of the Proposed Development, infrastructure may be micro-sited up to 25 m, where constraints allow. The potential for the relocation of infrastructure has been considered in the undertaking of this assessment and mitigation recommended, where appropriate.

Survey Methodology

Desk Study

[11] The Coal Authority interactive map [online] : Interactive Map Viewer | Coal Authority (bgs.ac.uk) (accessed 21/04/2023)

10.3.10. The assessment of peat and geology has included the study of published information relating to the baseline conditions at the Site, this information is detailed in the following section of this Chapter. This was supported by detailed site walkover surveys and ecology assessments included within Chapter 7: Ecology of this ER. The information has been reviewed in the context of the Proposed Development to evaluate both short and long-term effects.

10.3.11. The data sources used to assess the baseline conditions of the Site are:

- British Geological Survey (BGS)"Geology of Britain viewer".[12]
- BGS "GeoIndex Onshore".[13]
- Scotland's Soils, National Soils of Scotland, Scotland's Environment website.[14]
- Scotland's Soils, Carbon and Peatland 2016 Map.[15]

10.3.12. Soils are of high sensitivity where they are categorised as peat soils of high moisture content, such as those found in blanket bogs.

10.3.13. The methodology used in the PSRA is in accordance with the Scottish Government guidance on peat landslide hazard and risk assessments[16]. Through using experience of similar projects and consultation with SEPA, the assessment aims to assess the effects on geology, soils and peat as a direct or indirect result of the Proposed Development.

Phase One Peat Probing

10.3.14. Peat probing was carried out in the vicinity of the Site in May 2019 by Arcus (now part of the ERM Group) for the previous six-turbine layout of Toftingall Windfarm. Probes were sunk predominantly at 100m centres across the whole Site, where possible. The Proposed Development was revised in 2020 to a two-turbine layout, covering a much smaller area than the previous design option. The initial survey recorded sufficient peat data to inform an indicative site layout. In 2023, both

[12] BGS Geology of Britain viewer [online] Available at: BGS Geology Viewer (BETA) (accessed on 28/06/2023)
[13] BGS GeoIndex Onshore [online] available at: GeoIndex - British Geological Survey (bgs.ac.uk) (accessed on 28/06/2023)
[14] Scotland's Environment, National Soil Map of Scotland. Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 (Accessed 28/06/2023)
[15] Scotland's Soils, Carbon and Peatland 2016 Map [online] available at : Carbon and peatland 2016 map | Scotland's soils (environment.gov.scot) (Accessed 28/06/2023)
[16] The Scottish Government (2017) Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments Guidance [Online] Available at: http://www.gov.scot/Resource/0051/00517176.pdf (Accessed 21/04/2023)

turbines were removed from the design and the Proposed Development was revised from a wind farm to a BESS site.

Phase Two Peat Probing

10.3.15. Stage two probing was carried out in June 2022 by ERM. The survey was conducted largely in accordance with the Scottish Government guidance, with some deviation from the standards due to dense forestry plantations rendering parts of the Site inaccessible. This stage of probing was carried out with the aim of targeting formally proposed infrastructure, much of which has now been dropped from the Proposed Development. As a result, the stage two data gathered throughout the Site is more extensive than the current infrastructure footprint. Data was gathered at the Site according to the following methodology:

- Probes were sunk at 50m centres along the proposed access track, with points perpendicular to the track at 25m offsets; and
- Probes were sunk in a 25m x 25m grid across the proposed BESS compound.

10.3.16. Additional probing was carried out in July 2022 following an amendment to the infrastructure layout. The revised substation and access track locations were probed using the same methods as were used in previous stage two probing.

10.3.17. In March 2023, the scope of the Proposed Development was changed from a wind farm to a BESS facility and both of the proposed turbines were removed. Extensive probing has not been undertaken at the proposed BESS facility due to dense forestry and wind-blown trees restricting access to some of the proposed BESS footprint, however it is considered that sufficient peat probe data was gathered during both previous phases of probing to inform the revised site layout. Figure 10.5: 'Interpolated Peat Depths' displays the peat data collected during surveys and demonstrated that the revised layout has been designed to avoid the deepest areas of peat at the Site.

10.3.18. It should be noted that the oPMP and PSRA were undertaken on the findings of all phases of peat probing within the finalised Site boundary, with focus on the more detailed phase two peat probe data as this was within the proposed infrastructure envelope. Details of these assessments are included in Appendix 10.1: PSRA and Appendix 10.2: oPMP.

Peat Slide Risk Assessment and Outline Peat Management Plan

10.3.19. The PSRA and oPMP have been developed to assess the potential for peat destabilisation and the potential for disturbance of peat, considering the effects on key sensitive receptors. These include:

- Existing infrastructure, such as access tracks, footpaths and dwellings.

- Proposed infrastructure.
- Sensitive areas of Groundwater Dependent Terrestrial Ecosystems (GWDTEs), blanket bog and other sensitive habitats.
- Watercourses.

10.3.20. Details of GWDTEs and the presence of blanket bog are discussed in further detail in Chapter 7: Ecology while effects on watercourses are detailed in Chapter 11: Hydrology and Hydrogeology.

Assessment Methodology

10.3.21. The assessment of potential environmental effects is based upon the final design of the Proposed Development, as detailed in Chapter 4: Description of the Proposed Development of this ER.

Assessment Limitations

10.3.22. There were no assessment limitations in relation to geology and peat.

Embedded Mitigation

10.3.23. Embedded mitigation takes place through the design of the Site layout by avoiding key environmental constraints including avoidance of deepest peat or limiting the impacts on deep peat where possible, as well as taking cognisance of hydrological and ecological features and associated buffers, and cultural heritage assets.

10.3.24. The Site layout design was presented through pre-application consultation with SEPA to illustrate how the Site layout had avoided deep peat where possible and how infrastructure sited in peat greater than 1.0m was located within the shallowest peat possible. This consultation also presented other key constraints, such as watercourse buffers and GWDTEs.

10.3.25. Embedded mitigation measures are set out within the Outline Water Construction Environmental Management Plan (oWCEMP) (provided as Technical Appendix 11.1) and as detailed in Chapter 4: Description of the Proposed Development, which details embedded development design mitigation relating to the Proposed Development. They comprise good practice methods and works that are established and effective measures to which the Applicant will be committed through the planning consent.

10.3.26. Further details on hydrology constrains are included in Chapter 11: Hydrology and Hydrogeology.

Baseline Conditions

Topography and Land-Use

10.3.27. The topography of the Site and its surrounding areas is fairly level, with the elevation ranging between approximately 75m Above Ordnance Datum (AOD) and 100m AOD. There are various areas of deep peat on the Site, particularly in the north, south-east and south-west of the main Site area.

10.3.28. The land within the Site boundary consists predominantly of forestry plantations with an area of deforested land where access tracks have been proposed between the existing Halsary Wind Farm and the large, forested area in the North of the Site. The Site will be accessed via Halsary Wind Farm, which is adjacent to the A9 road.

Geology

10.3.29. The data presented within this report is based upon large scale mapping (1:50,000 scale), this may not be fully representative of the localised geology. Further site investigations were carried out and are detailed in the 'Peat Depth Survey Data' section of this Chapter. This section records the findings of the field survey which provides more detailed information of the local environment.

Bedrock Geology

10.3.30. According to mapping by the British Geological Survey (BGS) "Geology of Britain viewer"[17] the Site is underlain by a sedimentary Spital Flagstone Formation, consisting of Sandstone, Mudstone and Siltstone. The bedrock geology of the Site is displayed in Figure 10.2. Assessment of effects on geology are discussed later in this Chapter.

10.3.31. Bedrock is defined by the BGS as the main mass of rocks forming the Earth. It can be concealed beneath superficial soils and water, or visible at the surface as an outcrop. Typically, bedrocks are solid rocks that have formed over a vast period of time.

[17] BGS Geology of Britain viewer [online] Available at: BGS Geology Viewer (BETA) (accessed on 28/06/2023)

Soils and Peat

Superficial Soils

10.3.32. According to published geological mapping presented in the BGS "Geology of Britain viewer" and BGS "GeoIndex Onshore"[18], the superficial soils present at the Site are peat and peaty soils, there is also a small area of Glacial Till adjacent to the south-east of the Site. The superficial soils present on site are illustrated in Figure 10.1.

10.3.33. Superficial soils are described by the BGS as the youngest geological deposits that rest upon the much older bedrock. Peat is a spongy soil, formed largely by the decomposition of organic material.

National Soils of Scotland

10.3.34. The following information is a summary of the information on soil units within Scotland's Soils, Scotland's Environment website[19].

10.3.35. The soil classification within National Soils of Scotland mapping is based on the soil properties you can see in the field (for example: colour, texture etc.) and on the arrangement and nature of the different horizons (layers) within the soil.

10.3.36. The methodology to concentrate on surface soils in National Soils of Scotland mapping means it can vary from BGS mapping which generally considers material beneath surface soils or 'topsoils' when recording superficial deposits.

10.3.37. According to the National soil map of Scotland, the majority of the Site falls under the soil classification "blanket peat." A small area of the Site is described as belonging to the "gleys" soil group, these terms are defined as:

- Blanket Peat : "Poorly drained upland soil with an organic surface layer more than 50 cm thick. It is unconfined and « blankets » the landscape."

[18] BGS GeoIndex Onshore [online] available at: GeoIndex - British Geological Survey (bgs.ac.uk) (accessed on 28/06/2023)
[19] Scotland's Environment, National Soil Map of Scotland. Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 (Accessed 28/06/2023)

- Gleys : "Soils that are periodically or permanently waterlogged. They are typically greyish with greenish or blueish tinges and often have a blotchy appearance."

10.3.38. The National Soils of Scotland Map extract of the Site is shown in Figure 10.3.

Carbon-rich Soils, Deep Peat and Priority Peatland Habitats

10.3.39. The Carbon and Peatland Map, Scotland's Environment website[20] indicates the Carbon-rich soils and peatland importance categories to be:

- Class 1 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas likely to be of high conservation value.
- Class 2 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas of potentially high conservation value and restoration potential.
- Class 3 – Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat.
- Class 4 – Area unlikely to be associated with peatland habitats or wet and acidic type. Area unlikely to include carbon-rich soils.
- Class 5 – Soil information takes precedence over vegetation data. No peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat.
- Mineral soil – Peatland habitats are not typically found on such soils (Class 0).
- Unknown soil type – information to be updated when new data are released (Class -1).
- Non-soil (e.g. loch, built up area, rock and scree) (Class -2).

10.3.40. The Carbon and Peatland map extract for the Site area can be seen in Figure 10.4, this details that the Site consists almost entirely of class 5 peat soil. There are small

[20] Scotland's Environment, Carbon & Peatland 2016. Available at: https://map.environment.gov.scot/Soil_maps/?layer=10 (Accessed 28/06/2023)

areas of Class 1 and Class 2 peatland at the western extent of the Site, however, there is no infrastructure proposed in these areas.

Peat

10.3.41. Peat is a sedimentary material, which is dark brown or black in colour, and comprises partially decomposed remains of plants and organic materials preserved in anaerobic conditions, essentially within a waterlogged environment. There are two principal types of peat:

- Acrotelm is the upper layer, quite fibrous and contains plant roots. Acrotelmic peat is relatively dry, generally lying above the groundwater table and has some tensile strength.
- Catotelm is the lower layer of peat which is highly amorphous and has a very high water content. Catotelm generally lies below the groundwater table and has a very low tensile strength.

10.3.42. Interpretation of these principal types are discussed further in Appendix 10.1: PSRA and further details of baseline peatland habitats are also included in Chapter 7: Ecology.

10.3.43. The Scottish Government (Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, April 2017) define deep peat as being a surface layer of peat soil greater than 1.0m deep.

10.3.44. The peat depth survey is summarised below, and the details are included in Appendix 10.2: oPMP. The Technical Appendix provides site-specific peat depth information which informed the design of the Proposed Development layout and the subsequent assessment of effects.

Peat Depth Survey Data

10.3.45. The desk-based assessment recorded the potential presence of peat and peaty soils in line with NatureScot data described above. The results of the peat probing survey indicated that extensive areas of deep peat (i.e. a surface layer of peat soil greater than 1.0m deep) are present, particularly in the north of the Site, in-line with the published geological data.

10.3.46. A total of 195 probes were sunk within the Site during the peat probe surveys. The locations of the probes, as well as the variations of peat depths throughout the Site, are shown in Figure 10.5: Interpolated Peat Depths. Table 10.4 summarises the depths of peat encountered at the Site during all phases of the survey.

Table 10.4: Peat Depth Summary

Peat Depth Range (m)	No of peat probes	Percentage of Total (%)
0.00 – 0.50	18	9.2
0.51 – 1.00	19	9.7
1.01 – 1.50	13	6.7
1.51 – 2.00	18	9.2
2.01 – 2.50	7	3.6
2.51 – 3.00	36	18.5
3.01 – 3.50	24	12.3
3.51 – 4.00	30	15.4
4.01 – 4.50	18	9.2
4.51 – 5.00	12	6.2
Total	**195**	

10.3.47. Recorded peat depths averaged 2.68m across the Site, with approximately 81% of probes recording depths of greater than 1.0m. The area where deepest peat can be found at the Site is in the northwest, where depths of up to 5.0m have been recorded. Generally, the deepest peat was recorded in topographically low-lying, flat areas and the Proposed Development has avoided these areas; the BESS has been located in the western site area where shallower peat is present.

10.3.48. Over 81% of probes recorded peat depths of greater than 1.0m. As such, part of the Proposed Development is sited in areas of deep peat.

10.3.49. A more detailed representation of peat depths within the Site is available in Appendix 10.1: PSRA and Appendix 10.2: oPMP.

10.4. Design and Mitigation

10.4.1. Mitigation in relation to peat disturbance is initiated through embedded mitigation in design (i.e. avoidance) and adopting best practices during construction.

10.4.2. In addition, Chapter 7: Ecology outlines habitat management procedures and details the peat restoration proposals as part of the application to reinstate and enhance parts of the land under control of the Applicant, and proportionally compensate for the localised disturbance being caused to deep peat. Further details of the habitat management measures proposed are included in Appendix 7.2: Outline Habitat Management Plan (oHMP).

10.4.3. Proposed mitigation states that infrastructure which encroaches on deep peat could be micro-sited (if required) out with these areas in order to reduce the overall effect on peat disturbance, stability and loss of soils. Micrositing limits are discussed in Chapter 4: Description of the Proposed Development.

10.4.4. Management of existing drainage will be undertaken to allow flow, preventing new tracks acting as a hydrological barrier, as well as dewatering works within a 250m buffer of wetland habitat communities. Further mitigation will form part of the Habitat Management Plan to block ditches in a restoration scheme for some areas of sensitive peatlands across the Site. Further details are provided in Chapter 11 Hydrology and Hydrogeology, Appendix 11.1: Outline Water Construction Environmental Management Plan.

10.4.5. Intrusive site investigations will be undertaken prior to construction at proposed infrastructure locations to further delineate and characterise the peat. This will ensure that infrastructure is in the most appropriate locations and allow for accurate micro-siting where required.

10.4.6. Slope stability monitoring will occur during pre-construction and construction phases of the Proposed Development, including for both peat stability and non-peat related stability. These would focus on locations highlighted as being at risk in Appendix 10.1: PSRA.

10.4.7. Best practice measures for managing excavated peat and peaty soils are detailed in Appendix 10.2: oPMP.

10.5. Effects

10.5.1. The effect of the Proposed Development on geology and peat has been considered for the duration of the construction and operational phases. Short-term effects are defined as those occurring during the construction phase, whereas effects which occur during the operational phase are considered long-term.

Potential Construction Effects

Disturbance of Deep Peat

10.5.2. In its regulatory position statement, SEPA states that:

10.5.3. "Developments on peat should seek to minimise peat excavation and disturbance to prevent unnecessary production of waste soils and peat." [21]

10.5.4. The key items of infrastructure which influence this effect are the dimensions, location and type of new access tracks and BESS compound.

10.5.5. The access tracks generally avoid areas of deep peat, however peat depths in excess of 2m have been recorded at the proposed BESS location. It is recommended that micro-siting away from the deepest areas of peat should be adopted, where possible.

10.5.6. Figure 10.5: 'Interpolated Peat Depths' illustrates the extent of deep peat within the Site.

10.5.7. Further information on peat excavation is also included in Appendix 10.2: oPMP which details the volume of peat estimated for excavation, as well as re-use possibilities and mitigation measures to avoid impacting deep peat wherever possible and, when the disturbance of deep peat is unavoidable, to manage it as best as possible. Estimated volumes of peat to be excavated as part of the Proposed Development have been considered within calculations included in Chapter 16: Climate Change and Carbon Balance.

10.5.8. Construction activities, including excavation of tracks, hardstanding areas and other associated infrastructure can lead to the disturbance of peat. Beyond the main construction activities, other considerations include the temporary storage of soils and peat on Site. The details of peat disturbance through excavations and subsequent re-use methods are included in Appendix 10.2: oPMP. Figure 10.5: 'Interpolated Peat Depths' illustrates the areas of deep peat.

10.5.9. Due to the presence of deep peat throughout the Site, it was not possible to site all of the infrastructure in areas of shallow peat. These areas of deep peat are low-lying with flat topography.

10.5.10. Site infrastructure has been sited in the western sector of the Site where shallower peat depths have been recorded. The BESS is proposed in an area of shallower peat than the Site average, however, the assessment of peat disturbance has highlighted that the north and east of the BESS compound, as well as the northernmost portion of the access track, are currently sited on areas of deep peat.

[21] SEPA (2017) Developments on Peat and Off-Site Uses of Waste Peat [Online] Available at: wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf (sepa.org.uk) (Accessed 28/06/2023)

As a result, peatland restoration works are proposed at the Site to compensate for the disturbance of deep peat and to avoid the loss of the excavated peat. Details of proposed peatland restoration are included in Appendix 7.2: outline Habitat Management Plan (oHMP). The deepest peat at the Site, recorded in central and northern areas is not affected by the infrastructure footprint. Volumes of excavated peat and specific mitigation for peat disturbance at proposed infrastructure is outlined in Appendix 10.2: oPMP.

10.5.11. Whilst much of the infrastructure footprint encompasses areas of deep peat, these areas are currently being used for commercial forestry plantations and have therefore already been subjected to some modification. The alterations made to the peat at the Site are reflected in the Class 5 rating attributed to the vast majority of the Site, including all areas of proposed infrastructure, in the Carbon and Peatland 2016 Map. This suggests that the post-development characteristics or quality of peat will not be significantly altered from the baseline conditions. Furthermore, all peat excavated during construction will be reinstated or used in peatland restoration, as outlined in Appendix 10.2: oPMP.

10.5.12. On this basis, disturbance to peat is confined to Class 5 peatland, the effects relating to the disturbance of peat can be reduced by applying the mitigation measures outlined in Section 10.4 of this Chapter as well as Appendix 10.2: oPMP. No Class 1 or Class 2 peatland will be disturbed as a result of the Development.

Peat Stability

10.5.13. Peat instability generally results from a combination of different contributing factors. Several construction activities have the potential to increase the likelihood of peat slides in areas where peat is present at a sufficient depth and where slope gradients are sufficiently steep to result in a peat slide.

10.5.14. Peat slide potential is increased by any construction activity where surface vegetation is removed and where peat or other soils are excavated from either the bedding surface of the underlying rock or the formation level within underlying soils.

10.5.15. Peat slides have the potential to affect surface water systems through soil inundation, leading to sedimentation. Soils and sensitive habitats can also be affected when slip materials slide onto areas of sensitive habitat or cause damage to local surrounding surface soils, this can lead to drainage patterns being disturbed and adverse effects on water quality. Receptors identified at the Site are:

- Existing access tracks.
- Class 1 peatland.
- Class 2 peatland.
- Class 5 peatland.

- Minor watercourses.
- Proposed Site Infrastructure.

10.5.16. The majority of peat was recorded at depths greater than 1.0m across the Site, with 65% of probes recording depths greater than 2.0 m, peat was found to be particularly deep in central and northern areas of the Site. Generally, infrastructure has been sited to avoid the deepest areas of peat but there are some elements of Site infrastructure that remain sited in areas underlain by deep peat, including the BESS compound.

10.5.17. The PSRA analysis has highlighted areas in which infrastructure is proposed to pose negligible risk in terms of peat slide, as presented in Appendix 10.1: PSRA. The risk of peat instability will be further reduced through good practice measures embedded within the design and adoption of best practices in construction, as detailed in Appendix 11.1: oWCEMP.

Loss and Compaction of Soils

10.5.18. In relation to the compaction of soils, investigations at the Site have recorded extensive areas of deep peat. Deep peat will therefore be disturbed as part of the Proposed Development, however disturbance of the deepest areas of peat has been avoided.

10.5.19. Although some infrastructure elements are sited in areas of deep peat, the footprint of the proposed layout equates to approximately 0.96 ha (2.4% of the whole Site area). This number can be reduced by implementing measures such as the use of floating access tracks in areas of deep peat.

Effects on Geology

10.5.20. Excavation of rock is not anticipated during the construction phase of the Proposed Development because the Site is generally flat and there are no borrow pits at the Site; however, in the event that rock extraction is required it is anticipated that this will be minimal.

Potential Operational Effects

10.5.21. Peatland Restoration is proposed as part of the Habitat Management for the Proposed Development, which is likely to continue from the construction phase into the operational phase. Following consent, further surveys will be required to finalise the extent of restoration, as well as the methods used to achieve it. It is expected that deep peat excavated during the construction phase of the Proposed Development will be restored in areas of forestry plantation subject to felling prior to the beginning of construction.

10.5.22. The deep peat affected by the Proposed Development has been heavily modified and degraded by historical drainage associated with commercial forestry. Some aspects of the infrastructure are located on blanket bog habitats. It is unlikely, however, that the infrastructure will have a significant effect on surface water flow due to the location and orientation of the Proposed Development.

10.5.23. Embedded mitigation and good practice measures, such as those outlined in Section 10.4 of this Chapter and in Appendix 10.2: oPMP, will reduce the likelihood of any potential effects of the Proposed Development on deep peat.

10.5.24. Peatland restoration has many benefits including absorbing atmospheric pollutants, improving water quality and benefiting biodiversity; furthermore, damaged bogs emit carbon dioxide and other greenhouse gases, which contribute to climate change. Through the peatland restoration proposed at the Site, this will enhance some of the current areas where commercial forestry and artificial drainage is present.

10.5.25. Several Methods are currently being considered within the peat restoration areas; these are discussed in Appendix 7.2: oHMP.

10.5.26. With adoption of best practice measures as outlined in Appendix 11.1: oWCEMP, it is anticipated that any effects upon peat and soils during the operational phase will be minimal.

Residual Effects

10.5.27. Following the incorporation of mitigation measures detailed in Section 10.4 of this Chapter, as well as in Appendix 10.1: PSRA and Appendix 10.2: oPMP, residual effects associated with disturbance of peat, peat stability and peat and soil losses will all be minimal.

10.6. Concluding Statement

10.6.1. This Chapter of the ER has assessed the potential effects relating to the Proposed Development on geology and peat. The Proposed Development has been assessed as having a minimal effect through the adoption of embedded mitigation, best practice methods in construction and implementation of mitigation measures outlined in Appendix 10.1: PSRA and Appendix 10.2: oPMP.

11. Hydrology and Hydrogeology

11. Hydrology and Hydrogeology

11.1. Introduction

11.1.1. This chapter of the Environmental Report (ER) evaluates the effects of Loch Toftingall Battery Energy Storage System ('BESS') (the Proposed Development) on hydrology and hydrogeology resources. This assessment was undertaken by Environmental Resources Management (ERM).

11.1.2. The objectives of this chapter are to:

- Describe the water environment baseline.
- Identify the potential direct and indirect impacts on the water environment.
- Describe any mitigation measures proposed to address any identified likely impacts.

11.1.3. This ER is supported by Appendix 11.1 Outline Water Construction Environmental Management Plan (OWCEMP).

11.1.4. As stated in Paragraph 4.1.8 of Chapter 4: Project Description, the Proposed Development will be permanent; therefore, decommissioning will not be assessed as part of this ER Chapter.

11.2. Legislation, Policy and Guidance

11.2.1. The following legislation, guidance and information sources have been considered in carrying out this assessment.

- The Water Framework Directive (WFD) (2000/60/EC)[1], transposed within Scotland by the Water Environment and Water Services (Scotland) Act 20032 and subsidiary Regulations.

[1] European Commission (2000) The Water Framework Directive (2000/60/EC) [Online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html (Accessed 11/04/2023).
[2] Scottish Government (2003) The Water Environment and Water Services (Scotland) Act 2003 [Online] Available at: http://www.legislation.gov.uk/asp/2003/3/contents (Accessed 11/04/2023).

- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017[3].
- The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013[4].
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR)[5].
- The Water Quality (Scotland) Regulations 2010[6].
- The Private Water Supplies (Scotland) Regulations 2006[7].
- The Public and Private Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2017[8].

Scottish Planning Policy and Guidance

11.2.2. The National Planning Framework 4 ('NPF4')[9] was published in February 2023 and replaces the previous Scottish Planning Policy ('SPP')[10]. NPF4 is a national spatial strategy for Scotland which sets out spatial principles, regional priorities, national developments, and national planning policy.

[3] Scottish Government (2017) the Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 [Online] Available at: https://www.legislation.gov.uk/ssi/2017/282/note/made (Accessed 11/04/2023).
[4] Scottish Government (2013) The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013 [Online] Available at: http://www.legislation.gov.uk/ssi/2013/29/introduction/made (Accessed 11/04/2023).
[5] Scottish Government (2011) The Water Environment (Controlled Activities) (Scotland) Regulations 2011 [Online] Available at: https://www.legislation.gov.uk/ssi/2011/209/contents/made (Accessed 11/04/2023).
[6] Scottish Government (2010) The Water Quality (Scotland) Regulations 2010 [Online] Available at: https://www.legislation.gov.uk/ssi/2010/95/contents/made (Accessed 11/04/2023).
[7] Scottish Government (2006) The Private Water Supplies (Scotland) Regulations 2006 [Online] Available at: http://www.legislation.gov.uk/ssi/2006/209/contents/made (Accessed 11/04/2023).
[8] Scottish Government (2017) the Private and Public Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2017 [Online] Available at: http://www.legislation.gov.uk/ssi/2017/321/made (Accessed 11/04/2023)
[9] Scottish Government (2023) National Planning Framework 4 [Online] Available at: https://www.gov.scot/publications/national-planning-framework-4/ (Accessed 11/04/2023).
[10] UK Government (2014) Scottish Planning Policy [Online] Available at: https://www.gov.scot/publications/scottish-planning-policy/ (Accessed 11/04/2023).

11.2.3. Part 2 – National Planning Policy, Section 22 – Liveable Places: Flood risk and water management of the NPF4 sets out key guidance for development. The policy is intended to strengthen resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding.

Guidance for Pollution Prevention (GPPs)

11.2.4. Guidance for Pollution Prevention (GPPs)[11] provide environmental regulatory guidance directly for Scotland and replace the old series of guidance documents, Pollution Prevention Guidelines (PPGs). Any PPGs which have not been updated and reprinted as GPPs, should be regarded as a source of information on good practice only.

11.2.5. The following GPPs are of relevance, principally to surface water, however as surface water has the potential to affect groundwater, they are also of relevance to the assessment of groundwater:

- GPP1 (2021): Understanding your environmental responsibilities – good environmental practices.
- GPP2 (2021): Above ground oil storage tanks.
- GPP4 (2021): Treatment and disposal of wastewater where there is no connection to the public foul sewer.
- GPP5 (2018): Works and maintenance in or near water.
- PPG6 (2012): Working at construction and demolition Sites.
- GPP8 (2021): Safe storage and disposal of used oils.
- PPG18 (2000): Managing fire water and major spillages.
- GPP21 (2021): Pollution incident response planning.
- GPP22 (2018): Dealing with spills.

[11] NetRegs (n.d.) Guidance for Pollution Prevention (GPPs) Documents [Online]. Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/ (Accessed 11/04/2023).

Other Guidance

- The Scottish Government (2001), PAN 61: Planning and Sustainable Urban Drainage Systems[12].
- The Scottish Government (2019), The Conservation (Natural Habitats, & c.) Amendment (Scotland) Regulations 2019[13].
- SEPA (2010), Land Use Planning System Guidance Note 2, Version 8 (LUPS-GU2)[14].
- SEPA (2010), Engineering in the water environment: good practice guide: River crossings[15].
- SEPA (2015), Culverting of watercourses: Policy Statement and Supporting Guidance[16].
- SEPA (2023), Climate change allowances for flood risk assessment in land use planning (LUPS-CC1)[17].
- SEPA (2002), Managing River Habitats for Fisheries[18].

[12] The Scottish Government (2001) PAN61 Planning and Sustainable Urban Drainage Systems [Online] Available at: https://www.gov.scot/publications/pan-61-sustainable-urban-drainage-systems/ (Accessed 11/04/2023).
[13] The Scottish Government (2019) The Conservation (Natural Habitats, & c.) Amendment (Scotland) Regulations 2019 [Online] Available at: https://www.legislation.gov.uk/ssi/2019/64/contents/made (Accessed 11/04/2023).
[14] SEPA (2010) Land Use Planning System Guidance Note 2, Planning advice on Sustainable Drainage Systems (SUDS), Version 8 [Online] Available at: https://www.sepa.org.uk/media/143195/lups-gu2-planning-guidance-on-sustainable-drainage-systems-suds.pdf (Accessed 11/04/2023).
[15] SEPA (2010) Engineering in the water environment good practice guide: River Crossings, WAT-SG-25 [Online] Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed 11/04/2023).
[16] SEPA (2015) Culverting of watercourses: position statement and supporting guidance WAT-PS-06-02, Version 2.0 [Online] Available at: https://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf (Accessed 11/04/2023).
[17] SEPA (2023) Climate Change Allowances for Flood Risk Assessment in Land Use Planning (LUPS-CC1) [Online] Available: https://www.sepa.org.uk/media/594168/climate-change-guidance.pdf (Accessed 11/04/2023).
[18] SEPA (2002) Managing River Habitats for Fisheries: a guide to best practice [Online] Available at: https://www.sepa.org.uk/media/151323/managing_river_habitats_fisheries.pdf (Accessed 11/04/2023).

- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (the CAR Regulations)[19].
- SEPA (2022), CAR - A Practical Guide, Version 9[20].
- SEPA (2009), River Basin Management Plan[21].
- The Construction Industry Research and Information Association (CIRIA) (2015), Environmental Good Practice on Site (C741)[22].
- CIRIA (2001), Control of Water Pollution from Construction Sites (C532)[23].
- CIRIA (2015), The SuDS Manual (C753)[24].
- CIRIA (2006), Control of Water Pollution from Linear Construction Projects (C648)[25].
- CIRIA (2017), Guidance on the Construction of SuDS (C768)[26].
- SEPA WAT-RM-08 Regulatory Method: SuDS[27].

[19] Scottish Government (2011) the Water Environment (Controlled Activities) (Scotland) Regulations 2011 [Online] Available at: http://www.legislation.gov.uk/ssi/2011/209/pdfs/ssi_20110209_en.pdf (Accessed 11/04/2023).
[20] SEPA (2022) Controlled Activities Regulations - A Practical Guide, Version 9 [Online] Available at: https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf (Accessed 11/04/2023).
[21] SEPA (2009) River Basin Management Plan [Online] Available at: http://www.sepa.org.uk/water/river_basin_planning.aspx (Accessed 11/04/2023).
[22] CIRIA (2015) Environmental Good Practice on Site [Online] Available at: https://www.ciria.org/Training/Training_courses/Environmental_good_practice_on_Site.aspx (Accessed 11/04/2023).
[23] CIRIA (2001), Control of Water Pollution from Construction Sites (C532) [Online] Available at: https://www.ciria.org/ProductExcerpts/C532.aspx (Accessed 11/04/2023).
[24] CIRIA (2015) The SuDS Manual (C753) [Online] Available at: https://www.ciria.org/ProductExcerpts/tbyb_c753.aspx (Accessed 11/04/2023).
[25] CIRIA (2006) C648: Control of water pollution from linear construction projects: Technical Guidance [Online] Available at: https://www.ciria.org/ProductExcerpts/C648.aspx (Accessed 11/04/2023).
[26] CIRIA (2017) Guidance on the Construction of SuDS (C768) [Online] Available at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductcode=C768&Category=BOOK (Accessed 11/04/2023).
[27] SEPA (2019) WAT-RM-08: Regulatory Method Sustainable Drainage Systems (SUDS or SUD Systems) v6.4 [Online] Available at: https://www.sepa.org.uk/media/219048/wat-rm-08-regulation-of-sustainable-urban-drainage-systems-suds.pdf (Accessed 11/04/2023).

- SEPA WAT-SG-75 Sector-specific Guidance – Construction Site[28] .
- Water Assessment and Drainage Guide (WADAG)[29].

11.3. Methodology

11.3.1. A desk-based assessment, consultation and site walkover have been conducted to inform the hydrology and hydrogeology assessment.

11.3.2. The desk-based assessment includes:

- Identification of watercourses, surface water catchments and springs.
- Identification of underlying hydrogeology and connectivity to the Proposed Development.
- Collation of data provided through consultation, including details on public and private water supply sources.
- Assessment of flood risk data and mapping.
- Assessment of the potential for the presence of Groundwater Dependent Terrestrial Ecosystems (GWDTEs).
- Assessment of topography and slope to inform drainage patterns.

11.3.3. The following sources of information were used to inform the desk-based assessment:

- The Ordnance Survey (OS) 1:50,000 (Digital).
- OS 1:25,000 Map (Digital).

[28] SEPA (2018) WAT-SG-75 Supporting Guidance Sector Specific Guidance: Construction Sites [Online] Available at: https://www.sepa.org.uk/media/340359/wat-sg-75.pdf (Accessed 11/04/2023).
[29] SEPA (n.d.) Water Assessment and Drainage Assessment Guide [Online] Available at: https://www.sepa.org.uk/media/163472/water_assessment_and_drainage_assessment_guide.pdf (Accessed 11/04/2023).

- National River Flow Archive (NRFA)[30].
- SEPA Flood Map 2019[31].
- Meteorological Office Rainfall Data[32].
- Scotland's Environment web-based maps[33].
- The British Geological Survey (BGS) GeoIndex onshore geology viewer[34].

11.3.4. The site walkover was undertaken on the 28th and 29th of June 2022 to visually inspect surface water features, obtain an understanding of the local topography and drainage patterns, and to ground-truth the information reviewed and collated in the desk-based assessment.

11.3.5. The hydrology and hydrogeology study area (the Core Study Area) is defined by the Site boundary. A study area of 2km from the Core Study Area has been defined to assess the potential effects on PWS (the PWS Study Area), and a wider study area of 10km from the Core Study Area to assess potential effects on the downstream water environment (the Wider Study Area). All study areas are shown in Figure 13.1.

11.3.6. At distances greater than 10km within upland catchments, it is considered the Proposed Development is unlikely to contribute to a hydrological effect, in terms of chemical or sedimentation effects, due to dilution and attenuation of potentially polluting chemicals.

[30] Centre for Ecology and Hydrology (undated) National River Flow Archive [Online] Available at: http://nrfa.ceh.ac.uk/ (Accessed 11/04/2023).
[31] SEPA (n.d.) Flood Maps [Online] Available at: http://map.sepa.org.uk/floodmap/map.htm (Accessed 11/04/2023).
[32] Met Office (2019) Climate Data [Online] Available at: http://www.metoffice.gov.uk/public/weather/climate (Accessed 11/04/2023).
[33] Scotland's Environment (n.d.) [Online] Available at: https://www.environment.gov.scot/ (Accessed 11/04/2023).
[34] BGS (2019) GeoIndex Onshore [Online] Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html (Accessed 11/04/2023).

11.4. Baseline Conditions

Topography and Land Use

11.4.1. The Proposed Development Site occupies a lowland location which consists of mature forestry plantation. The Site has a slight slope from west to east, the topographic high point being the Site entrance (100m above ordnance datum (AOD)) and the topographical low point being the eastern site boundary (80m AOD).

11.4.2. The Site is bound by existing mature forestry plantation and then Loch Toftingall to the east, felled forestry forming part of the existing Halsary Wind Farm to the south, greenfield land and then Mybster Substation to the west, and existing mature forestry plantation to the north. The Proposed Development will utilise the existing access track that serves Halsary Wind Farm.

11.4.3. A portion of the Proposed Development to the south of the Site is situated in a habitat management area which is in place as part of the Halsary Wind Farm restoration plan.

Climate

11.4.4. The National River Flow Archive (NRFA)[35] reports Average Annual Rainfall (AAR 1961 – 1990) at Wick River at Tarroul gauging station, approximately 6.4km northeast of the Core Study Area, as 934 millimetres (mm).

11.4.5. As monthly long-term climate data is not freely available from the NRFA, long term average rainfall data (1991 to 2020) obtained by the Meteorological Office at Wick John O Groats Airport, located 16.2km east of the Core Study Area, are presented in Table 13.1.

Table 13.1 Long term average rainfall data (1991 – 2020), Wick John o Groats Airport

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	72.4	62.6	56.7	47.5	49.9	55.3	61.6	69.6	66.2	92.9	87.6	70.4	792.7

[35] Centre for Ecology and Hydrology (undated) National River Flow Archive [Online] Available at: http://nrfa.ceh.ac.uk/ (Accessed 12/04/2023).

Surface Hydrology

11.4.6. Based on SEPA mapping[36], the Site is largely located within the Wick River Catchment; a small portion of the western aspect of the Site, at the junction of the A9 with the existing access track through Halsary Wind Farm, lies within the River Thurso Catchment.

11.4.7. Most of the Site falls within the sub-catchment of Allt Eireannaich. Allt Eireannaich is a tributary of the Loch of Toftingall, which is located approximately 500m to the east of the Site and falls within the sub-catchment of Loch Burn. The very south of the Site, adjacent to the existing access track falls within the sub-catchment of Hector's Burn; the western aspect of the Site is shown to be within the sub-catchment of Black Burn, a tributary of the River Thurso via Achlachan Burn.

11.4.8. Within the Site boundary, Allt Eireannaich flows east, past the Site boundary before discharging into the Loch of Toftingall. The Loch of Toftingall itself lies downslope of the Site boundary and drains south into Loch Burn which continues to flow southeast before discharging into Snottergill Burn approximately 2.3km to the southeast of the Site. Snottergill Burn continues to flow east becoming Burn of Acharole, Scouthal Burn and then ultimately the Wick River.

11.4.9. The Loch of Toftingall is classified under the Water Framework Directive (WFD) as "Moderate" (SEPA ID: 100027); Wick River is classified as "Moderate" (SEPA ID: 20037); and Achlachan Burn is classified as "Good" (SEPA ID: 20646).

11.4.10. As the Site comprises mature plantation forestry and the surrounding area contains felled forestry, there are many artificial drains across the Site which ultimately drain into the Loch of Toftingall, either directly or via Allt Eireannaich.

11.4.11. There is a small waterbody present to the south of the Site, located to the northwest of the junction of the existing access track through Halsary Wind Farm and the proposed access track for the BESS. This waterbody is isolated and is not hydrologically connected to Allt Eireannaich or the Loch of Toftingall.

11.4.12. The surface hydrology throughout the Proposed Development is shown in Figure 13.2.

[36] SEPA (2021) Water Environment Hub [Online] Available at https://informatics.sepa.org.uk/RBMP3/ (Accessed 12/04/2023).

Hydrogeology

11.4.13. The groundwater units underlying the Site are identified by SEPA's Scotland's Environment mapping service[37] as the Caithness groundwater body (SEPA ID: 150692). These units have an overall SEPA classification of "Good".

11.4.14. BGS 1:50,000 digital mapping and the BGS GeoIndex mapper[38] shows the bedrock aquifer underlying much of the Site to consist of Spital Flagstone Formation - Siltstone, Mudstone, and Sandstone. The very southwest of the Site is situated on bedrock geology indicated to comprise Lybster Flagstone Formation – Siltstone, Mudstone, and Sandstone. These bedrock units are separated by fault lines which are present from south-west to north-east and from north-east to south-west. These rocks are classified as a "moderately productive aquifer" where "flow is virtually all through fractures and other discontinuities".

11.4.15. The bedrock groundwater units are overlain by Peat superficial deposits across the vast majority of the Core Study Area. A small area to the south-east of the Site is shown to be overlain by Devensian Till. Areas surrounding the Loch of Toftingall are not mapped on BGS 1:50,000 digital mapping.

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

11.4.16. In accordance with SEPA guidance[39], a Phase 1 habitat survey was undertaken to identify wetland habitats occurring within the Site. Wetland habitats were identified in line with the criteria outlined in 'A Functional Wetland Typology for Scotland' (SNIFFER, 2009[40]). Where wetland habitats were identified, further detailed habitat assessment was undertaken, with identification of National Vegetation Classification (NVC) communities. The survey methods employed for this assessment are outlined in Chapter 7: Ecology.

[37] SEPA (2020) Water Environment Hub [Online] Available at https://informatics.sepa.org.uk/RBMP3/ (Accessed 12/04/2023).
[38] BGS (n.d.) GeoIndex Onshore Map [Online] Available at https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.108909826.161073475.1659437544-300955731.1659437544 (Accessed 12/04/2023).
[39] SEPA (2017) Land Use Planning System Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3 [Online] Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf (Accessed 14/04/2023).
[40] SNIFFER (2009) WFD95 A Functional Wetland Typology for Scotland Field Report 2009 [Online] Available at: https://www.sniffer.org.uk/wfd95-a-functional-wetland-typology-for-scotland (Accessed 14/04/2023).

11.4.17. The survey was carried out through use of a 100m buffer of the Site infrastructure to allow for the extension of potential, hydrological effects.

11.4.18. The NVC communities which are within 100m of the proposed infrastructure on-site have been outlined below in Table 13.2. Any NVC communities with the potential to be moderately or highly groundwater dependent GWDTE based on the SEPA guidance are highlighted in blue.

Table 13.2 – Potential GWDTE Communities

Recorded NVC Community	SEPA Groundwater Dependency Potential (LUPS-GU31)	Location within Site
M20 (Blanket Bog)	Low	Small section of Site to the north of the BESS compound; follows forest ride from west to east.
M25, M25/M23b (Wet Modified Bog)	M25 (Moderate) M23b (Low)	Southern half of the site, following the existing and proposed access tracks.
M6c (Bryophyte Dominated Spring)	High	Small, isolated area to the west of the BESS compound, upstream of the Proposed Development, and outside of the Site boundary.

11.4.19. As the Site comprises felled forestry, plantation forestry, and forest rides, the drainage regime on-site and across the local area is dependent on artificial drainage. Therefore, the GWDTE habitats identified in the NVC survey will be compromised and are ombrotrophic in nature, meaning they are rain-fed as opposed to being supported by groundwater.

River and Coastal Flood Risk

11.4.20. The Indicative River and Coastal Flood Map (Scotland)[41] produced by SEPA shows the areas of Scotland with high (10% AEP), medium (0.5% AEP) and low (0.1% AEP) chance of flooding from Rivers or the Sea.

11.4.21. The Site is not indicated to be at risk of flooding from Rivers or the Sea, with a less than 0.1% chance of flooding in any given year. Flood risk as a result of river

[41] SEPA (n.d.) SEPA Flood Maps [Online] Available at: https://map.sepa.org.uk/floodmap/map.htm (Accessed 11/04/2023).

flooding is restricted to the Loch of Toftingall and its tributary watercourse from the north, as well as Loch Burn which issues from the Loch of Toftingall.

Surface Water Flood Risk

11.4.22. The Indicative Surface Water Flood Map (Scotland)[42], produced by SEPA, shows the areas of Scotland with high (10% AEP), medium (0.5% AEP) and low (0.1% AEP) chance of flooding from surface water.

11.4.23. Most of the Site is indicated to remain free from surface water flooding. However, there are isolated areas at increased risk of surface water flooding indicated across the Site. The southern edge of the existing forestry plantation is indicated to have a medium to high likelihood of flooding from surface water, as is the western boundary of the Site adjacent to the proposed access track to the BESS compound. The areas of increased surface water flood risk are likely associated with local variations in ground levels and the artificial drains throughout the forestry plantation.

Public Water Supplies

11.4.24. Scottish Water (SW) confirms through scoping consultation that there are no SW assets (abstractions) that will be affected by this Development.

Private Water Supplies

11.4.25. The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017[43] define private water supplies as either:

- Type A - Supplies providing 10m^3 of water a day or serving 50 or more persons and supplies to commercial or public activities irrespective of their size.
- Type B - Supplies serving only domestic premises with less than 50 persons supplied.

11.4.26. Consultation with the Council EHO identified one Type B PWS within the 2km PWS Study Area, as shown in Figure 13.3. The PWS supplies a property upstream

[42] SEPA (n.d.) SEPA Flood Maps [Online] Available at: https://map.sepa.org.uk/floodmap/map.htm (Accessed 11/04/2023).
[43] Scottish Government (2017) The Water Intended for Human Consumption (Private Supplies) (Scotland) 2017 [Online] Available at: https://www.legislation.gov.uk/ssi/2017/282/note/made (Accessed 12/04/2023).

to the north-west of the Core Study Area. The details of this PWS can be seen in Table 13.3.

Table 13.3 Information regarding Private Water Supplies supplied by Council EHO

Private Water Supply	Grid Reference	Type	Reason	Source	No. of properties
PWS Lower Toftingall	317721 E, 954004 N	Type B	Domestic	Spring	1

11.4.27. This private water supply is located 1.83km to the north and upslope of the Proposed Development. As this property is served by a groundwater source, it is highly unlikely to be hydrologically connected to the Proposed Development.

Designated Hydrological Receptors

11.4.28. The statutory designated sites relating to water within the wider 10km Study Area, have been identified using NatureScot and SEPA GIS datasets. The statutory designations considered hydrologically connected to the Proposed Development are listed in Table 13.4.

Table 13.4 - Statutory Designated Sites hydrologically connected to the Proposed Development (within 10km Wider Study Area)

Designation	Distance from the Proposed Development	Qualifying Interest	Hydrologically Connected to the Proposed Development
Shielton Peatlands SSSI	0.77km south of Site Boundary	Blanket bog vegetation, hen harrier, merlin, peregrine, short-eared owl, greylag goose, dunlin, golden plover, greenshank, wigeon, red-throated diver and artic skua.	Downslope of Loch Burn and therefore hydrologically connected
Caithness and Sutherland Peatlands SAC, SPA, Ramsar	0.77km south of Site Boundary	Blanket bog, depressions on peat substrates, otter, acid peat-stained lakes and ponds, wet heathland and cross-leaved heath, clear-water lakes and lochs with aquatic vegetation and poor to moderate nutrient levels, marsh saxifrage, very wet mires often identified by an	Downslope of Loch Burn and therefore hydrologically connected

Designation	Distance from the Proposed Development	Qualifying Interest	Hydrologically Connected to the Proposed Development
		unstable 'quaking' surface	
Wick River Marshes SSSI	9.68km east of Site boundary	Flood-plain fen	Situated on Wick River, downstream of the Site and therefore hydrologically connected

11.5. Potential Environmental Effects

Potential Construction Effects

11.5.1. Designated receptors downstream of the Proposed Development, Shielton Peatlands SSSI, Caithness and Sutherland Peatlands SAC, SPA, Ramsar, and Wick River Marshes SSSI are hydrologically connected and could be at risk from a pollution incident during construction.

11.5.2. Potential effects associated with the construction of the Proposed Development are:

- A spillage or leakage of chemicals, fresh concrete, foul water, fuel, or oil during use or storage on-site.
- Erosion and sedimentation from excavations, stone winning, ground disturbance or overburden stockpiling may cause sediment to enter watercourses, affecting water quality, ecology, and flood storage capacity.
- An increase in surface water runoff from the felling of trees.
- Brash build up within watercourses may impede the passage of waterborne ecology and divert/concentrate flow to riverbanks. If stored close to watercourses, nitrate leaching from stockpiled brash could result in acidification of watercourses.
- An increase in surface water runoff from the introduction of impermeable surfaces.

Potential Operational Effects

11.5.3. Potential effects associated with the operation of the Proposed Development are:

- Continued erosion and sedimentation caused by runoff from areas of hardstanding.

- Alterations to natural flow pathways by runoff from areas of hardstanding.
- Risk of chemical pollution as a result of battery fires from the BESS compound, or minor spills from maintenance vehicles.
- Risk of battery fires which could result in an environmental incident, should water that has been contaminated by cooling the batteries not being contained.

11.6. Design and Mitigation

11.6.1. The Proposed Development is not anticipated to have significant impacts on groundwater flows. There are also no watercourse crossings required as part of the Proposed Development.

11.6.2. Good practice methods and works for protection of hydrological receptors are outlined in the Outline Water Construction Environmental Management Plan (OWCEMP) (Appendix 11.1). Although the OWCEMP is draft and will evolve to take account of consultee feedback and detailed design, there is sufficient confidence in the effectiveness of the measures set out in the OWCEMP for them to be treated as part of the Proposed Development for the purposes of this assessment. Measures and procedures outlined in the OWCEMP will be adopted and incorporated into a single working document to be agreed with statutory consultees and the planning authority following consent by way of an appropriately worded planning condition.

11.6.3. A summary of the key mitigation measures relating to the hydrological environment which are embedded into the design and construction of the Proposed Development, and also detailed within the OWCEMP, are summarised below:

- SEPA authorisation will be obtained for any work within or hydrologically connected to the water environment.
- An Environmental Clerk of Works (EcoW) will be appointed for the construction period to monitor and advise on water pollution, condition of watercourses, and compliance with the mitigation measures outlined in this report, the WCMEP, and other relevant documentation.
- 50m watercourse buffers will be in place for construction works and Proposed Development infrastructure (see Figure 13.4).
- A surface water monitoring programme should be established prior to the construction phase, as per the indicative monitoring programme set out in the OWCEMP (Appendix 11.1).
- Pre-earthworks drainage should be implemented immediately prior to earthworks and construction works commencing, to divert clean surface water

runoff away from exposed soils and prevent it mixing with potentially silt-laden water generated from construction.

- Any areas of large earthwork excavations should have temporary sub-surface water controls, such as physical cut-offs or de-watering, to divert flows away from the excavation, and temporarily lower the local water table and sub-surface water levels.

- Sustainable Drainage Systems (SuDS) will be implemented to provide the required storage of surface water, alongside the treatment of water quality, before allowing a positive discharge into Allt Eireannaich at an allowable rate. This strategy is summarised in the Outline Feasibility Surface Water Drainage Strategy provided in Appendix 11.2.

- Suitable mitigation measures should be put in place to control potential fire water runoff.

- The felling works are not located within 50m of any watercourse. However, forestry good practice measures are set out in the Appendix 11.1 and will be implemented under the supervision of an Ecological Clerk of Works (EcoW). No brash or timber should be stacked or stockpiled within 50m of a watercourse, brash mats should be used for vehicle trafficking, and silt mitigation measures should be installed.

- Chemical pollution prevention should be employed on the Site in line with best practice guidance. An appropriately sized spill kit(s) will be provided, maintained, and located at strategic points across the Site.

11.7. Residual Effects

11.7.1. Following the implementation of the proposed mitigation measures, no residual effects are predicted for all phases of the Proposed Development. Given the levels of certainty in the success of application of the mitigation measures and their effectiveness, the embedded mitigation measures are determined to be effective for the receptors within this application.

11.8. Concluding Statement

11.8.1. This Chapter of the ER has assessed the potential effects relating to the Proposed Development on hydrology and hydrogeology. With the adoption of embedded mitigation, best practice methods in construction, and implementation of mitigation measures outlined in Section 11.6 – Design and Mitigation and Appendix 11.1: OWCEMP, the Proposed Development will not have a negative effect on the local or downstream hydrology or hydrogeology.

12 Noise

12 NOISE AND VIBRATION

12.1 Introduction

12.1.1 Environmental Resources Management Ltd (ERM) has been commissioned by Boralex ('the Applicant') to undertake a noise assessment in relation to the development of a battery storage energy storage system ('the Proposed Development') to support the electricity network.

12.1.2 The Proposed Development site is located near Loch Toftingall, southeast of Mybster, a small village in Caithness, in the Scottish Highlands ('the Site').

12.1.3 The aim of this assessment is to determine the existing acoustic climate, predict the sound levels due to the operation of the Proposed Development, and to assess these levels against relevant guidance. Where appropriate, mitigation measures have been recommended to ensure that the amenity of residents in the locality of the Proposed Development is not unreasonably impacted by the Proposed Development.

12.1.4 This Chapter of the ER Report is supported by Figure 12.1: BESS Noise Map.

12.2 The Proposed Development

12.2.1 The local area is rural in nature and sparsely populated although there are a small number of residential properties nearby. The Site is situated within the plantation associated with Loch of Toftingall at national grid reference (XY) 317625, 951903 m.

12.2.2 The Proposed Development is intended to provide services supporting the flexible operation of the electricity network and decarbonisation of electricity supply e.g., by storing excess electricity. The proposed batteries will store surplus electricity to be fed into the grid when required, thus improving stability and reducing the risk of power failures. The Proposed Development will have a maximum input and output capacity of 49.9 megawatts (MW).

12.2.3 The main items of noise generating plant associated with the Proposed Development are transformers, battery container inverters and cooling plant.

12.2.4 Further details on the noise emitting plant is provided in Table 12.5 of this report. A figure detailing the Proposed Development layout is presented in Figure 4.2

12.3 Legislation, Policy and Guidance

12.3.1 The assessment takes into account the following legislation and policy:

Legislation

12.3.2 The following legislation documents are of particular relevance to the assessment:

- The Control of Pollution Act 1974 (CoPA 1974)[1];
- The Environmental Protection Act 1990 (EPA 1990)[2].

The Control of Pollution Act 1974

12.3.3 CoPA 1974 provides Local Authorities with powers to control noise and vibration from construction sites.

12.3.4 Section 60 of the CoPA 1974 enables a Local Authority to serve a notice to persons carrying out construction work of its requirements for the control of site noise. This may specify plant or machinery that is or is not to be used; the hours during which construction work may be carried out; the level of noise or vibration that may be emitted; and provide for changes in circumstances.

The Environmental Protection Act 1990

12.3.5 The EPA 1990 specifies mandatory powers available to Local Authorities in respect of any noise that either constitutes or is likely to cause a statutory nuisance, which is also defined in CoPA 1974. A duty is imposed on Local Authorities to carry out inspections to identify statutory nuisances, and to serve abatement notices against these. Procedures are also specified with regards to complaints from persons affected by a statutory nuisance.

Policy and Guidance

12.3.6 The following key policy and guidance has been considered in carrying out this assessment:

- The Scottish National Planning Policy Framework (NPF4)[3];

1 UK Government (1974). The Control of Pollution Act 1974. Available at: http://www.legislation.gov.uk/ukpga/1974/40 (Accessed 18/07/2023)
2 UK Government (1990). The Environmental Protection Act 1990. Available at: http://www.legislation.gov.uk/ukpga/1990/43/contents (Accessed 18/07/2023)
3 Scottish Government (2023) *National Planning Framework 4* [Online] Available at: https://www.gov.scot/publications/national-planning-framework-4/pages/1/ (Accessed 23/03/2023)

- Planning Advice Note 1/2011 (PAN 1/2011): Planning and Noise[4];
- The Highland-wide Local Development Plan (2012)[5];
- BS 5228:2009+A1:2014[6] '*Code of Practice for noise and vibration control on construction and open sites*'; and
- BS 4142: 2014+A1: 2019[7] 'Methods for rating and assessing industrial and commercial sound'

The National Planning Policy Framework (NPF4)

12.3.7 Scotland 2045 – Our Fourth National Planning Framework was formally adopted on the 13th of February 2023. The policy aims to manage land-use and development in the long-term public interest. With regards to noise, the document states in Policy 11-e :

'In addition, project design and mitigation will demonstrate how the following impacts are addressed: i). *i*mpacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker'*;*

12.3.8 NPF4 further emphasises the need for a noise impact assessment for development likely to result in significant effects, in Policy 23-e :

*'*Development proposals that are likely to raise unacceptable noise issues will not be supported. The agent of change principle applies to noise sensitive development. A Noise Impact Assessment may be required where the nature of the proposal or its location suggests that significant effects are likely*'.*

Planning Advice Note PAN1/2011

12.3.9 PAN 1/2011 promotes the principles of good acoustic design and the appropriate location of new potentially noisy development. PAN1/2011 also note that construction noise control can be achieved through planning conditions that limit

4 The Scottish Government (2011) Planning Advice Note PAN 1/2011 Planning and Noise and accompanying Technical Advice Note, 2011
5 The Highland-wide Local Development Plan – 2012. Available at Highland-wide Local Development Plan | Highland-wide Local Development Plan | The Highland Council (Accessed 25/07/2023)
6 BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration
7 BS4142: 2014+A1: 2019 'Methods for rating and assessing industrial and commercial sound'

noise from temporary construction sites, or by means of the Control of Pollution Act (CoPA) 1974.

12.3.10 The associated Technical Advice Note accompanying PAN1/2011 offers advice on the assessment of noise impact and includes details of the legislation, technical standards and codes of practice appropriate to specific noise issues. Appendix 1 of the Technical Advice Note: 'Assessment of Noise' describes the use of BS4142:2014 for the assessment of industrial developments.

Highland-Wide Local Development Plan 2012

12.3.11 This document, developed by The Highland Council the Highland-Wide Local Authority, outlines the planning policy for development at the site. In relation to noise, the local development document provides the following policies pertaining to noise:

'*Policy 72 Pollution: Proposals that may result in significant pollution such as noise (including aircraft noise), air, water and light will only be approved where a detailed assessment report on the levels, character and transmission and receiving environment of the potential pollution is provided by the applicant to show how the pollution can be appropriately avoided and if necessary mitigated.*

12.3.12 Where the Council applies conditions to any permission to deal with pollution matters these may include subsequent independent monitoring of pollution levels. Major developments and developments that are subject of Environmental Impact Assessment will be expected to follow a robust project environmental management process, following the approach set out in the Council's Guidance Note "Construction Environmental Management Process for Large Scale Projects" or a similar approach'.

BS 5228:2009+A1:2014

12.3.13 Guidance relevant to the effects of noise and vibration during construction and decommissioning is provided by BS 5228[8]. This standard:

- Is published in two parts: Part 1 - Noise and Part 2 - Vibration. The discussion below relates mainly to Part 1, however, the recommendations of Part 2 in terms of vibration are broadly very similar;

8 BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration

- Refers to the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on construction and open sites;
- Recommends procedures for noise and vibration control in respect of construction operations;
- Stresses the importance of community relations, and states that early establishment and maintenance of these relations throughout site operations will go some way towards allaying people's concerns;
- Provides recommendations regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the operation;
- Describes methods of controlling noise at source and its spread; and
- Includes a discussion of noise control targets, and example criteria for the assessment of the significance of noise effects.

BS 4142:2014+A1:2019

12.3.14 BS 4142:2014+A1:2019 ('BS 4142') describes methods for rating and assessing sound in order to provide an indication of its likely impact upon nearby premises (typically residential dwellings).

12.3.15 The specific sound emitted from the development (dB, L_{Aeq}) is rated by taking into account both the level and character (i.e., tonal elements, impulsivity, intermittency and distinctiveness) of the sound. This is achieved by applying appropriate corrections to the specific sound level externally at the receptor location, which gives the rating level of the sound in question. This is then assessed against the existing prevailing background sound level (dB, L_{A90}) at that location in order to determine a likely level of impact.

12.3.16 The level by which the rating level exceeds the prevailing background sound level indicates the following potential impacts:

- A difference of 10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around 5 dB or more is likely to be an indication of an adverse impact, depending on the context; and
- Where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

12.3.17 BS 4142 states that where the background levels at the receptor is very low, absolute levels or alternative criteria may be more appropriate. It states:

'Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night'.

12.4 Consultation and Assessment Criteria

12.4.1 Consultation was undertaken with the Environmental Health Department of the Highland Council (THC) to agree the scope, methodology, and assessment criteria for the development. The following methodology was proposed on 13th July 2023 via email:

- Due to a number of operational windfarms in the area, a background survey in absence of windfarm noise is not possible. As such, use of absolute criterion/limit from past assessments in the area is to be used;
- Assessment will be undertaken in accordance with BS 4142 :2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (BS 4142);
- Daytime criteria of 35 dB(A) which is consistent with the cumulative lower limit applied to all nearby wind farm developments in accordance with ETSU-R-97, will be adopted; and
- NR25 Noise rating curve limit for internal noise within dwellings for night-time periods, accounting for open window attenuation, will be adopted.

12.4.2 A response from Zoe Skinner, Environmental Health Officer at The Highland Council was received on 1st August 2023, stating the following:

'I would advise that our Service requests that noise assessments for a Battery Storage Facility include the following information:

- *A description of the proposed development in terms of noise sources;*
- *A plan showing the location of noise sources, noise sensitive premises and survey measurement locations;*
- *A survey of the background ($L_{A90,T}$) ambient noise ($L_{Aeq,T}$), and 1/3rd octave band spectrum levels to determine the existing noise level in the area and at any nearby properties likely to be affected by the noise. Siting of monitoring equipment should ensure results are representative of the amenity for that location. To ensure that values are reliable and suitably represent the periods of interest a 1 week's continuous background monitoring should be conducted at agreed locations. This should comprise of continuous measurements of normally not less than 15 min intervals which can be continuous or disaggregated. Unless otherwise agreed by the Environmental Health Service;*

- *A prediction of noise levels at neighbouring noise sensitive premises;*
- *Predicted noise levels should include any relevant penalties for sound characteristics;*
- *The prediction of the accumulative noise level from the proposed development at neighbouring noise sensitive properties; and*
- *A description of any noise mitigation methods that will be employed. The effect of mitigation methods on the predicted levels should be reported where appropriate.*

The following criteria should be used when determining what, if any, noise mitigation measures would be required to protect noise sensitive premises: -

- *Noise arising from the development when measured and/or calculated as an Leq, 5min, in the 100Hz one third octave frequency band must not exceed 30 dB, at noise sensitive premises; and*
- *The Rating Level of noise arising from the use of plant, machinery, or equipment as a result of this development must not exceed the current background noise levels at noise sensitive premises. The Rating Level should be calculated in accordance with BS 4142: 2014+A1:2019: Methods for rating and assessing industrial and commercial sound*

Therefore, our Service would not be able to accept the criteria recommended in your email dated 13th July 2023. I would confirm that the assessment must be undertaken in accordance with BS 4142: 2014+A1:2019 and demonstrate that the Rating level does not exceed the background level.

I understand, however, that it is not possible to conduct a background survey as there are several windfarms operating in the area. Therefore, the BS4142: 2014+A1:2019 assessment must include justification for the choice of background noise level and the reason why the night-time background survey, referred to in my initial email[9], is not considered an appropriate background noise level for the site.'

12.4.3 It should be noted that the EHO's intial email proposed the use of 25 dB(A) background level criteria to be met externally during night-time; this does not reflect the principle of night-time assessments which assess disturbance of sleep or

[9] email received on 15 May 2023 from Zoe Skinner indicating the use of night-time background level of 25 dB(A) with criteria of 'rating level must not exceed the background level'

amenity within dwellings, therefore, night-time assessment of internal noise levels is considered more appropriate and has been undertaken.

12.4.4 Furthermore, the Proposed Development is not close to any designations or ecologically sensitive receptors that would increase the sensitivity of the Site (see Chapter 7), also, background levels adopted in this assessment are dated before the surrounding windfarms and substation operation, as such, a more relaxed criteria of 'less than adverse impact' in terms of BS 4142 is considered more appropriate for this assessment in order to avoid overly strict limits placed on the Development.

12.4.5 In consideration of the EHO response above, this assessment has be undertaken as follows:

- Use of background levels from other developments (listed in Table 12.1) in the proximity of the Proposed Development;
- Predicted noise levels from the Proposed Development at the nearest sensitive receptors;
- Assessment to BS 4142 criteria of 'rating level no more than background levels' if possible, or of 'less than adverse Impact' in terms of BS 4142 when considering the context of site;
- Qualitative assessment of noise effects on amenity and likelihood of nuisance (internal levels) to residents at the nearest receptors; and
- Any cumulative effects from the operation of the Development in combination with other developments in the area.

12.5 Scope of Assessment

Construction and Decommissioning

12.5.1 The assessment of noise from the construction phase is typically limited to Noise-Sensitive Receptors (NSRs) within 500 m of the construction works, as beyond this distance there is no reasonable prospect of a significant effect (any dwelling/property where noise may impact the quality of life or cause a nuisance is consdired as NSR). All infrastructure elements of the BESS and substation are located at a distance greater than 500 m from the surrounding NSRs (710 m closest NSR), as such, significant effects are unlikely from these construction works, therefore, as stated in PAN1/2011, control through council planning conditions and best practises as outlined in BS 5228-1 will be adopted. Figure 4.1 presents the BESS Layout, including ancillary infrastructure, as well as the road access point to the Proposed Development.

12.5.2 Construction noise will be limited in duration to working hours prescribed in the planning conditions, and no construction work will be expected on Sundays or

Bank Holidays. In addition, road construction works are temporary in duration and location and as such more readily accepted by residences, (i.e., BS 5228 states work duration of less than one month at a location is considered temporary and not typically subject to nuisance thresholds) noise levels from typical road works machinery are unlikely to exceed the lowest daytime noise threshold[10] at more than 500 m. On this basis, no further assessment of construction noise is considered necessary.

12.5.3 Any works out-with these hours will need to be approved in writing by the Council. Construction noise will be managed via a site-specific Noise Management Plan (NMP) provided to the Council. The embedded mitigation contained in the NMP will include the commitment to liaise directly with local residents, and the wider community via a Community Liaison Group.

12.5.4 With regards to Decommissioning; as stated in Paragraph 4.1.8 of Chapter 4: Project Description, the Proposed Development will be permanent; therefore, decommissioning will not be assessed as part of this ER Chapter.'

BESS and Substation Operational Noise

12.5.5 Operational noise is produced primarily by electrical equipment such as transformers, inverters, and heating, ventilation, and air conditioning (HVAC) units, located on site. Noise levels from these sources are generally low. For BESS developments, the key noise source is from operation of cooling fans which are generally located on, or near, the containerised battery units. Newer technology consisting of liquid-cooled battery units is also emerging and available, noise from these units is dominantly from cooling fans and the refrigerant pumps.

12.5.6 In order to determine the potential for a significant effect, modelling has been undertaken in line with ISO 9613. The exact layout of the BESS and substation is not finalised at this stage, as such, an indicative layout with expected number of battery units, inverters, and transformers, have been used to determine overall noise levels from the BESS compound, which has been used to determine noise levels at the nearest receptors.

Cumulative Noise Assessment

12.5.7 A cumulative noise assessment has been undertaken to ensure that combined noise from developments in the area (including the Proposed Development) does

[10] Lowest daytime threshold of 65 dB(A) in the 'ABC method' as outlined in BS5228-1: Noise

not adversely affect the amenity of the NSR or significantly change the acoustic environment of the local environment.

12.5.8 Specific criteria for cumulative noise are not outlined in BS 4142 or other relative standards and has not been set by the council, as such, the cumulative assessment is based on the change of environmental sound levels and a qualitative evaluation of its effect on human receptors.

12.5.9 Five cumulative developments have been identified, presented in Table 12.1.

Table 12.1 : Cumulative Developments

Development	Planning Reference	Status	Distance to Development
Mybster Substation	13/00595/FUL	Operational	~460 m east
Causeymie wind farm	01/00361/FULCA	Operational	~1,500m southwest to the nearest turbine
Halsary wind farm	09/00399/FULCA	Operational	~700m south to nearest turbine
Achlachan 1 and 2 wind farms	13/01190/FUL	Operational	~2,000m east to the nearest turbine
Bad A Cheo	12/02868/FUL	Operational	~2,200m south-southwest to the nearest turbine

12.5.10 As can be seen in Table 12.1, there are four wind farm development and a substation within the area, all the wind farms are operational and have been assessed to ETSU-R-97.

Vibration

12.5.11 All plant (e.g., battery units, inverters, and transformer) and site infrastructure of the BESS and Substation compound will be situated on hardstanding ground, at a distance of 710 m to the closest NSR. At this distance, the effects of vibration from the operation of the Proposed Development will be negligible and therefore, assessment of operational vibration is scoped out of this assessment.

Elements Scoped-out

12.5.12 The following elements have been scoped out of the assessment for reasons described in previous sections of this Chapter:

- Construction and decommissioning noise; and
- Vibration.

12.6 Baseline Conditions

Assessment Locations

12.6.1 Table 12.2 shows the closest surrounding NSRs and their distance/direction relative to the Proposed Development.

Table 12.2: Assessed Receptors

Receptor	Northing (X)	Easting (Y)	Distance (m)	Direction (approx.)
Croft of Bowerman	316934	952209	710	West
Wingfield Farm	316867	652353	840	West
Mybster Inn	316928	952537	925	Northwest
Knockgalss Farm Cottage	317486	953228	1,250	North
Backlass	320357	953610	3,150	Northeast
Shielton	320610	350960	3,100	Southeast

12.6.2 The assessed receptors are based on the closest sensitive receptor surrounding the Proposed Development, (annotated in Figure 12.1), it is understood that where noise levels at these closest receptors are acceptable then levels at receptors located further away will also be acceptable and lower.

Background Levels

12.6.3 As detailed in Section 12.4, background survey was not possible due to the operational windfarm developments in the area, as such, background levels from past noise surveys of the other developments in the area have been compiled and used in this assessment.

12.6.4 Table 12.3 below presents the background level for respective development at wind speeds less than 5 m/s. The levels have either been derived from the best-fit background level curve equations or from levels presented in the respective ES/EIA reports. Different lables have been used for receptors in various reports, the reference receptors labels are provided in brackets for traceabilty.

Table 12.3: Derived/Measured Background Levels from other Developments

Development	Background Level, L_{A90}, dB(A) at windspeeds in m/s									
	Day (amenity hours)					Night				
	1	2	3	4	5	1	2	3	4	5
Mybster Substation Extension EIA[11]										
Croft of Bowerman (1 New White House)	-					25				
Causeymire WF ES[12]										
Mybster Inn (Mybster Inn Croft)	-	24	24	26	29	-	24	25	27	29
Halsary WF ES[13]										
Mybster Inn (Mybster Inn Croft)	24	26	29	32	35	22	22	23	25	27
Knockgalss Farm Cottage	23	24	25	28	30	21	21	22	23	25
Backlass	23	23	24	26	29	21	21	22	23	24
Shielton	27	26	28	30	34	24	24	26	27	30
Aclachan 1 & 2 WF FEI[14]										
Mybster Inn	-	-	24	26	28	-	-	25	27	29
Croft of Bowerman (Croft of Mybster)	-	-	24	27	28	-	-	26	27	29
Wingfield Farm	-	-	24	26	28	-	-	25	27	29
Bad-A-Cheo WF ES[15]										
Croft of Bowerman (Mybster)	24	26	28	31	34	23	25	27	29	31

[11] Mybster 132/33 kv Substatoin Extension EIA – Chapter 13: Noise – Table 13.3 – Survey in Nov 2012
[12] Causeymire Life Extension Noise Assessment Table 4 – Survey in 2001
[13] Halsary Windfarm Environmental Statement Addendum A11: Noise Background Curve Equations – Survey in Dec 2012
[14] Achlachan Windfarm: Further Environmental Information: Noise - Appendix B: Cumulative Figures - 2013
[15] Bad-A-Cheo Windfarm Noise Assessment Report Table 5.1 – Levels derived from background levels polynomial equations – Survey in July 2012

12.6.5 Background levels from wind speeds 1 to 5 m/s have been averaged to determine represenatative background levels at the respective NSR. Table 12.4 below presents the respresentative day and night-time background levels. Receptors with multiple measured or derived levels have been averaged to provide a representative.

Table 12.4: Representative Background Levels

NSR	Representative Background Level, $L_{A90,T}$, dB	
	Day (0700-2300)	Night (2300-0700)
Croft of Bowerman[16]	29	28
Wingfield Farm	26	27
Mybster Inn	27	25
Knockgalss Farm Cottage	26	22
Backlass	25	22
Shielton	29	26

12.6.6 As seen in Table 12.4 above, background levels at all the receptors are below 30 dB and considered 'very low' in terms of BS 4142.

12.6.7 It shoud also be noted that these levels are from surveys dating back to 2012/2013, before the operation of the nearby windfarm developments. Taking into account the ETSU-R-97 lower fixed limit of 35 dB(A) consented for all the nearby windfarm

[16] Averaged background values at Croft of Bowerman include noise levels from Mybster Substation as the substation has been in operation for more than 20 years and is considered part of the local acoustic context – Table 13.4 of ES (13/00595/FUL)

developments, the present background environment will be significantly higher than those presented in Table 12.4.

12.7 Noise Modelling

Design Parameters

12.7.1 The Proposed Development comprises the following plant that have the potential to generate noise:

- 52 x battery storage containers, each with internal liquid cooling system;
- 13 x inverters/transformers;
- 1 x auxiliary transformer; and
- 2 x substation buildings with associated control/switch rooms.

12.7.2 The final plant selection has not been made at the time, so candidate plant currently in consideration have been used for the purpose of this assessment. Final plant chosen for installation will have the same or lower sound emission levels as shown in Table 12.5.

12.7.3 The substation buildings house switches and controls associated with connection to the substation, noise emission from within the substation buildings are considered negligible and not modelled in this assessment.

12.7.4 The sound-emitting plant included in the noise model is presented in Table 12.5.

Table 12.5 : Average Sound Power Levels of Noise Emitting Plant

Plant	Average Sound Power Level, dB L_{WA}	Octave Band Centre Frequency, Hz, dBA							
		63	125	250	500	1k	2k	4k	8k
Battery Units	87	70	80	74	79	81	80	78	71
Inverters	82	76	72	70	78	74	72	68	62
Transformer	78	57	63	70	73	73	68	62	56

Modelling Parameters

12.7.5 The specific sound level[17] at the nearest noise-sensitive receptors has been calculated in SoundPlan 8.2, using the environmental noise propagation model ISO 9613-2:1996 – Acoustics; 'Attenuation of sound during propagation outdoors – Part 2: General method of calculation'[18].

12.7.6 The ISO 9613-2 method predicts the level of sound at a receptor by taking the octave-band sound power level spectrum of the source and applying a number of attenuation factors that determine the resulting noise level at a receptor location.

12.7.7 The following parameters were used in the prediction model:

- Local terrain included;
- Atmospheric conditions of 10°C and 70% relative humidity;
- A ground factor of G=0.1 (soft ground) for green lands and G=0.5 (mixed ground) for Site area;
- Foliage volume attenuation up to 12 m height for forestry areas;
- Battery and Inverter units as noise radiating machines (Table 12.5 presents the averaged sound power levels and spectrum, this was adjusted for each facade of the unit to respective sound pressure level reported in manufacturer's data sheets);
- A 4 m high acoustic fence, with 1 m cantilever on top at 45° inwards around north, west, and south boundaries of the BESS compound; and
- A receiver height of 1.5 m, approximate head-height at the closest external façade of each assessed receptor.

12.7.8 It should be noted that as a worst-case, noise modelling has been undertaken assuming all plant is operating simultaneously, at full power, during both daytime

[17] The sound level produced by a source, without corrections for acoustic features as discussed in Section 7.2.
18 ISO 9613-2:1996 Acoustics; Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

and night-time periods. It is anticipated that this is very unlikely to occur in practice, and as such the assessment is considered to be worst-case.

Rating Level Corrections

12.7.9 BS 4142 states that corrections should be applied to account for certain acoustic features which have the potential to increase the level of noise impact at nearby dwellings.

12.7.10 The acoustic features to be considered in the application of rating corrections are as follows:

- Impulsivity: No impulsive characterises are anticipated from the Proposed Development;
- Tonal Elements: The sound emitted by the Proposed Development is likely to be characterised by the cooling systems of the battery and inverter units. These are broadband in character, and non-tonal;
- Intermittency: The Applicant has advised that the plant will operate 24/7, cooling systems will be temperature controlled and will therefore not have "identifiable on / off conditions" in terms of BS 4142; no correction for intermittency is therefore required.
- Distinctiveness: There are a number of wind farm developments as well as the Mybster Substation and extension in the area, and the primary source of noise (i.e., cooling systems) are broadband in characteristics, as such, the Proposed Development sound will not be readily distinguishable over the current acoustic character of the area and will, therefore, unlikely to be distinctive at the NSRs.

12.7.11 Based on the above, no correction for acoustic features has been applied; the rating level at the receptor location is therefore same as the specific level.

12.7.12 Predicted noise levels are shown on the noise map provided in Figure 12.1.

12.8 Assessment of Potential Effects

Assessment to BS 4142

12.8.1 An assessment of the likely impact has been made based upon the difference between the predicted Rating level and background levels for daytime and night-time periods. As stated in Paragraph 12.3.17, where background levels are very low BS 4142 advises consideration of absolute levels rather than margin of rating levels, especially at night. Therefore, a qualitative assessment of the absolute

levels at night-time is undertaken, for completeness night-time differences to background levels are shown in Table 12.6.

12.8.2 It should be noted that the modelling assumes all plant operating simultaneously and at maximum power as a worst-case. As such, noise levels in practice are likely to be substantially lower than those presented below.

Table 12.6 : BS 4142 Assessment of Effects – Daytime Only

Receptor Location	Rating Level, dB(A)	Background Sound Level, dB, L_{A90}		Difference, dB	
		Day	Night	Day	Night
Croft of Bowerman	32	29	28	3	4
Mybster Inn	30	26	27	4	3
Knockgalss Farm Cottage	28	26	22	2	6
Wingfield Farm	27	27	25	0	2
Backlass	22	25	22	-3	0
Shielton	20	29	26	-9	-6

12.8.3 Table 12.6 shows that rating levels are less than 5 dB above the daytime background noise level at all locations. As such, in terms of BS 4142 impact category, the noise effects during daytime periods are considered less than adverse impact.

Assessment of Predicted Noise at 100 Hz

12.8.4 The EHO requested an assessment of predicted Development noise levels at 100 Hz in third octave spectrum against the limit of 30 dB (A) at all NSR. Third octaves were not available for the modelled plant as such 1/3 octave frequency results could not be obtained. Table 12.7 below presents the 1/1 Octave spectrum of Predicted levels at all NSR (a '-' indicates negligible level i.e., below 0 dB).

Table 12.7: Assessment of Predicted Noise - Octave Spectrum

NSR	Predicted Octave Band Centre Frequency, Hz, dBA							
	63	125	250	500	1k	2k	4k	8k
Croft of Bowerman	26	26	18	21	22	16	-	-
Mybster Inn	24	24	15	18	19	12	-	-
Knockgalss Farm Cottage	22	21	14	18	18	10	-	-
Wingfield Farm	22	21	14	13	11	1	-	-
Backlass	17	15	6	9	8	-	-	-
Shielton	15	14	5	8	7	-	-	-

12.8.5 As can be seen in Table 12.7, the 1/1 octave band levels at any frequency do not exceed 30 dB(A) and therfore, by extension, also do not exceed 30 dB(A) at any 1/3 Octave band including 100 Hz.

12.8.6 The Proposed Development, therefore, meets this criteria at all receptors.

Qualitative Assessment

12.8.7 Due to the restrictions in undertaking a background survey and the low derived background levels pre-dating (by 10 years or more) the four windfarm developments which are curently operational, as well as the substation extension in 2012, the background levels used in the assessment are overly conservative and significantly lower than levels likely represntative of the current acoustic environment.

12.8.8 Therefore, a qualitative assessment based on the absolute predicted levels, as advised by BS 4142, has been undertaken. The assessment consits of evaluating the likelyhood of noise nuisance and disturbance from the operation of the Proposed Development by assessing absolute noise level within dwellings.

Assessment of Internal Noise levels

12.8.9 Noise levels at the nearest facade of each NSR has been assessed. The assessment accounts for an open window attenuation of 15 dB D_n, this value and the associated attenuation spectrum are taken from research results undertaken by Napier University[19] and supporting research findings in the Environmental Research and Public Health journal[20]. The research shows that typical attenuation of slightly open or tilted windows ranges from 14 to 19 dB on average across frequencies, a 15 dB attenuation has therefore been taken to determine internal levels.

12.8.10 An open window attenuation of 15 dB D_n is subtracted from the facade level resulting in the calculated internal levels within dwelings, shown in Table 12.8 below.

[19] NANR116: Open/Closed Window Research – Sound Insulation Through Ventilated Domestic Windows: Napier University 2007
[20] Barbara et al. Difference between Outdoor and Indoor Sound Levels for Open, Tilted, and Closed windows: International Journal of Environmental Research and Public Health.

Table 12.8: Assessment of Internal Noise Levels at NSR

NSR	Noise Level at Façade, $L_{Aeq,T}$, dB(A)	Internal Noise Levels, $L_{Aeq,T}$, dB(A)	Qualitative Evaluation
Croft of Bowerman	32	17	Internal noise levels at all NSR are below 20 dB(A). Broadband sound at this level is inaudible to most receptors and indistinct from the ambient acoustic environment. Effects at these levels are negligible and will not impact the quality of life, or cause sleep disturbance at night within dwellings.
Mybster Inn	30	15	
Knockgalss Farm Cottage	28	13	
Wingfield Farm	27	12	
Backlass	22	7	
Shielton	20	5	

12.8.11 As seen in Table 12.8, internal levels during day and night-time are below 20 dB(A), sound at this level will not cause sleep disturbance at night or affect the quality of life within the dwellings.

12.8.12 Therefore, considering internal noise and relevant effects in practise, the Proposed Development is considered acceptable in terms of noise.

12.9 Assessment of Cumulative Effects

Cumulative Noise Levels

12.9.1 Cumulative developments close to the Proposed Development are presented in Table 12.1. As stated in Paragraph 12.5.8, no specific criteria for cumulative assessments are provided in BS 4142 applicable to the Proposed Development, as such, an assessment has been undertaken based on the Proposed Development's contribution to the overall cumulative noise and a change in ambient noise levels.

12.9.2 Table 12.9 presents the noise levels from cumulative developments (listed inn Table 12.1). As a conservative approach, the assessment assumes that the noise contribution from all cumulative wind developments meets the cumulative limit of 35 dB(A) (ETSU-R-97 lower limit) for all the windfarms combined, applicable to all receptors at all wind speeds. The noise contribution from the Mybster substation at the NSR closest to the substation is taken from the results of the assessment

carried out for the substation's planning application[21]. The receptor assessed in the Mybster report correlates to 'Croft of Bowerman' NSR in this assessment. Noise level from the substation will be lower at further away receptors.

Table 12.9: Cumulative Noise Levels

Development	Combined Noise levels at Nearest NSRs, dB(A)
Mybster Substation	29.5
Causeymie wind farm	35
Halsary wind farm	
Achlachan 1 & 2 wind farms	
Bad A Cheo wind farm	

12.9.3 NSRs at further distances will have negligible noise contribution from the Mybster Substation, therefore, except Croft of Bowerman, only wind farm cumulative contributions are assessed at the other NSRs outlined in Table 12.10.

12.9.4 Table 12.10 presents the cumulative levels at each receptor and the change in these levels due to the noise from the Proposed Development, the total Cumulative level is calculated by logarithmically adding noise from the Proposed Development and other developments.

Table 12.10: Cumulative Assessment

Receptor Location	Proposed Development noise level[22], dB(A)	Cumulative Development, dB(A)	Total Cumulative Level, d(A)	Change in Ambient levels, dB
Croft of Bowerman	32.1	36.1	37.8	1.5
Mybster Inn	29.8	35.0	36.7	1.1
Knockgalss Farm Cottage	28.1	35.0	36.5	0.8
Wingfield Farm	27.1	35.0	36.2	0.7
Backlass	22.0	35.0	35.2	0.2
Shielton	19.9	35.0	35.2	0.1

[21] Application Ref : 13/00595/FUL – Noise Imact Assessment Report – Receptor GT2, Table 13.5
[22] Predicted levels from the Proposed Development as shown in Table 12-4, to 1 decimal place.

12.9.5 As can been seen in Table 12.10, introduction of the Proposed Development results in an overall change in the acoustic climate of 1.5 dB only when combined with other developments in proximity. It should be highlighted that this is based on the lower ETSU-R-97 cumulative limit, in practice, noise from the wind farms will increase with higher wind speeds, whereas noise from the Proposed Development is independent of wind speeds. As such, the effects from the Proposed Development are reduced at high wind speeds due to elevated ambient levels.

12.9.6 A change of less than 2 dB (as worst-case scenario) is barely perceptible to human receptors and will not result in a noticeable change in the acoustic environment of the area. In terms of BS 4142; a 2 dB change in ambient levels results in low impact, considering context of the site and area. Therefore, cumulative effects are low and considered acceptable in terms of noise.

Discussion and Uncertainty

Modelling Assumptions

12.9.7 Modelling of the proposed plant has been undertaken on a worst-case basis, with a number of conservative assumptions, such as: each receptor being directly downwind of the Proposed Development, all plant operating at maximum load, all plant operating simultaneously and continuously over 24 hours.

12.9.8 In practice, battery Iliquid-cooling systems, inverters, and transformer units are temperature controlled, and will operate in varying loads depending on grid requirements. Noise levels in practice will therefore be lower than presented in this assessment during typical operation.

12.9.9 It is considered that the modelling assumptions made in this assessment are likely to result in an over-prediction of levels than in practice; the uncertainties inherent in the model will therefore not have a significant impact on the outcome of the assessment.

Baseline Context

12.9.10 The assessment has been undertaken on a very conservative basis; inherited from the use of past background levels pre-dating the surrounding windfarm developments and the substation extension. Use of these background levels and modelling assumptions in this assessment result in a worst-case effect, in practice, the ambient acoustic environment will include operational noise of all the surrounding windfarms as well as the nearby substation and therefore will have lower effects from the Proposed Development than those presented.

12.9.11 The existing acoustic environment in the locality of the Proposed Development consists of sound sources comprised of wind farms, substation, and the A9 road traffic. The sensitivity of the noise sensitive receptors is deemed to be high, as the receptors are residential in nature and are located in a rural area. However, the Rating Levels during the day do not exceed the background more than 5 dB and

night-time internal levels are unlikely to be audible or cause disturbance to sleep or quality of life.

12.9.12 Taking the context into account, it remains the case that noise emissions generated from the Proposed Development is unlikely to have an adverse effect on any receptor surrounding the Site.

12.10 Mitigation Measures

Construction Noise and Vibration

12.10.1 An assessment of construction noise and vibration has been scoped out due to the large distance to the nearest NSR; in accordance with BS 5228 the good practice measures detailed below will be implemented to manage the effects of noise and vibration during construction operations, and will be required of all contractors:

- Construction operations shall be limited to times agreed with the Council.
- The site contractors shall be required to employ the best practicable means of reducing noise emissions from plant, machinery, and construction activities, as advocated in BS 5228-1:2009.
- Where practicable, the work programme will be phased, which would help to reduce the combined effects arising from several noisy operations.
- Where necessary and practicable, noise from fixed construction plant and equipment will be contained within suitable acoustic enclosures or behind acoustic screens.
- All sub-contractors appointed by the main contractor will be formally and legally obliged, and required through contract, to comply with all environmental noise conditions.
- Where practicable, night-time working will not be carried out. Local residents shall be notified in advance of any night-time construction activities.

Operational Noise

12.10.2 As demonstrated in Sections 12.8 and 12.9, operational noise from the Proposed Development is compliant with the appropriate noise limits for day and night-time periods, the results include shielding effects from a 4 m high acoustic fencing to the north, west, and south boundary of the compound, therefore no further mitigation measures are required for operational or cumulative operational noise.

12.10.3 The acoustic fence can be made from timber, metal, or absorptive panels (a minimum surface density of 10 kg/m^2), should be imperforate, i.e., no gaps

between or at the base, and have a height no less than 4 m AGL (Above Ground Level) with 1 m cantilever at 45^{o} at the top inwards to the compound.

12.11 Residual Effects

12.11.1 Application of the above measures (Section 12.10.1) to manage construction noise will ensure that effects are minimised as far as is reasonably practicable and that the construction process is operated in compliance with the relevant legislation.

12.11.2 The residual operational effects are the same as the operational effects identified in this assessment.

12.12 Conclusion

12.12.1 An assessment of potential noise effects associated with the Proposed Development has been carried out.

12.12.2 Predicted noise effects due to the operation of the Proposed Development has been found to be less than adverse in terms of BS 4142 at all receptors; external rating levels do not exceed more than 4 dB above background during the daytime and do not exceed 30 dB(A) at any frequency, internal levels are below 20 dB(A) within all dwellings during day and night, and cumulative effects show an increase of less than 2 dB in the total ambient levels, as such, considering all the results above, noise associated with the Proposed Development is considered to be acceptable.

12.13 Glossary of Terms

12.13.1 **Background Sound:** The background sound level is the underlying level of noise present at a particular location for the majority (usually 90%) of a period of time.

12.13.2 **Decibel (dB):** The decibel is the basic unit of noise measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hertz (Hz). Each increase of 3 dB on the scale represents a doubling of the Sound Pressure, and is typically the minimum noticeable change in sound level under typical listening conditions.

12.13.3 **dB(A):** Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hz), and less sensitive at lower and higher frequencies. The A weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out

automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

12.13.4 **Frequency:** The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

12.13.5 $L_{A90,t}$: This term is used to represent the A-weighted sound pressure level that is exceeded for 90% of a period of time, t. This is used as a measure of the background noise level.

12.13.6 **$L_{Aeq,t}$:** This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

12.13.7 **Noise:** Unwanted sound: May refer to both natural (e.g. wind, birdsong etc.) and artificial sounds (traffic, industrial noise, aircraft etc.).

12.13.8 **Rating Level:** Sound levels which have been corrected for certain acoustic features, as required under BS4142 methodology.

12.13.9 **Sound pressure (P):** The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

12.13.10 **Sound pressure level (L_p):** Sound pressure measured on the decibel scale, relative to a sound pressure of 2 x 10-5 Pa.

12.13.11 **Specific Level:** In terms of BS4142 methodology, the specific level is the sound level produced by a source, without corrections for acoustic features.

12.13.12 **Time Weighting:** Time weightings determine how quickly the sound level meter responds to changes in noise level, and is generally set to ‘Fast’ or ‘Slow’. A fast time weighting resulting in the sound level meter sampling every 1/8th second: a slow time weighting results in a sample measurement being taken by the sound level meter every 1 second.

13 Traffic and Transport

13. Traffic and Transport

13.1. Introduction

13.1.1. This Chapter of the Environmental Report assesses the potential effects of the proposed Toftingall Battery Energy Storage System (BESS) and associated infrastructure (the Proposed Development) on the traffic and transportation resource. Vehicle associated with the Proposed Development will primarily consist of heavy goods vehicles (HGV), light goods vehicles (LGV) and cars. This assessment was undertaken by Environmental Resources Management (ERM).

13.1.2. This Chapter is supported by the following figures:

- Figure 13.1: Construction Traffic Route to Site;
- Figure 13.2: Traffic Count Locations; and
- Figure 13.3: Road Traffic Collision Assessment.

13.1.3. This Chapter includes the following elements:

- Legislation, Policy, and Guidance;
- Methodology;
- Study Area;
- Baseline Conditions;
- Construction Traffic;
- Operational Traffic;
- Mitigation; and
- Concluding Statement.

13.2. Policy, and Guidance

13.2.1. The following policy, and guidance has considered when undertaking this assessment.

Policy

The National Planning Framework 4[1] (NPF4) (2023)

13.2.2. This provides a statement of the Scottish Government's policy on nationally important land use planning matters. Paragraph e) Section vi of Policy 11, included in this document indicates that proposals for onshore wind and other renewable developments should consider the impact on road traffic and on adjacent trunk roads. Section xiii of Paragraph e) also indicates that any cumulative impacts should also be assessed.

The National Transport Strategy (2020)

13.2.3. This document provides an overview of the Scottish National Transport Strategy 2, which discusses a vision for creating a safer and sustainable transport network within Scotland and discusses measures to be taken to reduce the impact of freight deliveries within the country.

The Scottish Planning Advice Note 75 (PAN 75) – Planning for Transport[2] (2005)

13.2.4. Provides guidance on sustainable transport planning in the context of new and existing development. The document also indicates that all planning applications that involve the generation of person trips should provide information which covers the transport implications of the development. The level of detail is to be proportionate to the complexity and scale of impact of the development.

Guidelines

13.2.5. Guidance has also been sought from the Institute of Environmental Management and Assessment (IEMA 2023)[3]. The guidelines for the Environmental Assessment of Road Traffic, which set out guidance for determining the appropriate traffic effects as a result of a proposed

[1] The Scottish Government (2023) National Planning Framework 4 [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4.pdf (Accessed 10/04/2023)
[2] The Scottish Executive (2005). Planning Advice Note, PAN 75, Planning for Transport. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/publication/2005/08/planning-advice-note-pan-75-planning-transport/documents/0016795-pdf/0016795-pdf/govscot%3Adocument. (Accessed on 10/04/2023)
[3] Institute of Environmental Management and Assessment (IEMA) (2023). IEMA Guidelines: Environmental Assessment of Traffic and Movement

development, have been used to prepare this report. The IEMA (2023) guidelines are intended for the assessment of environmental effects of road traffic associated with major new developments giving rise to traffic generation, as opposed to short-term construction. In the absence of alternative guidance and as the traffic generation during the operational phase is very low, these guidelines have been applied to assess the short-term construction phase of the Proposed Development.

13.3. Methodology

13.3.1. The specific methodology for the assessment of transport and traffic is based upon the likely effects of the Proposed Development evaluated in accordance with the Institute of Environmental Assessment (now Institute of Environmental Management and Assessment, IEMA) Guidelines.

13.3.2. The purpose of this assessment is to determine how the Proposed Development's construction and operation will affect traffic and transportation receptors. The Proposed Development's traffic effects have been evaluated in relation to current road users, pedestrians, cyclists, and other sensitive receptors. The following types of impacts have been assessed:

- Changes in traffic conditions and the potential for delays and congestion;
- Changes to conditions for pedestrians and cyclists;
- Severance, fear, and intimidation; and
- Accidents and safety.

13.3.3. IEMA Guidance provides information on how the magnitude of changes in traffic flow should be determined, as shown in Table 13.1 Magnitude of Change

13.3.4. This is used to assess the effects, particularly of construction traffic, on the local highway network.

Table 13.1: Magnitude of Change

Magnitude	Change in Total Traffic	Description
Negligible	<30%	No Discernible change in conditions
Minor	30 – 60%	Perceptible change in conditions
Moderate/Medium	60 – 90%	Apparent and noticeable change in conditions
Major/High	>90%	Considerable change in conditions

13.3.5. The IEMA Guidelines advise that detailed assessment should be undertaken on:

- Highway links where traffic flows will increase by more than 30% (or the number of Heavy Goods Vehicles (HGV's) will increase by more than 30%); and
- Any specifically sensitive areas where the traffic flows have increased by 10% or more.

13.3.6. Where the predicted increase in traffic flows is lower than the thresholds, the IEMA guidelines suggest effects can be stated to be low and not adverse and further detailed assessments are not warranted. Peak traffic flows will be identified to assess a worst-case scenario.

13.4. Study Area

13.4.1. The Study Area has been defined by the public road network in the vicinity of the Proposed Development; the potential delivery corridors to be used during construction and by general construction traffic, including construction workers. These consider the local strategic / trunk road network, sources of labour and the potential sources of construction materials, specifically stone and concrete from local quarries. Therefore, the proposed Study Area is shown on Figure 13.1and defined as:

- A882 – between Wick and Georgemas; and
- A9 – between Latheron and Georgemans.

13.4.2. The Proposed Development is situated on land located approximately 16km (kilometres) west of Wick, and 2km south-east of Spittal and is centred on an approximate National Grid Reference (eastings) 318770 and (northings) 952645 ('the Site'). The Site and the Proposed Development are wholly located within the administrative boundary of The Highland Council (THC).

13.4.3. The origin of construction traffic is not currently known but it is likely to be distributed throughout the region. It has been assumed that vehicles will approach the Proposed Development from either the north or the south via the A9. Two potential routes for general construction traffic have therefore been identified as follows;

Route 1

- Follow the A882 from Wick, westbound for approximately 23.15km until reaching the junction connecting to the A9;
- Turn left onto the A9 heading southbound;
- Follow the A9 southbound for approximately 9.3km until reaching the Site entrance junction; and
- Turn left into the Site.

Route 2

- Connect to the A9 from the A99 at the junction in Latheron;

- Follow the A9 northbound for approximately 9.3km until reaching the Site entrance junction; and
- Turn right into the Site.

13.4.4. Both potential route options have been outlined in Figure 13.1.

Existing Road Network

A9

13.4.5. The A9 is the main trunk road in the area and connects Perth to Scrabster. The road is operated on behalf of Transport Scotland by BEAR Scotland. Outwith the settlements in the area, the road is subject to the national speed limit. The A9 in the vicinity of the Site is a single carriageway road, with centre line markings operating at the national speed limit.

13.4.6. The A9 is currently maintained as part of the trunk road network with no posted weight limits. Given its trunk road status, it is expected that the road is well suited to accommodate HGV traffic and that any effect of temporary construction traffic on this route should be negligible.

A882

13.4.7. The A882 is a rural traffic distributor road which carries traffic between the A9 and the A99 trunk roads and provides an alternative route connecting the northern towns of Wick and Thurso. The A882 is a rural single carriageway road, running in an east-west direction while operating at the national speed limit, except in built up areas including Haster and Watten, where the limit reduces to 30-mph.

13.4.8. As the A882 is one of the major traffic routes in the region, it is assumed that temporary increases in HGV traffic are not uncommon and that any effects of the increase in traffic numbers due to construction of the Proposed Development will be low.

Access Strategy

13.4.9. Access to the Site will be via the existing access junction into the Halsary Wind Farm off the A9 located to the southwest of the Site. This priority junction is well formed with good visibility and was used during construction and maintenance of the Halsary Wind Farm. It, therefore, will not require improvement works to enable access to the Proposed Development.

13.5. Baseline Conditions

Baseline Traffic Flows

13.5.1. Baseline traffic flow conditions on the construction traffic route were established using publicly available information published by the Department for Transport (DfT)[4]. The baseline traffic flows have informed the analysis to determine the impact of the Proposed Development on the road network.

13.5.2. The principal measurement considered in this study is the Average Annual Daily Flow (AADF). The latest available traffic count data from the DfT is for the year 2021 and is considered appropriate for this assessment. Table 13.2 Existing Average Annual Daily Flow (AADF) 2021.

13.5.3. below summarises the traffic data at four locations on the proposed transport routes whiles the locations of each point are shown on Figure 13.2.

Table 13.2: Existing Average Annual Daily Flow (AADF) 2021

Ref	Road	Location	Total AADF	HGV AADF	HGV% of Total AADF
1	A882	A882, near Haster, DfT Point ID: 91247	2,161	69	3.19
2	A882	A882, near Oldhall, DfT Point ID: 30804	1,569	92	5.86
3	A9	A9, North of Banniskirk, DfT Point ID: 40960	1,346	99	7.35
4	A9	A9, North of Achavanich, DfT Point ID: 10959	882	144	16.32

Sensitive Receptors

13.5.4. Sensitive receptors include existing users of the A9, and the A882 as well as non- motorised users of the surrounding road network including cyclists and pedestrians.

[4] UK Government, Department for Transport, Road Traffic Statistics. Available at: https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints. Accessed on 18/07/2023.

Road Traffic Collision Assessment

13.5.5. An analysis of all 'Slight', 'Serious' and 'Fatal' Road Traffic Collisions (RTCs) within the last five years was undertaken using data from Crash Map[5] for the routes identified within the Study Area.

13.5.6. 'Slight' RTCs are defined as a collision in which nobody is fatally or seriously injured, but at least one person is slightly injured. 'Serious' RTCs are defined as those which result in hospitalisation or death more than 30 days after the incident of one or more of the parties involved. 'Fatal' RTCs are defined as those in which one or more parties dies within 30 days as a result of injuries sustained during the RTC.

13.5.7. In total,12 'slight', 1 'serious' and 1 'fatal' RTC were recorded along the A882 with 5 'Slight' and 1 'Fatal' RTCs identified along the A9.

13.5.8. Having reviewed the collision data obtained from Crash Map, it was noted that the majority of the collisions that occurred could be attributed to driver error and a lack of awareness of other road users, rather than the highway design. No clear trends or strongly identifiable hotspots were apparent within the data and no RTCs were identified within the vicinity of the proposed Site access junction location on the A9.

13.5.9. The routes identified in the Study Area have therefore been categorised as having 'low' sensitivity to accidents. This assessment was made using professional judgement comparing these routes with other examples. Whilst several RTCs were noted within the Study Area, it was noted that these roads are not busy, and that as stated above no clear hotspots were identified. The locations of each of the identified RTCs are shown on Figure 13.3.

13.6. Construction Traffic

13.6.1. Heavy goods traffic associated with the construction of the Proposed Development will mainly consist of the importation of construction materials and the importation of all plant and machinery required onsite. A number of car and LGV movements will be required in order to transport onsite staff members to/from the Site. No abnormal load delivery vehicles (ALVs) are predicted to be required for the Proposed Development.

[5] AGILYSIS (2019) CrashMap. UK Road Safety Map. Available at: www.crashmap.co.uk. (Accessed 18/07/23)

13.6.2. Each component of the works required in the construction of the Proposed Development is described in detail in the following subsections. Detailed assumptions have been made in estimating material quantities.

Forestry

13.6.3. In order to create working areas for construction of the BESS compound, existing trees within the area of the site will need to be removed.

13.6.4. Construction traffic associated with felling works, will consist of unloaded HGVs arriving on Site, which will then depart the Site fully loaded, and for the delivery/removal of the required forestry plant and equipment.

13.6.5. The exact number of vehicles associated with felling works required on Site is currently unknown, however it is likely that a maximum of 40 HGVs will be required on Site per month, which will equate to 80 two-way movements required per month (that is 40 unloaded HGVs arriving on Site, and the same 40 departing fully loaded).

13.6.6. Assuming a 26 day working month, two-way HGV movements required on Site during works associated with the felling of existing forestry is expected to be no more than 4 per day. In addition, a further 16 vehicle movements per month associated with activities to support forestry operations will be required.

Site Mobilisation and Demobilisation

13.6.7. At the commencement of construction of the Proposed Development, HGVs, and other vehicle movements will be required during the mobilisation of the Site. This will consist of mainly the erection of welfare facilities, delivery of any plant and equipment including cranes and the formation of the Temporary Construction Compound (TCC). Many of these movements will be as HGVs and low loaders which will deliver and then depart the Site unloaded. This is expected to require up to 15 HGV deliveries or 30 two-way HGV movements at the commencement of the Proposed Development.

13.6.8. During demobilisation, much of this equipment will be removed from the Site including the TCC. Vehicle movements for demobilisation will result from empty HGVs and low loaders travelling to the Site and then departing loaded. This is expected to result in the same number of vehicle movements as during mobilisation.

Access Tracks & Hardstandings

13.6.9. It has been estimated from the Site layout (Figure 4.1, included in Chapter 4) that approximately 937m of new access tracks will be required on Site.

13.6.10. The Proposed Development will require the construction of a new access track from the existing tracks within Halsary Wind Farm to the entrance into the BESS compound, and the length of this track has been estimated at 747m. Access tracks will be of an average width of

5m, therefore the total surface area of this new track is approximately 3,735m^2. In addition to the new access track from Halsary Wind Farm to the BESS Compound, a small number of internal access tracks will be required within this compound. The total length of internal tracks within the BESS compound is estimated at 190m, therefore the total surface area of internal track is approximately 950m^2.

13.6.11. Tracks will be constructed to an average depth of 0.45m using Type 1 aggregate. Taking the total surface area of 4,685m^2 and applying a 0.45m depth, this will result in a total volume of material of 2,108m^3 being required.

13.6.12. The TCC will be located to the east of the BESS compound and will have a proposed surface area of 2,500m^2. It has been assumed that the full extents of this compound will be surfaced with aggregate materials, therefore assuming the aggregate required for the TCC is laid to a depth of 0.45m, approximately 1,125m^3 of material will be required.

13.6.13. In addition to the access tracks and TCC, approximately 7,704m^2 of hardstanding areas will be required. These will be constructed to a depth of 0.45m using Type 1 aggregate resulting in an approximate total volume of aggregate of 3,467m^3 being required.

13.6.14. Summing the above elements, a total of 6,700m^3 of aggregate is estimated to be required for the Proposed Development. The aggregate will be transported by HGV dumpers with an assumed volumetric capacity of 9m^3; therefore 621 vehicle loads will be required which will result in 1,242 two-way HGV movements for this element of works.

Inverters and Electrical Cabling Delivery

13.6.15. A total of 13 inverters will be required on Site, these units will be transported to Site using standard HGV and will require 7 HGV deliveries (two per HGV) or 14 two-way HGV movements.

13.6.16. Concrete will be required for the foundations of the above inverters to a depth of 0.5m and is expected to amount to approximately 116m^3. Assuming a volumetric capacity of 9m^3 for the concrete delivery vehicles, this will result in approximately 14 loads or 28 two-way vehicle movements.

13.6.17. An additional 5 HGV deliveries has been assumed for internal electrical cabling, resulting in an additional 10 two-way HGV movements.

Battery Containers

13.6.18. The battery containers will be delivered following the completion of the access tracks. The containers will be transported to the Site using standard HGV and will require 52 deliveries (one per HGV) or 104 two-way HGV movements.

13.6.19. Concrete will be required for the foundations of the battery containers, which will be laid to a depth of 0.5m. It is expected that this will amount to approximately 444m^3. Assuming a

volumetric capacity of 9m³ for the concrete delivery vehicles, this will result in approximately 50 loads or 100 two-way vehicle movements.

Substation Compound

13.6.20. Once the access tracks have been fully formed, construction of the substation and supporting facilities will begin. A Distribution Network Operator (DNO) switchgear and control room building & Battery Facility Operator switchgear and control room building will be located within the compound alongside an auxiliary transformer.

13.6.21. Concrete will be required to form the foundations of the components to be installed within the substation compound. The total area of concrete required will be approximately 272m^2, therefore for foundations laid to a depth of 0.5m, the total volume of concrete required will be 138m^3. Assuming a volumetric capacity of 9m³ for the concrete delivery vehicles, this will result in approximately 36 loads or 72 two-way vehicle movements for this element of works.

13.6.22. A further 10 HGV deliveries has been assumed for materials to be imported namely roof materials and internal electrical cabling, resulting in an additional 20 vehicle movements.

Miscellaneous Deliveries

13.6.23. It is estimated that there will be approximately 150 two-way vehicle movements associated with miscellaneous deliveries (including fencing, cranes, skips, etc.) to maintain the compound areas and running of the Site during construction.

Fuel

13.6.24. Fuel for plant will be required regularly throughout construction and, this is estimated to result in one HGV fuel tanker delivery per week (4 per month) or eight vehicle movements per month.

Staff

13.6.25. It is anticipated that approximately 20 staff members will be required on Site throughout construction, resulting in an average of 40 two-way movements per day required. Therefore, it is expected that assuming a 26-day working month, 1,040 two-way car/light vans movements will be made to the Site per month.

13.6.26. The above figures are conservative, as staff will be encouraged to car share (including the use of Minibuses). It is anticipated that this is likely to be considerably lower than the above estimates in practice.

Summary

13.6.27. Table 13.3Table 13.3 below shows an indicative construction programme and schedule of deliveries.

Table 13.3: Anticipated Construction Programme

Activity	Month									
	1	2	3	4	5	6	7	8	9	Total**
	HGVs									
Site Mobilisation	30								30	60
Forestry	96	96								192
Access Track and Hardstanding			414	414	414					1,242
Inverters and Electrical Cabling Delivery								23		23
Battery Containers						52	52			104
Substation Compound								24		24
Concrete Delivery						52	52	52		155
Foundation Steel				6		6				12
Miscellaneous Deliveries (Including Fencing, cable sand etc.)	10	10	20	20	20	20	20	20	10	150
Fuel	8	8	8	8	8	8	8	8	8	72
Sub Total	**144**	**114**	**442**	**448**	**442**	**138**	**132**	**127**	**48**	**2,034**
	Staff Cars and Vans									
Commissioning/Testing									20	20
Staff	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	9,360
Sub Total	**1,040**	**1,040**	**1,040**	**1,040**	**1,040**	**1,040**	**1,040**	**1,040**	**1,060**	**9,380**
Total (All Vehicles)	1,184	1,154	1,482	1,488	1,482	1,178	1,172	1,167	1,108	11,414
Total (HGV Only)	144	114	442	448	442	138	132	127	48	

Activity	Month									
	1	2	3	4	5	6	7	8	9	Total**
Average Total Traffic per Day*	46	45	57	58	57	46	46	45	43	
Average Total HGV Traffic per Day*	6	5	17	18	17	5	5	5	2	

*ASSUMES 26-DAY WORKING MONTH; ** TOTALS MAY NOT ADD UP DUE TO ROUNDING

13.6.28. As indicated in Table 13.3, during the peak month of construction (Month 4), approximately 1,488 two-way movements, made up of 1,040 car/van movements and 448 HGV movements per month. Assuming a 26-day working month, this would equate to a maximum of 58 two-way vehicle movements per day, made up of 40 car/van movements and 18 HGV movements on average.

Effect of Traffic Increase During Construction

13.6.29. The percentage change in traffic volume expected during the peak month of construction was calculated, for each of the traffic count locations identified in the Study Area is shown in Table 13.4 below.

Table 13.4: Predicted Peak Month Average Annual Daily Flow (Month 4)

Traffic Count Location	Total Vehicle Movements			HGV Movements Only		
	Baseline	Baseline + Development	Increase (%)	Baseline	Baseline + Development	Increase (%)
1: A882, near Haster	2,161	2,219	2.7	69	87	26.1
2: A882, near Oldhall	1,569	1,627	3.7	92	110	19.6
3: A9, North of Banniskirk	1,346	1,404	4.3	99	117	18.2.
4: A9, North of Achavanich	882	940	6.6	144	162	12.5

13.6.30. As detailed in the assessment methodology, the lower threshold of impact (10%) was considered appropriate for those locations with identified sensitive receptors, mostly along the A882, with the 30% threshold considered appropriate for routes along the A9 where no sensitive receptors have been identified. Table 13.4 above demonstrates that, overall traffic is predicted to increase by a maximum of 6.6% which does not exceed the lower threshold of impact on the A882. However, HGV traffic is predicted to exceed the lower threshold and therefore further assessment is required. Table 13.4 further demonstrates that the lowest threshold of impact on the A9 will not be exceeded and no further assessment of the A9 is warranted.

13.6.31. When considering increases in traffic on roads with a low baseline traffic flow, it is important to consider the overall and residual capacity of the road in question. The baseline HGV flow levels on the A882 are low (circa 80 on average vehicles per day) and the magnitude of the predicted increase is low in absolute terms (total vehicles 58 movements made up of 18 HGV movements and 40 car/LGV movements per day). HGV traffic on rural A class-roads roughly make up 10% of the estimated capacity of the road as such it is considered the proportion of HGVs will remain significantly below a typical 'A' Road capacity, and baseline flows suggest

that there is sufficient capacity on this route to accommodate this increase in HGV traffic during construction.

13.6.32. Construction staff will be encouraged to car share through the use of minibuses or LGVs, so it is anticipated that the figure for car or van movements is likely to be considerably reduced.

13.6.33. Therefore, in line with IEMA guidance detailed in Table 13.1: Magnitude of Change

13.6.34. the temporary increase in HGV traffic on the A882 will not create or result in a material change in existing conditions and the effects of construction traffic on existing users of the A882 are considered to be minor.

Cumulative Assessment

13.6.35. Following a review of proposed developments which have the potential to result in cumulative traffic and transport effects stemming from construction traffic which will utilise parts of the road network used by the Proposed Development the following developments were identified:

- Mybster Battery Storage Facility (Planning Ref: 23/00933/PAN). Screening Stage;
- Stemster Wind Farm (Planning Ref: 19/03049/SCOP). Screening Stage; and
- Cryobattery Storage Scheme, Spittal Quarry (Planning Ref: 21/04369/SCOP) Screening Stage

13.6.36. These applications are in the early stages of the planning process, and the construction timescales are currently unknown. However, both the A882 and the A9 are major transport links in this area, therefore it has been determined that temporary increases in HGV traffic are not uncommon.

13.6.37. Baseline flows in Table 13.2 Existing Average Annual Daily Flow (AADF) 2021 indicates there will be spare capacity on these routes, therefore, it is considered that there will be sufficient capacity on each of the roads to accommodate the predicted increase in traffic arising from these developments.

13.6.38. That notwithstanding, if these developments are scheduled to be constructed simultaneously, it is assumed that the respective Construction Traffic Management Plan (CTMP) for the Proposed Development will make provisions for coordinating with the other developers in order to minimise disruption.

13.7. Operational Traffic

13.7.1. Vehicle movements to the Site during the operation of the Proposed Development will comprise activities associated with inspection, monitoring, and general Site up-keep. It is anticipated that such visits will occur up to once per week on average using vans or other similar sized vehicles.

13.7.2. Operational traffic is therefore expected to be minimal and negligible in terms of existing traffic flow levels on routes within the vicinity of the Proposed Development. Consequently, there is no potential for significant effects resulting from the traffic generated during the operational phase and it is not assessed further in this chapter.

13.8. Mitigation

13.8.1. Traffic movement will be controlled during the construction phase to minimise potential impacts on the surrounding road network. A range of best practice measures during the construction phase to minimise traffic impacts on the local road network will be applied through the implementation of a Construction Traffic Management Plan (CTMP), to be secured by a suitable worded planning condition. It is anticipated the following measures will be observed:

- All vehicles accessing the Site must be able to do so upon arrival, without delay. The Site entrance junction must not be blocked;
- The Developer and Principal Contractor must ensure that there is adequate parking and laydown areas for the anticipated vehicles of construction;
- A banksman should be employed to control access to the Site entrance junction to ensure that it is clear at all times;
- Wheel washing facilities to be implemented where necessary;
- The Principal Contractor will agree appropriate and safe routes to and from the Proposed Development with the Highland Council. All construction vehicles will be required to use approved access routes;
- Arrangements for road maintenance and cleaning if required, e.g., road sweeping in the vicinity of Site access point as necessary;
- As far as reasonably as possible, deliveries should be scheduled outside of school opening and closing times;
- Prior to the start of construction, the Principal Contractor to l install temporary construction phase signage on the approved route to Site; and
- Drivers to be made aware during the Site induction of the presence of schools and other amenities with these settlements.

13.8.2. Table 13.5 presents the likely level of effects on receptors after the implementation of proposed mitigation measures.

Table 13.5: Appraisal of Traffic

Environmental Feature	Development Interaction	Receptor Sensitivity	Magnitude of Change	Mitigation Measures	Level of Effect
A9. Other road users: delays, severance, limited short-term impacts, increased risk of accidents	Construction traffic, temporary	Medium	Negligible	CTMP to be provided to THC pre-construction.	Negligible
A882. Other road users: delays, severance, limited short-term impacts, increased risk of accidents	Construction traffic, temporary	High	Minor	CTMP to be provided to THC pre-construction	Minor
Cumulative Developments					
A9. Other road users: delays, severance, limited short-term impacts, increased risk of accidents.	Construction traffic, temporary	Medium	Negligible	CTMP to be provided to THC pre-construction.	Negligible
A882. Other road users: delays, severance, limited short-term impacts, increased risk of accidents.	Construction traffic, temporary	High	Minor	CTMP to be provided to THC pre-construction	Minor

13.9. Concluding Statement

13.9.1. The potential impacts of the Proposed Development on traffic and transport receptors have been evaluated in this chapter. Construction-related traffic will cause small increases in traffic flows, including HGVs, on the surrounding road network.

13.9.2. The increase in traffic flows during the construction of the Proposed Development have been determined to be of minor effect. That notwithstanding, additional mitigation measures have been proposed in this chapter to ensure no adverse effect will arise as a result of the Proposed Development.

13.9.3. Traffic generation during the operational phase of the Proposed Development is minimal when compared to the construction phase. Therefore, traffic and transport effects for the operational phase of the Proposed Development are also considered to be negligible.

14. Socio-economics

14. Socio-economics

14.1. Introduction

14.1.1. This chapter considers the potential socio-economic impacts associated with the Proposed Development. The assessment of socio-economic benefits is based on the Proposed Development featuring a maximum export capacity of up to 49.9MW, with a 4-hour discharge period.

14.1.2. The Proposed Development will generate economic benefits, during its development and construction, and during the operation and maintenance phase.

14.1.3. During development and construction, the economic benefits that are expected are:

- £5.0 million Gross Value Added (GVA) and 67 years of employment in Highland; and
- £10.8 million GVA and 151 years of employment in Scotland.

14.1.4. The expenditure for the operation and maintenance of the Proposed Development could deliver up to:

- £0.2 million GVA and 3 jobs in Highland; and
- £0.3 million GVA and 4 jobs in Scotland.

14.1.5. The Proposed Development will also support the delivery of local services through the annual payment of £0.5 million in non-domestic rates.

14.2. Legislation, Policy and Guidance

14.2.1. There is no specific legislation, policy or guidance available on the methods that should be used to assess the socio-economic impacts of a battery energy storage system development. The method implemented has based on established best practice in the socio-economic assessment of renewable energy projects.

14.3. Methodology

Study Area

14.3.1. The analysis of the socio-economic effects from the Proposed Development considered the following study areas:

- Highland, as defined by the local authority area;

- Scotland; and
- the UK

Desk Study

14.3.2. The following data sources have been used in characterising the baseline:

- ONS (2023), Annual Population Survey 2022
- ONS (2023), Annual Survey of Hours and Earnings 2022
- National Records of Scotland (2022), Mid-Year Population Estimates 2021
- National Records of Scotland, (2020), Sub-National Population Projections 2018-2043
- Scottish Government (2021), Scottish Index of Multiple Deprivation 2020
- Scottish Government (2018), National Performance Framework
- Scottish Government (2023), National Planning Framework 4
- Scottish Government (2022), National Strategy for Economic Transformation

Assessment of Socio-Economic Effects

14.3.3. Given that no specific legislation or guidance is available on the methods which should be used when assessing the socio-economic effects of a proposed battery energy storage system development, the identification and assessment of the significance of predicted socio-economic effects has been based on professional judgement on the degree of change resulting from proposals using methods similar to that used in EIAs for proposed renewable energy developments.

14.3.4. The assessment of economic impacts was undertaken using a model that has been developed by BiGGAR Economics specifically to estimate the socio-economic effects of renewable energy generation and storage developments.

14.3.5. The units of measurement which are used to quantify the economic impacts of the Proposed Development are:

- GVA: this is a measure of the economic value added by an organisation or industry
- job years: this is a measure of employment which is equivalent one person being employed for an entire year and is typically used when considering the short-term employment impacts, such as those associated with construction
- jobs: this is a measure of employment, which considers the headcount employment in an organisation or industry.

14.3.6. To begin estimating the economic activity supported by the Proposed Development, it was first necessary to calculate the expenditure during the development and construction, and operation and maintenance phases. The total expenditure figure was then divided into its main components using calculated assumptions regarding the share that could be expected by main and sub-contractors. This provides an estimate for each main component that could be secured in Highland, Scotland and in the UK.

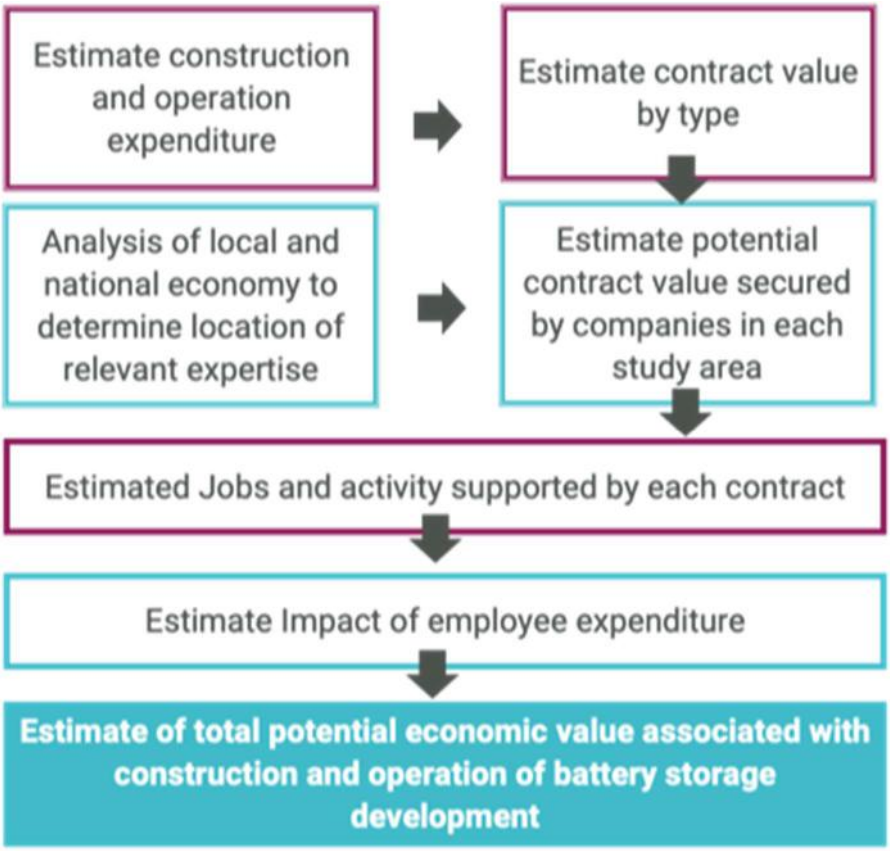
14.3.7. There are three sources of economic activity:

- component contracts and the jobs they support (direct effect)
- wider spending in the supply chain (indirect effect)
- spending of people employed in these contracts (induced effect).

14.3.8. There are four key stages of this model, which are illustrated in Figure 14.1 below:

- estimation of the capital and operational expenditure
- estimation of the value of component contracts that make up total expenditure
- assessment of the capacity of businesses in the study area to perform and complete component contracts
- estimation of economic impact from resultant figures.

Figure 14-1 Approach to Economic Impact Assessment



14.4. Socio-economic context and baseline

Strategic Economic Context

Scotland's National Performance Framework

14.4.1. Scotland's National Performance Framework, first published in 2018 (Scottish Government, 2018) sets out the ambitions of the Scottish Government to provide a vision for national wellbeing across a range of economic, social and environmental factors. The framework includes 'increased wellbeing' as part of its purpose, and combines measurement of how well Scotland is doing in economic terms with a broader range of wellbeing measures. The National Performance Framework is designed to give a more rounded view of economic performance and progress towards achieving sustainable and inclusive economic growth and wellbeing across Scotland. The aims for Scotland set out in the National Performance Framework are to:

- create a more successful country;

- give opportunities to all people living in Scotland;
- increase the wellbeing of people living in Scotland;
- create sustainable and inclusive growth; and
- reduce inequalities and give equal importance to economic, environmental and social progress.

14.4.2. The National Performance Framework also sets out outcomes and indicators which illustrate the progress Scotland is making in achieving the aims of the National Performance Framework. The outcomes outlined in the National Performance Framework are that people in Scotland:

- grow up loved, safe and respected so that they realise their full potential;
- live in communities that are inclusive, empowered, resilient and safe;
- are creative and their vibrant and diverse cultures are expressed and enjoyed widely;
- have a globally competitive, entrepreneurial, inclusive and sustainable economy;
- are well educated, skilled and able to contribute to society;
- value, enjoy, protect and enhance the environment;
- have thriving and innovative businesses, with quality jobs and work for everyone;
- are healthy and active;
- protect and fulfil human rights and live free from discrimination;
- connected and make a positive contribution internationally; and
- tackle poverty by sharing opportunities, wealth and power or equally.

14.4.3. The development and operation of the Proposed Development would contribute to the achievement of the national outcomes set out in the National Performance Framework, with the project advancing the development of a competitive, inclusive and sustainable economy in Scotland.

Scotland's National Strategy for Economic Transformation

14.4.4. In March 2022, the Scottish Government published the National Strategy for Economic Transformation (Scottish Government, 2022), which set out its ambition for Scotland's economy over ten years. The Scottish Government's vision is to create a wellbeing economy where society thrives across economic, social and environment dimensions, which delivers prosperity for all Scotland's people and

places. Of particular importance is the ambition to be greener, with a just transition to net zero, a nature-positive economy and a rebuilding of natural capital.

14.4.5. A key longer term key challenge identified in the strategy is to address deep-seated regional inequality, which includes in rural and island areas that face problems such as a falling labour supply, and poorer access to infrastructure and housing. The transition to net zero presents a further challenge of delivering positive employment, revenue and community benefits.

14.4.6. To deliver its vision and address the economy's challenges, five programmes of action have been identified (with a sixth priority of creating a culture of delivery), including:

- establishing Scotland as a world-class entrepreneurial nation
- strengthening Scotland's position in new markets and industries, generating new, well-paid jobs from a just transition to net zero
- making Scotland's businesses, industries, regions, communities and public services more productive and innovative
- ensuring that people have the skills they need to meet the demands of the economy, and that employers invest in their skilled employees
- reorienting the economy towards wellbeing and fair work.

14.4.7. The strategy notes that Scotland has substantial energy potential and that it has developed a growing green industrial base. This provides a strong foundation for securing new market opportunities arising from the transition to net zero. Renewable energy has a role to play in supporting productive businesses and regions across Scotland.

National Planning Framework 4

14.4.8. The Scottish Government's National Planning Framework 4 (Scottish Government, 2023) is Scotland's national spatial strategy, setting out the principles to be applied to planning decisions, regional priorities and national developments.

14.4.9. One of the six spatial principles to be applied is a just transition that ensures the transition to net zero is fair and inclusive, as is rural revitalisation, supporting sustainable development in rural areas. Applying these and other principles is intended to support the planning and delivery of sustainable places, where emissions reduce and biodiversity is restored and better connected.

14.4.10. As part of the policy 11a all forms renewable technologies, including energy storage, will be supported. This is subject to the test outlined in policy 11c, that developments will only be supported where they 'maximise net economic impact

including local and community socio-economic benefits such as employment, associated business and supply chain.

Summary of Strategic Context

14.4.11. The Scottish Government considers the renewable energy sector as a key driver of economic growth, with the potential to make a substantial contribution to economic transformation. The construction and operation of the Proposed Development is aligned locally, regionally and nationally with economic strategies by supporting the creation of sustainable and inclusive growth in Highlands.

Existing Environment

14.4.12. As shown in Table 14.1, in 2021 the population living in Highland was 238,100, representing around 4.3% of Scotland's population (National Records of Scotland, 2022). Table 14.1 also shows that Highland has a lower proportion of working age population (60.8%) compared to Scotland as a whole (63.8%) and a higher proportion of population aged 65 and over.

Table 14-1 Population Structure, 2021

	Highland	Scotland
Total	238,100	5,479,900
0-15	16.0%	16.6%
16-64	60.8%	63.8%
65 and over	23.2%	19.6%

Source: National Records of Scotland (2022), Mid-year Population Estimates 2021.

14.4.13. Compared to the population in 2018, the population of Highland is projected to decrease by 1.0% by 2043, whereas the population of Scotland will increase by 2.5% to almost 5.6 million people (National Records of Scotland, 2020) (See Table 14.2).

14.4.14. The projections for the population structure would see a decrease in Highland's working age population of around 9.5%. This trend in working age population of rural areas is associated to economic opportunities, since if they are limited, working age people will tend to move in search of opportunities elsewhere.

Table 14-2 Population Structure, 2018-43

	Highland		Scotland	
	2018	**2043**	**2018**	**2043**
Total	235,540	233,250	5,438,100	5,574,800
0-15	16.7%	14.3%	16.9%	14.8%
16-64	61.2%	56.0%	64.2%	60.3%
65 and over	22.1%	29.8%	18.9%	24.9%

Source: Scotland, National Records of Scotland (2020), Population Projections for Scottish Areas (2018-based)

14.4.15. As shown in Table 14.3, in 2022 the rate of economic activity in Highland was 74.2%, lower than the Scottish rate of 77.1% (ONS, 2023). Additionally, and as previously mentioned, the proportion of the working-age population in Highland was lower than that of Scotland (60.8% vs. 63.8%). When we consider these two factors together, it results in nearly 10,000 fewer economically active individuals in Highland than there would have been if the population structure rate matched the Scottish average. This highlights the need for employment opportunities in the area.

14.4.16. Table 14-3 also shows that unemployment in Highland was slightly higher (3.7%) than that of Scotland (3.4%). The median annual gross pay for full-time workers in Highland was £26,566, compared to £27,698 in Scotland (ONS, 2022).

Table 14-3 Economic Indicators, 2022

	Highland	Scotland
Economic Activity Rate (16-64)	74.2%	77.1%
Unemployment Rate	3.7%	3.4%
Median Annual Gross Income	£26,566	£27,698

Source: annual population survey - Data for Jan 2022-Dec 2022 and the annual survey of hours and earnings. Resident analysis data for - 2022

14.4.17. The largest sector of employment in Highland is human, health and social activities, accounting for 15.7% of employment compared to 15.3% in Scotland as a whole (ONS, 2023). The local area has also a higher proportion of people working in accommodation and food services (10.4%) than Scotland as a whole (7.5%).

14.4.18. Highland has also a higher share of the population employed in construction (7.2%), compared to Scotland as a whole (6.0%). On the contrary, Highland has a lower share employed in professional, scientific and technical activities (4.4%) compared to Scotland (6.4%).

Table 14.4 Industrial Structure, 2022

	Highland	Scotland
Human health and social work activities	15.7%	15.3%
Wholesale and retail trade; repair of motor vehicles and motorcycles	14.1%	14.1%
Agriculture, forestry and fishing	10.8%	3.4%
Accommodation and food service activities	10.4%	7.5%
Education	7.2%	8.3%
Construction	7.2%	6.0%
Administrative and support service activities	5.2%	7.7%
Manufacturing	4.8%	6.8%
Public administration and defence; compulsory social security	4.8%	6.3%
Professional, scientific and technical activities	4.4%	6.4%
Transportation and storage	4.0%	4.1%
Arts, entertainment and recreation	2.8%	2.4%
Information and communication	1.7%	3.0%
Other service activities	1.7%	1.8%
Water supply; sewerage, waste management and remediation activities	1.7%	0.8%
Real estate activities	1.3%	1.5%
Electricity, gas, steam and air conditioning supply	1.0%	0.7%
Financial and insurance activities	0.6%	3.0%
Mining and quarrying	0.3%	0.9%
Total	124,475	2,617,000

Source: ONS, (2023). Business Register and Employment Survey 2022.

Scottish Index of Multiple Deprivation

14.4.19. The Scottish Index of Multiple Deprivation (SIMD), is a relative measure of deprivation which ranks small areas of Scotland across seven dimensions: income, employment, education, health, access to services, crime and housing. These areas can be ranked based on which quintile (fifth of the distribution) they belong to, with a small area in the first quintile being in the 20% most deprived areas in Scotland.

14.4.20. There are 99 small areas in Highland, 13.1% of which are in the most deprived quintile, and 18.2% being in the second quintile. In contrast, 5.1% of areas are in the least deprived quintile (Scottish Government, 2021).

Table 14.5 Scottish Index of Multiple Deprivation by Quintile, 2020

SIMD – rank quintile	Highland
1 (most deprived quintile)	13.1%
2	18.2%
3	32.3%
4	31.3%
5 (least deprived quintile)	5.1%

Source: Scottish Government (2021), Scottish Index of Multiple Deprivation 2020.

Summary Socio-Economic Baseline

14.4.21. Highland has a lower proportion of working age population than Scotland. Similarly, Highland employment rate is lower than Scotland which highlights the need for employment opportunities in the area. Additionally, the working age population is projected to decrease more quickly than for Scotland as a whole, suggesting that this needs for employment opportunities will increase in the future. Based on SIMD, Highland has a lower proportion of areas that are considered to be deprived when compared to Scotland as a whole.

14.5. Effects

Development and Construction

14.5.1. The Proposed Development will consist of up to 52 battery energy storage units. The development will have a maximum export capacity of up to 49.9MW. The project has been designed with a 4-hour discharge period. Using information from Boralex and the energy cost table assumption from Aurora (Aurora Energy Research, 2022), the average expenditure on development and construction of battery storage sites can be estimated based on the average spend per MW/h. Industry data suggests that this may be expected to cost around £942,000 per MW/h.

14.5.2. On the basis of this methodology, the total development and construction cost for the Proposed Development was estimated to be £47.0 million.

14.5.3. The expenditure was split into six main categories of contract. As shown in Table 14.6 it was assumed that 57.1% of capital expenditure would be on battery unit contracts, 11.6% of spending will be on balance of system, 10.6% on development and planning, 8.6% on EPC soft cost[1], 6.1% on grid connection and 5.9% on inverter contracts.

Table 14.6 Development and Construction Spend by Expenditure Type

	%	Total (£m)
Battery system	57.1%	26.8
Inverter	5.9%	2.8
Balance of system	11.6%	5.5
Development and planning	10.6%	5.0
EPC soft costs	8.6%	4.1
Grid connection	6.1%	2.9
Total	100%	47.0

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.4. The economic impact of the development and construction phase was estimated for Highland and Scotland as a whole. In order to do this, it was necessary to estimate the proportion of each type of contract that might be secured in each of the study areas. The assumptions were based on BiGGAR Economics' previous experience in other energy developments and information received by the developer.

14.5.5. To estimate the expenditure for each contract in each of the study areas, the proportions of contract type that might be secured in each area were multiplied by the estimated expenditure on each development and construction contract.

[1] EPC cost refers not instantly visible of tangible cost from the Engineering, Procurement, and Construction phase of the project (e.g. fees, land cost, off-site costs)

14.5.6. It was estimated that Highland could secure contracts worth up to £9.1 million, equivalent to 19% of total capital expenditure. The largest opportunities would be the contracts related to balance of system[2], as companies in the area could secure up to 80% of contracts, worth £4.4 million.

14.5.7. Scotland (including Highland) was estimated to secure £14.3 million, equivalent to 30% of total capital expenditure. The largest opportunity would be balance of system contracts, worth around £5.5 million.

Table 14.7 Development and Construction Spend by Study Area

	Highland		Scotland	
	%	£m	%	£m
Battery system	0%	-	0%	-
Inverter	0%	-	0%	-
Balance of system	80%	4.4	100%	5.5
Development	6.3%	0.3	38%	1.9
EPC soft costs	80%	3.2	100%	4.1
Grid Connections	40%	1.2	100%	2.9
Total	19%	9.1	30%	14.3

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.8. To estimate the direct GVA from each of the main contract categories, each contract was split into sub-contracts. Using industry-specific data on turnover and GVA from the Scottish Annual Business Statistics (Scottish Government, 2022), turnover/GVA ratios were applied to each specific sub-contract in order to estimate GVA.

14.5.9. In this way, it was estimated that development and construction contracts could directly generate £3.6 million GVA in Highland and £6.1 million GVA in Scotland, as shown in Table 14.8.

[2] Balance of system refers to the non-battery components and expenses involved in constructing and operating the storage system. It includes elements such as power converters, control systems, cooling systems, electrical connections, installation costs, permitting, and project management. Contracts associated with it typically include those related to general construction and electrical engineering.

Table 14.8 Direct GVA by Contract Type and Study Area (£m)

	Highland	Scotland
Battery system	-	-
Inverter	-	-
Balance of system	1.7	2.1
Development	0.2	1.0
EPC soft costs	1.2	1.5
Grid Connections	0.6	1.5
Total	3.6	6.1

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.10. Similarly, the contract values potentially awarded in each area would support employment. Turnover per employee for each of the industries involved is also given by the Scottish Annual Business Statistics (Scottish Government, 2022), which allows the employment from any increase in turnover to be estimated.

14.5.11. In this way, it was estimated that the Proposed Development could support 49 direct years of employment in Highland, and 86 direct years of employment in Scotland.

Table 14.9 Development and Construction Employment by Contract Type and Study Area (Years of Employment)

	Highland	Scotland
Battery system	-	-
Inverter	-	-
Balance of system	26	33
Development	3	17
EPC soft costs	11	14
Grid Connections	9	23
Total	49	86

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.12. There would also be multiplier effects associated with spending in the supply chain and from spending by employees in the local economy. These effects are estimated by applying Type I (indirect) and Type II (indirect and induced) GVA and employment multipliers (Scottish Government, 2022) to the direct GVA and employment impacts.

14.5.13. Indirect effect refers to the impact associated with spending in the supply chain of Tier 1 suppliers. This is captured by applying Type 1 multiplier to the direct economic impact. The induced effect is the impact associated with staff spending their wages in the wider economy and is captured by subtracting Type 1 multipliers from Type II multipliers, and applying this to the direct impact.

14.5.14. In order to adjust these multipliers, which consider the national economy, for the economy of Highland it was assumed that indirect multiplier effects would be 33% of the national impact, and induced multiplier effects, which consider the effect of local spending, would be 70% of the national impact.

14.5.15. Adding together direct, indirect and induced impacts, it was estimated that the Proposed Development could generate a total £5 million GVA and support 67 years of employment in Highland and £10.8 million GVA and 151 years of employment in Scotland.

14.5.16. The construction phase is expected to take approximately one year and the impacts will occur during this time period.

Table 14.10 Development and Construction GVA Impacts by Study Area (£m)

	Highland	Scotland
Direct	3.6	6.1
Multiplier	1.4	4.8
Total	5.0	10.8

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

Table 14.11 Development and Construction Employment Impacts by Study Area (Years of Employment)

	Highland	Scotland
Direct	49	86
Multiplier	18	65
Total	67	151

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

Operation

14.5.17. The operation and maintenance impact of the Proposed Development was estimated as the impact that would persist throughout the lifespan of the Proposed Development.

14.5.18. Annual expenditure on operations and maintenance was estimated based on evidence from existing battery storage farms. It was estimated that the annual operations and maintenance expenditure associated with the Proposed Development could be up to £1.1 million (which excludes community benefit payments and non-domestic rates).

14.5.19. In order to estimate the economic impact of the operation and maintenance expenditure in Highland and Scotland, it was first necessary to estimate the proportion of contracts that could be secured in each of these areas. These assumptions were based the analysis of the industries present in each of the study areas, as well as BiGGAR Economics' previous experience on other energy developments and information provided by the developer.

14.5.20. On this basis it was estimated that Highland could benefit from £0.3 million in operations and maintenance contracts, with Scottish businesses potentially benefitting from £0.4 million.

Table 14.12 Operations and Maintenance Spending by Study Area

	Highland	Scotland
Turnover (£m)	0.3	0.4
Share (%)	25%	43%

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.21. As with the construction phase, the contract values awarded in each of the study areas represent an increase in turnover in those areas. The economic impact of the increase in turnover on GVA and employment was estimated in the same way as the construction expenditure.

14.5.22. Therefore, it was estimated that turnover generated by the operation and maintenance of the Proposed Development could support £0.1 million GVA and 2 jobs in Highland, and £0.1 million GVA and 2 jobs in Scotland.

Table 14.13 Annual Operations and Maintenance Direct Impact by Study Area

	Highland	Scotland
GVA (£m)	0.1	0.1
Employment	2	2

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

14.5.23. There would also be indirect and induced impacts during the operation and maintenance of the Proposed Development, which were estimated using the same method as for the development and construction phase.

14.5.24. By applying relevant economic multipliers, it was estimated that each year the spending required for the operation and maintenance of the Proposed Development could support £0.2 million GVA and 3 jobs in Highland, and £0.3 million GVA and 4 jobs in Scotland.

Table 14.14 Annual Economic Impact during Operations and Maintenance by Study Area

	Highland	Scotland
GVA (£m)	0.2	0.3
Employment	3	4

Source: BiGGAR Economics Analysis. *Totals may not add up due to rounding.

Non-Domestic Rates

14.5.25. The Proposed Development would be liable for non-domestic rates, the payment of which would contribute directly to public sector finances. By applying guidance developed by the Scottish Assessors Association (SAA, 2023), it has been estimated that the Proposed Development would contribute £0.5 million annually through the payment of non-domestic rates.

14.6. Concluding Statement

14.6.1. The Proposed Development will have a positive net impact on the economy of both Highland and the wider Scottish economy. The main opportunities will be for the construction sector. The largest economic impacts will occur during the construction phase, during which time it will support up to £10.8 million GVA to the Scottish economy, including £5.0 million in Highland. The Proposed Development could support 151 employment years in Scotland, including 67 employment years in Highland during the construction activity.

14.6.2. In addition, the Proposed Development will also support the energy transition in Scotland by providing crucial storage capacity to the electricity market. This directly supports the strategic economic objectives of the Scottish Government.

14.7. References

Aurora Energy Research. (2022). *Aurora Battery Cost Assumptions .*

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Scottish Government. (2021). *Scottish Index of Multiple Deprivation 2020.*

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Scottish Government. (2023). *National Planning Framework 4.*

15. Outline Battery Safety Management Plan

15. Outline Battery Safety Management Plan

15.1. Introduction

15.1.1. This Chapter of the Environmental Report (ER) evaluates the procedures relating to safe management of battery technologies of the proposed Loch Toftingall Battery Energy Storage System (BESS) and associated infrastructure ('the Proposed Development'). This assessment was undertaken by Environmental Resources Management (ERM).

Background

15.1.2. The BESS aspect of the Proposed Development will provide a maximum export capacity of up to 49.9MW and comprises shipping container-like modules housing batteries and inverter units. The battery units are likely to incorporate a liquid cooling system rather than an air conditioning based cooling system. It is therefore unlikely that there would be HVAC (Heating Ventilation and Air Conditioning) units on top or on the side of the container units (Paragraph 4.4.4, Chapter 4: Description of the Proposed Development).

15.1.3. The BESS compound is likely to contain 52 battery storage units each measuring approximately 6.1m long, 2.4m wide and 2.9m high. The units are likely to be supported on small, concrete footings approximately 0.5m high, making the maximum height of any individual unit 3.4m above ground level. The dimensions of all proposed on-site components are specified in the planning application drawings and the figures associated with chapter 4. Any changes to the dimensions as a result of the procurement process will be dealt with as non material amendment submissions.

15.1.4. The Proposed Development will also include the following components:

- Switchgear and control room buildings;
- On site access track and parking area;
- CCTV and fencing;
- Temporary construction compound;
- Potential, future, augmentation area;
- Attenuation pond; and
- Landscape planting.

15.1.5. This outline document is required to be updated to a Detailed Battery Safety Management Plan (DBSMP) prior to construction of the energy storage facility to be tailored to the specific technology chosen for deployment.

Planning Permission Conditions

15.1.6. It is anticipated that an appropriate planning condition would be applied to any planning permission for Loch Toftingall BESS requiring that, prior to the implementation of any BESS, a DBSMP in accordance with this OBSMP (Outline Battery Safety Management Plan) will be submitted to and approved by the Highland Council following consultation with the HSE, and the relevant Fire Authority.

Consultation

15.1.7. During the determination of this scheme, consultation should be undertaken with both a Chartered Fire Engineer and Thurso Fire Service. Feedback should be sought on any concerns about the proposed scheme design, the content of the DBSMP report and to seek advice on how best to consider/manage risks.

15.2. Legislation, Policy and Guidance

15.2.1. There is a suite of legislation and regulations with regards to electrical safety that apply to the Proposed Development. These regulations are not set out here, as they do not apply to fire safety, but it is important to emphasise that the controls set out within those regulations on the safe deployment of energy storage technology apply alongside this report.

15.2.2. There is a lack of legislation, policy and guidance within Scotland, and the UK, that advises on BESS and fire safety. More detailed UK guidance is emerging, and it is expected that the regulatory environment will be more developed by the detailed design stage. Examples of existing UK guidance include:

- Department for Business, Energy & Industrial Strategy BEIS (2020) Domestic Battery Energy Storage Systems[1];
- The Energy Institute: Battery Storage Guidance Note 1 - Battery Storage Planning (August 2019)[2];

[1] BESS (2020) Domestic Battery Energy Storage Systems (September 2020) Available at: Study on domestic battery energy storage (publishing.service.gov.uk)
[2] The Energy Institute: Battery Storage Guidance Note 1 - Battery Storage Planning (August 2019). Available at: https://publishing.energyinst.org/topics/power-generation/battery-storage/battery-storage-guidance-note-1-battery-storage-planning

- Institute of Engineering and Technology - Code of Practice for Electrical Energy Storage Systems (August 2017)[3]; and
- The Energy Operators Forum "Good Practice Guide" (December 2014)[4].

15.2.3. As such, a number of international guidance documents have been considered in the preparation of this OBSMP as the findings remains relevant:

- Allianz Risk Consulting (ARC), Tech Talk Volume 26 (2019). Battery Energy Storage Systems (BESS) using Li-ion batteries[5];
- National Fire Protection Association (NFPA) 855, Standard for the Installation of Stationary Energy Storage Systems, (2023 Edition)[6];
- Underwriter Laboratories (UL) 9540, Standard for Energy Storage Systems and Equipment (2020)[7]; and
- Consolidated Edison and New York State Energy Research and Development Authority - Considerations for ESS Fire Safety (February 2017)[8].

15.2.4. The NFPA and UL United States of America standards are not specifically relevant to the UK; however, it is felt that that the guidance provided is still valuable and is referred to in the ARC technical note which is addressed in Section 3.1 of this document.

15.2.5. The choice of battery make and model affects the selection of fire risk control measures. At the time of production of this report, decisions on the battery make and model for the Proposed Development are yet to be made. During the procurement process, the most up to date guidance available at that time shall be

[3] Institute of Engineering and Technology - Code of Practice for Electrical Energy Storage Systems (August 2017). Available at: https://shop.theiet.org/code-of-practice-for-electrical-energy-storage-systems-2nd-edition
[4] The Energy Operators Forum "Good Practice Guide" (December 2014). Available at: https://www.eatechnology.com/engineering-projects/electrical-energy-storage/
[5] Tech Talk 26: Battery Energy Storage Systems Using Lithium-Ion Batteries (July 2029). Available at: https://www.agcs.allianz.com/news-and-insights/risk-advisory/tech-talk-volume-26-bess-english.html
[6] NFPA 855: Standard for the Installation of Stationary Energy Storage Systems. Available at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=855
[7] UL9540: Standard for Energy Storage Systems and Equipment. Available at: https://standardscatalog.ul.com/standards/en/standard_9540_1
[8] Consolidated Edison and New York State Energy Research and Development Authority - Considerations for ESS Fire Safety. Available at: Energy Storage - NYSERDA

reviewed to ensure appropriate safety measures are included in the Proposed Development.

Li-Ion Battery Transportation

15.2.6. Transportation and removal plans must be in place when considering the movement of Li-Ion batteries to adequately mitigate risk. Transportation of Li-Ion batteries from origin location to the Proposed Development must be monitored to ensure the preservation of the batteries, it is important that trained individuals with the appropriate tools perform the necessary stages to ensure safe conditions are maintained.

15.2.7. International guidance for the transportation of Li-Ion batteries exists in the form of UN 38.3[9]. These rules, issued by the United Nations, are recommendations. European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019[10] includes mandatory rules for signatory states based on these recommendations.

15.2.8. In the ADR UN 38.3 is mentioned as obligatory. The United Kingdom is a signatory to these rules, so must apply them. UK guidance on the transport of dangerous goods is available online on the Government's "Moving dangerous goods, Guidance" webpage[11].

Installation and Decommissioning

15.2.9. Li-Ion batteries and associated infrastructure must be thoroughly inspected for any damages, flaws or errors that could have occurred during transportation or manufacture.

15.2.10. Certified professionals must sustain correct connections and proper protections, under adequate technical supervision at the installation and decommissioning stages to mitigate fire risk.

[9] UN Manual of Tests and Criteria (UN38.3 is chapter 38 of this document): ST/SG/AC.10/11/rev 6 with 2 corrigendum. Available at: https://www.unece.org/fileadmin/DAM/trans/danger/ST_SG_AC.10_11_Rev6_E_WEB_-With_corrections_from_Corr.1.pdf

[10] European Agreement Concerning the International Carriage of Dangerous Goods by Road. Available at: https://www.unece.org/trans/danger/publi/adr/adr2019/19contentse.html

[11] Moving dangerous goods, Guidance. Available at: https://www.gov.uk/guidance/moving-dangerous-goods

Operation Phase

15.2.11. The operational phase begins once the battery system has been fully integrated into the electrical grid and all installation procedures have been completed. Adequate utilisation of stationary Li-Ion batteries on site must be in place to deal with unexpected power fluctuation in the electricity grid, limiting effects of high temperature, fire propagation and/or heat transfer.

15.3. BESS Design Approach

15.3.1. Loch Toftingall BESS will minimise fire risk by:

- Procuring components and using construction techniques which comply with all relevant legislation;
- Including automatic fire detection systems in the Proposed Development design;
- Including automatic fire suppression systems in the Proposed Development design;
- Including redundancy in the design to provide multiple layers of protection;
- Designing the Proposed Development to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS;
- Approaching the fire service to consult on the potential fire risk and hazards of fire for the Proposed Development, the surrounding environment, nearest properties and the appropriate procedures to mitigate these risks;
- Ensuring that the local fire service's recommendations and requirements are addressed to enable an adequate emergency response to a fire; and
- At the commissioning stage the facility should be tested in accordance with the international standard on thermal runaway[12].

[12] UL9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. Available at: https://www.ul.com/services/ul-9540a-test-method

Allianz Risk Consulting BESS Design Recommendations

15.3.2. The recommendations set out in the ARC publication are set out in Table 15.1 with the Project response to each.

Table 15.1 - ARC Recommendations

ARC Recommendation	Project Response
1. Fire Department Invite the fire department to your property to discuss BESS hazards. An adequate emergency response is the key to avoiding an uncontrolled fire. Keep in mind that some fire fighters will not fully understand the hazards and may assume that lithium-ion batteries are the same as lithium batteries. Key questions to discuss with the fire department include: • What the main difference between extinguishing and cooling; • How to handle a damaged battery; and • How to manage the flammable and toxic gases. Plan training exercises with the fire department when the system is commissioned. Standard Operating Procedures (SOP) & Standard Operating Guidelines (SOG) are of major importance and should be updated and tested on a regular basis.	The Applicant has not yet completed the detailed design of the project and as such seeks a pre-commencement planning condition to provide a detailed Battery Safety Management Plan. When the system is being commissioned, training exercises should be planned with the local fire service. Standard Operating Procedures (SOP) should be drawn up in consultation with the fire service and these should be updated and tested on a regular basis.
2. Construction and location Install BESS outdoors a minimum of 20 m (65 ft.) from important buildings or equipment. Maintain a minimum of 3 m (10 ft.) separation from lot lines, public ways and other exposures.	The design of the BESS will reflect prevailing legislative requirements and UK industry recommendations. All buildings will use the relevant building regulations including BS 9999 'Fire safety in the design, management and use of buildings, Code of practice'13.

[13] BS 9999 'Fire safety in the design, management and use of buildings, Code of practice' Available at: https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=316664

ARC Recommendation	Project Response
Within the module, maintain a minimum of 1 m (3 ft.) separation distance between enclosures for all units up to 50 kWh when not listed, or up to 250 kWh when listed. Install a thermal barrier where the minimum space separation cannot be provided. If the BESS must be located indoors, install in a 2-hour fire rated cut-off room, which is accessible directly outdoors for manual firefighting. Restrict the access to competent employees or sub-contractors. Ensure enclosures are non-combustible.	A minimum of 3 m separation or the minimum separation specified in applicable UK legislation will be utilised between individual battery containers. Separation between components within BESS containers/modules will comply with identified applicable UK regulations and legislation identified at the time of detailed design (see Table 15.1). The BESS containers will be located outdoors. Access to the BESS containers will only be available to competent operational staff who have received appropriate training and certification where required by legislation, or under the supervision of competent operational staff. All enclosures will be non-combustible with EI120 standard.
3. Material, equipment and design BESS should be tested in accordance with UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. This standard evaluates thermal runaway, gas composition, flaming, fire spread, re-ignition and the effectiveness of fire protection systems. Data generated can be used to determine the fire and explosion protection requirements for a BESS. Place capacitor, transformer, and switch gear in separate rooms according to best engineering practices.	Thermal runaway was identified as the main fire risk concern for the Proposed Development. The BESS whould be tested with UL 9540A method.
4. Ventilation and temperature control Install adequate ventilation or an air conditioning system to control the temperature. Maintaining temperature control is vital to these batteries' longevity and proper operation as they degrade exponentially at elevated temperatures. Ensure ventilation is provided in accordance with the manufacturer's recommendations. Install and maintain the ventilation during all stages of a fire. Ventilation is important since batteries will continue to generate	The battery units would either incorporate a liquid colling system or a Heating Ventilation and Air Conditioning (HVAC) installation. The behaviour of HVAC and air circulation in the event of a pre-alarm and main alarm will be defined by the manufacturer (and, if applicable, the certifier) with due regard to the extinguishing agent used. Gas detectors will be part of a wider supervisory control and data acquisition (SCADA) system, including an advanced battery management system which would continually monitor the performance of each

ARC Recommendation	Project Response
flammable gas as long as they are hot. Also, carbon monoxide will be generated until the batteries are completely cooled through to their core.	battery cell and immediately draw attention to any potential faults to the site operator.
5. Gas detection and smoke detection Install a very early warning fire detection system, such as aspirating smoke detection. Install carbon monoxide (CO) detection within the container or BESS room.	A minimum of two types of fire detection system will be deployed, (e.g., heat and gas), including an aspirating smoke gas detector system within each enclosure within each unit. This would provide an early warning of any battery cell failure. There would be carbon monoxide detectors within the containers and other buildings within the facility. The detectors would send an alarm to a monitoring station and would trigger an automatic power disconnection. The fire detection system will be installed with fire resistant wires and components.
6. Fire protection and water supply Install sprinkler protection within BESS rooms and ideally within BESS containers. The sprinkler system should be designed to provide 12.2 l/min/m² over 232 m² (0.30 gpm/ft2 over 2500 ft²). Water has been proven to be the best agent to fight a fire involving lithium-Ion batteries. It is important to note that other extinguishing agents, such as aerosols or gaseous extinguishing systems, will extinguish the fire, but they do not provide cooling like water. Insufficient cooling allows a hot and deep-seated core to remain. The heat will rapidly spread back through the battery and reignite remaining active sections. This is the primary reason ARC recommends the use of water for fighting the fire and cooling the batteries. Implement a procedure for battery submersion in the pre-emergency plan performed by the fire department. Submerging batteries in water (preferably outdoors) after they burn has proven to be effective at cooling the batteries and neutralising the thermal threat. They will continue to release gases, mostly carbon monoxide, but also flammable gas such as hydrogen. Therefore, never submerge several batteries in a confined space without adequate ventilation.	The fire protection concept will be based on the prevention of propagation with high construction standards, suppression systems and distances to adjacent installations. The BESS will include an inert gas extinguishing fire suppression system as a first barrier of security against fire propagation within a container. Separation between adjacent installations is a security redundancy measure to limit fire propagation in case of a suppression system failure or a non-typical failure event. Allowance has been made in the drainage design for a concrete slab with water tank and valve house for fire-fighting purposes. This has been sized so that it would contain approximately 160m3 of water. There will be a Sustainable drainage systems (SuDs) attenuation pond adjoining the compound which could also be used as an additional source of water. The Applicant will liaise with the local fire service to agree whether there are any further requirements for any form of water supply for the BESS, and if so then what specification is required for this. Any required water supply information must be provided in the design responses to fire risk information (see Table 15.1).

ARC Recommendation	Project Response
Ensure that sufficient water is available for manual firefighting. The ability of the fire department to control a fire involving a BESS depends on the presence of an adequate water supply and their knowledge of the hazards. The following should be considered: • An external fire hydrant should be located within 100 m (300 ft.) of the BESS room or containers; and • The water supply should be able to provide a minimum of 1,900 l/min (500 gpm) for at least 2 hours.	
6. Fire protection and water supply Install sprinkler protection within BESS rooms and ideally within BESS containers. The sprinkler system should be designed to provide 12.2 l/min/m² over 232 m² (0.30 gpm/ft2 over 2500 ft²). Water has been proven to be the best agent to fight a fire involving lithium-Ion batteries. It is important to note that other extinguishing agents, such as aerosols or gaseous extinguishing systems, will extinguish the fire, but they do not provide cooling like water. Insufficient cooling allows a hot and deep-seated core to remain. The heat will rapidly spread back through the battery and reignite remaining active sections. This is the primary reason ARC recommends the use of water for fighting the fire and cooling the batteries. Implement a procedure for battery submersion in the pre-emergency plan performed by the fire department. Submerging batteries in water (preferably outdoors) after they burn has proven to be effective at cooling the batteries and neutralising the thermal threat. They will continue to release gases, mostly carbon monoxide, but also flammable gas such as hydrogen. Therefore, never submerge several batteries in a confined space without adequate ventilation. Ensure that sufficient water is available for manual firefighting. The ability of the fire	

ARC Recommendation	Project Response
department to control a fire involving a BESS depends on the presence of an adequate water supply and their knowledge of the hazards. The following should be considered: • An external fire hydrant should be located within 100 m (300 ft.) of the BESS room or containers; and • The water supply should be able to provide a minimum of 1,900 l/min (500 gpm) for at least 2 hours.	
7. Maintenance Follow original equipment manufacturer recommendations for the inspection, testing and maintenance of BESS. In addition, ensure that the following are completed: • Measure the internal resistance of the cells. Replace the cells when a dramatic drop is detected. Keep in mind that the internal resistance is mainly independent of the state of charge but increases as the battery ages. Therefore, it is a good gauge or predictable life; • Perform infrared scanning at least once per year; and • Check the fluid for leakage. Implement electric terminal torquing procedures to maintain connection integrity.	Internal resistance is measured as part of the State of Health (SOH) control system, with maintenance and replacement carried out regularly to respond to the results. Constant insulation monitoring of each battery bank detects potential leakage. Prepare an operating procedure (within the Standard Operation Procedures and Guidelines referred to in Table 15.1) for the swap-out of faulty cells/modules. This will include plans for suitable storage locations for the modules prior to removal from site. Torque tests are part of the operation and maintenance (O&M) processes.

15.4. BESS Detailed Design Stage

15.4.1. Table 15.2 sets out the minimum information to be included with the final version of this OBSMP, before the BESS is implemented.

Table 15.2 - Detailed Design Information Requirements

Requirement	Reason for Information Required
Statement of Compliance with Applicable Legislation	To demonstrate compliance with legislation, will cross reference to the other documents set out below.

Requirement	Reason for Information Required
Detailed Design Drawing of BESS	To ensure available and safe access to the BESS for fire appliances. To enable the local fire service to evaluate the available access for fire appliances to all parts of the BESS. To show separation between components of BESS.
Statement of design responses to fire risk	To accompany the detailed design drawing and explain how the risk of fire spreading has been addressed through the Proposed Development's Design.
Battery Specification	To ensure that the local fire service is aware of the specific type of batteries installed. This would include the battery 'chemistry' as well as size and format of each cell.
Fire Detection System Specification	To demonstrate how the requirement for fire detection has been addressed.
Fire Suppression System Specification	To demonstrate how the requirement for fire suppression has been addressed.
Standard Operating Procedures and Guidelines (Relevant to Safety)	To demonstrate an ongoing commitment to regular checks and maintenance during operation e.g., plans for swap-out of suspected modules. Include a list of competencies and/or certification requirements for competent site operating staff.
BESS Installation Contractor Emergency Protocol (during construction)	To demonstrate that protocols are in place to manage a fire during construction.
Site Operator Emergency Protocol (during operation, including decommissioning)	To demonstrate that protocols are in place to manage a fire during operation and decommissioning.
Other information requested by the local fire service to inform their Tactical Response Plan	To ensure that the local fire service has the information it requires to adequately address a fire at the BESS.
Battery Transportation Plan	To ensure that the transportation of battery cells, including delivery of new, used, failed and replacement battery cells to and from the site is carried out in accordance with prevailing legislation.

Requirement	Reason for Information Required
Environmental Risk Assessment[14]	To ensure that the potential for indirect risks (e.g., through leakage or other emissions) is understood and mitigated using methods consistent with Best Available Techniques (BAT) in relation to the specific battery chemistry selected.

15.5. Conclusion

Should planning permission be granted for the Proposed Development, it would require a pre-commencement condition to provide a DBSMP which would be in accordance with this report.

Following the adoption of the measures set out in this OBSMP, the risk of a fire occurring from the BESS will be minimised, and if a fire did occur, the risk of it spreading to the point where it became a major incident will be reduced to an acceptable

[14] E.g., as may be required when applying for an environmental permit.

16. Climate Change and Carbon Assessment

16. Climate Change and Carbon Assessment

16.1. Introduction

16.1.1. This chapter of the Environmental Report (ER Report) sets out the sustainable design characteristics of the Loch Toftingall Battery Energy Storage System (BESS) (the Proposed Development) and provides an assessment of the carbon benefits of the scheme. This assessment was undertaken by Environmental Resources Management (ERM).

16.2. Background

16.2.1. Scotland has a legally binding commitment to reach net zero by 2045 under the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[1]. In Scotland's updated Climate Change Plan, the electricity sector is recognised as a key industry which will advance Scotland's Net Zero targets[2]. Scotland is already recognised as a world leader in renewable energy; however, a variety of energy infrastructure is essential in reaching net zero targets, including emerging technologies such as BESS, which will allow Scotland to have a more resilient supply of renewable energy and limit the reliance of fossil fuels and nuclear energy generation.

16.2.2. The Proposed Development seeks to support the national requirement to increase the resilience of low carbon energy generation by providing energy storage. The Site is considered to be viable due to its proximity to Mybster Substation which will supply the Proposed Development with low carbon energy from the grid.

16.2.3. As described in Chapter 4: Project Description, the BESS unit has been designed to provide a 4-hour discharge, and therefore a sizeable amount of balancing can occur between period of surplus energy generation and energy generation deficits.

[1] Scottish Government (2019) Climate change (Emissions Reduction Targets) (Scotland) Act 2019 [Online] Available at: Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (legislation.gov.uk) (Accessed on 28/07/2023)
[2] Scottish Government (2020) update to the Climate Change Plan 2018 – 2032 : Securing a Green Recovery on a Path to Net Zero [Online] Available at : Update to the Climate Change Plan 2018 - 2032: Securing a Green Recovery on a Path to Net Zero (www.gov.scot) 9Accessed on 28/07/2023)

16.3. Sustainable Design

16.3.1. The role of the Proposed Development in assisting with the decarbonisation of the electricity grid, and security of renewable energy supply, is set out below.

16.3.2. The Proposed Development will be in permanent use, allowing the project to contribute to the establishment of a low carbon grid, and therefore net zero targets, over a longer period of time (as discussed in Paragraph 4.1.8 of Chapter 4: Project Description). Battery cells within the units will be replaced at various stages in the future, with initial repowering exercises after 10-15 years and then again at 20-25 years.

16.3.3. Landscaping, as well as restoration and enhancement measures, will be provided as part of this application. As well as limiting the visibility of the scheme, landscaping will allow for biodiversity enhancement through the planting of native tree and shrub species, as noted in the 'Landscaping' section of Chapter 4: Project Description (Paragraphs 4.5.55 – 4.4.59). Peatland restoration works will also be completed by ground smoothing and cross tracking. Further details on restoration works can be found in Appendix 7.2 Outline Habitat Management Plan (oHMP).

16.3.4. The Proposed Development will also maximise the use of Sustainable Drainage Systems (SuDS) to manage surface runoff and sediment control at the Proposed Development**.** Further detail on SuDS can be found in Appendix 11.2.

16.4. Grid Resilience and Carbon Benefits

16.4.1. Wind power generation (the predominant technology supplying the Mybster Substation) fluctuates depending on the weather conditions. The Proposed Development will help protect the electricity grid from fluctuations, to further the deployment of low carbon energy systems. It will also aid the Scottish Government's Net Zero and Sustainable Development Targets by providing capacity to accommodate some of the increased generation of low carbon power from renewable energy sources.

16.4.2. Installation of batteries results in a reduction of curtailment (see Section 16.5). Curtailment is the loss of renewable energy from the electricity grid. This occurs when power from renewable energy sources is available but cannot be exported due to capacity constraints. By reducing the occurrence of curtailment and storing excess renewable energy for later use, battery storage facilities can lead to significant carbon savings.

16.4.3. In addition, if the alternative technologies for balancing the UK electricity grid are considered, which include diesel generators or 'peaking plant' gas fired power stations, these alternatives have high carbon impacts per unit of electricity generated.

16.4.4. In 2021, Lane Clark and Peacock published a report entitled: 'Is battery storage a good investment opportunity?'[3]. In this report it is estimated that 50% of the 3.7 terrawatt hours (TWh) of 'lost' wind energy generation within the UK electricity grid could be saved through the installation of 20 gigawatt hours (GWh) of battery storage.

16.4.5. The Proposed Development has a maximum export capacity of up to 49.9MW and has been designed with a 4-hour discharge period giving a total storage capacity of 200MWh. Based on the Lane Clark and Peacock figures, it is assumed 18.5GWh of low carbon generation will be saved by the Proposed Development in the first year of operation.

16.4.6. The UK Government's Department for Energy Security and Net Zero produce an annual dataset of the climate change impacts of a range of fuels, including the UK grid average[4].

16.4.7. The UK Government's Department for Energy Security and Net Zero (DESNZ) 2022 figure for the UK electricity grid mix was 0.19338 kgCO2eq/kWh. Therefore, if this figure is multiplied by the estimated 18.5GWh of un-curtailed renewable energy saved by the project it equates to a carbon saving of 3,578 tonnes of CO_2eq. per year.

16.4.8. The above calculation is however based on the battery project making up for the curtailment of grid mix electricity. However, it could be more relevant to assume that the battery avoids the use of gas fired (OCGT) generation when it is discharging rather than grid mix electricity. The OCGT carbon intensity figure from the Ecoinvent database is 0.36439 kgCO2eq/kWh[5]. When this figure is multiplied by the estimate 18.5GWh of un-curtailed renewable energy saved by the project it equates to a carbon saving of 6,741 tonnes of CO_2eq. per year.

16.4.9. To further contextualise this carbon saving, Ofgem calculated that the average domestic home uses around 2,900kWh of electricity every year[6]. Therefore, the

[3] Land, Clark and Peacock (2021) Is Battery Storage a Good Investment Opportunity? [Online] Available at: Is battery storage a good investment opportunity? | Report | Lane Clark & Peacock LLP (lcp.com) (Accessed 24/08/2023)
[4] Department for Energy Security and Net Zero Greenhouse Gas Report Conversion Factors 2022 https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022
[5] Wernet G et al The ecoinvent database version 3 (parti) overview and methodology. The International Journal of Life Cycle Assessment 21(9) p 1218 – 1230.
[6] Ofgem (2023) Average Gas and Electricity Usage [Online] Available at: Average gas and electricity usage | Ofgem (Accessed 25/08/2023)

Proposed Development would equate to saving the electricity that could be used to operate 6,379 homes.

16.5. Reducing Curtailment

16.5.1. Occasionally, renewable energy sources produce more energy that is required by the grid, causing curtailment. In Scotland, a small proportion of renewable energy sources are not being used. In total, renewable energy provided 87.8% of gross electricity consumption in 2021[7]. To increase this to 100% and meet Scottish Government renewable energy targets, facilities such as BESS can be utilised to increase the security of renewable energy supply and reduce reliance on other modes of electricity generation, like fossil fuels.

16.5.2. The International Energy Agency revealed that in 2022 the UK generated a quarter of its electricity from wind power, mainly onshore wind in Scotland and offshore installations; however, as a result of most electrical demand coming from the southeast of the country, almost around 4.0TWh of wind was curtailed[8]. This was due to a mix of network constraints and the limited transmission capacity at the Scottish/English interface.

16.5.3. By adjusting the Lane Clark and Peacock report figures to bring them up-to-date to reflect 2022 curtailment levels, it can be seen that 21.5GWh of battery storage will reduce the curtailment in the UK by approximately 50%. The Proposed Development will contribute to the 21.5GWh of battery storage needed to reduce curtailment levels and increase the security of renewable energy.

16.6. Conclusion

16.6.1. The Proposed Development represents a significant opportunity to reduce curtailment levels throughout the UK and increase the security of renewable energy which will aid Scotland, and the UK, to achieve net zero targets. It is estimated that the Proposed Development will provide carbon dioxide savings that are within the range 3,578 to 6,741 tonnes of CO_2eq. per year depending on the assumptions used.

[7] Scottish Government (2023) Energy Statistics for Scotland – Q1 2023 [Online] Available at: Renewable Electricity Generation - Energy Statistics for Scotland - Q3 2022 - gov.scot (www.gov.scot) (Accessed on 02/08/2023)
[8] IEA (2023) Will more wind and solar PV capacity lead to more generation curtailment? [Online] Available at: Will more wind and solar PV capacity lead to more generation curtailment? – Renewable Energy Market Update - June 2023 – Analysis - IEA (Accessed on 24/08/2023)

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