Viking Wind Farm Construction Compounds - Main Compound

June 2019

Volume 2: Main Report

Environmental Impact Assessment Report

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VOLUME 2: MAIN REPORT - TABLE OF CONTENTS

PREFACE

Viking Energy Wind Farm LLP (the Applicant) is developing proposals to seek planning permission for three temporary construction compounds on mainland Shetland, known as the Main Compound, West Compound and North Compound. This document relates to the Main Compound.

The construction of temporary construction compounds is included as part of the existing consent however, the Applicant has identified a requirement to increase the size of the compounds in order to facilitate the expeditious construction of the proposed wind farm. As such the Applicant is proposing to bring forward applications for permission to construct three temporary construction compounds.

The applicant has provided an Environmental Impact Assessment Report (EIA Report) to accompany the application. The EIA Report comprises the following sections:

- Volume 1: Non-Technical Summary;
- Volume 2: Main Report;
- Volume 3: Figures; and
- Volume 4: Technical Appendices.

Additional documentation that will be submitted with the application includes:

- Design and Access Statement; and
- Pre-Application Consultation Report.

The EIA Report and additional documents will be available for viewing on the Shetland Islands Council online portal (https://www.shetland.gov.uk/planningcontrol/ViewandComment.asp), on the application website (https://www.vikingenergy.co.uk/document-archive) and also during normal opening hours at the following locations:

- Shetland Islands Council, 8 North Ness Business Park, Lerwick, ZE1 0LZ; and
- Shetland Library, Lower Hillhead, Lerwick, ZE1 0EL.

A paper copy of the Non-Technical Summary is available free of charge. A copy of the EIA report is available on DVD at a cost of £10. A printed copy of the EIA Report can be provided upon request (£300). Copies of the documents may be obtained from the applicant by contacting:

Viking Energy Partnership

The Gutters Hut

North Ness Business Park

Lerwick

Shetland

ZE1 0LZ

Any comments (representations) on the application must be made in writing via letter to Development Management, Development Services, 8 North Ness Business Park, Lerwick, ZE1 0NT, via email or online (please note registration is required to be able to comment online). Shetland Islands Council will advertise the application and will set a closing date for the submission of representations.

Any subsequent additional information which is submitted by the applicant will be subject to further public notice in this manner, and representations to such information will be accepted.

1. INTRODUCTION

1.1 Introduction

1.1.1 Viking Energy Wind Farm LLP ("the Applicant") is developing proposals to seek planning permission under the terms of the Town and Country Planning (Scotland) Act 1997 as amended for three temporary construction compounds on Mainland Shetland, known as the Main Compound, West Compound and North Compound. The location of the compounds is illustrated on Figure 1.1. Separate planning applications will be made for each compound with an accompanying Environmental Impact Assessment Report ("EIA Report") under the terms of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 ("2017 EIA Regulations"). This document provides the EIA Report for the Main Construction Compound (hereafter referred to as the proposed development) shown in Figure 1.2.

1.2 Background and Relationship to Viking Wind Farm

1.2.1 The necessary statutory consents for the construction and operation of the Viking Wind Farm were granted by the Scottish Ministers on 4 April 2012. The Scottish Ministers granted consent under Section 36 of the Electricity Act 1989 ("the relevant section 36 consent"), together with a direction under section 57(2) of the Town and Country Planning (Scotland) Act 1997 ("the 1997 Act") granting deemed planning permission, for the proposed 103 turbine Viking Wind Farm. By letter dated 29 March 2017, the Scottish Ministers extended the period for commencement of development by three years thereby permitting commencement of development up to 4 April 2020 unless further extended by the Scottish Ministers under Condition 2 of the relevant section 36 consent.

1.2.2 The Applicant subsequently (14 November 2018) submitted an application for variation under Section 36C of the Electricity Act 1989. The proposed variation includes an increase in maximum tip height from 145 m to a maximum of 155m and an increase in the maximum rotor diameter from 110 m to 120 m. The variation was granted consent on 24 May 2019 ("s36C Consented Viking Wind Farm").

1.2.3 The construction of temporary construction compounds is included as part of the existing consent however, the Applicant has identified a requirement to increase the size of the compounds in order to facilitate the expeditious construction of the proposed wind farm. As such the Applicant is proposing to bring forward applications for permission to construct three temporary construction compounds. Figure 1.3 illustrates the proposed construction compounds in relation to Viking Wind Farm.

1.3 Consultation

1.3.1 No formal EIA screening or scoping has been carried out. The Applicant consulted with the Planning Authority (Shetland Islands Council (SIC)), Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) and Historic Environment Scotland (HES) (the statutory consultees) on the likely significant effects associated with the proposed development by providing a pre-application briefing note. The scope for the EIA report was agreed (informally) through a teleconference call on 12 April 2019. The minutes of the teleconference call are provided in Technical Appendix 3.1. Further information on the scoping consultation and outcome can be found in Chapter 3.

1.3.2 Given the nature and scale of the proposed development, pre-application consultation is required under regulation 3 of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013. As such the Applicant held a drop-in Public Information day prior to submission on 12th June 2019.

1.4 Scope of EIA Report

Description of the Development

1.4.1 The three proposed temporary construction compounds are located across Central Mainland Shetland. Table 1.1 below details the indicative maximum dimensions of each compound, with the proposed development highlighted in bold. Further detailed description is provided in Chapter 2: Description of the Development.

Table 1.1: Proposed Construction Compound Indicative Maximum Dimensions

Construction Compound	Floor Space (m)	Footprint (ha)	Maximum Height (m)
Main Construction Compound	250 x 250	6.25	7
West Construction Compound	200 x 200	4	7
North Construction Compound	200 x 200	4	7

Reasonable Alternatives

1.4.2 The only reasonable alternative considered in the context of the proposed development is the 'do nothing' alternative whereby the already consented construction compound would be used as part of the s36C Consented Viking Wind Farm. The main reasons for deciding to proceed with the larger construction compound are detailed in Section 1.5.

Baseline Conditions and Cumulative Context for Impact Assessment

1.4.3 The baseline conditions for the proposed development would be as the site is now (i.e. undeveloped). Without implementation of the proposed development, with respect to 'natural change', no significant changes to the baseline are anticipated. It should be noted that the construction of the proposed development is required to facilitate the development of the consented Viking Wind Farm. As such the Viking Wind Farm will be considered not as a 'future baseline' but covered under the cumulative effects section of each technical chapter in this EIA Report, whereby 'additional' and/or 'in-combination effects' of the proposed construction compounds and the proposed Viking Wind Farm will be assessed.

1.5 Factors Affected by the Development

1.5.1 The EIA Report provides impact assessment chapters for the relevant factors specified in regulation 4(2) and schedule 4 of the 2017 EIA Regulations where they are likely to be significantly affected, taking account of the description of the proposed development and the mitigation by design. Each assessment chapter describes the assessment methodology used and the criteria by which a significant effect is defined. This EIA Report has been prepared to include the information specified in regulation 18 of the 2017 EIA Regulations.

1.6 EIA Quality

1.6.1 In accordance with regulation 18(5) of the 2017 EIA Regulations, by appointing Ramboll UK Limited (Ramboll), the Applicant has ensured that the EIA Report has been prepared by 'competent experts'. The EIA Report has been compiled and approved by professional EIA practitioners at Ramboll, holding relevant undergraduate and post-graduate degrees, full membership of IEMA (MIEMA) and Chartered Environmentalist (CEnv) status with the Society for the Environment. The EIA Report meets the requirements of the Institute of Environmental Management and Assessment

(IEMA) EIA Quality Mark scheme. This is a voluntary scheme operated by IEMA that allows organisations to make a commitment to excellence in EIA and to have this commitment independently reviewed on an annual basis.

1.6.2 Each of the impact assessment chapters provides details of the relevant professional memberships of the authors and code of practice followed in order to confirm relevant competence. The chapters also include details of the assessment methodology used, including the specific criteria for defining the sensitivity of the baseline environment, quantifying the magnitude of change and for assessing whether the effects are deemed significant or not significant under the terms of the EIA Regulations.

Structure of the EIA Report

1.6.3 Overall the EIA Report is provided in 4 volumes:

- Volume 1: Non-Technical Summary;
- Volume 2: Main Report;
- Volume 3: Figures; and
- Volume 4: Technical Appendices.

1.6.4 Specialist consultants, considered to be competent experts in their field, have been appointed by the Applicant to consider the following shown in Table 1.2 below:

Table 1.2: Technical Consultants and Respective Technical Competency

Competency	**Consultant**
Landscape and Visual	Ramboll
Ornithology	Atlantic Ecology
Noise	TNEI
Ecology	MBEC
Hydrology	Ramboll
Peat Landslide Hazard Risk Assessment (PLHRA)	SLR Consulting
Cultural Heritage and Archaeology	Headland Archaeology

1.6.5 A glossary of terms is also included at the front of this EIA Report.

List of Figures

2. DEVELOPMENT DESCRIPTION

2.1 Introduction

2.1.1 This chapter provides a description of the proposed development for the purposes of identifying and assessing likely significant effects. Information is provided on:

- the physical characteristics of the whole proposed development, including construction, operation and decommissioning;
- land use requirements during the construction and operational phases;
- the main characteristics of the operation of the proposed development, material and natural resources used; and
- an estimate by type and quantity of expected residues and emissions produced during the construction and operation phases.

2.1.2 This chapter is supported by the technical appendices described in Table 2.1.

Table 2.1: Technical Appendices Supporting Chapter 2

Title	Description
Technical Appendix 2.1: Project Description Details	Schedule providing details of land-use (as required by the 2017 EIA Regulations).
Technical Appendix 2.2: Outline Construction Traffic Management Plan (CTMP)	An outline of the structure and topics that would be covered in more detail in the final Construction Traffic Management Plan (CTMP).
Technical Appendix 2.3: Peat Landslide Hazard Risk Assessment (PLHRA)	An assessment presenting peat landslide hazard risks associated with the site.
Technical Appendix 2.4: Carbon Calculator	Using the Scottish Government's Carbon Calculator Tool v1.5.1 (June 2019), updated the Viking Wind Farm carbon calculator to take account of the increased size of the construction compounds.

2.1.3 Figures 1.2 and 2.1 are referenced in the text, where relevant.

2.1.4 The proposed development would comprise a single temporary construction compound (Figure 1.2) for the construction phase of the proposed Viking Wind Farm along with associated infrastructure and access, as shown on Figure 1.3 and as described in more detail in the remainder of the Chapter and supporting Technical Appendices. The proposed development would include the following key components:

- a temporary construction compound area of no more than 250 m x 250 m;
- access tracks and internal circulation routes for vehicles and pedestrians;
- lighting for security and safety during hours of darkness;
- surface water management;
- temporary office accommodation and welfare buildings (toilets, kitchen/canteen, drying rooms) with a height no more than 7 m;
- equipment storage;
- maintenance and refuelling facilities;
- waste, recycling and materials management facilities;
- general laydown areas; and
- parking.

2.1.5 Technical Appendix 2.1: Project Description Details provides the temporary land use requirements for the proposed development. Figure 2.1: Construction Compound Indicative Detailed Design Drawing provides shows both the larger indicative compound search area (i.e. 250 m x 250 m), as well as the smaller indicative construction compound area in which the proposed development will be situated.

2.2 Site Access

2.2.1 The proposed development will be accessed via the A970 Access Point 8 (east of Sandwater) - an access track proposed as part of the consented Viking Wind Farm[1]. The EIA Report accompanying the proposed Viking Wind Farm stated that this 'new junction would be designed and constructed in accordance with SIC roads department requirements as part of wind farm construction'[2]. No change to this is proposed as part of the construction compound EIA Report.

2.3 Construction Programme

2.3.1 It is proposed that the construction of the three temporary construction compounds would be carried out between November 2019 and March 2020. This would fit into the wider construction programme of Viking Wind Farm as shown in table 2.2 below:

Table 2.2: Indicative Viking Wind Farm Construction Programme

Activity (Key Milestone)	**Date**
Advanced works	
Ground investigation	June 2019 – May 2020
Kergord access track	Jan 2020 – July 2020
Compounds (3 off)	**Nov 2019 – Mar 2020**
Access junctions (4 off)	Jan 2020 – July 2020
Main Works	
Sandwater road	May 2020 – Jan 2021
Develop borrow pits	June 2020
Access tracks	July 2020 – onwards
WTG bases and crane hard standings	Q4 2020 – onwards
HV cable installation	Q4 2020 – onwards
Turbine component delivery	Dec 2021 – Oct 2022
Turbine erection works, fit out and commissioning	Mar 2022 – June 2023
Kergord 132/33kv sub-station (Viking Energy Wind Farm)	Mar 2022 – Mar 2023
Kergord HVDC convertor station (Scottish and Southern Electricity Networks)	Mar 2020 – Mar 2024
Commercial operations	April 2024
Handover to operations	Oct 2024

[1] Viking Wind Farm, Section S36C Application – EIA Report (2018), Figure 10.3. Available at: https://www.energyconsents.scot/ApplicationDetails.aspx
[2] Viking Wind Farm, Section S36C Application – EIA Report (2018), Chapter 10, Table 10.6. Available at: https://www.energyconsents.scot/ApplicationDetails.aspx

2.4 Construction Working Practices

Construction Environmental Management Plan and Peat Management Plan

2.4.1 The Applicant proposes to meet the requirements of a site wide joint Construction Environmental Management Plan (CEMP) as per condition 4 of the Viking Wind Farm consent.

2.4.2 Furthermore, the applicant proposes to discuss with SEPA how to present an all-encompassing CEMP and PMP for Viking Wind Farm and its associated applications (e.g. the construction compounds).

Construction Working Hours

2.4.3 General construction activities would typically be limited to the working hours of 07:00 to 19:00 Monday to Friday, and 07:00 to 16:00 on Saturday. However, to ensure that optimal use is made of fair weather windows and daylight, or at critical periods within the programme, it will be necessary to work outwith these hours and on Sundays, however this would be in accordance with the consented Viking Wind Farm planning condition, part 2, condition 9.

Formation of Compound

2.4.4 A cut and fill exercise will be required to create the compound platform prior to construction as illustrated in Figure 2.1. The cut and fill design is based on desk based calculations and a digital terrain model for the development footprint, and as such the volumes will be subject to change. The cut and fill design would be revisited based on a detailed ground investigation and site specific topographic survey. The indicative calculations suggest that a balance between cut and fill would be achieved, with cut vegetation, topsoil and peat to be used for landscaping where appropriate.

2.4.5 The overall compound establishment is likely to comprise the following activities:

- Formation of junction with public road and construction of site access;
- Installation of construction stage upslope cut-off drainage and construction stage surface water management;
- Soil, peat and vegetation strip and temporary storage;
- Excavation using tracked excavators, potentially rock breaking/ripping equipment;
- Creation of platform using general fill, followed by capping and surfacing using vibrating rollers for compaction;
- Landscaping of temporary soil and peat storage for reuse in site reinstatement;
- Installation of services (telecoms, water & drainage, and low voltage electrical supply);
- Installation of site drainage and fencing (2.5m high) around the site perimeter;
- Delivery and set up of temporary buildings for offices, kitchens, toilets, meeting rooms; and
- Set up of laydown area along with material management areas, areas for segregation of waste, tool storage, fuel storage and generation equipment.

2.5 Site Operation and Maintenance

Site Operations

2.5.1 The operational site compound would provide:

- temporary offices and meeting rooms (potentially two storeys with a maximum height of 7 m above ground level);
- kitchens;
- toilets and showers;

- equipment storage;
- drying rooms;
- car parking;
- general material laydown/storage;
- waste management areas;
- fuel storage and refuelling facilities;
- temporary generation equipment and fuel storage;
- general security lighting (designed to meeting good practice guidance on avoiding intrusive lighting); and
- wheel wash facilities.

2.5.2 As the proposed development will be temporary it shall be designed with the purpose of being used for only the construction phase of Viking Wind Farm.

2.5.3 There would be regular safety inspections, maintenance of facilities, tracks, fencing and other infrastructure.

2.6 Site Decommissioning

2.6.1 The decommissioning period for a construction compound of this size is estimated to be XX-XX months. Detailed decommissioning proposals would be established and agreed with relevant authorities prior to commencement of decommissioning activities, in accordance with relevant conditions.

2.6.2 Decommissioning would likely involve:

- dismantling and removing the temporary infrastructure (office accommodation, tracks, fencing etc); and
- reprofiling the site to tie in with the surrounding landform and re-instating with topsoil or peat turves, where appropriate and under the supervision of the project environmental clerk of works.

Site Reinstatement

2.6.3 As the construction compound are only intended for the construction phase of Viking Wind Farm. Following the completion of the construction phase the site of the proposed development would be reinstated to levels equal to or better than prior to construction.

2.6.4 The above has been considered when predicting decommissioning effects in each of the technical assessments reported in this EIA Report.

2.6.5 This habitat re-instatement work will draw on the experience of implementing the Viking Wind Farm Habitat Management Plan (RPS, 2016) with regard to restoring and enhancing peatland habitats to benefit breeding bird species.

2.7 Residues and Emissions

2.7.1 Table 2.3 details the potential residues / emissions from various sources associated with the proposed development, along with the relevant proposed compliance / mitigation measures.

Table 2.3: Residues and Emissions

Topic	Potential Residue / Emission
Water	All surface water runoff from the proposed development would be captured by a sustainable drainage systems (SuDS) to control the rate, volume and quality of discharge in to the water environment. All discharges would be subject to regulations in accordance with a

Table 2.3: Residues and Emissions	
	pollution prevention plan to be approved under the Controlled Activities Regulations (CAR), and subject to a Construction Site License to be issued by SEPA. Drainage would be design by civil contractor and agreed with SEPA and the Local Authority.
Air	Due to the nature of the proposed development no significant point source or diffuse air emissions would be produced during its construction or operation. Technical Appendix 2.4: Carbon Calculator presents the results of the updated Viking Wind Farm carbon calculator to take account of the increased size of the proposed development, comparing this with the s36C Consented Viking Wind Farm. The results indicate that there is no material change in the carbon payback period (using grid mix of electricity generation), when compared with the s36C Consented Viking Wind Farm.
Noise	Construction and operation noise is likely from the proposed development. The noise limit would be designed to comply with relevant standards. Further details are presented in Chapter 6: Noise.
Light	Construction compounds (during construction and operation) will require lighting, especially considering the low number of day light hours during the winter months on Shetland. The proposed development may be equipped with passive infra-red sensor-controlled security lighting in accordance with Institution of Lighting Professionals (ILP) standards for avoiding obtrusive lighting[3]. These would illuminate the sub-station compound area when activated. Any effect would be temporary and not expected to be significant during normal operation of the proposed development.
Soil Pollution / Waste	The compound will provide areas for materials management, segregation for recycling and waste disposal. Waste streams are likely to include typical domestic wastes from the offices and canteens, alongside construction related materials. All waste would be managed in accordance with the relevant legislation. The volumes and types of wastes anticipated are not considered likely to give rise to significant effects. Peat excavated during construction would be managed in accordance with any future Peat Management Plan (PMP).

2.8 Health and Safety and Related Issues

2.8.1 Health and safety would be initially addressed as part of the Pre-Construction Information Pack prepared by the Construction Design Management (CDM) Coordinator for the project under the Construction (Design and Management) Regulations 2015. The contractor would be required to prepare a Construction Phase Health and Safety Plan and forward information to the CDM Co-ordinator during the works to enable the Health and Safety File to be completed.

2.8.2 In accordance with the Land Reform (Scotland) Act 2003 as amended, general public access rights are removed throughout the construction working area for health and safety reasons.

2.8.3 An Operations and Maintenance Manual for the proposed development would be prepared, which would cover all operational and decommissioning procedures.

[3] Available at: http://www.wiltshire.gov.uk/guidance-notes-for-the-reduction-of-obtrusive-light.pdf

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3. SCOPING AND CONSULTATION

3.1 Introduction

3.1.1 This chapter describes the scoping and consultation process undertaken from the purposes of the EIA. In addition, it provides a summary of the key issues raised by consultees and reports the conclusions reached as a result of consultations and desk studies.

3.1.2 As the construction compounds individually are considered a 'major' class of development as set out in The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013 and circular 3:2013 - Development Management Procedures. Public consultation is required and has been undertaken by the Applicant. A Pre-Application Consultation Report (PACR) has been prepared by Ramboll on behalf of the applicant for this proposed development.

3.1.3 The purpose of scoping and pre-application consultation is to:

- Ensure that statutory consultees and other bodies with a particular interest in the environment are informed of the proposal and provided with an opportunity to comment at an early stage in the EIA process;
- Obtain baseline information regarding existing environmental site conditions;
- Establish key environmental issues and identify potential effects to be considered during the EIA;
- Identify those issues which are likely to require more detailed study and those which can be justifiably excluded from further assessment; and
- Provide a means of confirming the most appropriate methods of assessment.

3.2 Scoping

3.2.1 No formal screening or scoping opinion was requested by the Applicant. However, the Applicant did engage in pre-application consultation with key statutory consultees. To facilitate this consultation a briefing note was prepared. The briefing note included an outline description of the proposed development and the site location, set out the likely environmental effects that could result from the proposed construction compounds, and the assessment methodology by which these issues would be evaluated.

3.2.2 A conference call took place on 12th April 2019 to discuss the likely significant environmental effects. Statutory consultees: Shetland Islands Council, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Historic Environment Scotland (HES) were invited to comment on the scope of the EIA. Those that could not attend the call provided comment separate to the call. Minutes from this call have been used to inform the EIA Report preparation (see Appendix 3.1).

3.3 Public Consultation

3.3.1 As agreed with Shetland Islands Council through the Proposal of Application Notice, public information events were held on Wednesday 12 June 2019 as follows:

- Whiteness & Weisdale Hall from 10am-2pm; and
- Voe Hall from 3.30pm-8pm.

3.3.2 The events were advertised in the local press and advertised on local notice boards. Community councils, local councillors, MSPs and MPs were advised in advance of these exhibitions in writing. Local community councils consulted included:

- Nesting and Lunnasting Community Council;

- Whiteness, Weisdale and Tingwall Community Council; and
- Delting Community Council.

3.3.3 The information available included plans of the proposed site layout, information boards explaining the potential environmental effects, along with an explanation of the consenting process and the current project stage within that process. Representatives of the Applicant and Ramboll were also available to provide additional information and answer queries. The exhibition material and adverts are also contained in the PACR.

3.4 Summary of Scoping and Consultation

3.4.1 Table 3.1 below provides an outline of the potential environmental effects scoped in and out of the EIA report, as agreed with statutory consultees.

Table 3.1 Summary of Environmental Effects to be Scoped In and Scoped Out

Technical Area	Issues to be Scoped In	Issues to be Scoped Out
Peat Stability and Peat Management	• Assessment of effects on peatland habitats; • Provision of Peat Management Plan (PMP)[1]; and • Peat Landslide Hazard Risk Assessment.	• None.
Ornithology	• Habitat loss; • Disturbance/reinstatement; and • Disturbance/displacement effects.	• Collision risk.
Ecology and Aquatic Ecology	• Mammal species surveys; • Vegetation surveys and peatland habitat condition; and • Amphibian and reptile monitoring.	• Aquatic ecology.
Cultural Heritage and Archaeology	• Direct effects on cultural heritage and archaeological assets.	• Indirect effects on cultural heritage and archaeological assets.
Hydrology	• Potential for pollution linkage with sensitive water catchments; • Watercourse crossing; and • Groundwater Dependent Terrestrial Ecosystems (GWDTE).	• Private water supplies (PWS).
Noise	• Construction Noise.	• Operational noise; • Vibration; • Low Frequency noise; and • Amplitude Modulation.
Landscape and Visual	• Landscape character; • Visual amenity; and • Assessment of potential effects from intrusive lighting.	• All other landscape and visual aspects.
Human Health, Air Quality and Population	• No stand-alone assessment (noise and visual amenity considered separately).	• Air Quality; and • Population.

[1] The Applicant is seeking to agree an all-encompassing PMP and CEMP with SEPA prior to construction. The proposed development shall adhere to this agreed PMP/CEMP.

Table 3.1 Summary of Environmental Effects to be Scoped In and Scoped Out		
		• Health and Safety at Work; and including best practice.
Access, Traffic and Transport	• Outline Construction Traffic Management Plan.	• Operational Traffic.
Climate Change Impact Assessment	• Updated Carbon Calculator to account for greater footprint of the proposed construction compounds.	• All other aspects of Climate Change Impact Assessment.
Recreation and Tourism	• None.	• All aspects of Recreation and Tourism.
Socio-economics	• None.	• All aspects of Socio-economics.
Aviation and Telecommunications	• None.	• All aspects of Aviation and telecommunications.

4. LANDSCAPE AND VISUAL AMENITY

Executive Summary

4.1.1 A landscape and visual impact assessment (LVIA) was undertaken to assesses the potential effects on the local landscape and visual resource arising from the proposed compound required to enable the construction of the recently consented Viking Wind Farm. The LVIA addresses the construction and operation of the temporary proposed development, and its subsequent removal and the reinstatement. The assessment considers effects on landscape fabric, landscape character, landscape designations and classifications, as well as the visual amenity of an area equivalent to a 2 km radius from the proposed development boundary.

4.1.2 The proposed development would be located within a sparsely settled and remote area within an Inland Valley, enclosed by elevated uplands to the east and west and is therefore considered to have a high susceptibility and sensitivity to the type of development proposed. However, there was considered to be some capacity to accommodate the proposed compound within the rolling valley side without widespread significant effects.

4.1.3 The assessment identifies the principal sources of landscape and visual effects, including cumulative effects and sets out a series of mitigation measures with which to ameliorate effects during the construction, operation and decommissioning of the proposed development. Whilst these would not entirely eliminate potential effects they would reduce the level of some effects and the prominence of the proposed development.

4.1.4 The LVIA concludes that, in general, the effect of the proposed compound on the landscape and visual amenity of the area would not be significant. However, localised significant effects were identified at a small number of locations close to the proposed compound, within Petta Dale. Such effects would be confined to locations in close proximity to the proposed compound, would be short to medium-term in duration, and reversible.

4.2 Introduction

4.2.1 This chapter provides as assessment of the potential landscape and visual effects associated with the main temporary construction compound (hereafter referred to as the proposed development) for the recently consented Viking Wind Farm, as described in Chapter 1: Introduction, of the EIA Report.

4.3 Scope of the Assessment

4.3.1 The proposed development would be temporary in nature and would be removed following completion of construction activities at the consented Viking Wind Farm site. Consequently, the assessment addresses the construction and operation of the proposed development, a period of around 5 years and its subsequent removal and the reinstatement of the proposed development site. The assessment considers effects on:

- Landscape Fabric;
- Landscape Character;
- Landscape Designations and Classifications; and
- The visual amenity of the study area.

4.3.2 Effects on landscape fabric occur when there is physical change to components of the landscape such as the landform, land use or land cover. Effects on landscape character arise when there is change to the key characteristics of the landscape and its associated distinct and recognisable pattern of elements. Visual effects are a subset of landscape effects and comprise changes in views of the landscape and the overall effects on visual amenity.

4.3.3 Landscape and visual effects may have effects on cultural heritage facets of the landscape, specifically on the setting of Gardens and Designed Landscapes (GDLs) and on listed buildings and ancient monuments. The landscape and visual assessment (LVIA) considers potential effects on GDLs, whilst effects on other cultural heritage receptors are considered in EIA Report Chapter 9: Archaeology and Cultural Heritage.

4.3.4 Landscape and visual considerations have influenced the design of the proposed development and these are explained in ES Volume 2: Chapter 2: Proposed Development.

4.3.5 The scope of the assessment has been informed by consultation responses, published guidance and planning policy.

4.3.6 Cumulative effects are also considered in respect of the additional and in-combination effects of the proposed development construction in conjunction with the consented Viking Wind Farm.

Study Area

4.3.7 Given the temporary and short-term nature of the proposed development, its relatively small scale and position within a landscape that has a high degree of enclosure and few receptors, a study area of 2 km from the boundary of the proposed development has been adopted.

4.4 Methodology

Guidance

The landscape and visual assessment was based on guidelines provided in Guidelines for Landscape and Visual Impact Assessment (GLVIA)[1] and comprises:

[1] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition.

- The establishment of the landscape and visual baseline context for the study area;
- The establishment of the sensitivity of the landscape and visual resource within the study area in respect of the type of development proposed;
- Identification of sources of potential landscape and visual impacts;
- Identification of any standard or site-specific mitigation measures;
- Assessment of potential magnitude of residual landscape and visual impacts; and
- Assessment of residual landscape and visual effects and statement of significance.

Data Sources

4.4.1 Datasets utilised in the preparation of the LVIA included:

- Ordnance Survey 1:50,000 and 1:250,000 mapping;
- Ordnance Survey 50 – 5 m Digital Terrain Model;
- Scottish Landscape Character Assessment data – SNH data sets;
- Gardens and Designed Landscapes – Historic Environment Scotland datasets;
- National Scenic Areas – Scottish Government data sets;
- Special Landscape Areas – SNH data sets;
- Wild Land Areas - SNH data sets; and
- Road network – Meridian 2 data.

Illustrative Materials

4.4.2 The LVIA is illustrated by a range of tools including a ZTV plans, and annotated photographs. All outputs have been prepared in accordance with Landscape Institute (2018) Technical Guidance Note - Photography and Photomontage in Landscape and Visual Impact Assessment - Public Consultation Draft.

Assessment of Landscape and Visual Effects

4.4.3 The purpose of the landscape and visual impact assessment is to identify, predict and evaluate potential significant effects arising from the proposed development. Wherever possible, identified effects are quantified, but the nature of landscape and visual assessment requires interpretation by professional judgement. In order to provide a level of consistency to the assessment, landscape sensitivity to change, the prediction of magnitude of impact and assessment of significance of the residual effects has been based on pre-defined criteria, the level of effects being determined by a comparison of the sensitivity of receptors and the magnitude of impact arising from the proposed development, as indicated in Table 4.1, below

4.4.4 In order to assist in evaluating the potential landscape and visual effects arising from the proposed development, a Zone of theoretical Visibility drawing (ZTV) was produced (Figure 4.1) to identify the potential extent of the proposed developments' visibility within the study area. An assessment of the predicted visibility of the proposed development from each of the landscape character types, designated and sensitive non-designated landscapes in the study area has been carried out by analysing the ZTVs and verifying the findings during field reconnaissance. The visibility assessment has concentrated on the publicly accessible areas including outdoor recreational areas, cycle routes, roads, and the public footpath network.

4.4.5 The viewpoints selected for consideration as part of this assessment are considered to be representative of the main sensitive receptors in the study area. Viewpoint locations are detailed in Figure 4.1.

4.4.6 Analysis of the potential effects on landscape and visual amenity arising from the proposed development at each of these viewpoints has been carried out. This analysis has involved the production of computer-generated wirelines and/or photomontages to predict the operational views of the proposed development from each of the agreed viewpoints. The existing and predicted views from each of these viewpoints have been analysed to identify the magnitude of impact and the residual effects on landscape character and visual amenity at each viewpoint location.

Criteria for Assessing the Sensitivity of Receptors

4.4.7 The sensitivity of the landscape to change is defined as high, medium or low based on professional interpretation of a combination of its susceptibility to change associated with the type of development proposed, and the value attributed to the landscape. The following parameters were therefore applied in determining the susceptibility of the landscapes within the study area:

- Landscape quality;
- Existing land-use;
- The pattern and scale of the landscape;
- Visual enclosure/openness of views and distribution of visual receptors;
- The scope for mitigation, which would be in character with the existing landscape; and
- The degree to which the particular element or characteristic contribution to the landscape character and can be replaced or substituted.

4.4.8 In determining value, the LVIA uses, as its primary indicator, formal landscape designations. Where other clearly defined indicators were identified, these have also been referred to.

4.4.9 Visual receptor sensitivity is also defined as high, medium or low based on an interpretation of a combination of parameters, and also relates to the susceptibility and value ascribed to visual receptors or receptor locations. The following criteria were utilised in determining viewpoint sensitivity:

- The land use or main activity at the viewpoint/receptor location;
- The frequency and duration of use of receptor location; and
- The landscape character and quality of the intervening landscape.

4.4.10 In relation to land use at the viewpoint, visual sensitivity is defined in Table 4.1, below.

Table 4.1: Sensitivity in Relation to Receptor Type and Activity

Sensitivity	Receptor Type and Activity
High	Tourists and those engaged in outdoor recreational activities for which the landscape and views form a key part of their experience, including hill walkers and visitors to formal vantage points, strategic recreational footpaths, cycle routes or rights of way); Visitors to landscapes/sites that have a strong physical, cultural or historic connection with the landscape or a particular view; residential receptors.
Medium	Local road users/commuters whose are generally travelling alone and/or are focused on the road rather than the adjoining landscape.
Low	People engaged in outdoor sports or recreation (other than appreciation of the landscape), commercial buildings, and other locations where people's attention may be focused on their work or activity. People in commercial buildings, and other locations where people's attention may be focused on their work or activity.

4.4.11 The magnitude of impact arising from the proposed development is described as substantial, moderate, slight, negligible or none based on the interpretation of a combination of largely quantifiable parameters, as follows:

- The distance of receptors from the proposed development;
- The duration of the predicted change and whether it is reversible;
- The size and scale of the change anticipated;
- The geographical extent of the study area, landscape character unit, designation or route that would be affected;
- The angle of view in relation to main receptor activity;
- The degree of contrast;
- The background context to the proposed development; and
- The extent and nature of other built development visible, including vertical elements.

4.4.12 Table 4.2, below, provides a brief definition for different magnitudes of impact.

Table 4.2: Magnitude of Impact	
Magnitude	**Definition**
Substantial	Total loss or considerable alteration/interruption of key elements features or characteristics of the landscape character and/or composition of views resulting in a substantial change to baseline conditions.
Moderate	Partial loss or alteration to one or more key features or characteristics of the baseline, resulting in a prominent, but localised change within a broader unaltered context.
Slight	Discernible loss or alteration to one or more key elements, features or characteristics of the baseline conditions. Change arising from the loss/alteration would be discernible but underlying landscape character or view composition would be broadly consistent with baseline.
Negligible	Very limited or imperceptible loss or alteration to one or more key elements/characteristics of the baseline. Change may be barely discernible.
None	No aspect of the proposed wind farm would be discernible. The proposed wind farm would result in no appreciable change to the landscape resource or view.

4.4.13 The findings of the LVIA were verified and augmented by targeted field reconnaissance during which all key sensitive receptor locations were visited. During the field reconnaissance draft wireline images, mapping, GIS/GPS data collection systems and augmented reality tools such as *Ventus AR* were utilised to verify theoretical visibility.

4.4.14 Cumulative impacts have been assessed in respect of the additional and in-combination effects of the proposed development when seen in conjunction with construction works related to the consented Viking Wind Farm. The magnitude of cumulative impacts is defined in Table 4.3, below.

Table 4.3: Magnitude of Cumulative Impact	
Magnitude	**Definition**
Substantial	The proposed development would represent a considerable increase in the influence of construction activities and development on the character of the landscape and/or the composition of views.
Moderate	The proposed development would represent a notable increase in the influence of construction activities and development on the character of the landscape and/or the composition of views. Moderate cumulative change equates to a localised change within an otherwise unaltered context.
Slight	The proposed wind farm would represent a minor addition to the influence of construction activities and development on the character of the landscape and/or the composition of views. The change would be discernible, but the original baseline conditions would be largely unaltered.
Negligible	The proposed development would represent a barely discernible additional influence of construction activities and development on the character of the landscape and/or the composition of views. The baseline condition of the landscape or view would, for all intents and purposes, be unaffected.
None	No other cumulative development would be discernible.

Criteria for Assessing Significance

4.4.15 Table 4.4 below, illustrates how residual effects are determined by comparison of the sensitivity of receptors with the magnitude of predicted change. For the purposes of this assessment significant landscape or visual effects are **major** or **major/moderate**.

Table 4.4 Residual Effects

	Magnitude of Change				
Landscape and Visual Sensitivity	**Substantial**	**Moderate**	**Slight**	**Negligible**	**None**
High	Major	Major/moderate	Moderate	Moderate/ minor	None
Medium	Major/moderate	Moderate	Moderate/minor	Minor	None
Low	Moderate	Moderate/minor	Minor	Minor/none	None

4.4.16 In line with the recommendations in the GLVIA the matrix is not used as a prescriptive tool or arithmetically, and the methodology and analysis of potential effects at any particular location must allow for the exercise of professional judgement. Descriptions of residual effects, especially those considered significant, are described in narrative text.

4.4.17 Landscape and visual effects can be adverse (i.e. having a detrimental effect on the physical elements, character and visual amenity of the area) or beneficial (i.e. having a positive effect on the landscape and visual amenity of the area through strengthening or augmentation of baseline conditions and/or improvement of the existing landscape or views). For the purposes of this assessment residual effects are assumed to be adverse, unless stated otherwise.

4.5 Baseline Conditions

Landscape Baseline

Site Description and Context

4.5.1 The proposed development is located on the side of a scarp slope that forms a prominent edge up to 100 m AOD and which encloses the eastern side of Petta Dale. The proposed development site slopes in a southerly direction and is located on the gently sloping southern end of East Kame.

4.5.2 In the immediate vicinity of the proposed development site the landscape is typified by unimproved grassland and moorland habitats and is adjoined by the A970 carriageway and the open waters of Sand Water.

4.5.3 The proposed development is intended to facilitate the construction consented Viking Wind Farm and associated infrastructure which is to be located in East Kame, Mid Kame and West Kame on prominent elevated positions above the Petta Dale and Valle of Kergord.

Landscape Designations and Classifications

4.5.4 The proposed development site and wider study area contains no designated landscape and no classified landscape such as Wild Land Areas or Gardens and Designed Landscapes.

Landscape Character Areas

4.5.5 According to SNH's national landscape character database[2] the study area comprises part of the Inland Valleys Landscape Character Type (LCT 352), enclosed by Major Uplands (LCT349) to the east and west. The key characteristics of these LCTS are summarised below.

4.5.6 The Inland Valleys Landscape Character Type on Shetland consists of low lying, narrow channels cutting through Major Uplands, and often aligned with fault lines. They are dominated by crofting, rough grazing, moorland and mires, and extend to the coast as Farmed and Settled Voes and Sounds. The largest area of this Landscape Character Type, at Petta Dale and Weisdale, forms a broad north–south band in the centre of Shetland Mainland, and is part of the consistent and predictable profile of parallel hill and valleys in this area. These inland landscapes with limited sea views are unusual in Shetland.

4.5.7 The key characteristics of the Inland Valleys LCT comprise:

- Long, narrow channels cut through major uplands, mainly located inland and often associated with the erosion of fault lines.
- Relatively level valley floors and steep mid-slopes rising to concave upper slopes.
- Fertile soils in lower, accessible areas with enclosed fields, contrasting with upper moorland slopes, the boundary usually abruptly delineated at the inbye/outbye boundary.
- Extensive areas of peat deposits and unimproved moorland in central Shetland Mainland valleys.
- Settled in accessible, lower areas with farms and crofts and connected by roads following the line of the valley.
- Abundant archaeological remains visible in the low ground cover.
- Enclosed views along the valley and up to skylines, occasionally opening to the sea and adjoining coastal farmland.
- Inland and enclosed larger valleys with few sea views.

4.5.8 The Major Uplands form prominent features in what is a generally low-lying set of islands. The Major Uplands occur as several upland hill masses incorporating the highest land in Shetland, forming the main physical structure of Shetland. The Landscape Character Type occupies large parts of central and south Shetland Mainland, with western and eastern outliers at Bressay, Sandness Hill, Ronas Hill, Foula, Fair Isle and in the north at Unst. The landcover is dominated by peatland and heather moorland peaty mires. Other key characteristics of the Major Uplands comprise:

- Rounded hills, occurring either in series connected by high level rounded ridges along a linear band, or as isolated single hills or hill groups.
- Often steep slopes at the coast, or cliff edges with dramatic natural coastal landforms.
- Exposed, frost shattered rock and boulder fields in Ronas Hill.
- Mainly simple landcover of peat bog and heather moorland grading to rough grassland on some lower slopes, contrasting with the ordered fields of adjoining lowlands.
- Hill grazing and low-key peat cutting.
- Mainly uninhabited and often difficult to access on foot or by road, with roads mainly absent on higher land.
- In some areas tracks ascend to hillside or hilltop features such as masts, wind turbines, isolated farms and peat cuttings.

[2] Available at https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions

- Exposed high land with panoramic views, forming landmark features which themselves are often visible for miles.
- Relatively expansive, although scale is difficult to discern and reduced by the presence of manmade structures.

4.5.9 The proposed development is located on the boundary of these two landscapes and the transition between the uplands and the valley interior where it benefits from some enclosure within the folds of the upland edge topography.

Visual Baseline

4.5.10 A key aspect of the visual context within the study area relates to the enclosure of the Petta Dale and prominent undulating skyline formed by the elevated Major Uplands. Views are channelled along valley sides to the north and south and follow the alignment of the A970 carriageway. Currently, there are few large-scale developments or man-made features, the main structures being related to roads, scattered settlement and dwellings as well as low voltage power lines and fencing, both within the valley, but more prominently in the valley sides and skyline. However, once the consented Viking turbines are erected these will form prominent vertical features on the skyline of views along the valley.

4.5.11 Key visual receptors within the study area include: road users, including tourists travelling on the road network, as well as hill walkers and a small number of residential receptors.

4.5.12 In order to represent some of the key sensitive receptors in study area for the proposed development a series of viewpoints were selected. These are listed in Table 4.5, below, along with the receptors they represent.

Table 4.5: Representative Views

Vpt No.	Viewpoint Name	Approximate coordinates	Approximate Distance and Direction to proposed development	Receptors represented
1	Viewpoint 1: Southbound view from A970, North of B9075 Junction	441911, 115560	600 m S	Views from boundary of Inland Valley and major Uplands LCT. Road Users and Tourists on the A970 and B9075.
2	Viewpoint 2: View from land west of the A970	441752, 115516	400m SE	Views from within the Inland Valley LCT and showing transition into Major Uplands LCT. Road Users and Tourists on the A970 and B9075. Nearby residential receptors.
3	Northbound view from A970	442226, 115446	300 km N	Views from interior of Major Uplands LCT. Road Users and Tourists on the A970 and B9075.
4	Eastbound view from B9075	441025, 115493	1 km E	Views from within the Inland Valley LCT bounded by Major Uplands LCT. Road Users and Tourists on the A970 and B9075.
5	Northbound View from junction of B9075 and A970	443142, 115364	1.2 km NW	Views from edge of Major Uplands LCT. Road Users and Tourists on the A970 and B9075.

4.5.13 Descriptions of the baseline view from each viewpoint are included in Table 4.5: Viewpoint Assessment, below.

4.6 Sensitive Landscape and Visual Receptors

4.6.1 Based on the preceding appraisal of the baseline context, the sensitive receptors within the study area were identified and include:

- Inland Valley and Major Uplands LCTs – The enclosed position, small to medium scale, distinctive form and focused views and prominent skylines when seen from the interior of the valley mean that development on the valley floor or adjoining valley sides are especially susceptible to development of the type proposed. Seen from elevated positions within the Major Uplands LCT, development is likely to be viewed from above, increasing its prominence. Moreover, any engineered forms or regular geometrical shapes (e.g. relating to the excavation and base of the proposed development), could prove especially conspicuous and detract from the more natural rolling form of the topography.
- Tourists travelling on the local road network who are engaged in enjoyment of the landscape (including receptors at parking spots, vantage points and laybys;
- Hill walkers whose appreciation of the landscape is a key reason for their activity; and
- Residential receptors at the small number of scattered properties present in the study area.

4.7 Sources of potential Landscape and Visual Effects

4.7.1 The formation, operation and decommissioning are described in Sections 2.4, and 2.5, respectively, of the EIA Report. The key impact generators during these phases would be as described below.

Formation of Compound

4.7.2 The key sources of impact during this period are listed in paragraph 2.4.5 of the EIA Report, which should be read in conjunction with the CEMP. Key landscape and visual impacts would be associated with the following activities and elements and are likely to be of approximately 6 month's duration, and therefore short-term:

- Stripping of surface vegetation and temporary storage of any peat turves for later reinstatement of the decommissioned site[3];
- Excavation and formation of uncharacteristically steep cut/tipped batters and consequent interruption of the gently sloping horizon;
- temporary stockpiling of peat for backfilling of site during decommissioning works[4];
- Excavation of cut-off ditches
- Construction of temporary surfacing within the proposed development and access track;
- Erection of site buildings and associate structures; and
- Erection of security lighting.

4.7.3 Other construction within the wider Viking Wind Farm is anticipated to be limited during this initial construction phase at the proposed development.

Operational Compound

4.7.4 Impact generators associated with the operational life of the proposed development would have a duration of around 5 years, and would include:

- Potentially uncharacteristically steep excavated slopes and 'batters and interruption of the gently graded skyline;

[3] Cutting, transportation and temporary storage of peat turves arising from the compound site will be incorporated into the all-encompassing Peat Management Plan for the Viking Wind Farm and its associated applications.
[4] Excavation, transportation and temporary storage of peat material arising from the compound site will incorporated into the all-encompassing Peat Management Plan for the Viking Wind Farm and its associated applications.

- Site surfacing and access track;
- temporary offices and welfare facilities (including some 2 storey buildings with a maximum height of 7 m above ground level);
- plant and car parking;
- general material laydown/storage, including peat/peat turf storage;
- waste management areas;
- fuel storage and refuelling facilities;
- temporary generation equipment and fuel storage;
- use of uncharacteristic perimeter fencing;
- general security lighting (designed to meeting good practice guidance on avoiding intrusive lighting); and
- wheel wash facilities.

4.7.5 Construction works within the Viking Wind Farm site would be ongoing throughout the life of the operational compound, the greatest sources of potential cumulative impact being associated with formation of the wind farm site access track immediately east of the proposed development, and the erection of turbines at East Kame, which would be seen on the skyline in views form the Petta Dale.

Decommissioning of the Compound

4.7.6 The key sources of impact during this period are listed in paragraph 2.4.5 of the EIA Report, which should be read in conjunction with the CEMP. Key landscape and visual impacts would last for around 6 months, and would be associated with the following activities and elements:

- Removal of all site structures and surfacing;
- Backfilling of excavation and grading to existing levels utilising previously stockpiled spoil;
- Placement of previously stockpiled peat and peat turves;
- Infilling and reinstatement of cut-off ditches; and
- Removal of site access track and any perimeter fencing;
- Operation of site plant and security lighting.

The compound would be one of the final elements of the wind farm construction to be decommissioned and removed. Consequently, few cumulative elements would be present at this time, except for the installed turbines at East Kames.

4.8 Mitigation

Formation of the Compound

4.8.1 A number of measures have been incorporated into the proposals that are intended to reduce potential landscape and visual impacts associated with this phase of the development. These include:

- adoption of cut and fill to achieve a near balance of material at the site and the reduction of the amount of spoil requiring transportation and stockpiling;
- avoidance, wherever possible of positioning perimeter fencing on elevated slopes that have potential to skyline the fencing in views from low lying receptor locations nearby;
- preferential use of characteristic post and wire fencing as opposed to a more industrial character of fencing;
- Use of darker muted colours for fencing so that it appears recessive when backclothed;

- Establishment of a fenced construction site to restrict the working area and avoid incursion by plant, vehicles or materials into adjoining areas, thereby limiting the extent of disturbance associated with this phase of the development;
- Concurrent construction and reinstatement works to minimise the amount of the site that is subject to disturbance at any one time and provide for its rapid "greening" to reduce the prominence of the site in views from adjoining receptor locations;
- Reinstatement of disturbed ground around the proposed development and greening of the cut and formed batters with a medium-term moorland grass cover to reduce the visibility and prominence of these aspects of the site;
- Formation of chamfered edges/sealed and vegetated edges to peatland abutting the excavation to avoid forming unsightly exposed peat edges that would be liable to drying with consequent changes to characteristic vegetation around the excavation edges; and
- Adherence to agreed working times and adoption, as far as practicable, of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting.

Operational Compound

4.8.2 The position of the proposed development was selected, in part, to be low lying and to take advantage of the enclosure provided by the natural folds in the topography, thereby minimising its visibility from neighbouring receptor locations. The proposed development would be placed within an excavation thereby further reducing its visibility.

4.8.3 In order to mitigate potential effects on the natural topography of the area, the adoption of less regular and slacker slopes is proposed that will avoid the appearance of uncharacteristic engineered slopes.

4.8.4 Despite the enclosed position of the proposed development, it is possible that site buildings, which would form some of the tallest elements in the proposed development, are positioned at the eastern side of the proposed development, thereby avoiding skylining these elements in views from the A970 carriageway and adjoining landscape to the west.

4.8.5 The colour selected for site buildings and structures will be selected according to whether they are skylined or backclothed by topography, skylined features being rendered with a pale grey, whilst backclothed elements would be rendered in a dark muted colour that would blend into the background.

4.8.6 The adherence to agreed working times and adoption of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting both internal and external to offices and welfare buildings is also proposed in order to reduce potential impacts on the landscape and the amenity of receptors nearby at night.

4.8.7 The continued management and upkeep of any reinstated land and landscaping is proposed in order to ensure the successful establishment of temporary grasslands, thereby reducing the impact of cut and formed slopes.

4.8.8 The adoption of a tidy-site policy and management processes would ensure that the proposed development is kept in good order and does not deteriorate in condition or appearance.

Decommissioning of Compound

4.8.9 The level of impacts and effects occurring during the decommissioning of the site is anticipated to mirror that of its construction. In order to minimise potential effects during this phase of the proposed development, the following measures are proposed:

- Concurrent demolition and removal of all of the proposed development features and elements, and backfilling/regrading of the proposed development and reinstatement works to minimise the amount of the site that is subject to disturbance at any one time and provide for its rapid "greening" and assimilation back into the wider landscape;
- Ongoing management, maintenance of the reinstated compound and rectification/remediation of any defects or failures in landscaping works; and
- Adherence to agree working times and adoption, as far as practicable, of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting.

4.9 Assessment of Residual Effects

Effects on Landscape Fabric

4.9.1 The construction and operation of the proposed development would result in the temporary removal of around 4 hectares of mostly blanket bog, excavation of 400 linear metres of cut-off drains and formation of an excavation and flat base. However, this relatively localised effect would be temporary and reversible in the medium term (after 5 years). Whilst impacts on the fabric of the site itself would be substantial and the residual effects **major** and significant in the short to medium term, effects on the study area as a whole would be slight and the residual effect would be moderate in the medium term, and minor in the long-term, and not significant.

Effects on Landscape Designations and Classifications

4.9.2 No landscape designations or classification would be affected.

Effects on Landscape Character

4.9.3 Effects on landscape character would arise from both the construction works and subsequent operational life of the proposed development which would entirely change the established characteristic landcover at the site as well as its form, and would, in turn, interrupt the existing form and character on the scarp edge that defines the transition between the valley and the uplands beyond. The changes would also introduce anomalous forms and colours as well as movement to a part of the landscape that is currently a muted colour and essentially still. Viewed from a number of locations on the floor of the valley the distinctive natural form of the skyline which is formed by the upland topography, is likely to be altered. This would lead to localised moderate impacts and **major/moderate** effects which would be significant (e.g. Viewpoint 3: A970 East of Sand Water, and Viewpoint 4: B9075 West of Sand Water). However, in the context of the wider study area, proposed mitigation measures (including slackening and greening of excavated and tipped batters as well as the selection of recessive colours for proposed development structures) would ameliorate such effects. Consequently, impacts on both the Inland Valley LCT and Major Uplands LCT would be slight, equating to a moderate residual effect on this landscape within the study area.

4.9.4 Where the proposed development would be seen in conjunction with the turbines and infrastructure of Viking Wind Farm (i.e. from within the Inland Valley at locations along the B9075, west of the A970 carriageway) the proposed development would constitute a localised moderate additional cumulative effect during its operational life. However, the in-combination effect of construction activities at the proposed development and the wider wind farm site would be **major/moderate** and significant at this location as these activities would form prominent and extensive disturbance on the side of the valley and on the skyline, interrupting the form, scale and stillness of the valley side and horizon. However, such effects would cease once the proposed development and wider construction works cease and the proposed development and wider

construction sites within the wind farm have been reinstated. Remaining impacts would concern the operational wind farm and have previously been assessed in the LVIA contained in the 2009 Environmental Statement and subsequently in Chapter 4 of the Section 36 Variation Application EIA Report that was submitted to the Energy Consents Unit in November 2018 and consented in May 2019

Effects on Visual Amenity

4.9.5 Table 4.6: Viewpoint Assessment, below, summarises the anticipated effects on the amenity at the representative viewpoints listed in Table 4.4: Representative Viewpoints. It is apparent from an analysis of views from these viewpoints that there is some potential for the accommodation of the proposed development without accruing widespread or numerous significant visual effects. This is due, in part to the possibilities to position the proposed development in an enclosed location towards the base of the scarp slope that forms the side of the valley. The adoption of a sympathetic design that doesn't form unsightly scars or 'cut' on the skyline, the greening of excavated/formed batters/slopes and the use of selected muted colours for the proposed developments structures would all serve to lessen potential visual effects in the short to medium-term. Ultimately, the reinstatement of the site to a condition consistent with its current condition will reverse any construction and operational effects. Notwithstanding this, it is acknowledged that some localised significant visual effects would occur, especially during the operational life of the site and in close proximity to the proposed development. Similarly, significant in-combination effects would occur during the construction and operation of the proposed development and the wider construction activities within the wind farm site. Such effects would, however, cease once the proposed development and wider construction works cease and the proposed development and wider construction sites within the wind farm have been reinstated. Remaining impacts would concern the operational wind farm.

Table 4.6: Viewpoint Assessment					
Vpt No.	**Viewpoint Name**	**Existing View**	**Effects during construction of the proposed development**	**Effects after construction of the proposed development**	**Effects following removal of the proposed development**
1	Southbound view from A970, North of B9075 Junction	The existing view from this location is channelled southwards and northwards along the route of the A970. To the west of this position, the view extends across a valley comprising marshy pasture and open waterbodies, whilst to the east, the viewpoint is enclosed by the gently rolling scarp of the uplands which is typifid by pronounced low summits which form local focal points.	Construction works would be all but entirely screened by intervening topography, only limited views of site plant stripping vegetation along the edges of the site would be apparent and would be a temporary feature on the skyline for a short duration. The erection of the perimeter fence around the northern and western sides of the proposed development would also be visible on the skyline but would be a construction activity of short duration. Given the limited visibility of construction works from this location the magnitude of impact would be negligible, equating to a moderate/minor effect on the amenity of receptors at this viewpoint, which would not be significant	The operational compound would be almost entirely screened from this viewpoint due to the screening effect of intervening topography. Whilst perimeter fencing on the western side of the proposed development would be visible on the skyline it would be consistent with other agricultural fencing in the landscape and would therefore not be anomalous. Given the limited visibility of the operational compound from this location and the consistency of proposed perimeter fencing with the existing character of the landscape in the view, the proposed development would represent a negligible impact and minor residual and temporary effect on the visual amenity of receptors at this viewpoint, which would not be significant	During decommissioning and reinstatement of the site the most visible element would be related to earthworks. Site plant and earthmoving equipment would be seen relatively briefly. Given the limited visibility of anticipated decommissioning works and their short duration, the impact on the amenity of this viewpoint would be negligible, equating to a moderate/minor and reversible visual effect, which would not be significant.
2	Land adjacent to Junction of B075/A970	This viewpoint is set back from the A970 carriagewayand is dominated by a forground and middlegournd of open, semi-imroved pasture and the open waters of Sand Water lochan. The view is bounded,	Much of the construction works would be screened behind intervening topography. However, the formation of the pad at the southern extents of the site would be evident on the skyline, site plant introducing visual disturbance and movement to a currently still	Throughout the life of the operational compound the only discernible aspects of the development would be the batters associated with the southernmost part of the proposed development and perimeter fencing. Both elements being seen on the skyline	During decommissioning and reinstatement of the site the most visible elements of the proposed development would be the regrading and infilling of the proposed development void and related to earthworks and revegetation of the site. Site plant and earthmoving

		to the east, by the gently rolling scarp of the uplands which is typified by occasional pronounced low summits which form local focal points. Vehicles moving along the A970 carriageway introduce considerable movemnet in what is otherwise an essentially still landscape.	horizon. These elements of the proposed development would constitute a slight impact and moderate effect on what would be an otherwise unchanged landscape and would be of relatively short duration and would affect a relatively small proportion of the view. On this basis the residual effect on the amenity of nearby residential receptors, tourists/road users would be moderate and not significant. Construction works at the proposed development would also represent a moderate cumulative effect when seen in conjunction with construction activities within the Viking Wind Farm site. In combination effects experienced at this viewpoint would also be moderate and not significant.	to the south-east of this viewpoint. Whilst the perimeter fence would be consistent with vernacular agricultural fencing, the proposed developments topography would have a medium-term duration and would be inconsistent with the smoothly graded natural form of the underlying landscape. However, this impact would be mitigated to a degree by proposed slackening and greening of batters. On this basis the magnitude of impact on views from this location would be slight, equating to a moderate medium-term effect on the amenity of this viewpoint. The proposed development would also represent a moderate cumulative effect when seen in conjunction with ongoing construction activities within the Viking Wind Farm site. In combination effects experienced at this viewpoint would also be moderate and not significant.	equipment would, however, be seen relatively briefly. Given the limited visibility of anticipated decommissioning works and their short duration, the impact on the amenity of this viewpoint would be negligible, equating to a moderate/minor and reversible visual effect, which would not be significant.
3	A970 East of Sand Water	The existing view from this location is channelled southwards and northwards along the route of the A970. To the west of this position, the view extends across a valley comprising marshy pasture and open waterbody of Sand Water, whilst to the east, the viewpoint is	During the construction of the proposed development there would be clear views provided of the cutting and translocation of peat turves as well as excavation and infilling operations on the skyline of the view close-by. Vehicle movements would add to the complexity and disturbance experienced at this viewpoint.	The southernmost section of the proposed development, which would comprise an elevated pad with side batters, would be seen on the skyline and would screen a large proportion of the interior of the proposed development. Notwithstanding this the proposed development is likely to have an uncharacteristic form compared to	During decommissioning and reinstatement of the proposed development there would be clear views provided of the restoration earthwork activities at the site and the reinstatement of the site to a condition similar to that of its current baseline condition.

		enclosed by the gently rolling scarp of the uplands which is typified by pronounced low summits which form local focal points.	Whilst such effects would be of relatively short duration and would stop once construction activities ceased, they would represent a moderate impact and a **major/moderate** residual effect which is considered significant in the short term. Construction of the proposed development would occur at the beginning of wider construction activities at the Viking Wind Farm site and would therefore be unlikely to result in significant cumulative effects.	the existing topography in the vicinity. Moreover, whilst proposed seeding of the southern batters at the proposed development would lessen their prominence, this would be only partially successful. Given the proximity and prominence of the operational compound at this viewpoint and the proportion of the view it would affect, the magnitude of impact would be substantial, equating to a **major** effect, albeit temporary and reversible, on the amenity of this viewpoint. During construction of the Viking Wind Farm the proposed development would be seen in conjunction with the construction of the wind farm access track and erection of turbines on East Kame and would constitute a **major** (significant) cumulative effect, both in respect of additional and in-combination effects.	Consequently, there would be short-term adverse effects on the amenity at this viewpoint. Decommissioning works result in substantial disturbance to the view in the short-term but would largely cease once the site has been reinstated. Consequently, in the short term there would be **major** adverse effects, reducing to minor once decommissioning works are complete and the reinstated landscape has matured sufficiently for it to blend in with the adjoining landscape.
4	B9075 West of Sand Water	This viewpoint is dominated by a foreground and middlegournd of open, semi-improved pasture and the open waters of Sand Water lochan. The view is bounded, to the east, by the gently rolling scarp of the uplands which is typified by occasional pronounced low summits which form local focal points. Vehicles moving	Excavation and infilling operations to form the proposed development landform would be visible on the skyline above Sand Water. Vehicle movements and earthworks would form prominent elements and interrupt the stillness and gently graded form of the landscape in the background of the view, and despite being temporary and short term, would be equivalent to moderate impacts. Residual effects would	Key aspects of the operational compound would include its modified landform with uncharacteristic steep batters and a flat pad at its southern end. Views into the main compound area would also be provided where site buildings and structures would be evident on the skyline, along with vehicle parking. This would lead to increased complexity on a	Decommissioning of site structures, removal of infrastructure and restorative earthworks would represent prominent, albeit short term moderate impacts and **major/moderate** residual effects which would be significant in the short term, but which would cease and be reversed once site decommissioning and reinstatement works are complete

		along the A970 carriageway introduce considerable movemnet in what is otherwise an essentially still landscape.	therefore be **major/moderate** and significant in the short term. Construction of the proposed development would occur at the beginning of wider construction activities at the Viking Wind Farm site and would therefore be unlikely to result in significant cumulative effects.	prominent horizon in the view. These elements would be present in the medium term and constitute a moderate impact and **major/moderate**, albeit temporary effect, which is considered significant. During construction of the Viking Wind Farm the proposed development would be seen in conjunction with the construction of the wind farm access track and erection of turbines on East Kame and would constitute a **major/moderate** (significant) cumulative effect, both in respect of additional and in-combination effects.	and characteristic moorland grassland cover has re-established at the site.
5	Junction of A970/B9075	This viewpoint is located at a car parking area on the side of the A970, south-east of the proposed development. The view from this location is medium scale and channels along the valley between Catfirth and the Hill of Bretto. Key features of the view include vehicles on the A970 and the background that comprises the natural form and remote character of the Major Uplands, beyond.	Excavation and infilling operations to form the proposed development landform would be visible on a prominent hillside on the northern side of the valley. Vehicle movements and earthworks would form prominent elements and interrupt the stillness and gently graded form of the landscape in the background of the view, and despite being temporary and short term, would be equivalent to moderate impacts. Residual effects would therefore be **major/moderate** and significant in the short term. Construction of the proposed development would occur at the	Key aspects of the operational compound would include its modified landform with uncharacteristic steep batters and a flat pad at its southern end. Views into the main compound area would also be provided where site buildings and structures would be evident on the hillside. This would lead to increased complexity on a prominent horizon in the view. These elements would be present in the medium term and constitute a moderate impact and **major/moderate**, albeit temporary effect, which is considered significant.	Decommissioning of site structures, removal of infrastructure and restorative earthworks would represent prominent, albeit short term moderate impacts and **major/moderate** residual effects which would be significant in the short term, but which would cease and be reversed once site decommissioning and reinstatement works are complete and characteristic moorland grassland cover has re-established at the site.

			beginning of wider construction activities at the Viking Wind Farm site and would therefore be unlikely to result in significant cumulative effects.	During construction of the Viking Wind Farm the proposed development would be seen in conjunction with the construction of the wind farm access track and erection of turbines on East Kame and would constitute a **major/moderate** (significant) cumulative effect, both in respect of additional and in-combination effects.	

4.10 Summary and Conclusions

4.10.1 The preceding LVIA assesses the potential landscape and visual effects associated with the proposed development required to enable the construction of the recently consented Viking Wind Farm. The assessment addresses the construction and operation of the temporary proposed development, and its subsequent removal and the reinstatement. The assessment considers effects on landscape fabric, landscape character, landscape designations and classifications, as well as the visual amenity of an area equivalent to a 2 km radius from the proposed development boundary.

4.10.2 The proposed development would be located within a sparsely settled and remote area within an Inland Valley, enclosed by elevated uplands to the east and west. A consequence of this is that the landscape has a high susceptibility and sensitivity to development either within or on the side of the valley or on the skyline adjoining it. Some capacity was identified, however, for the accommodation of the type of development proposed due to the rolling nature of the valley side where a sensitively designed compound could be accommodated without widespread significant effects on the character or amenity of the valley, the uplands, or the adjacent coastline of Shetland from where the uplands form prominent horizons.

4.10.3 The assessment discusses the principal sources of landscape and visual effects. Those most pertinent during construction operation and decommissioning are associated with:

- Stripping of characteristic moorland vegetation at the site;
- Excavation of the compound and formation of compound floor and batters;
- Establishment of compound offices and structures;
- Vehicle movements and site lighting; and
- Site decommissioning, removal of site structures and reinstatement of site to its current condition.

4.10.4 Cumulative effects are also discussed in respect of the construction works within the Viking Wind Farm site.

4.10.5 In order to ameliorate potential landscape and visual effects associated with the construction, operation and decommissioning of the proposed development, a series of mitigation measures have been proposed that concern the location, layout and design of the proposed development, as well as lighting design and usage and the colour of compound structures. Whilst these would not entirely eliminate potential effects they would reduce the level of some effects and the prominence of the proposed development.

4.10.6 This is borne out by the findings of the LVIA which indicates that temporary significant effects, including some significant cumulative effects would be experienced from locations within the valley, but these would be located in close proximity to the proposed development and would be short to medium-term in duration and reversible. On this basis, the overall effect on the landscape and visual resource of the area is not considered significant.

5. ORNITHOLOGY

Executive Summary

The proposed Viking Wind Farm Main Construction Compound ('the proposed development') lies within the s36 boundary of the consented 103-turbine Viking Wind Farm (VWF) and forms an integral part of the preliminary works required to construct the wind farm. This chapter reports on the assessment of the likely significant effects on bird receptor populations of high or medium nature conservation importance.

Using baseline breeding bird survey data collected in 2018 and 2019, and drawing on additional VWF survey data for earlier years, the assessment concludes that one pair of golden plover and one pair of curlew could be displaced by the construction, operation and decommissioning of the proposed development. The impact of this on the regional breeding populations of these receptor species is evaluated as Not Significant for the purposes of the 2017 EIA Regulations.

The assessment concludes that there are no species listed on Schedule 1 bird of the Wildlife and Countryside Act (as amended) (e.g. red-throated diver, merlin, whooper swan and whimbrel) breeding sufficiently close to the proposed development to give concerns for a potential disturbance effects.

The assessment also identifies that the proposed development would not affect any sites designated for bird conservation (e.g., Special Protection Areas and Sites of Special Scientific Interest).

The assessment predicts no significant effects and consequently no mitigation is required. In keeping with best-practise, construction and operation of the proposed development will be undertaken in way that minimises damage to the peatland bird habitats surrounding the development site. The decommissioning of the proposed compound will occur after the construction of the wind farm is completed and will included reinstatement of habitats across the proposed development site.

The assessment also considers the contribution that the proposed development would make to the cumulative impact of wind energy projects on the Shetland breeding populations of golden plover and curlew. It is concluded that the proposed development would contribute in a minor way to the cumulative impact on these species. In both cases the cumulative impacts on these species are judged to be Not Significant for the purposes of the 2017 EIA Regulations.

Should the construction of the proposed development occur in the bird breeding season (it is planned to occur outside the breeding season) the measures set out in the Viking Wind Farm Breeding Bird Protection Plan designed to avoid disturbance of breeding Schedule 1 bird species and reduce disturbance to other breeding bird species will also be adopted.

5.1 Introduction

5.1.1 This chapter reports on the likely significant effects with respect to ornithology associated with the construction, operation and decommissioning of the proposed development.

5.1.2 Figure 5.1 is referenced in the text where relevant.

5.1.3 This chapter is supported by Confidential Appendix 5.1, and Confidential Figure 5.2. Following best practice (SNH,2009), this appendix contains information relevant to the assessment that relates to the breeding sites of scarce and specially protected bird species.

5.2 Methodology

Scope of the Assessment

Scope of Effects Examined

5.2.1 Informal scoping by the proposed development's EIA team (SSER, Ramboll and Atlantic Ecology) identified that the construction, operation and decommissioning of the proposed development could potentially affect bird receptors through:

- Habitat loss and change effects;
- Disturbance/displacement effects;
- Cumulative effects with other projects, including the associated 103-turbine Viking Wind Farm; and
- Effects on sites designated for bird conservation.

5.2.2 The informal scoping exercise scoped-out collision effects on bird receptors as requiring assessment because the proposed development does not include tall structures that could pose a collision risk to birds.

5.2.3 Disturbance may occur when birds respond to the ground-based activities associated with construction, operations or decommissioning activities.

Spatial Scope

5.2.4 The red line boundary of the proposed development lies within the s36 boundary of the consented 103-turbine Viking Wind Farm.

5.2.5 Baseline bird surveys covered the whole of red line boundary area buffered to a species-appropriate distance. For wader and skua species the buffer extended to 500 m, for red-throated diver to 1 km and for merlin to 2 km. In practise, most of the bird surveys were undertaken to inform the assessment of the area potentially affected by the VWF and therefore extended over much larger areas than indicated above.

Scope of Species Examined

5.2.6 The assessment examines all bird species receptors considered to have very high, high or medium nature conservation importance. Nature conservation importance is a measure of the conservation value of a species potentially affected by the proposed development. The criteria used to determine nature conservation importance and the categorisation of relevant species is summarised in Table 5-1.

5.2.7 Species that receive a higher level of protection under bird protection legislation are considered to have greater nature conservation importance, e.g., species listed on Annex 1 of the EU Birds Directive or on Schedule 1 of the Wildlife and Countryside Act (as amended). Species on these lists tend to have relatively small UK populations and breeding ranges. These higher-level-protection species are considered to have very high nature conservation importance in cases where the individuals that may be affected form part of the qualifying interests of a site designated for bird conservation Table 5-1.

5.2.8 Species are also considered to have greater nature conservation importance if they are recognised as having a poor conservation status through inclusion on the red or amber lists of Birds of Conservation Concern (BOCC) (Eaton *et al.,* 2015) or listed by the International Nature Conservation Union (IUCN) as a threatened species (Table 5-1).

Table 5-1. Criteria for Determining Nature Conservation Importance of Bird Receptors

Value	Definition
Very High	Species that are listed on one or more of: • Annex 1 of the EU Birds Directive (A1); • Schedule 1 of the Wildlife and Countryside Act (S1); and • The individuals potentially affected are likely to be part of the qualifying interest of a SPA. The following species meet these criteria for the proposed development under consideration: red-throated diver (A1, S1).
High	Species that are listed on one or more of: • Annex 1 of the EU Birds Directive (A1); and • Schedule 1 of the Wildlife and Countryside Act (S1). The following species meet these criteria for the proposed development under consideration: merlin (A1, S1), whimbrel (S1), golden plover (A1), dunlin (A1), Arctic tern (A1) and whooper swan (A1, S1).
Medium	Other species that are listed on one or more of: • Birds of Conservation Concern Red List and that have a small population size (guide, <5,000 pairs breed in region) (RL); and • IUCN threatened list (IUCN). The following species meet these criteria for the proposed development under consideration: Arctic skua (RL), curlew (IUCN), lapwing (RL), ringed plover (RL).
Low	Other species that are listed on one or more of: • Birds of Conservation Concern Red List and that have large and widespread populations (e.g. >5,000 pairs breed in region) (RL); and • Birds of Conservation Concern Amber List (AL). The following species meet these criteria for the proposed development under consideration: skylark (RL), starling (RL), teal (AL), wigeon (AL), common sandpiper (AL), snipe (AL), oystercatcher (AL), redshank (AL), common gull (AL), great skua (AL), red grouse (AL) and meadow pipit (AL).
Negligible	All other species. The following species meet this criterion for the proposed development under consideration: raven, hooded crow, wren and wheatear.

Temporal Scope

5.2.9 The results from baseline bird studies undertaken in 2018 and 2019 are used as the primary source of information to inform impact assessment. Survey information is also available for some additional years between 2005 and 2017, and this is taken into consideration. In particular, there is survey information available for almost all the years in this period for red-throated diver and merlin.

Technical Scope

5.2.10 The following legislation was taken into account during this assessment:

- The Council Directive on the Conservation of Wild Birds 2009/147/EC (EU Birds Directive);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Conservation of Habitats and Species Regulations 2010; ('the Habitats Regulations');
- The Nature Conservation (Scotland) Act 2004 (as amended); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

5.2.11 The following guidance and data sources have been consulted:

- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment (The Scottish Government, 2013);
- SNH Guidance: Assessing the Significance of Impacts from Onshore Windfarms on Birds outwith Designated Areas (SNH 2006);

- SNH Guidance: Assessing the cumulative impact of onshore wind energy developments (SNH 2012);
- SNH: A Handbook on Environmental Impact Assessment (SNH 2013);
- SNH Guidance: Recommended bird survey methods to inform impact assessment of onshore wind farms (SNH 2014);
- SNH SiteLink web pages (online information on designated sites);
- Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). Guidelines for Ecological Impacts Assessment in the UK and Ireland;
- Birds of Conservation Concern 4 (BoCC) 'Red list' (Eaton *et al*. 2015); and
- The Birds of Shetland (Pennington *et al*., 2004).

Consultation

5.2.12 A conference call took place on 12th April 2019 to discuss the likely significant environmental effects. Statutory consultees: Shetland Islands Council, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Historic Environment Scotland (HES) were invited to comment on the scope of the EIA. Those that could not attend the call provided comment separate to the call.

Baseline Conditions

Desk Study

5.2.13 As part of the information gathering required for the assessment, recent literature and other sources of contextual information on species receptor populations were consulted.

5.2.14 With the exception of golden plover, the bird population sizes for the Shetland Natural Heritage Zone estimated by Wilson *et al*. (2015) are considered to be appropriate for the purposes of assessment. For golden plover, the size of the Shetland population estimated by Wilson *et al* is likely to be an overestimate (RSPB Scotland comment on VWF VES 2018), and therefore, in the interest of a precautionary assessment, a lower population size of 2,600 pairs is assumed for this species (this is 50% of the Wilson *et al* lower 95% confidence estimate).

5.2.15 The Shetland ringed plover population size is assumed to be 800 pairs (Pennington *et al*., 2004).

Field Study Methods

5.2.16 An extensive programme of ornithological field studies has been undertaken between 2003 and 2018 to provide information on the distribution, abundance and flight activity metrics of bird species breeding in the vicinity of the VWF site (Viking, 2018). These studies included survey coverage of development site and its vicinity. The results of these studies provide information to establish baseline conditions at the proposed development site. In addition, bird surveys covering the vicinity of the proposed development site were undertaken in 2019 using the same survey methods, however these surveys were limited to two visits in the main part of breeding season (May and June).

5.2.17 The results from bird surveys undertaken in 2018 and 2019 are used as the primary source of baseline information for the impact assessment. Survey results from earlier years were also examined and are referred where relevant, for example if it there is evidence that over a longer time frame the 2018/19 results do not fully reflect the use of the proposed development site and its vicinity by a species.

5.2.18 The distribution and abundance of breeding birds was determined using the species-appropriate survey methods recommended by SNH for wind farm impact assessment (SNH, 2014).

5.2.19 The moorland bird survey (MBS) method (Brown and Shepherd, 1993) was used to determine the distribution of breeding wader, skua, gull, wildfowl, gamebird and passerine species. MBS involves an experiences ornithologist making a series of walkover visits during the breeding season across a defined area of interests (e.g., a development site buffered to 500m). The surveyor approaches all parts to within approximately 100m and records the bird species seen and heard with standard species codes and behaviour notation on large scale maps. Survey data are later analysed to determine the number and location of the breeding territories based on the proximity of registrations of the same species (Brown and Shepherd, 1993).

5.2.20 Surveys of nesting merlin followed the methods described in Hardey *et al*. (2012). Breeding merlin in Central Mainland have been subject to a long-term study going back over 20 years and currently co-ordinated by Peter Ellis on behalf of the Shetland Raptor Study Group. Almost all Central Mainland merlin sites have received annual survey coverage since 2005, including 2019.

5.2.21 Red-throated diver site occupancy and breeding success was surveyed using the standard methods for this species described in Gilbert *et al.* (1998). Surveys of VFW site buffered to at least 1km have been conducted annually from 2003 to 2019 (except 2015). The diver surveys also provide information on other bird species that breed on lochs and lochans, including whooper swan and wigeon.

Cumulative Baseline

5.2.22 SNH guidance on wind farm cumulative impact assessment was followed (SNH, 2012). Eight other wind energy projects in Shetland are taken into consideration in the assessment of potential cumulative impacts. These are: Viking Wind Farm, Viking Wind Farm North Construction Compound, Viking Wind Farm West Construction Compound, Beaw Field Wind Farm, Yell; Garth Wind Farm, Yell; Luggie Knowe Wind Farm, near Lerwick; Mossy Hill Wind Farm, near Lerwick; and, Burradale Wind Farm, near Lerwick.

Assessment of Effects

5.2.23 The assessment of significance of an effect takes into consideration the characteristics of the effect in terms of:

- Effect nature (adverse or beneficial, direct or indirect);
- Spatial magnitude (see below); and
- Temporal magnitude (see below).

5.2.24 The assessment of significance also takes into consideration the characteristics of the receptor being considered in terms of:

- Nature conservation importance (Table 5-1);
- Sensitivity to the effect (see below); and
- Conservation status.

Criteria for Assessing Sensitivity of Receptors

5.2.25 Receptor sensitivity is a judgement of the tolerance of a receptor to tolerate an impact. In the case of birds, the receptors are defined as spatially limited populations of a species, for example the Shetland breeding population. Sensitivity to an impact is affected by the population status of a species; for example declining populations are likely to be more sensitive than species with increasing populations.

5.2.26 Sensitivity is also affected by the habitat and feeding requirements of a particular species. For example, species that are habitat specialist may have greater sensitivity than species that are habitat generalists. The criteria used to categorise receptor sensitivity are defined in Table 5-2.

Table 5-2. Criteria for Categorising the Sensitivity of Receptors

Sensitivity	Definition
High	Receptor population has very limited tolerance of effect. e.g., likely to have no capacity to absorb change, so a population level effect likely. Likely to be limited to populations with poor existing conservation status.
Medium	Receptor population has limited tolerance of effect. e.g., very minor capacity to absorb change so a population level effect possible. Likely to include but not be limited to populations with poor existing conservation status.
Low	Receptor population has some tolerance of effect. e.g., likely to have minor capacity to absorb additional mortality or reduction in productivity or habitat loss, so a population level effect unlikely.
Negligible	Receptor population generally tolerant of effect. e.g., likely to have moderate capacity to absorb additional mortality or reduction in productivity or habitat loss, so a population level effect very unlikely.

Criteria for Assessing Effect Magnitude

5.2.27 Impacts are judged in terms of magnitude in space and time (Regini, 2000).

5.2.28 Temporal magnitude was categorised according to whether an impact is judged to be short term, medium term or long term, and whether it is considered to be temporary (reversible) or permanent (irreversible).

5.2.29 Spatial magnitude is considered in terms of the proportion of the receptor that would be affected by the impact and classified into five categories (Table 5-3).

5.2.30 Determination of spatial magnitude requires that a species receptor population is appropriately defined. Following guidance, it is considered that the appropriate receptor population is defined as the breeding population for Natural Heritage Zone 1, this corresponds to Shetland (SNH, 2006; CIEEM, 2006).

Table 5-3. Criteria for Categorising the Magnitude of Effect

Magnitude	Definition
Very high	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of breeding productivity in a bird population due to disturbance. Guide: • >50% of population affected; and • proportional change to mortality rate of >100% (i.e., at least a doubling of the baseline mortality rate).
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: • 26-50% of population affected; and • proportional change to mortality rate of 51-100%.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: • 6-25% of population affected; and • proportional change to mortality rate of 11-50%.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: • 1-5% of population affected; and • proportional change to mortality rate of 2-10%.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: • < 1% population affected; and • proportional change to mortality rate of <2%.

Significance Criteria

5.2.31 Information on the spatial and temporal magnitude of an impact on a receptor is integrated with categories describing the receptor's nature conservation importance, sensitivity to the impact and conservation status to reach a reasoned judgement on the significance of an effect resulting from the identified impacts (Table 5-4). In this integration the form of the spatial magnitude of the impact is considered (e.g. mortality, displacement or failed breeding) as regards its potential influence on the conservation status of the receptor population. Evaluations of effect significance are set in the context of the objective of maintaining favourable conservation status of species receptors, or not impede the recovery of species receptors that currently have an unfavourable conservation status.

5.2.32 In order to reflect the requirements of the 2017 EIA Regulations, each likely effect considered is evaluated and classified as either significant or not significant. Effects categorised as having Moderate or Major significance are evaluated as Significant under the 2017 EIA Regulations, whilst those categorised as Low or Negligible significance are evaluated as Not Significant.

5.2.33 If a potential effect is determined to be significant, mitigation measures to avoid, reduce or remedy the effect are identified wherever possible.

Table 5-4. Criteria used to Categorise Significance of an Effect

Significance of Effect	Description
Major	Detectable changes in national or regional receptor population of nature conservation importance that is likely to have a severe effect on conservation status.
Moderate	Detectable changes in national or regional receptor population of nature conservation importance that is likely to have a low or moderate effect on conservation status.
Minor	Small or barely detectable changes that are unlikely to have an effect on the conservation status of a national or regional population of nature conservation importance.
Negligible	No or non-detectable changes in the conservation status of national or regional receptor population of nature conservation importance.

Assumptions and Limitations

Assumptions Regarding Nature of Effects

5.2.34 It assumed that the potential for breeding bird species to be affected by disturbance depends on the proximity of the breeding site from the disturbance source, a species'/individual's tolerance to disturbance, the nature of the disturbance and its duration. Similarly, it assumed that the potential for breeding bird species to be affected by habitat loss/change will depend on the scale, nature and proximity of the habitat loss/change to a bird territory.

5.2.35 It is assumed that if severe enough, disturbance could potentially displace birds from areas of habitat they would otherwise choose to use and is thus would be equivalent to habitat loss. It is also assumed that disturbance could affect birds' time and energy budgets, potentially leading to reduced feeding and breeding success. Although it is displaced birds may be able to successfully relocate to vacant habitat elsewhere for the purposes of assessment it is cautiously assumed that displaced birds would not successfully relocate to an alternative site.

5.2.36 The assessment of the potential for disturbance or habitat loss to lead to displacement or breeding failure is approached in a quantitative way, the same approach as used in the VFW Variation ES. Assumptions are made regarding the distance from the source of disturbance or habitat loss (i.e. the proposed development site) at which breeding birds are considered to be at risk and the proportion of these birds that would be affected. The choice of the threshold distance for identifying pairs at risk and the assumed proportion that would be displaced or experience reduced breeding success is informed by published literature and expert judgement. The estimated number of breeding pairs of a species that would be affected expressed as a proportion of a receptors' population sizes is the basis for determining effect magnitude.

5.2.37 For breeding golden plover and curlew species it is assumed that only pairs whose nominal territory centre lies within 200m of the proposed development site boundary would be at risk of showing an adverse response to disturbance or habitat loss. This threshold is considered precautionary in light of evidence from wind farm studies. For these species it is assumed that breeding pairs with nominal territory centres within 200m of the proposed development site would be displaced or experience breeding failure for the duration of the three stages of the proposed development. These assumptions are informed by studies of these species breeding on windfarms (e.g., Douglas *et al*., 2011; Pearce-Higgins *et al*. 2012; Fielding and Haworth, 2013; Sansom *et al*., 2016).

5.2.38 Evidence from Before-After Control-Impact studies conducted at several windfarms indicate that golden plover show little or no evidence of distribution or abundance change in response to wind farm infrastructure (e.g., Douglas *et al*., 2011; Pearce-Higgins *et al*. 2012; Fielding and Haworth,

2013). Although a study at Gordonbush Wind Farm shows a decline in golden plover up to 400m from wind turbines (Sansom *et al*., 2016), this was a response to operational wind turbines. Breeding waders are unlikely to show similarly strong response to the ground based activities associated with the construction and operation of a construction compound

5.2.39 Curlew in Shetland commonly nest and rear chicks within 100m of public roads and occupied dwellings (D Jackson, personal observation) and therefore it is reasonable to assume that this species is relatively tolerant of ground-based disturbance. Indeed, results from before-after studies from wind farm sites across the UK and two control sites concluded that at four of the five study wind farms studied there was no suggestion that curlew were displaced as a result of the turbine operation, while at the fifth site results were inconclusive (Whitfield *at al*., 2010). It is likely that the proximity that initiates an adverse response from curlews to ground-based potential disturbance sources (like those associated with the proposed development) will be lower than that for operational wind-turbines.

5.2.40 Both curlew and golden plover have relatively large territories covering several tens of hectares (breeding densities in Central Mainland are typically around 1 pair per square kilometre, though not all habitat is suitable). Therefore, the proposed development site represents well below the area of a typical territory of these species. It is assumed that after decommissioning (included the reinstatement of habitat) any affected territories of these species are re-occupied and breeding success reverts to normal.

5.2.41 Compared to curlew and golden plover, breeding ringed plover are relatively tolerant of human disturbance. Therefore, it is assumed that potential ground-based disturbance from the proposed development that is more that 100m from ringed plover breeding habitat (stony loch shores and bare ground) would not lead to adverse disturbance.

5.3 Baseline Conditions

Current Baseline

5.3.1 The results from baseline surveys relevant to the assessment are summarised in Table 5-5 in terms of the number of each bird species breeding in the vicinity of the proposed development site, up to 500m from the boundary.

5.3.2 The 2018 and 2019 surveys also confirmed that there were no occupied breeding sites of red-throated diver or merlin within 1 km of the proposed development boundary.

5.3.3 Surveys of red-throated diver going back to 2005 show that this species has not bred within 1km of the proposed development in any year, nor are then any potentially suitable lochans for breeding within 1km of the proposed development.

5.3.4 The 2018 and 2019 surveys identified no pairs of breeding whimbrel within 500m of the proposed development. A single flying whimbrel was seen on one survey visit in 2018 calling over a wide area approximately 300 m north-east of the proposed development . This bird was not seen on other visits or on the ground, and it is therefore considered unlikely that there was a breeding territory at this location.

5.3.5 MBS surveys that covered the proposed development site and its nearby vicinity in other years (2005, 2006, 2013 and 2015) identified no ornithological sensitivities additional to those identified in 2018 and 2019

Table 5-5. The Number of Territories of Breeding Bird Species in 2018 and 2019 at the Proposed Development Site Buffered to 200m and in a Surrounding 200-500m Buffer

Species	Nature Conservation Importance (Table 1)	2018		2019	
		Dev. Site & 200m Buffer	Surrounding 200-500m Buffer	Dev. Site & 200m Buffer	Surrounding 200-500m Buffer
Red-throated diver	High	0	0	0	0
Merlin	High	0	0	0	0
Whimbrel	High	0	0*	0	0
Golden plover	High	1	0	1	2
Dunlin	High	0**	0	0**	1
Arctic tern	High	0	1	0	2
Lapwing	Medium	0	0	0	1
Ringed plover	Medium	1***	0	1***	1
Curlew	Medium	0	2	1	3
Arctic skua	Medium	0	0	0	0
Redshank	Low	0	1	0	2
Snipe	Low	1	3	2	5
Oystercatcher	Low	1	3	1	3
Great skua	Low	0	0	0	0
Common sandpiper	Low	0	0	0	1
Common gull	Low	0	0	0	0
Greylag goose	Low	0	1	1	3
Wigeon	Low	0	0	0	1
Red grouse	Low	0	1	1	1
Skylark	Low	4	8	5	9

*As single individual was seen inside the 200-500m buffer on one occasion only, this was likely to have been a non-breeding prospecting bird.
**Up to seven dunlins were seen feeding along shores of Sand Water, but there was no evidence these birds were breeding within 500m of the proposed development site.
*** Pair bred along Sand Water shore, closest breeding habitat is 120m at from proposed development site.

Future Baseline

5.3.6 EIA should identify existing processes of change in the environment so that any changes that are predicted to occur due to a project can be distinguished from those which are expected to occur anyway. This is commonly referred to in EIA as the '*do nothing scenario*'.

5.3.7 All bird species are subject to a certain amount of annual local variation in their abundance and distribution. Bird populations may also be subject to more widespread longer-term trends of increase or decline leading to changes in their overall population size and conservation status. A like-for-like comparison of results from VWF MBS surveys undertaken in the period 2005-8 with those undertaken in the period 2014-2018 show that several species have shown abundance changes over this time. For example golden plover showed an increase of approximately 19%, whereas curlew show decline of an approximately 28% (VWF, 2018).

5.3.8 Changes in bird numbers and distribution can be caused by many factors and may be driven by conditions in Shetland (e.g., breeding habitat quality and predation pressure) or away from Shetland (e.g., on wintering grounds). The VWF studies also show that the peatland habitats across Central Mainland, including in the vicinity of the proposed development, are in places degraded by erosion, a process that is likely to further degrade peatland habitat in the future (VWF, 2018). The VWF Habitat Management Plan included measures to restore existing erosion (RPS, 2016).

Identified Sensitive Receptors

5.3.9 Based on the results of baseline surveys (Table 5-5) and applying species-appropriate distance thresholds to identify the territories at which pairs could potentially show an adverse response to disturbance or habitat loss, it is concluded that two species of high or medium conservation importance could potentially be affected by the proposed development. These are:

- Golden plover (high nature conservation importance); and
- Curlew (medium nature conservation importance).

5.3.10 Ringed plover, a species of medium nature conservation importance, breed relatively near to the proposed development site but is not likely to be adversely affected by the proposed development.

5.3.11 The potential for adverse effects on two specially protected species of high conservation importance (whooper swan and merlin) that have bred relatively near to the proposed development site are considered in Confidential Appendix 5.1.

5.4 Assessment of Effects

Effect 1. Disturbance

Construction Effects

5.4.1 It is planned that construction of the proposed development would not occur during the bird breeding season (April to August). Construction during outside the breeding season would not lead to disturbance of breeding bird species, in which case it follows that the effect would be **Not Significant** for the purposes of the 2017 EIA Regulations. However, it is possible that the construction timetable could change and overlap the bird breeding season. If this happened, there could be potential for construction activities to disturb breeding birds. For the purposes of assessment the worst case is assumed, i.e. that the construction phase overlaps the bird breeding season.

Golden Plover and Curlew

5.4.2 Baseline surveys show that two bird species categorised as having high or medium nature conservation importance regularly breed close enough to the proposed development to be potentially adversely affected by disturbance. These are up to one pair each of golden plover and curlew (for these species a 200m safe-working-distance is assumed). For the purposes of assessment, it assumed that one breeding pair of golden plover and one pair of curlew would be displaced by disturbance during construction. A single pair of golden plover and a single pair of curlew represent well below 0. 1% of the Shetland receptor populations of these species (2,600 pairs and 3,643 pairs respectively), and therefore these losses are considered to be negligible.

5.4.3 For both golden plover and curlew, the Shetland receptor population is considered to have **low sensitivity** (Table 5-2). The disturbance/displacement of one pair of each these species through the construction period are characterised as **short term**, **adverse, reversible** effects of **negligible magnitude** (Table 5-3) that are considered to have negligible significance (Table 5-4)**.** As such the impacts are judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

Other Species

5.4.4 For the reason described earlier (see Section 5.2, *Assumptions and Limitations*) it is considered that the single pair of ringed plover, breeding close to the Sand Water shoreline would not be affected by potential disturbance from the proposed development. As such the impact on this species is judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

5.4.5 For the reason presented in Confidential Appendix 5.1 it is considered that merlin and whooper swan would not be affected by potential disturbance from the proposed development. As such the

impact on these species is judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

Operational Effects

5.4.6 The potential for birds to be disturbed through the anticipated five-year operating phase of the proposed development is essentially the same as assessed for the construction phase, accept that the potential disturbance would occur over a longer period (i.e., the five-year operational life span of the construction compound).

5.4.7 The disturbance/displacement of one pair of golden plover and one pair of curlew due to operational activities are characterised as a **medium term**, **adverse, reversible** effects of **negligible magnitude** (Table 5-3) that are considered to have negligible significance (Table 5-4)**.** As such the impacts of these effects are judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

Effect 2. Habitat Loss/Change

Construction Effects

5.4.8 The proposed development site comprises gently sloping blanket bog which in parts is degraded by peat erosion and small-scale peat cutting. The construction of the proposed development would cause the temporary loss/change of approximately 7-8 ha of moorland habitat. This would potentially degrade the quality of one golden plover and one curlew territory (the same territories identified to be at potential risk from disturbance effects). Although the size of area affected by habitat loss is well below the size of a single territory of these species, nevertheless it may be enough to result in the displacement of these pairs. No other bird species of high or medium nature conservation value is predicted to be affected by habitat loss/change resulting from the proposed development.

5.4.9 For the purposes of assessment, it assumed that one breeding pair of golden plover and one pair of curlew would be displaced by habitat loss/change. A single pair of golden plover and a single pair of curlew represent well below 0.1% of the Shetland receptor populations of these species (2,600 pairs and 3,643 pairs respectively), and therefore these losses are considered to be negligible. The effects of habitat loss/change would occur during the construction stage but would persist through the operational stage and until the habitat was reinstated during decommissioning. Therefore this effect is considered to be medium term and reversible.

5.4.10 For both golden plover and curlew, the Shetland receptor population is considered to have **low sensitivity** (Table 5-2). The disturbance/displacement of one pair of each these species through the construction period are characterised as **short term**, **adverse, reversible** effects of **negligible magnitude** (Table 5-3) that are considered to have negligible significance (Table 5-4)**.** As such the impacts are judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

5.4.11 As habitat loss/change is predicted to affect the same pair of golden plover and same pair of curlew already predicted to be affected by disturbance. Thus the impact on receptors of the two effects in-combination would be no greater than assumed for either effect assessed in isolation.

Operational Effects

5.4.12 There will be no habitat loss/change effects during the operation stage additional to those identified and assessment above for the construction stage, and therefore no further assessment is made.

Cumulative Effects

5.4.13 The assessment of the proposed development identifies that one pair of golden plover and one pair of curlew could effectively be 'lost' from their respective receptor populations due to

disturbance and/or habitat loss/change effects. In both cases the pair affected is additional to the pairs of these species predicted to be displaced by the Viking Wind Farm (Viking Energy, 2018). Therefore the proposed development could contribute to the cumulative impacts on these species from wind-energy projects in Shetland.

5.4.14 The cumulative impact assessment (CIA) presented below is limited to consideration of golden plover and curlew as these are the only species of high or medium nature conservation importance predicted to be affected by the proposed development.

5.4.15 Eight other developments are considered for CIA that are either constructed, consented or in planning. These are as follows:

- Viking Wind Farm (103 turbines consented);
- Viking Wind Farm North Construction Compound (in planning);
- Viking Wind Farm West Construction Compound (in planning);
- Burradale Wind Farm, near Lerwick (5 turbines, operational);
- Luggies Knowe Wind Farm, Gremista, near Lerwick (3 turbines, consented);
- Mossy Hill Wind Farm, near Lerwick (12 turbines, consented);
- Garth Wind Farm, Yell (5 turbines, operational); and
- Beaw Field Wind Farm, Yell (17-turbines consented).

5.4.16 The assessment for the Viking Wind Farm predicted that 15 pairs of golden plover and 18 pairs of curlew could be displaced (Viking Energy, 2018). It also predicted that up to 40 golden plovers and 12 curlews could be killed each year through collision if a 98% avoidance rate was assumed, but pointed out that this would reduce to 10 and 3 birds, respectively, if a more realistic avoidance rate of 99.5% avoidance rate is assumed. The Viking Wind Farm assessment also noted that disturbance and collision effects were likely to act antagonistically, and thus the in-combination effect was likely to be lower than the sum of these effects in isolation.

5.4.17 The assessment for the Viking Wind Farm North Construction Compound predicts that up to one pair of golden plover and one pair of curlew could be lost due to habitat loss/change and disturbance effects (Viking Energy, 2019a). However, as the same pairs are also assumed to be displaced by the Viking Wind Farm (due to their proximity to roads or turbines) (Viking Energy, 2018). Therefore the effects of the North Construction Compound project would not further contribute to the wider cumulative impact (i.e. the loss of these territories is already included in the CIA by consideration of the Viking Wind Farm).

5.4.18 The assessment for the Viking Wind Farm West Construction Compound predicts that up to one pair of golden plover and one pair of curlew could be lost due to habitat loss/change and disturbance effects (Viking Energy, 2019b). Both these pairs are additional to the pairs assumed to be displaced by the Viking Wind Farm.

5.4.19 No information is available on the impacts on ornithology of the five-turbine Burradale Wind Farm. However given the small size of the wind farm and the large size of curlew and golden plover breeding territories it is unlikely to have led to the displacement of more than a few pairs at most. For the purposes of CIA it is assumed that this development has displaced one pair each golden plover and curlew.

5.4.20 The assessment for the three-turbine Luggies Knowe Wind Farm (also referred to as Gremista Wind Farm) found that all impacts on important bird receptors were negligible (Amec, 2011). Given the small size of the wind farm and the large size of curlew and golden plover breeding territories it is unlikely to lead to the displacement of more than a few pairs at most. For the purposes of CIA it is assumed that this development will displace one pair each of golden plover and curlew.

5.4.21 The ornithological assessment of the 12-turbine Mossy Hill Wind Farm (Peel Energy, 2018), concluded that up to two pairs of golden plover and two pairs of curlew would be affected by disturbance and displacement effects.

5.4.22 The ornithological assessment of the five-turbine Garth Wind Farm on Yell predicted impacts on curlew and golden plover would be negligible (North Yell Development Council, 2009). Given the small size of the wind farm (five turbines) and the large size of curlew and golden plover breeding territories it is unlikely to lead to the displacement of more than a few pairs at most. For the purposes of CIA it is assumed that this development has displaced one pair each of golden plover and curlew.

5.4.23 The ornithological assessment of the 17-turbine Beaw Field Wind Farm concluded that up three pairs of golden plover and one pair of curlew could be lost due to disturbance and habitat loss/change effects (Peel Energy, 2016).

5.4.24 Summing the numbers of golden plover territories predicted to be affected by habitat loss/change and disturbance effects from the nine wind energy developments considered for CIA, wind energy projects in Shetland are estimated to result in the displacement/loss of up to approximately 25 pairs of golden plover. This represents approximately 1% of the assumed Shetland receptor population size of 2,600 pairs, and is thus considered to be a cumulative effect of low magnitude. Wind farm collision mortality could potentially add to this cumulative impact but only to a limited extent because disturbance/habitat loss displacement effects and collision effects are unlikely to combine additively. Adding in additional effects of collision, the overall cumulative effect of wind energy developments on the Shetland breeding golden plover receptor population is considered to be an effect of **low magnitude** (Table 5.3).

5.4.25 Summing the numbers of curlew territories predicted to be affected by habitat loss/change and disturbance effects from the nine wind energy developments considered for CIA, wind energy projects in Shetland are estimated to result in the displacement/loss of up to approximately 26 pairs of curlew. This represents approximately 0.7% of the assumed receptor population size of 3,643 pairs, and is thus considered to be a cumulative effect of negligible magnitude. Wind farm collision mortality could potentially add to this cumulative impact but only to a limited extent because disturbance/habitat loss displacement effects and collision effects are unlikely to combine additively. Adding in the additional effects of collision, the overall cumulative effect of wind energy developments on the Shetland breeding curlew receptor population is considered to be an effect of **low magnitude** (Table 5.3).

5.4.26 For both golden plover and curlew, the Shetland receptor population is considered to have **low sensitivity** (Table 5-2). The cumulative effect of wind energy developments on Shetland is characterised as **long term**, **adverse, reversible** and of **low magnitude** (Table 5-3) and is considered to have **low significance** (Table 5-4)**.** As such the cumulative impacts on these receptors are judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

5.5 Mitigation

5.5.1 The EIA assessment predicts no significant effects and consequently no mitigation is required.

5.5.2 The construction of the proposed development is planned to take place outside the bird breeding season, and therefore construction will not disturb breeding birds. However, in the unlikely event that construction phase overlaps the bird breeding season, then ahead of construction work starting, the development site buffered to 500m would be surveyed for breeding bird species. If this survey work finds species listed on Schedule 1 of the Wildlife and Countryside Act breeding sufficiently close to the development site that they could be disturbed by construction activity, the developer will instigate measures to prevent disturbance of the breeding site.

5.5.3 In keeping with best practise, the developer will undertake construction work in ways that minimises damage to the peatland habitats surrounding the development site. Surrounding ground that is disturbed during construction (for example along access track verges) will be reinstated such that the natural vegetation is allowed to recover.

5.5.4 The decommissioning of the proposed construction compound will reinstate the vegetation across the development site to a close as practical to the baseline conditions using best-practice methods, e.g. ensuring peat layers, including turves, are stripped and stockpiled separately, prior to timeous reinstatement in the correct horizontal order. This habitat re-instatement work will draw on the experience of implementing the Viking Wind Farm Habitat Management Plan (RPS, 2016) with regard to restoring and enhancing peatland habitats to benefit breeding bird species. The habitat reinstatement programme will identify opportunities to include small-scale habitat enhancement measures designed to benefit birds, for example the creation of shallow bog pools for breeding wader species.

5.6 Residual Effects

5.6.1 The residual effects on all bird receptors following mitigation remain Not Significant (Table 5-6).

Table 5-6. Summary of Predicted Impacts on Bird Receptors before and after Mitigation

Receptor	Nature Conservation Importance	Receptor Conservation Status	Significance Category before Mitigation	Residual Significance Category after Mitigation	Significance after Mitigation
Whooper swan, Shetland population	High	Favourable	Negligible	Negligible	Not significant
Merlin, Shetland population	High	Favourable	Negligible	Negligible	Not significant
Golden plover, Shetland population	High	Favourable	Negligible	Negligible	Not significant
Curlew, Shetland population	Medium	Probably favourable	Negligible	Negligible	Not significant
Ringed plover, Shetland population	Medium	Favourable	Negligible	Negligible	Not significant

5.7 Summary and Conclusions

5.7.1 The EIA presented examines the potential for impacts on bird receptors to arise from disturbance and habitat loss/change effects during the construction, operation and decommissioning of the proposed development.

5.7.2 The impacts of the proposed development on all Shetland bird receptor population, including golden plover and curlew, are judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

5.7.3 A cumulative impact assessment concludes that the impact of the proposed development together with the impacts of other wind energy developments in Shetland would give rise to a cumulative impact on the Shetland Islands breeding golden plover and curlew receptor populations that is judged to be **Not Significant** for the purposes of the 2017 EIA Regulations.

List of Figures

5.8 References

Amec, (2011). Gremista Wind Turbine Project Environmental Statement.

Brown, A.F. and Shepherd, K.B. (1993). A method for censusing upland breeding waders. Bird Study 40: 189-195.

CIEEM (2018). Guidelines for Ecological Impacts Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.

Douglas, D.J.T., Bellamy, P.E. & Pearce-Higgins, J.W. (2011). Changes in the abundance and distribution of upland breeding birds at an operational wind farm. Bird Study 58: 37–43.

Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108, 708-746.

Fielding, A.H., and Haworth, P.F., (2010). Farr windfarm: A review of displacement disturbance on golden plover arising from operational turbines between 2005-2013. Haworth Conservation Ltd.

Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird monitoring methods. RSPB Sandy, Bedfordshire.

Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2009). Raptors, a field guide to survey and monitoring. The Stationery Office, Edinburgh.

North Yell Development Council. (2009). Garth Wind Farm Environmental Statement.

Pearce-Higgins, J.W., Stephen, L., Douse, A. & Langston, R.H.W. (2012). Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. J. Appl.Ecol. 49: 386–394.

Peel Energy. (2016). Beaw Field Wind Farm Environmental Statement. Chapter 10 Ornithology.

Peel Energy. (2018). Mossy Hill Wind Farm Environmental Statement. Chapter 8 Ornithology.

Pennington, M., Osbourne, K., Harvey, P., Riddington, R., Okill, D., Ellis, P. and Heubeck, M. (2004). The Birds of Shetland. Christopher Helm. London.

Regini, K. (2000). Guidelines for ecological evaluation and impact assessment. Ecology and Environmental Management. In Practice, 29 (September), pp. 1, 3-7. Winchester, Institute of Ecology and Environmental Management.

RPS (2016). Viking Wind Farm Habitat Management Plan 2016. Report prepared for Viking Energy Wind Farm LLP by RPS and Natural Research (Projects) Ltd.

Sansom, A., Pearce-Higgins. & Douglas, D. (2019). Negative impacts of wind energy development on a Breeding Shorebird Assessed with a BACI design.

Scottish Government (2013). Planning Advice Note 1/2013: Environmental Impact Assessment http://www.gov.scot/Resource/0043/00432581.pdf

Scottish Natural Heritage (2006). Assessing significance of impacts from onshore windfarms on birds outwith designated areas.

SNH (2009). SNH Guidance, Environmental Statements and Annexes of Environmentally Sensitive Bird Information.

SNH (2012). Assessing the cumulative impact of onshore wind energy developments. SNH Battleby, UK.

SNH (2013). A Handbook on Environmental Impact Assessment. 4th edition. SNH, Battleby.

SNH (2014). Guidance: Recommended bird survey methods to inform impact assessment of onshore wind farms. SNH, Battleby, UK.

Viking Energy (2018), Viking Wind Farm Section S36C Application – EIA Report Chapter 5: Ornithology.

Viking Energy (2019a). Viking Wind Farm Voluntary EIA Report for North Construction Compound Chapter 5: Ornithology.

Viking Energy (2019b). Viking Wind Farm Voluntary EIA Report for West Construction Compound Chapter 5: Ornithology.

Whitfield, D.P. (2007). The effects of wind farms on shorebirds (waders: Charadrii), especially with regard to wintering golden plovers. Report from Natural Research to Your Energy. Natural Research Ltd, Banchory.

Whitfield, D.P., Ruddock, M. and Bullman, R. (2008). Expert opinion as a tool for quantifying bird tolerance to human disturbance. Biological Conservation 141: 2708-2717.

Whitfield, D.P., Green, M. and Fielding, A.H. (2010). Are breeding Eurasian curlew Numenius arquata displaced by wind energy developments? Natural Research Projects Ltd, Banchory, Scotland.

Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72. Available from: www.swbsg.org

Glossary and Abbreviations

BBPP	Breeding Bird Protection Plan
HMP	Habitat management plan
MBS	Moorland Bird Survey
NHZ	(SNH) Natural Heritage Zone
SNH	Scottish Natural Heritage
SPA	Special Protection Area
VWF	Viking Wind Farm

6. NOISE

Executive Summary

6.1.1 This Chapter has assessed the impacts of noise from the construction and operation of the proposed development on the nearest residential receptor. The assessment has been undertaken following the guidance contained within BS5228-1 'Code of practice for noise and vibration control on construction and open sites. Noise'.

6.1.2 Predicted noise levels have been assessed against a set of threshold levels, which are based on the existing ambient sound levels occurring in the vicinity of the receptor. The appropriate threshold levels have been determined through the analysis of baseline sound level data that was collected during the baseline survey for the Viking Wind Farm in 2018.

6.1.3 Three scenarios have been considered, namely the construction of the compound and access track, typical operational activities that will occur during daytime periods and the operation of lighting rigs and generators during the night-time. The predicted noise levels, including consideration of cumulative noise from other Viking Wind Farm construction activities, indicate that the BS5228 threshold levels will not be exceeded. Accordingly, the assessment concludes that noise impacts are Not Significant.

6.2 Introduction

6.2.1 Environmental, or community noise is a broad term that encompasses noise emitted from many sources, including road, rail & air traffic, industry, construction, public work and neighbourhood noise. All of these sources potentially contribute adversely to the overall noise environment. It is therefore reasonable to expect communities to be sensitive to any deterioration in their acoustic environment as a result of a proposed development.

6.2.2 This Chapter reports on the likely significant effects with respect to environmental noise associated with the construction, operation and decommissioning of the proposed development. Specifically, the Chapter considers the construction activities that are likely to occur for the construction of the access track and temporary construction compound as well as typical activities that are likely to occur during the operation of the compounds during daytime and night-time periods.

6.2.3 This chapter is supported by:

- Technical Appendix 6.1: Baseline Sound Level Data; and
- Technical Appendix 6.2: Source Noise Level Data.

6.2.4 Figures 6.1 – 6.3 are referenced in the text where relevant.

6.3 Methodology

Scope of the Assessment

6.3.1 The specific objectives of the chapter are to:

- Identify potential Noise Sensitive Receptors (NSRs) in the vicinity of the proposed development and quantify the existing baseline sound levels at these locations;
- Calculate the likely levels of construction and operational noise at the nearest NSRs to determine the potential for significant noise effects associated with the proposed development; and
- Indicate any requirements for mitigation measures in order to provide sufficient levels of protection for nearby receptors.

6.3.2 The study area is defined by the closest NSRs to the proposed development on the assumption that if noise levels are within acceptable levels at the closest receptors then it is reasonable to assume they will also be acceptable at more distant locations.

6.3.3 NSRs are properties, people or fauna which are sensitive to noise and, therefore, may require protection from nearby noise sources. There is only one NSR close to the proposed development, which is located at 441741,1155167, approximately 500 m west north west from the centre of the construction compound and 630 m from the end of the proposed compound access track (which is the closest point of the track to the receptor).

6.3.4 The closest NSR, which is known as Sandwater, is a residential property. No non-residential NSRs have been identified for assessment.

6.3.5 At a national level the relevant policy documents for the assessment of environmental noise are: Planning Advice Note (PAN) 1/2011 – 'Planning and Noise,' [1] and the associated Technical Advice Note (TAN) – 'Assessment of Noise'.[2]

6.3.6 PAN 1/2011 provides little guidance in respect of construction noise, other than recommending that the use of planning conditions is not the preferred method for controlling temporary construction noise. Specifically, the document states:

"32. While planning conditions can be used to limit noise from temporary construction sites, it is most effectively controlled through the Control of Pollution Act 1974 (COPA74) and the Pollution and Prevention Control Act 1999 for relevant installations. Notice can be served in advance of works and site conditions set to control activities."

6.3.7 BS5228:1997 'Noise and vibration control on construction and open sites. Code of practice for basic information and procedures for noise and vibration control' parts 1 to 5 (BSI, 1997) is the approved Code of Practice under COPA74, however, it is the 2009 version of the Standard which should be used for Environmental Impact Assessments (EIA) and planning applications. In this regards the TAN states;

"However, under Environmental Impact Assessments and for planning purposes i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable. The 2009 version of the standard consists of Parts 1 and 2 for noise and vibration respectively."

6.3.8 The BS5228:2009 standard provides useful guidance on practical noise control. Part-1, provides recommendations for basic methods of noise control including sections on community relations, training, occupational noise effects, neighbourhood nuisance and project supervision. The annexes provide information on noise sources, noise calculation procedures, mitigation measures and their effectiveness.

6.3.9 Part 1 also contains sound power level data for a variety of construction plant. This data was obtained from field measurements of actual plant operating on construction and open sites in the United Kingdom and is therefore appropriate to use as source level data for construction noise propagation calculations.

6.3.10 The 2009 version of BS5228 was subject to an additional update in 2014. Accordingly, the construction noise assessment in this chapter has been undertaken in accordance with BS5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise', [3] hereafter referred to as BS5228.

[1] The Scottish Government (2011). PAN 1/2011 Planning and Noise. Scotland: The Crown

[2] The Scottish Government (2011). Technical Advice Note, Assessment of Noise. Scotland: The Crown

[3] BSI (2014). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise. UK: British Standards Institute.

Consultation

6.3.11 No formal scoping opinion has been sought for the proposed development, however, in April 2019 a conference call was held between the Developers and a number of stakeholders (SIC, SEPA and SNH), the minutes of which have been distributed as an informal scoping opinion. In regard to noise, it was determined that it would be appropriate to consider construction noise within the EIA, however, no specific recommendations were made with regards to the required assessment methodology.

Baseline Conditions

Field Study

6.3.12 Baseline sound level surveys were undertaken at thirteen locations in order to support the planning application of the associated Viking wind farm. Detailed information regarding the surveys is presented within Chapter 6 of the Viking wind farm Environmental Statement with further information provided in Technical Appendix 6.1.

6.3.13 The closest Noise Monitoring Location (NML) to the proposed development was at 441728, 1155165, within the grounds of Sandwater itself. Data measured at this location has been used to determine typical ambient sound level.

Assessment of Effects

6.3.14 Annex E, part E.3.2 of BS5228, clearly sets criteria for assessing the significance of construction noise effects and gives examples of suitable threshold values which can be used to assess construction noise. Table E.1 of BS5228 (represented here as Table 6.1) contains an example of the significance criteria that can be used to assess construction activities.

Table 6.1: Example of Threshold of Potential Significant Effect at Dwellings (dB_A)

Assessment Category and Threshold Value Period	**Threshold Value LAeq,T dB**		
	Category $A_{(A)}$	**Category $B_{(B)}$**	**Category $C_{(C)}$**
Night-Time (23:00 – 07:00)	45	50	55
Evenings and Weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	65	70	75

(A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values;

(B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values; and

(C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

6.3.15 The threshold values can be considered limits for the construction noise levels (quantified using the LAeq noise metric). The limits in each category are to be used where the existing noise level at each location, rounded to the nearest 5 dB, is below the level given for a particular time of day. BS5228 provides the following advice regarding the threshold limits:

"Note: 1 A potential significant effect is indicated if the LAeq,T noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total LAeq,T noise level for the period increases by more than 3 dB due to site noise.

Note 3: Applied to residential receptors only."

6.3.16 Therefore, the assessment of significance of effects for construction noise reflects a specific noise threshold for the locality for a particular period of the day, rather than an absolute noise level.

Criteria for Assessing Sensitivity of Receptors

6.3.17 The TAN (1/2011) states; *"The initial process requires the identification of all noise sensitive receptors (NSR) that may potentially be affected by the development and to prioritise each NSR according to their level of sensitivity."*

6.3.18 Table 2.1 of the TAN presents the levels of sensitivity associated with a variety of receptors. For residential receptors the sensitivity is classed as 'High'.

Criteria for Assessing Magnitude of Change

6.3.19 The assessment of construction noise against fixed noise threshold values is simply a case of pass or fail and as such cannot be used to determine the magnitude of change.

Significance Criteria

6.3.20 Having due regard to the existing ambient noise levels at NSRs around the proposed development, the BS5228 threshold values for daytime, evenings and weekends (as detailed in Table 6.1) have been used for the construction noise assessment. Accordingly, any predicted levels above the relevant category threshold (A, B or C) is assessed as a Significant effect; whilst predicted levels below the relevant category threshold is assessed as Not Significant.

Assumptions and Limitations

6.3.21 The noise propagation models are intended to give a good approximation of the specific noise level and the contribution of each individual source. However, it is expected that measured levels are unlikely to be matched exactly with modelled values and the following limitations in the model should be considered:

- All assessment locations are modelled as downwind of all noise sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night;
- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for;
- Unless specifically stated the models assume all fixed noise sources are operating continuously and simultaneously, estimating a worst-case source noise level; and
- All mobile plant (excavators, dozers, rollers etc) have been modelled as a line source along their anticipated movement paths and the sound power level of the source averaged out across the length of the entire line. This will give an approximation of the overall noise levels from mobile plant at receptor locations; however, in reality noise levels will fluctuate as construction plant and activities moves around the activity area.

6.4 Baseline Conditions

Current Baseline

6.4.1 The ambient sound level (LAeq) at both NMLs has been calculated for each threshold value period on a daily basis. The average ambient sound level for each NML is presented in Table 6.2.

Table 6.1: Average Ambient Sound Level (dB LAeq)	
Threshold Value Period	**NML08, Langerview**
Night-Time (23:00 – 07:00)	38
Evenings and Weekends	41 (evenings) 44 (weekends)
Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	44 (weekdays) 42 (Saturday)

6.4.2 Technical Appendix 6.1 presents the measured levels in more detail.

6.4.3 Having due regard to the existing ambient sound levels at the NML, the BS5228 threshold values (as detailed in Table 6.1) have been determined and for all assessment periods the Category A threshold values are to be used. Therefore, the strictest of the BS5228 noise limits are used for assessment. Accordingly, the thresholds for significance are:

- 65dB LAeq(t) for weekdays (07:00 – 9:00) and Saturday mornings (07:00 – 13:00);
- 55dB LAeq(t) for evenings, Saturday (13:00 – 19:00) and all-day Sunday; and
- 45dB LAeq(t) for night-time (23:00-07:00).

6.5 Assessment of Effects

Methodology for the Prediction of Noise

6.5.1 In order to predict the noise immission levels attributable to the proposed development, noise propagation models have been produced using the propriety noise modelling software CadnaA. Within the software, complex models can be used to simulate the propagation of noise according to a range of international calculation standards.

6.5.2 The noise immission level has been calculated at 441755, 1155165. This Noise Assessment Location (NAL) has been chosen to represent the closest point on the garden boundary to the proposed development. The NAL can be seen in Figures 6.1 through to 6.3.

6.5.3 The noise levels have been predicted in accordance with ISO9613 2:1996 'Acoustics - Attenuation of sound during propagation outdoors: General method of calculation'.[4]

6.5.4 The ISO 9613 propagation model was chosen in preference to the calculation method presented in BS5228, primarily because of the significant distances between many of the sources to the receptor. Specifically, BS5228 notes in F 2.2.2.2, that at distances over 300 m noise predictions using the BS5228 methodology should be treated with caution, especially where a soft ground correction factor has been applied because of the increasing importance of meteorological effects; whereas ISO 9613-2 provides equations that have been validated up to 1,000 m.

6.5.5 The ISO 9613 model can take account of the following factors that influence sound propagation outdoors:

- geometric divergence;
- air absorption;
- reflecting obstacles;
- screening;
- vegetation; and
- ground reflections.

[4] ISO (1996). ISO 9613-2:1996 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2 – General Method of Calculation. Geneva: International Organization for Standardization.

6.5.6 The model uses the octave band sound power output of the proposed plant as its acoustic input data, and calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects.

6.5.7 For the purposes of this assessment, the noise level predictions have been undertaken using a receiver height of 1.5m above local ground level. Soft ground (G=1) attenuation has been assumed at all locations except for roads, water and the construction compound itself, which have been modelled with a ground attenuation of G=0 (hard ground). Air absorption based on a temperature of 10°C and 70% relative humidity has been assumed.

6.5.8 All stationary items of plant and activities, for example, the use of generators, have been modelled as single point sources. Activities that would occur along a linear activity area, for example, the grading of the access track, have been modelled as a moving point source (represented as a line source). Specifically, the relevant plant has been modelled assuming the SWL is distributed evenly along the entire length of the work area.

Noise Modelling Scenarios

6.5.9 Noise levels will vary throughout the construction period as construction activities, plant and locations vary. For much of the working day the noise associated with construction activities would be less than predicted, as the assessment has assumed all equipment is continually operating at full power, whereas in practice, equipment load and precise location may vary throughout the day. This approach has been adopted to represent a worst-case assessment.

6.5.10 At this stage, a detailed plant list or construction schedule is not available, so a generic plant list based upon experience of similar projects has been used, as well as input from SSE's engineers on what plant and activities are likely to be required.

6.5.11 Three scenarios have been modelled to represent each of the likely construction and operational phases of the proposed development. Specifically;

- Scenario 01 considers the construction of the access track from the A917 up to the construction compound, as well as the compound itself;
- Scenario 02 considers everyday operations within the compound, such as deliveries, movement of materials, road sweeping etc; and
- Scenario 03 considers noise which may be emitted during evening and night-time periods i.e. from the use of generators and lighting rigs. No specific construction activities are anticipated during the night-time.

6.5.12 Decommissioning activities have not been modelled; however, it is anticipated that any noise generated during decommissioning would be similar in terms of the plant and activities modelled within Scenario 01.

6.5.13 Machinery onsite would produce noise levels that are transient in nature and fluctuate due both to the location of the activity and the load on any individual machine. The works would generally comprise both moving and static sources. Mobile sources, which include both mobile construction plant and HGVs, have been modelled either moving around the area of the construction compound (e.g. excavators) or moving along the access track (e.g. road sweeping, delivery vehicles, graders etc.). Details of all of the noise sources modelled for each Scenario are included in Technical Appendix 6.2.

6.5.14 All Sound Pressure Level (SPL) data has been sourced directly from Annex C of BS5228.

Predicted Effects

6.5.15 Table 6.4 details the calculated noise immission levels for each scenario.

Table 6.4: Predicted Noise Immission Levels, dB $L_{Aeq(t)}$				
Assessment Location		**Immission Level**		
NAL ID	**NAL Descriptor**	**Scenario 01 - Construction**	**Scenario 02 – Typical daytime operations**	**Scenario 03 - Typical night-time operations**
NAL01	Halfway House	45	36	22

6.5.16 Scenario 01 and Scenario 02 consider daytime operations only. It can be seen that the calculated noise immission levels at Halfway House are below the daytime 65 dB LAeq(t) limit.

6.5.17 Scenario 03 considers noise sources that may be operational during evening, weekend and night-time only. It can be seen that the calculated noise immission levels at Halfway House are below the daytime 55 dB LAeq(t) evening limit and the 45 dB LAeq(t) night-time limit.

6.5.18 Accordingly, comparison of the predicted levels against the BS5228 Threshold Values for the closest NSRs across each of the modelled scenarios indicates that construction noise impacts are Not Significant.

Cumulative Effects

6.5.19 No other construction activities associated with the Viking Wind Farm will have commenced during the construction of the access track and compound area (Scenario 01), therefore, no cumulative noise effects are predicted.

6.5.20 During the day to day operation of the proposed development (Scenario 02) construction of the Viking Wind Farm will have commenced and other noise sources associated with the construction of the wind farm will be operational. As such it is necessary to consider any cumulative noise effects during this period.

6.5.21 Scenario 02 considers operations during the daytime only therefore the assessment of noise for this scenario is against a noise limit of 65 dB $L_{Aeq(t)}$. The predicted noise immission level at Halfway House is 36 dBA for Scenario 02. As such it is not possible for the contribution of the proposed development to push the cumulative noise levels above the noise level limit, due to the logarithmic nature of the addition of sound pressure levels. This can be demonstrated as follows;

- When two noise levels of the same value are added together the overall increase in noise is +3 dB e.g. 60 dB + 60 dB = 63 dB.
- When two noise levels are more than 10 dB apart there is no noise level increase e.g. 50 dB + 60 dB = 60 Db.
- Therefore, even if the noise level attributable to other noise sources outwith the proposed development was at the noise level limit of 65 dB, there would be no noise level increase i.e. 36 dB + 65 dB = 65 dB.

6.5.22 No other construction activities associated with the Viking Wind Farm are anticipated during the evening or night-time, therefore, no cumulative noise effects are predicted with regards to Scenario 03.

6.6 Mitigation

6.6.1 No significant effects are predicted and consequently no mitigation is required.

6.6.2 Notwithstanding the above, a number of best practice measures could be employed, as detailed within BS5228, which would help to minimise noise output and reduce noise effects from the proposed development. Examples of these are:

- keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- ensure that haulage vehicles would not arrive at or leave the site between 19.00 and 07.00 hours;
- ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and 'smart' reversing alarms and be subject to programmed maintenance;
- select inherently quiet plant where appropriate - all major compressors, pumps and generators would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
- ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- instruct that machines would be shut down between work periods or throttled down to a minimum;
- ensure regular maintenance of all equipment used on site, including maintenance related to noise emissions;
- ensure that vehicles are loaded carefully to ensure minimal drop heights so as to minimise noise during these operations; and
- ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

6.7 Residual Effects

6.7.1 During the construction of the access road and construction compound (Scenario 01,) noise at Halfway House is likely to be audible during the daytime depending on a number of factors such as the number and location of operational plant, as well as wind speed and wind direction, however, it will remain below the BS5228 threshold levels.

6.7.2 During normal everyday use (Scenario 02) noise at Halfway House will be below the existing ambient noise levels, however, may still be audible during the daytime on occasions.

6.7.3 With regards to weekend, evening and night-time noise (Scenario 03), the difference between the predicted noise levels and the existing ambient noise levels is -22 dB (weekends, -19 dB (evenings) and -16 dB (night-time) i.e. the predicted levels will remain below the existing ambient noise levels. As this margin is greater than 10 dB there will be no increase in existing ambient noise levels.

6.7.4 Use of best practice noise control measures could reduce construction noise levels to lower levels than reported in the noise assessments; however, this will not result in a change of assessment outcome.

6.7.5 Noise levels will remain below the BS5228 threshold levels at Halfway House for all assessed scenarios and for all time periods.

6.8 Summary and Conclusions

6.8.1 The assessment of construction noise on the nearest residential receptor has been undertaken following the guidance contained within BS5228. The predictions assume that all plant is operating concurrently in full operational mode in order to provide a worst-case scenario (whereas in reality only a proportion of the plant may be operating for a proportion of time).

6.8.2 Predicted noise levels have been assessed against a set of threshold levels, which are based on the existing ambient sound levels occurring in the vicinity of the receptor. The appropriate threshold

levels have been determined through the analysis of baseline sound level data that was collected during the baseline survey for the Viking Wind Farm in 2018.

6.8.3 The noise models consider three scenarios which replicate the construction of the compound, typical activities that will occur during the daytime and the operation of lighting rigs and generators during the night-time. The predicted noise levels indicate that the threshold levels will not be exceeded. Accordingly, the assessment concludes that noise impacts are Not Significant.

6.8.4 It is assumed that any noise generated during decommissioning activities would be similar to that generated during the construction of the access track and compound, therefore, noise impacts during decommissioning will also be Not Significant.

6.8.5 The assessment considers the cumulative noise effects that could occur during the normal operation of the proposed development alongside other construction activities associated with the Viking Wind Farm, however, it has been demonstrated that the noise levels from the proposed development can't increase the overall, cumulative noise level above the threshold levels. As such, the assessment concludes that cumulative noise impacts are Not Significant.

List of Figures

6.9 References

The Scottish Government (2011). PAN 1/2011 Planning and Noise. Scotland: The Crown

The Scottish Government (2011). Technical Advice Note, Assessment of Noise. Scotland: The Crown

BSI (2014). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise. UK: British Standards Institute.

ISO (1996). ISO 9613-2:1996 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2 General Method of Calculation. Geneva: International Organization for Standardization.

Glossary and Abbreviations

Emission	Refers to the sound level emitted from a sound source, expressed as either a sound power level or a sound pressure level
Immission	Refers to the sound pressure level received at a specific location from a noise source(s);
NSR	Noise Sensitive Receptor – any identified receptors that are sensitive to noise
NML	Noise Monitoring Location - any location where baseline or specific noise levels have been measured;
NAL	Noise Assessment Location - refers to any location where the noise immission levels are calculated and assessed.
SPL	Indicates the sound pressure level in decibels (dB)
SWL	Indicates the sound power level in decibels (dB)

7. ECOLOGY

7.1 Executive Summary

7.1.1 This chapter reports on the potentially significant effects with respect to ecology associated with the construction, operation and restoration of the proposed development. This chapter is supported by Technical Appendix 7.1: Main Compound Ecology Technical Report.

7.1.2 The ecology surveying and this assessment has been undertaken by Dr Andy Mackenzie, a partner in Mackenzie Bradshaw Environmental Consultants (MBEC). Andy is a very experienced applied ecologist, with construction experience, as well as the relevant survey and assessment skills.

7.1.3 The scope of the ecology assessment was based on an informal meeting undertaken to discuss a Scoping Technical Note on 12/4/19, which included both SNH and SEPA.

7.1.4 The ecology assessment was undertaken with due regard to relevant legislation, related policy and guidance.

7.1.5 Baseline work included a desk study, biological records search, vegetation surveying and otter surveying. All methods used followed recognised standards and relevant guidance, Technical Appendix 7.1 provides further details.

7.1.6 The assessment of effects methodology is detailed in the chapter and follows a systematic approach. Professional judgement plays an important role in the evaluation of ecological receptors and determining the significance of any potential changes due to the frequent complexities involved in natural systems.

7.1.7 Sandwater Site of Special Scientific Interest is located directly west of the proposed development and is downhill from it. No evidence of any recent otter presence was found within the proposed main compound area or the surrounding 250 m buffer in early June 2019. Vegetation surveying completed included both a Phase 1 habitat survey and a National Vegetation Classification survey for the proposed development site and a 250 m buffer around the site. The whole of the proposed main compound area was found to contain blanket bog on peat of generally a metre or more in depth. The majority of the surrounding 250 m buffer to the proposed development boundary is also blanket bog and again, the area generally contains peat of at least 1 m in depth. The plant communities present are described with areas and percentages accorded for both the proposed main compound and the surrounding wider 250m buffer zone. Groundwater Dependent Terrestrial Ecosystems are also detailed with areas calculated.

7.1.8 Receptors identified as being sensitive to the proposed development and which are assessed are the Sandwater Site of Special Scientific Interest and the native vegetation present within and immediately surrounding the boundary of the site.

7.1.9 While there are significant effects prior to mitigation the assessment on ecology concludes that, provided all mitigation and compensation detailed is implemented then there are not likely to be any significant effects on ecology for the construction and operation of the proposed main compound. Overall, a residual assessment of up to **Minor Adverse** and not significant under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 applies to the important ecological features in the area of the Proposed Development. This is accounting for all expected best practice and specific mitigation being implemented. The assessment also concludes by fully acknowledging that the Sandwater SSSI must be treated as sensitive at all times during all wind farm related works.

7.2 Introduction

7.2.1 This chapter reports on the potentially significant effects with respect to ecology associated with the construction, operation and restoration of the proposed development.

7.2.2 This chapter is supported by:

- Technical Appendix 7.1: Main Compound Ecology Technical Report

7.2.3 Figures 1, 2 & 3 from the accompanying Technical Appendix are referenced in the text where relevant.

7.2.4 The ecology surveying and assessment has been undertaken by Dr Andy Mackenzie, a partner in Mackenzie Bradshaw Environmental Consultants (MBEC). Andy is a very experienced applied ecologist having completed numerous impact assessments and practically implemented mitigation for a wide range of species and habitats. He has been working on wind farm construction sites in Scotland, as a lead Ecological and Environmental Clerk of Works (ECoW) for the last few years and therefore understands the practicalities of construction, as well as ecological surveying and assessment. Andy is a Chartered Ecologist and holds/has held a variety of protected species licenses in Scotland. Andy and MBEC have been put forward by VEWF to undertake the ECoW roles for the construction of Viking Wind Farm (and all associated infrastructure).

7.3 Methodology

Scope of the Assessment

7.3.1 The study area used for this assessment varied depending on particular ecological receptors. The following search areas/field survey areas were used for potentially sensitive receptors:

- Desk Study – up to 3 km, biological records up to 1 km;
- Phase 1 Habitat Survey – compound area and surrounding 250 m buffer;
- National Vegetation Classification (NVC) and related groundwater dependent terrestrial ecosystems (GWDTEs) – compound area and surrounding 250 m buffer; and
- Otter Survey – all suitable habitat within the compound area and the surrounding 250 m buffer.

7.3.2 The scope of the ecology assessment was based on an informal meeting undertaken to discuss a Scoping Technical Note. This meeting was convened on 12/4/19 and included both SNH and SEPA. There was further email correspondence from SEPA following the meeting. In relation to ecology, aquatic ecology was scoped out of the assessment. However, SNH and SEPA made it clear that the potential for impacts on the Sandwater SSSI must be assessed. SEPA also noted that an NVC survey should be included, accounting for the appropriate buffer, in relation to Groundwater Dependent Terrestrial Ecosystems (GWDTEs). As noted above, a 250 m buffer has been included to allow for excavations of >1m in depth within the main compound.

7.3.3 This assessment has been undertaken with due regard to the following legislation and related nature conservation policies;

- The Conservation (Natural Habitats etc.) Regulations 1994 (as amended) (called "The Habitats Regulations") transposed from the EC Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora;
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011;
- Wild Mammals (Protection) Act 1996;
- Wildlife and Countryside Act 1981 (as amended);
- The Convention for the Conservation of European Wildlife and Natural Habitat (The Bern Convention) 1979; and
- The UK Biodiversity Action Plan (UK BAP, now superseded by the Scottish Biodiversity Strategy).

7.3.4 The following guidance has been referred to in relation to this ecological surveying and assessment:

- Handbook for Phase 1 habitat survey; a technique for environmental audit;[1]
- British Plant Communities, Volume 2, Mires and Heaths;[2]
- British Plant Communities, Volume 3, Grasslands and Montane Communities;[3]
- SEPA Guidance Note 31, Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems;[4]
- SNH Protected Species Advice for Developers: Otter;[5] and
- Current and previous CIEEM Guidelines on Ecological Impact Assessment.[6]

Consultation

7.3.5 Informal consultation was undertaken with Mr Paul Harvey of the Shetland Biological Records Centre (Shetland Amenity Trust) in late May/June 2019. This consultation related to the biological records he provided and the subsequent fieldwork undertaken. He provided additional local context in relation to email discussion on plants and vegetation types.

Fieldwork Methods

7.3.6 All methods used for both vegetation surveying and otter surveying followed the recognised standards and the relevant guidance listed above. See Technical Appendix 7.1 for further details.

Assessment of Effects

7.3.7 The Environmental Impact Assessment (EIA) process involves applying specific criteria to systematically evaluate the effects on receptors resulting from a proposed development. The methods adopted for this ecological assessment are based on best practice guidance and the application of professional judgement by an experienced ecologist with prior Scotland wide experience of EIA. Professional judgement plays an important role in the evaluation of ecological receptors and determining the significance of any potential changes due to the frequent complexities involved in natural systems.

Defining Receptor Sensitivity

7.3.8 Determining the sensitivity of ecological receptors to development is an established concept for which there is standard guidance such as SNH's Handbook[7] and CIEEM's Guidelines[8].

7.3.9 Determining the sensitivity of each ecological receptor involves considering a wide range of criteria. In practice, rarity is often the most important criterion. Therefore, ecological receptor sensitivity is usually defined by rarity at different geographical scales (e.g. local, regional, national, international). This is also useful in placing the receptor in the context of nature conservation designations which tend to be selected and ranked according to the rarity of the qualifying species or habitats at different geographical scales, e.g. habitats or species that are rare at a global or European level are usually covered by European legislation and often protected within designated

[1] Joint Nature Conservation Committee (2004). Handbook for Phase 1 habitat survey – a technique for environmental audit. English Field Unit, Nature Conservancy Council, 1990. Revised reprint in 2004. JNCC, Peterborough.
[2] Rodwell, J.S. (1991). British Plant Communities, Volume 2, Mires and Heaths. UK Joint Nature Conservation Committee. Cambridge University Press, Cambridge.
[3] Rodwell, J.S. (1992). British Plant Communities, Volume 3, Grasslands and Montane Communities. UK Joint Nature Conservation Committee. Cambridge University Press, Cambridge.
[4] Scottish Environmental Protection Agency. (2017). SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3. Online publication.
[5] Scottish Natural Heritage. (2019). Protected Species Advice for Developers: Otter. Online publication.
[6] Chartered Institute of Ecology and Environmental Management. (2018 and previous versions). Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. Online publication.
[7] Scottish Natural Heritage, 2013, A Handbook on Environmental Impact Assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. Fourth edition. Online publication.
[8] Chartered Institute of Ecology and Environmental Management. (2018 and previous versions). Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. Online publication.

sites defined by the European legislation, namely Special Areas of Conservation (SACs). Definitions of ecological receptor sensitivity are outlined in Table 7.1.

7.3.10 However, some habitats or species that are listed in European legislation may be more extensive in Britain than other countries, and there may be some poor quality examples of their presence on some sites. With such examples, the receptor may be defined as being of a lower level of importance, depending on the situation. Assigning a level of receptor sensitivity therefore relies upon a combination of the application of standard criteria along with the informed professional judgement of the ecologist undertaking the assessment.

Table 7.1: Defining Ecological Receptor Sensitivity

Receptor Sensitivity	Definition
International	Habitats or species that form part of the cited interest within an internationally protected site or candidate site (for example, Special Area of Conservation (SAC), Special Protection Area (SPA), or Ramsar site). This includes European protected habitats and species, and internationally important wetlands. A habitat or species which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being an area or population of the highest quality example in an international/national context that the site is likely to be designated as an SAC/SPA.
National **(i.e. at the Scottish or UK level)**	Habitats or species that form part of the cited interest within a nationally designated site (for example, a Site of Special Scientific Interest (SSSI) or a National Nature Reserve (NNR)). A habitat which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being one of the highest quality examples in a national context for which the site could potentially be designated as an SSSI. This includes Annex I habitats and UK BAP priority habitats. A population of a species which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being of nature conservation value at up to a country context. This includes European protected species, 'Nationally Rare/Scarce' species, and priority UK BAP species.
Regional **(i.e. Southern Scotland)**	Viable areas of internationally- or nationally-important habitats (i.e. Annex 1 habitats and priority UK BAP habitats) present in quality and extent at a regional (e.g. biogeoclimatic zone as partially defined by the SNH Natural Heritage Futures) level of importance. Sites supporting a regularly occurring, regionally significant number of internationally- or nationally-important species. This includes European protected species, 'Nationally Scarce/Uncommon' species and priority UK BAP species.
Local (High)	Sites that are a Local Nature Reserve or Wildlife Site. Sites containing viable area(s) of any priority UK BAP habitat or presence of species identified in the UK BAP or Local BAP. Sites supporting viable breeding populations of species known to be Scottish Local Authority rarities and/or supplying critical elements of their habitat requirements.
Local (Medium)	Habitats which are not considered extensive and/or of good enough quality to qualify for non-statutory designation but which provide locally important semi-natural habitats within an approximate radius of 15-20 km from the site.

Receptor Sensitivity	Definition
	Populations of any species of conservation importance in the context of the local area within an approx. radius of 15-20 km from the site. However, any such population would not be of a significant number to deem it as being of 'regional' importance.
Local (Low)	Habitats which are not considered to qualify for non-statutory designation but which provide locally-important semi-natural habitats in the context of the immediate surrounding area, such as species-rich hedgerows or small ponds. Populations of any species of conservation importance in the context of the immediate surrounding area.
Negligible	Commonplace habitat or species with little or no significance, the loss of which would not be seen as detrimental to the ecology of the area.

Defining Potential Effects

7.3.11 The potential impacts and effects first need to be listed and described. Potential effects can arise from an impact which is direct or indirect. The duration of impacts and effects can vary; they can be temporary or permanent and can be for a short, medium or longer-term period. It is important to note that while impacts normally result in Adverse effects on ecology, they can also be Beneficial.

Defining the Magnitude of Change

7.3.12 To assess the potential magnitude of change for each ecological receptor, information on the proposed development (e.g. size and location of proposed infrastructure, timing and duration of the proposed works) along with relevant information from the scientific literature, are carefully considered using professional experience. In this assessment, the magnitude of change is categorised into five: Total, High, Medium, Low and Negligible. The duration of the effects are also included. These categories are described in Table 7.2.

Table 7.2: Magnitude of Change and Duration

Magnitude	Description
Total/Near Total	Would cause the loss of a major proportion or whole feature/population, or cause sufficient damage to a feature to immediately affect its viability.
High	Major effects on the feature/population, which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. For example, more than 20% habitat loss or damage.
Medium	Effects that are detectable in short and long-term, but which should not alter the long-term viability of the feature/population. For example, between 10 - 20% habitat loss or damage.
Low	Minor effects, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. For example, less than 10% habitat loss or damage.
Negligible	Minimal change on a very small scale.
Duration definitions	Long-term (5 - 25 years or longer) Short-term (<5 years)

7.3.13 The magnitude of change for each receptor is described for the phases of the Development; the construction phase and the operational/decommissioning phase.

Defining the Significance of Potential Effects

Table 7.3: Determining the Effect Significance on Ecological Receptors, with those highlighted in grey being regarded as "significant".

Receptor Sensitivity	Level of effect				
	Total/near total	**High**	**Medium**	**Low**	**Negligible**
International	Major	Major	Major	Major-Moderate	Negligible
National	Major	Major	Major-moderate	Moderate	
Regional	Major	Major - Moderate	Moderate	Moderate - Minor	
Local (High)	Major-moderate	Moderate	Moderate-Minor	Minor	
Local (Medium)	Moderate	Moderate - Minor	Minor	Minor	
Local (Low)	Moderate – Minor	Minor	Minor	Minor	
Negligible	Negligible				

7.3.14 In this assessment an effect on an ecological receptor can be defined in one of six categories, from Negligible through Minor and Moderate to Major. For the purposes of this assessment, effects are considered as being *significant*[9] if they are Moderate or above, e.g. a receptor with a sensitivity of 'Regional' having a 'total or near total' effect is regarded as having a level of effect as "Major" and therefore significant.

7.3.15 There is often a wide range of factors that have to be considered in the assessment of significance, because of the complexity of ecological systems and the wide range of potential effects resulting from development, therefore, as with all other aspects of the assessment professional judgement play a critical role. However, an indicative matrix is provided as Table 7.3 in order to help illustrate how levels of effect magnitude and receptor sensitivity can relate to judgements of effect significance. It is important to emphasise that this table is used alongside professional judgement and can be altered should the experienced assessor wish.

7.3.16 Where potentially significant changes are predicted, mitigation measures are recommended in order to reduce the severity. Mitigation measures are actions proposed to prevent, reduce or compensate for any potential changes on ecological receptors. This includes reconsidering the design of the proposal (e.g. size, shape, extent) at an early stage as well as the use of best practice construction methods, timing of works and effective habitat restoration. In some cases, mitigation measures may also be specified where effects are considered to be non-significant as part of a best practice approach to development. The assessment process then concludes with the final or Residual Effects, accounting for any mitigation, enhancement or compensation which may be included.

[9] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

7.4 Current Baseline Conditions

Desk Study

Designated Sites

7.4.1 As outlined in Technical Appendix 7.1 a search for designated sites in the immediately surrounding area was completed. There is one designated site adjacent to the proposed development site: Sandwater Site of Special Scientific Interest (SSSI). Sandwater SSSI is located to the west of the main road (A970) and includes the whole of the loch. It is directly west of the proposed development and is downhill from it (see Technical Appendix 7.1: Figure 1). Details of the SSSI designation are provided in Technical Appendix 7.1 but in summary, it is notified as an example of a mesotrophic loch and for its open-water transition fen (extensive beds of common club-rush (*Schoenoplectus lacustris*)[10]. The Sandwater SSSI was assessed by Scottish Natural Heritage (SNH) in 2004 as being in Favourable, maintained condition[11].

Existing Wildlife Records

7.4.2 Existing Biological Records for the proposed development area and the immediately surrounding area (up to 1 km, depending on the record detail) were provided in late May 2019 by the Shetland Biological Records Centre (Shetlands Amenity Trust). These records are provided in full in Technical Appendix 7.1: Appendix 1. There were 87 records of insects, mainly moths and butterflies and there are 7 records of stoat and mountain hare from the area. These records indicate there are a variety of insects present in the general area and at least two of the expected common mammals.

7.4.3 In addition to the supplied biological records, previous NVC data was available for part of the proposed development and part of the surrounding 250 m. 27% of the complete field survey area had been surveyed for the original Viking Wind Farm Planning Application and this was available electronically for MBEC to use. This data was checked and updated, as necessary, as part of the field surveying for this proposed development. Aspects of recent fieldwork undertaken in January 2019 by the author relating to a separate Viking planning application nearby also provided some useful crossover to this work; in particular, in relation to known otter presence in the surrounding area.

Field Study

Otter

7.4.4 No evidence of any recent otter presence was found within the proposed main compound area or the surrounding 250m buffer. The Burn of Crookadale and a tributary offered potentially suitable habitat but a complete search of this area failed to find any evidence. It is known from a recent survey by the author (January 2019) that otter are present and using the Sandwater loch and both upstream and downstream from it. However, no evidence of recent otter use was found along the Sandwater shoreline within 250m of the proposed main compound site.

Vegetation

7.4.5 A Phase 1 habitat survey was completed of the proposed development area and a 250 m surrounding buffer. The mapped results of this survey are presented in Technical Appendix 7.1: Figure 1. Target Notes, text discussion and calculated areas for the different habitat types are also presented in Technical Appendix 7.1. In summary, the whole of the proposed main compound area is blanket bog on peat of generally a metre or more in depth. There was one small bog pool identified within the boundary and there are two areas of modified bog present. Downslope from the proposed main compound, towards the road, there is drainage from the bog which is caught below by a road cut-off drain. These drainage gullies have localised areas of acid grassland and rush

[10] Scottish Natural Heritage. (2019). SNH Sitelink Website. Sandwater SSSI Citation.
[11] Scottish Natural Heritage. (2019). SNH Sitelink Website. Sandwater SSSI Features.

pasture but they are small in extent and hence were not mapped separately. The majority of the surrounding 250 m buffer to the proposed development boundaries is also blanket bog and again, the area generally contains peat of at least 1 m in depth. A species list of all plants that were noted during the Phase 1 habitat survey is included in Technical Appendix 7.1, Appendix 3. No invasive plant species were recorded within the study area. The most notable native species found, having a limited oceanic distribution (northern and western), was Spring squill (*Scilla verna*). One plant was found in the eastern road verge. While this plant is fairly common on Shetland it tends to be found in more exposed coastal habitats.

7.4.6 The mapped results of the NVC survey of the proposed main compound and a surrounding 250m buffer can be seen in Technical Appendix 7.1: Figure 2. This figure is accompanied by Appendix 4 in Technical Appendix 7.1 which details the quadrat data undertaken to assist with the classification mapping. Nine quadrats in total were undertaken within the area surveyed and their locations are also indicated on Figure 2.

7.4.7 Descriptions of all the vegetation communities present within the study area, along with a table indicating the areas of each and their percentage within the study area are given in Technical Appendix 7.1. Table 7.4 below details the plant communities present, their areas and percentages within the proposed development boundary. While all the vegetation present is on blanket bog this table indicates that the category of M19b, which is mainly active blanket bog, accounts for just over 36% of the proposed development area. This is present towards the west of the proposed site (see Technical Appendix 7.1: Figure 2). The other categories of vegetation present in the central and eastern part of the site are indicative of mainly inactive/modified blanket bog. This is important because it affects the nature conservation value (sensitivity) of the habitats; active, mainly intact blanket bog being more valuable in nature conservation terms than inactive eroded and drier bog.

Table 7.4: NVC Plant Community Areas and Percentages within the Proposed Main Compound Boundary.

National Vegetation Classification	Area (m^2)	Area (ha)	Percentage of Compound Area
H10c - *Calluna vulgaris-Erica cinerea* heath, *Festuca ovina-Anthoxanthum odoratum* sub-community.	156	0.01	0.25
M17b - *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire, *Cladonia* sub-community.	38675	3.87	61.78
M19b - *Calluna vulgaris-Eriophorum vaginatum* blanket mire, *Empetrum nigrum ssp. nigrum* sub-community.	22588	2.26	36.09
M20a - *Eriophorum vaginatum* blanket and raised mire, species-poor sub-community.	1176	0.12	1.88
Total	**62596**	**6.26**	**100.00**

Groundwater Dependent Terrestrial Ecosystems

7.4.8 SEPA require information on Groundwater Dependent Terrestrial Ecosystems (GWDTEs) to be provided.[12] This can be provided using the NVC data (Technical Appendix 7.1: Appendix 4) and NVC mapping (Technical Appendix 7.1: Figure 2), along with Geographical Information System (GIS)

[12] Scottish Environmental Protection Agency. (2017). SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3. Online publication.

based area calculations. The study area includes a buffer of 250m, which is required when excavation will be >1m in depth, as is the case with this proposed development.

7.4.9 There are no groundwater sensitive vegetation communities within the boundaries of the proposed main construction compound. However, there is one community present within the wider study area (250m buffer) which can have a groundwater dependency at a Moderate Sensitivity level and that is the **MG10a - *Holcus lanatus-Juncus effusus* rush-pasture**, typical sub-community. There are two small stands of this vegetation to the west and south west of the proposed main construction compound near the road (see Technical Appendix 7.1: Figure 2). The areas and percentage of the total study area are detailed in Table 7.5 below. However, these two stands were noted as MG10a, being the closest fit, but they were acid rather than neutral in character and were very grassy, in surface water drainage gullies. Averis *et al.*[13] note under MG10 that there is a species poor vegetation type similar to the one recorded here that does not fit into any NVC category.

Table 7.5: GWDTE Plant Communities Present, Total Area and Each Stand Area.

GWDTEs	Area (m^2)	Area (ha)	% of Total Survey Area
MG10a/Moderate Sensitivity **Total Area**	3221	0.32	0.63
MG10a/Moderate Sensitivity **West Area**	1248	0.12	0.24
MG10a/Moderate Sensitivity **South West Area**	1973	0.2	0.39

Assumptions and Limitations

7.4.10 There are no significant assumptions made in relation to this assessment. There is one limitation for the vegetation survey work and that related to the cold spring and early summer in 2019. The NVC surveying was undertaken in early June 2019 which is within the optimal period for such surveying. However, due to the relatively cold temperatures and the location of Shetland some plants were not out in flower. This did make identification of some plants more difficult (particularly sedges) and it is possible that plants may have been missed due to their earlier growth stage. This limitation, while not ideal, is not viewed as being significant in terms of the findings of the NVC surveying. It is very unlikely that any of the vegetation communities identified here would have changed should it have been completed later in the year, however, fuller species lists may have resulted.

Identified Sensitive Receptors

7.4.11 No evidence of otter presence was found within the proposed development or in the surrounding 250m buffer zone. Therefore, otter is not considered any further in this assessment.

7.4.12 Figure 3 indicates that there are two areas of vegetation that were classified as MG10a but as noted above this was not a good vegetation "fit" and it is recognised that there is a category which is a better "fit" that does not equate to any NVC category. This vegetation did not appear to be groundwater dependent but rather in drainage gullies which will take surface water following larger precipitation events/bog drainage. On this basis, GWDTEs are not considered further in relation to the proposed main compound and the surrounding 250m area. See the Hydrology Chapter (Chapter 8) for further relevant details.

7.4.13 A summary of the receptors identified as being sensitive to the proposed development and which have been 'scoped-in' to the assessment are as follows:

[13] Averis, A., Averis, B., Birks, J., Horsfield, D., Thompson, D. & Yeo, M. 2004. An Illustrated Guide to British Upland Vegetation. Joint Nature Conservation Committee, Peterborough.

- There is some potential for the Sandwater SSSI to be affected by the proposed development due to it being located locally and downhill. This is assessed further in the sections which follow; and
- The native vegetation present within and immediately surrounding the boundary of the site will be affected by the proposed development. This is assessed further in the sections which follow.

7.5 Assessment of Effects

Effects on Sandwater SSSI

7.5.1 Sandwater SSSI is outside of the proposed development and the nearest shoreline is over 100m outside of the proposed site boundary. The Sandwater SSSI sensitivity is evaluated as being nationally important for nature conservation due to its notified features and the quality of those features. The proposed development is upslope from the loch edge and there is some vegetation evidence of mainly surface water drainage moving downhill from just below the area of the proposed development towards the road and the loch edge. To an extent, there will be a protective effect from the existing A970 due to an upslope cut-off drain with limited crossing of the road. Crossing points can be adequately seen, marked and safeguarded before and during construction. However, there is some potential for water pollution from the main compound area to migrate downhill to the loch edge during both construction and operation of the compound. Such pollution could be caused by dirty water, concrete runoff, hydrocarbon release or e.g. a malfunctioning septic tank. It is thought that any significant hydrological alteration (causing an increase or decrease in Sandwater, water residence times); and/or water chemistry change is very unlikely in relation to the proposed main compound because the volumes of water releasing from this area are very small when compared to the overall catchment feeding the loch. There is also some potential for dust created during drier weather from the compound to be blown onto the loch surface, again during both construction and operation. Depending on the constituents, dust can have a nutrient enrichment effect on waterbodies and can cause clouding, adversely affecting the water column, particularly of shallower lochs. Both of these impacts have the potential to occur throughout the temporary duration of this proposed main compound, which is likely to be for up to 5 years, then the area restored.

7.5.2 The impact magnitude of water pollution and dust into Sandwater SSSI during both compound construction and operation are both assessed as a maximum of **Low**. The effects would be likely to be of short-duration and while some habitat damage is possible there would not be likely to be any long-term/permanent harm to the SSSI. Due to the national importance of the SSSI, and its sensitivity, this would result in an effects significance of **Moderate Adverse**. This would be significant[14] prior to the consideration of mitigation.

Effects on Vegetation

7.5.3 The boundary for the proposed main construction compound encloses 6.25ha. Therefore there is the potential for up to 6.25ha of native vegetation to be lost. In practice, it is likely to be slightly less than this but up to this amount could be lost. As detailed in the Technical Appendix 7.1 and summarised above, the whole of the proposed main compound area is currently blanket bog on peat of generally a metre or more in depth. While there is one identified very small bog pool (M2) and there are two small areas of modified bog present (H10c and M20a) within the proposed compound boundary, the majority of the plant communities are either M17b or M19b. While both M17b and M19b are blanket bog (mire), it was observed on the site that the M17b is not in good condition due to large-scale erosion and less peat forming ability, whereas the M19b is in good condition.

[14] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

7.5.4 The nature conservation evaluation (sensitivity) detailed in Technical Appendix 7.1, accounts for this variation in the habitats present within the proposed development site. Blanket bog is generally regarded to be of international importance due to the relative importance of Scottish bogs in a world context. The M17b and M20a blanket mire is capable of recovery and is evaluated as nationally important in its current condition, from a nature conservation perspective. The M19b dominated area to the west side of the proposed main compound (see Technical Appendix 7.1: Figure 2) and covering just over 36% or 2.26ha of the proposed development area (see Table 7.4) is of greater value for nature conservation. It is assessed as being of up to international importance for nature conservation due to its overall quality.

7.5.5 While the main construction compound is temporary and will be restored, the current vegetation will be largely lost during the construction phase. While every effort will be made to store the vegetation, a storage of up to 5 years is very likely to result in almost total loss, although the fibrous surface of the vegetation will still provide a useful covering over the restored peat. To determine the impact magnitude of this loss it is necessary to consider the wider surrounding area and the amount of these vegetation types present. On the Shetland Mainland and surrounding the wider Sandwater area M17b, while still being of national importance, is a very abundant vegetation community. Good quality M19b, at an international level of importance, is also an abundant vegetation community locally and on the Shetland Mainland but covers less area than M17b. However, there will still be at least a long-term, if not permanent impact from the loss of these two vegetation communities for the construction of the proposed development. The impact magnitude for the loss of the M17b community within the proposed development is assessed as being **Negligible** and the impact magnitude for the loss of the M19b community within the proposed development is assessed as being between **Low** and **Negligible**, accounting for the overall amounts of these vegetation communities present in the Shetland Mainland as a whole.

7.5.6 The effects of this vegetation loss are at least long-term (20 years+) and could be permanent. This would be likely to result in an effect significance of **Negligible** for the loss of the M17b community within the proposed development and an effect significance of between **Moderate and Minor Adverse** for the loss of the M19b community within the proposed development. Therefore, prior to the consideration of mitigation, the loss of the M19b vegetation would be considered significant under the EIA Regulations[15].

7.5.7 There is also the potential for indirect impact on surrounding blanket bog vegetation, particularly downslope from the proposed development. Such indirect impacts can arise due to localised hydrological changes in the peat, causing peat drying and subsequent vegetation change. The likely required use of cut-off drainage on the upslope sides of the construction works combined with the sloping topography of the proposed development downslope to the south and west has the potential to locally impact remaining M19b vegetation adjacent to proposed main compound. From experience, any such effects are likely to be localised to within approximately 30m of the proposed compound edges and while potentially increasing the area of temporary disturbance/vegetation alteration, they are unlikely to be permanent and/or of any significance, even locally. Therefore this element, although considered, is not assessed further.

Cumulative Effects

7.5.1 Cumulative effects on otter are not applicable in relation to this proposed development along with the linked Viking Energy Wind Farm infrastructure construction and operation because no evidence of otter presence was found within the study area.

7.5.2 There is the potential for cumulative effects on the Sandwater SSSI when this proposed development is considered alongside the linked Viking Energy Wind Farm infrastructure construction and operation. The B9075 Sandwater Road upgrade and the local wind farm access

[15] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

track are likely to overlap with the construction and operation of the proposed main construction compound. All three of these construction areas have some potential to cause impacts on the Sandwater SSSI, should any dirty/polluted water enter the loch from more than one source[16]. This potential impact was also considered carefully in relation to the recent B9075 Sandwater Road planning application[17]. The impact magnitude of water pollution into Sandwater SSSI from combined sources during both the main construction compound construction/operation and the construction/operation of other local wind farm infrastructure is assessed as a maximum of **Low**. The effects would be likely to be of short-duration and while some damage is possible there would not be likely to be any long-term/permanent harm to the SSSI. Due to the national importance/sensitivity of the SSSI, this would result in an effects significance of **Moderate Adverse**, and significant, prior to the consideration of mitigation.

7.5.3 There will be a cumulative impact on vegetation (direct and indirect impacts) should this proposed development be built alongside other Viking Energy Wind Farm infrastructure. Given that the M17b blanket bog vegetation within the proposed development is in poor condition, the only vegetation community where a significant cumulative loss would apply relates to the M19b vegetation. There will be other losses of M19b in relation to the construction of other wind farm infrastructure. For example, M19b will also be lost for the construction of the B9075 Sandwater Road[14] and several wind farm access tracks. As a result of this, there would be an impact magnitude for the loss of the M19b community cumulatively at **Low**, accounting for the overall amounts of this vegetation community present in the surrounding area and the Shetland Mainland as a whole. This would result in an assessed effect significance of **Moderate Adverse** for the loss of the M19b community collectively/cumulatively. Therefore, prior to the consideration of mitigation, the loss of the M19b vegetation would be considered significant under the EIA Regulations[18].

7.6 Mitigation

7.6.1 Mitigation measures should only be used if complete avoidance of significant ecological impacts is not possible. Mitigation measures should be used to reduce the level of impact and risk as much as possible. They can also be used as compensation for remaining effects, if necessary and likely to be successful. It is important to note that specific mitigation measures are only detailed here in relation to significant effects. Best practice construction and operational environmental measures are assumed to occur to minimise all ecological/environmental impacts as much as possible and this will be managed through the Viking Energy Wind Farm Construction Environment Management Plan (CEMP), which the main contractor will be required to fully implement. There will also be a full-time Ecological/Environmental Clerk of Works (ECoW) working through Viking Energy who is independent and will be supervising all works.

Minimising the Risks of Pollution and Sedimentation

7.6.2 The Sandwater SSSI downhill from the proposed development will be treated, at all times, as being extremely sensitive to all forms of pollution. As well as the use of all applicable best practice techniques for the control of water on site, the CEMP and associated Construction Site Licence Pollution Prevention Plan (CSL PPP) will be fully adopted for all construction and initial operational works to ensure that water quality within and leaving the construction area is maintained. To control pollution and sedimentation risk as far as is possible, all water related issues will be mitigated at source, where they occur, within the proposed development. This is likely to include the use of constructed lagoons within the proposed development site to maximise sediment deposition and allow for temporary water storage. Everything possible will be done to ensure that water is of acceptable quality before it is allowed to leave the site using the latest best practice

[16] After careful consideration construction dust is not regarded as a potential cumulative impact on the Sandwater SSSI because of the unlikely requirement for regular and multiple wind directions over repeated short periods to result in such a cumulative impact.

[17] B9075 Sandwater Road Realignment, submitted to Shetland Islands Council on 18th March 2019.

[18] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

methods (e.g. the use of oil interceptors and impermeable hard stands for all generator and fuel supply areas and the use of adequate sized lagoons and controlled safe vegetation spread for dirty water). The control of dust on sites is straightforward but requires contractor commitment and is undertaken by damping down roads and parking areas regularly. The key to controlling dust is that during dry weather, normally in the summer/autumn and particularly if it is windy, damping down must be repeated at regular intervals during times when traffic is moving around. While this is standard good practice, it is important that sufficient plant and operators are tasked with this at short notice and again, every effort will be made to implement this for the proposed development. As well as implementing such practices fully, the CEMP will help to ensure that regular monitoring occurs within the proposed development area to deal with any new issues which occur promptly and adequately. Previous experience has indicated that full implementation on site of a detailed CEMP helps to ensure that direct and indirect significant water pollution, sedimentation and dust impacts are avoided.

Construction Monitoring

7.6.3 During construction, continuous monitoring of the site and its immediate surroundings will take place. To ensure the full implementation of appropriate mitigation measures and monitoring requirements, an ECoW will be present on the site for the pre-construction, construction and restoration phase of the proposed development. The ECoW will monitor the EIA Report/CEMP compliance of all the proposed mitigation measures for ecology and environment. In addition to this, there is a specific Water Quality Management Plan (WQMP) for the construction of the Viking Energy Wind Farm. This regular water monitoring includes the Sandwater SSSI. Specifically, there are four sampling points detailed for Sandwater. Diatoms will be monitored, as well as hydrochemistry for the Sandwater SSSI. These monitoring points will be sampled and tested once a month pre and during construction of the wind farm (this monitoring for baseline conditions has already started), which will include for the proposed development. This will allow measures such as pH, conductivity, turbidity and alkalinity to be tested regularly, as well as other chemical parameters and will allow cumulative effects, as well as single pollution sources to be monitored. In addition, the ECoW can also test a more limited range of chemical determinants on an ad-hoc field sampling basis; these parameters include pH, conductivity and turbidity.

Habitat Reinstatement

7.6.4 Best practice techniques for vegetation and habitat reinstatement will be adopted and implemented in all areas of disturbed vegetation within the proposed main construction compound. Where vegetation is to be removed all vegetation turves will be carefully stripped and stored outside of the construction area and outside of any peat storage areas. Turves will be removed first in areas being used for peat and turf storage. This will be undertaken prior to any additional vehicle tracking across all such areas of vegetation. It is likely that peat and turf storage will be required for up to 5 years and it is fully acknowledged that storage for this length of time will lead to degradation. Where possible, turves will be re-used locally within this period to save long-term storage e.g. for track edges. However, even if some vegetation dies and fresh colonisation is required, it will still provide an important fibrous protection to restored peat. Seeding (with an agreed seed mix) will also be used as necessary into the restored turf and peat. Similarly, surface peat (acrotelm) will be stored separately from deep peat (catotelm) and the two layers will be restored in the order they were excavated to try to ensure that surface peat is returned on top of deep peat. The depths to be excavated of different types of peat will be determined by the ECoW, depending on local circumstances, and agreed with the main contractor prior to the start of all stripping operations. All peat stripped for the main construction compound will be returned to ensure that similar depths of peat are restored to that present originally, with the underlying contours being replicated as closely as possible. Early reinstatement of disturbed areas will be undertaken where possible to minimise the effects of peat storage and maximise the

success of turf reinstatement, should areas not be required for the whole operational period. Any seed that is necessary for reinstatement will be fully agreed with the ECoW prior to any use within the site. All reinstatement techniques, appropriate to the proposed development, will be detailed in the CEMP, and will all be implemented in consultation with the ECoW.

Habitat Compensation

7.6.5 There will be a loss of blanket bog habitat, at least into the longer-term, within the proposed main construction compound boundary in relation to the Proposed Development. The loss of up to 2.26ha of M19b - *Calluna vulgaris-Eriophorum vaginatum* blanket mire, *Empetrum nigrum ssp. nigrum* sub-community has been judged to be significant under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. Therefore, mitigation or compensation should be undertaken to minimise the level of this impact. A Habitat Management Plan, including for a blanket bog enhancement scheme, has been committed to for the main wind farm and includes for 260ha of damaged bog enhancement. This area is greater than the combination of the replacement areas required for all the wind farm's related infrastructure, including for the additional planning application areas. Over time, this enhancement of existing degraded bog habitat will aim to return it to actively accreting bog with the diversity of micro-habitats/plant communities that would support. This also provides compensation for the vegetation cumulative impacts reported in this assessment as well as the more intact M19b habitat within the proposed main construction compound.

7.7 Residual Effects

7.7.1 Taking the mitigation and compensation into account, as detailed above, the following residual effects on ecology are likely in relation to the construction and operation of the proposed main construction compound.

Sandwater SSSI

7.7.2 The impact magnitude for water pollution and dust into the Sandwater SSSI during both the main compound construction and operation, are both re-assessed as **Negligible** following the inclusion of the mitigation detailed. The effects, would be likely to be of minimal duration at worst and it is likely that habitat damage would be minimal with no longer-term harm to the SSSI. This would result in a residual effect of **Minor to Negligible Adverse**, and not significant.

Vegetation

7.7.3 The impact magnitude for the loss of the M19b vegetation community within the proposed main construction compound boundary is re-assessed as **Negligible**, accounting for the restoration proposed and the habitat management compensation committed to. While the effects of this vegetation loss are still regarded as being at least long-term, accounting for the habitat compensation committed to for the whole wind farm, this would result in a residual effect of **Minor Adverse**, and not significant.

Cumulative Effects

7.7.4 The impact magnitude of water pollution into Sandwater SSSI from combined sources is re-assessed as a maximum of **Negligible**, accounting for the mitigation proposed. There is not the same level of risk following the inclusion of this mitigation and there is unlikely to be any significant harm to the SSSI. This would result in a residual effect of **Minor to Negligible Adverse**, and not significant. It is fully acknowledged that the SSSI must be treated as sensitive at all times during all wind farm related works and regular monitoring, reporting and safeguarding by all workers is extremely important.

7.7.5 The impact magnitude for the loss of the M19b plant community cumulatively is re-assessed at **Negligible**, accounting for the habitat management compensation committed to for the wind farm. This would result in a re-assessed residual effect of **Minor Adverse** for the loss of the M19b community collectively/cumulatively accounting for this proposed development, which would not be significant.

7.8 Conclusions

7.8.1 Provided that all the mitigation and compensation detailed in this chapter is implemented then there are not likely to be any significant effects on ecology for the proposed main compound construction and operation. Overall, a residual assessment of up to **Minor Adverse** and not significant under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 applies to the important ecological features in the area of the Proposed Development, accounting for all expected best practice and specific mitigation being implemented.

7.8.2 In addition to this assessment, it is fully acknowledged that the Sandwater SSSI must be treated as sensitive at all times during all wind farm related works and regular monitoring, reporting and safeguarding by all workers will be extremely important.

7.9 References

All references are listed as footnotes.

8. HYDROLOGY

Executive Summary

This chapter considers the likely significant effects on hydrology and hydrogeology associated with the construction, operation and decommissioning of the proposed Main Construction Compound.

Sand Water loch is located approximately 100m west of the Main Construction Compound site. The Burn of Sandwater drains from the south of Sand Water Loch and eventually discharges to the Loch of Strom approximately 4.5km south of the site. The Sand Water Loch is designated as a Site of Special Scientific Interest (SSSI) and is notified as an example of a mesotrophic loch and for its open-water transition fen. The west of the site (approximately 50% of the total site area) currently drains towards Sand Water Loch. The east area of the site drains to the Burn of Crookadale approximately 175 east of the site, the watercourse flows south before discharging into the Cat Firth approximately 1.8km south east of the site. No surface water flood risk is shown near or on the site.

The Main Construction compound is underlain by bedrock geology of metamorphosed sedimentary rock comprising Colla Firth Formations of granofelsic psammite and granofelsic semipelite. The BGS 50K superficial geology data (Figure 8.3) indicates that the site is directly underlain by peat. The Scottish Natural Heritage Carbon and Peatland Map 2016[1] indicates that the area of the site within the Sand Water Loch catchment is mapped a 'class 5' (peat soil), with the eastern portion of the site within the Burn of Crookadale catchment deposits mapped as 'class 1' 1' (priority peatland habitat) in the SNH Carbon-rich soils, deep peat and priority peatland habitat mapping. Surveying has shown the site to be underlain by thick, highly fibrous peat deposits with extensive erosion features (hags) present.

Three Private Water Supplies (PWS) have been identified in the vicinity of the proposed Main Construction compound. The nearest PWS to the Main Construction compound is approximately 7.5 Km north west of the site as presented in Figure 8.5: Private Water Supplies.

In accordance with Scottish Environment Protection Agency (SEPA) guidance (SEPA, 2017), the locations of potential sensitive groundwater dependent terrestrial ecosystems (GWDTE) within the site have been identified. No GWDTE habitats were identified on the site. Two potentially groundwater dependent GWDTE areas were identified in ecological surveying within 250m of the site, downgradient to the west of the site (Appendix 7.1, Figure 3: Groundwater Dependent Terrestrial Ecosystems).

There are no watercourses identified as crossing the site on 1:25,000 OS mapping. Crossings of minor field drains and eroded peat channels are likely to be required for the access to the site. It is expected that these would be simple culverted crossings permitted under General Binding Rules (GBRs).

The assessment of the likely significant effects for the proposed Main Construction Compound concludes that, following the consideration of proposed mitigation (based on measures set out in the Outline Construction Environmental Management Plan for the wider consented Viking Energy Wind Farm), all activities with potential to affect hydrology and hydrogeology would be appropriately managed and there would be **no significant effects**.

[1] URL: https://www.spatialdata.gov.scot/geonetwork/srv/eng/catalog.search#/metadata/51b36efb-3521-4243-9bb0-93f8a7a60a71 (accessed 14.6.2019)

8.1 Introduction

This chapter reports on the likely significant effects on hydrology and hydrogeology associated with the construction, operation and decommissioning of the Main Construction Compound. The specific objectives of the chapter are to:

- describe the geological, hydrogeological and hydrological baseline;
- summarise the assessment methodology and significance criteria used in completing the impact assessment;
- describe the likely significant effects of the proposed Main Construction Compound;
- describe the mitigation measures proposed to address likely significant effects; and,
- describe the residual effects of the proposed Main Construction Compound.

8.1.1 This chapter has been prepared by Ramboll Environment and Health UK Limited (Ramboll).

8.1.2 Figures 8.1-8.5 are referenced in the text where relevant. Further detail on GWDTE is provided in Chapter 7: Ecology.

8.2 Methodology

Scope of the Assessment

8.2.1 The proposed Main Construction Compound would introduce physical changes which have the potential to alter the hydrological and hydrogeological characteristics of the site. This assessment considers likely significant effects on water quality, flooding and water resources during both the construction and operation of the Main Construction Compound, as described in Chapter 2 (Description of Development). The assessment of residual effects is made based on the assumption that best practice measures will be followed in construction and operation of the site and that these will be set out in a Construction Environmental Management Plan (CEMP) to be implemented by the contractor.

8.2.2 The effects on surface and groundwater may also result in secondary effects on terrestrial ecology such as peat forming habitats and groundwater dependent terrestrial ecosystems (GWDTE) and/or aquatic ecology. Such receptors are considered in this chapter only in terms of the potential for changes to the hydrological and hydrogeological regimes to impact upon them. Effects on peatland habitats and GWDTEs are considered in more detail in Chapter 7: Ecology.

8.2.3 This chapter does not provide detailed assessment of potential impacts of the Main Construction Compound on peat habitats. Further information on the extent and depth of peat on the site is considered in Technical Appendix 2.3: Peat Stability Assessment and a site specific Peat Management Plan (PMP) shall be developed post-consent for the site based on recent peat surveying, to be incorporated into the wider Viking Wind Farm.

Study Area

8.2.4 The study area is based on the site boundary, as detailed in Chapter 2 (Development Description), and includes areas downstream of the site which are potentially affected. Potential impacts on watercourses are assessed downstream to their point of discharge at the coast.

Baseline Conditions

Desk Study

8.2.5 A review of the desk study carried out for the 2018 Viking Wind Farm EIA report (Chapter 9, Hydrology, Hydrogeology, Geology, Soils and Peat), referred to in this report as the 'Viking Wind Farm EIA Report', has been undertaken, in respect of the Main Construction Compound, in order to:

- identify all catchments, watercourses, springs and boreholes;
- collate data on public and private abstractions;
- collate historic hydrological and flooding information for the immediate area and the main downstream watercourses;
- collate geological and hydrogeological information; and
- collate topographic (digital terrain model) information.

Field Study (delete if not applicable)

8.2.6 No direct field study has been carried out with respect to this chapter. Reference is made to ecological NVC surveying carried out and detailed in Chapter 7: Ecology and peat surveying carried out and reported in Technical Appendix 2.3.

Cumulative baseline

8.2.7 In respect of hydrology and hydrogeology, the Viking Energy Wind Farm ES concluded 'activities with the potential to affect the soil and water environment would be appropriately managed with no significant effects identified'. It is noted that the Scottish Environment Protection Agency (SEPA) identified that the nature and scale of the proposed wind farm make some level of adverse effect inevitable. Nevertheless, it is considered the addition of the proposed development (main construction compound) to the much larger consented Viking Wind Farm would not result in any additional or new cumulative effects.

8.2.8 Two further construction compounds are proposed in addition to the Main Construction Compound (a North Compound and West Compound). These compounds are located in separate catchments with no hydrological connection. Therefore, the potential for cumulative effects are not considered further in this assessment.

Assessment of Effects

Criteria for Assessing Sensitivity of Receptors

8.2.9 Effects on water resources are described as beneficial, neutral or adverse and are considered with reference to the value or sensitivity of the receptor, as described in Table 8.1.

Table 8.1: Sensitivity of Environmental Resource

Sensitivity of Receptor	Definition	Typical Criteria
High	International or national level importance. Receptor with a high quality and rarity, regional or national scale and limited potential for substitution/ replacement.	• High likelihood of fluvial/ tidal flooding in the sub catchment – defined as 1:10 probability in a year. • EC Designated Salmonid / Cyprinid fishery. • Surface water WFD class 'High'. • Scottish Government Drinking Water Protected Areas. • Aquifer providing regionally important resource such as abstraction for public water supply, abstraction for private water supply. • Supporting a site protected under EC or UK habitat legislation / species protected by EC legislation. • Protected Bathing Water Area. • Active floodplain. • Highly Groundwater Dependent Terrestrial Ecosystems.

Table 8.1: Sensitivity of Environmental Resource		
		• Qualifying characteristics for class 1 priority peatland habitat – all vegetation cover indicates priority peatland habitat; all soils are carbon rich soils and deep peat.
Medium	Regional, county and district level importance. Receptor with a medium quality and rarity, regional scale and limited potential for substitution/replacement.	• Medium likelihood of fluvial/ tidal flooding in the sub catchment – defined as a 1:200 probability in a year. • Surface water WFD class 'Good' or 'Moderate'. • Aquifer providing water for agricultural or industrial use. • Local or regional ecological status / locally important fishery. • Contains some flood alleviation features. • Qualifying characteristics for class 2 peatland habitat – most vegetation cover indicates priority peatland habitat; all soils are carbon rich soil and deep peat. • Moderately Groundwater Dependent Terrestrial Ecosystems.
Low	Local importance Receptor is on-site or on a neighbouring site with a low quality and rarity, local scale. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character.	• Surface water WFD class 'Poor'. • Unproductive strata / no abstractions for water supply. • Sporadic fish present. • No flood alleviation features. • Sewer. • Qualifying characteristics for class 3, 4 or X habitat – vegetation cover does not indicate priority peatland habitat (as defined by SNH[2]).

Criteria for Assessing Magnitude of Change

8.2.10 The size or magnitude of each impact is determined as a predicted deviation from the baseline conditions during construction, operation and decommissioning, as described in Table 8.2.

Table 8.2: Magnitude of Impact on a Receptor	
Magnitude of Impact	**Criteria**
Large	Large alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
Medium	Medium alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
Small	Small alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
None	No alteration / change detectable in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.

8.2.11 In describing a potential effect, consideration has also been given to its geographical scale and duration, which have been defined as follows:

[2] Scottish Natural Heritage (2016) Carbon-rich soils, deep peat and priority peatland habitat mapping, Consultation analysis report. URL: https://www.nature.scot/carbon-and-peatland-map-consultation-analysis-report

- The geographical scale of an impact refers to the zone of influence, and can be described as: localised, site-wide, a specific distance / range from a source, regional, national, global; and
- The duration of an impact can be described as: short to long term, permanent or temporary for the duration of the construction / operational period.

Significance Criteria

8.2.12 The significance of residual effects is defined as a function of the sensitivity of receptors and the magnitude of change, as presented in Table 8.3, taking account of any mitigation proposed. Differentiations between categories, and thus the final significance ratings, are based upon professional judgement.

Table 8.3: Significance Criteria

		Magnitude of Impact			
		None	**Small**	**Medium**	**Large**
Sensitivity of Receptor	**High**	None	Minor	Major	Major
	Medium	None	Minor	Moderate	Moderate
	Low	None	Negligible	Minor	Minor

8.2.13 Major and moderate impacts (shaded in grey) are deemed significant in the context of the EIA Regulations. Minor and negligible impacts are not considered significant in EIA terms.

8.3 Baseline Conditions

Current Baseline

Surface Hydrology

8.3.1 Sand Water Loch is approximately 100m west of the Main Construction compound site. The Burn of Sandwater drains from the south of Sand Water Loch and eventually discharges to the Loch of Strom approximately 4.5km south of the site. Sand Water Loch is designated as a Site of Special Scientific Interest and is notified as an example of a mesotrophic loch and for its open-water transition fen. The west of the site (approximately.50% of the total site area) currently drains towards Sand Water Loch. The east area of the site drains to the Burn of Crookadale approximately 175 m east of the site, the watercourse flows south before discharging into the Cat Firth approximately 1.8km south east of the site. These are shown on Figure 8.1.

Flood Risk

8.3.2 A review of the Scottish Environment Protection Agency's (SEPA) online Flood Mapping[3] indicates that an area of potential High and Medium flood risk is confined to the area immediately alongside Sand Water Loch. However, no infrastructure would be located within these flood risk areas and they present no flood risk to the site. Therefore, no further assessment of fluvial or tidal flood risk is considered necessary.

Water Quality

8.3.3 The boundary between the Shetland Coastal and the Stormfirth Burn at Mouth catchments runs through the centre of the Main Construction Compound. As such, approximately 50% of surface water from the site drains west towards the Sand Water Loch and the Burn of Sandwater (which forms part of the Stormforth Burn Catchment, both of which have been classified by SEPA under the Water Framework Directive as being of Good Overall Status, with a target to keep this status in the forthcoming years. The remaining 50% of the site currently drains to towards the Burn of

[3] URL: http://map.sepa.org.uk/floodmap/map.htm

Crookdale approximately 175m east of the site which is not classified by SEPA under the WFD. Coastal waters around the Shetland Isles are designated as being of Good Overall Status under the WFD.

Geology

8.3.4 The Shetland Isles are elongate and dominated by north to south trending geological units separated by similar trending faults. The British Geological Society (BGS) 50K bedrock geology data (Figure 8.2), indicates that the majority of the site is underlain by Colla Firth Formations of granofelsic psammite and granofelsic semipelite.

8.3.5 The BGS 50K superficial geology data (Figure 8.3) indicates that the site is directly underlain by deposits of peat as detailed below.

Soils and Peat

8.3.6 The eastern part of the site has been mapped as 'class 1' in the SNH Carbon-rich soils, deep peat and priority peatland habitat mapping[4]. This mapping indicates the likely presence of 'nationally important carbon-rich soils, deep peat and priority peatland habitat' likely to be of high conservation value, as referenced in SNH guidance on Spatial Planning for Onshore Wind Turbines (2015)[5]. Peat surveys were undertaken to gather site specific information of the presence and condition of peaty soils and/or peat. Peat is defined as an organic soil in excess of 0.5 m, if the soil is less than 0.5 m, then it is considered to be potential carbon-rich soil.

8.3.7 Peat was found to be widespread across the Main Construction Compound site in terms of thickness and coverage. The ground conditions were assessed by using peat depths recorded during the peat probing surveys in 2019[6] and are generally above 1m in depth as recorded in Technical Appendix 2.3. The peat was recorded as highly fibrous with extensive erosion features (hags) present. The presence of erosion features suggest a modified peatland habitat condition reflective of 'class 2' peatland, whereby the habitats are modified but with potential for restoration.

Groundwater Bodies

8.3.8 The 625K hydrogeological data available from the British Geological Society (BGS), classifies bedrock formations belonging to the Appin and Argyl Group (undifferentiated) as comprising a low productivity aquifers with flow virtually all through fractures and discontinuities (Figure 8.4).

8.3.9 Groundwater within peat is generally perched on the less permeable basement or drift it overlies, such as the Appin and Argyl Group bedrock underlying the Main Construction Compound. Where the peat is thick and located in areas of low relief, as observed on valley floors and saddles in elevated areas, it provides baseflow to local streams. While peat aquifers in some areas have sufficient storage to ensure perennial flow, flow in the majority of peat aquifer-fed watercourses is intermittent and restricted to periods during, and immediately following, prolonged wet weather. In lower-lying areas of lesser relief and where peat is relatively thin, the groundwater generally occurs at shallow depth. Groundwater may rise above the surface for short periods following extended rainfall. These areas are often defined by the presence of sphagnum species on the site surface.

[4] SNH and JHI (2016) Carbon and Peatland 2016 map, URL: http://soils.environment.gov.scot/maps/carbon-and-peatland-2016-map/#technicalAndReferenceMaterial (accessed 15/8/18)
[5] Scottish Natural Heritage (2015) Spatial Planning for Onshore Wind Turbines – natural heritage considerations; URL: https://www.nature.scot/sites/default/files/2017-06/A1663759.pdf (accessed 20/8/18)
[6] SLR Peat Depth plan – Main Construction compound 2019

8.3.10 The Shetland groundwater body, which underlies the entire site, is classified by SEPA under the RBMP system as having an overall status of Good[7].

Private Water Supplies

8.3.11 Details of private water supplies, as shown in Figure 8.5 are provided in Table 8.4 below.

Table 8.4: PWS with Potential Hydraulic Connectivity

Ref	Property	Location	Source
1	Easthouse	Grobsness NGR HU370633	Hillside spring source located approximately 9.5km north west of the site.
2	Lea of Burrafirth	East Burrafirth NGR HU352586	Supplied by a spring source located downslope and approximately 7.4 km north east of the site.
3	'Abandoned property'	South of Selie Ness NGR HU351596	Located approximately 8 km north east of the site. This property appeared abandoned and in a derelict state during the site visit conducted in April 2006. There was evidence of water supply infrastructure at the location, but this did not appear to be fit for operation.

8.3.12 SEPA has stated that all groundwater abstractions within the following distances of development need to be identified, in order to assess potential risk:

- within 100 m radius of all excavations shallower than 1 m; and
- within 250 m of all excavations deeper than 1 m.

8.3.13 None of the identified PWS locations fall within these radii; therefore, no further assessment is required.

Groundwater Dependant Terrestrial Ecosystems

8.3.14 Two GWDTE sites were identified within 250m of the Main Construction Compound, as shown in Technical Appendix 7.1, Figure 3. Both are classified as being potentially moderately ground water dependent and located in a position potentially downstream of the site. They are located approximately 50m west and 80m south west of the site. The GWDTE south west of the site is located on the opposite side of the A970 road and alongside the Sand Water Loch, water draining towards Sand Water Loch appears to be channelled to a drain adjacent to the A970 and conveyed below the road in a culvert feeding the area that includes the GWDTE.

8.3.15 The SNIFFER (2007) guidance[8] states that the dependence of wetlands on groundwater bodies is a result of the hydrological connectivity. The degree of dependency will vary depending upon whether the wetland is underlain by a low productivity or high productivity aquifer and whether there is a hydrological linkage mechanism between groundwater and the surface wetland. Likelihood of dependency is based upon the following:

- High Likelihood: Characterised by intergranular, high productivity drift aquifer and dominantly intergranular, highly productive aquifer;
- Moderate Likelihood: Characterised by intergranular, moderate productivity drift aquifer and fractured, very low productivity aquifer; and

[7] https://www.sepa.org.uk/data-visualisation/water-classification-hub/?display=information_sheet&waterbodyid=150687 (accessed 20/8/18)
[8] Scotland & Northern Ireland Forum for Environmental Research, Wetland Hydrogeomorphic Classification for Scotland [available at: http://www.envirobase.info/PDF/SNIFFER_WFD66_Final_Report.pdf]

- Low Likelihood: Characterised by intergranular, low productivity drift aquifer and fractured, very low productivity aquifer.

8.3.16 The Main Construction Compound is underlain by bedrock aquifers with low productivity where the flow is virtually all through fractures and other discontinuities. Where drift deposits are present within the site, these would also be of low productivity. Figure 3 in Technical Appendix 7.1 presents the location of the potential GWDTEs relative to the proposed site infrastructure.

Future Baseline

8.3.17 There is potential for climate change to impact on future baseline conditions. Climate change studies generally predict a potential decrease in average summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. Extreme summer storms are, however, predicted to be of greater individual intensity. Peak fluvial flows associated with extreme storm events may, therefore, increase in volume and velocity. The predominant habitat on the Main Construction Compound site (peat bog) is highly dependent on the frequency and volume of precipitation. While 'active' peat bog is likely to have a high resilience to potential future climate change, areas which are damaged and degraded (haplotelmic) e.g. by overgrazing are likely to be more vulnerable to climate change effects (e.g. increased erosion) as a result of lacking an active vegetation layer. These climate change factors have been taken into account when considering the potential for likely significant effects.

Identified Sensitive Receptors

8.3.1 A summary of the receptors identified as being sensitive to the proposed development and which have been 'scoped-in' to the assessment are as follows:

- Sand Water Loch and further receiving waters;
- GWDTE; and
- Surface water run-off / site drainage and water quality.

8.4 Assessment of Effects

Effects on GWDTE

Construction Effects (pre-mitigation) – Main Construction Compound

8.4.1 NVC surveying (reported in Chapter 7: Ecology) shows that there are no GWDTE areas located on the proposed Main Construction Compound. Therefore, it is anticipated that there would be no direct impacts on GWDTE habitats as a result of either the construction or operation phases. NVC surveying identifies two areas classified as potentially Moderately Groundwater Dependent within a 250m buffer of the site and situated downgradient from the proposed Main Construction Compound. These areas could, therefore be at risk of indirect impacts due to development of the proposed compound.

8.4.2 However, it is also noted that the underlying geology is likely to be of low productivity and unlikely to support groundwater dependent habitats. Therefore, the potential GWDTE areas identified within 250m of the site are considered likely to be predominantly rainwater fed. The sensitivity of the potential GWDTE areas within a 250m buffer of the Main Construction Compound to changes in the groundwater resource is considered to be low

8.4.3 Where no mitigation is put into place during construction of the Main Construction Compound, potential impacts on the habitat areas identified could occur as a result of a reduction in downstream surface water supply and negative impacts on surface water quality. This is considered further in the next section below.

Summary of Effects (pre-mitigation)

8.4.4 Overall, when assessing the proposed varied development, assuming no further mitigation is implemented, the magnitude of potential impacts on the potential GWDTE are minor and not significant.

Operational Effects – Main Construction compound

8.4.5 There are not anticipated to be any impacts on GWDTE further to those identified during the construction phase for the proposed Main Construction Compound.

Effects on Surface Water Runoff and Water Quality

Construction Effects (pre-mitigation) – Main Construction Compound

8.4.6 Approximately 50% of the site is considered to drain to the west towards Sand Water Loch and the Burn of Sandwater further downstream. The flow of water from the site is expected to predominantly comprise overland surface water flows via rills, runnels and minor drains. Sandwater Loch is a SSSI based on a biological designation and both Sand Water Loch and the Burn of Sandwater are considered to be of Good Overall Status under the WFD. The east of the site drains towards the The Burn of Crookadale approximately 175 m east of the site. The overall sensitivity of the receiving surface water environment is therefore considered to be high.

8.4.7 In the absence of mitigation, the following potential impacts have been identified:

- There is a potential to alter in-channel or overland flow regimes in terms of runoff volume, rate and quality through excavations, disruption to existing drainage patterns and exposure of bare earth or rock.
- There is the potential for the discharge of increased sediment loads due to construction activity and erosion, to negatively impact on aquatic ecology or fluvial morphology of receptors downstream from the proposed development. The magnitude of potential impacts is considered to be medium, leading to a potential major adverse and significant effect. There is the potential to impact on receiving soils, groundwater and watercourse quality through the release of contaminated water and stored chemicals used on-site during construction works. Potential effects include degradation of water quality and indirect effects on aquatic ecology. Due to the low infiltration potential of peat, contaminants are considered unlikely to penetrate into the peat or groundwater. The high surface runoff coefficient means that in the event of a pollution event, when assessed assuming no further mitigation is implemented, a large area could be affected resulting in a large magnitude effect. This could potentially result in a major adverse and significant effect.

Summary of Effects (pre-mitigation) – Main Construction Compound

8.4.8 Overall, when assessing the proposed Main Construction Compound assuming no further mitigation is implemented, the magnitude of potential impacts on the surface water runoff are assessed as:

- major adverse and significant effect as a result of potential increases in downstream sediment loads; and
- major adverse and significant effects as a result of chemical pollution.

Operational Effects - Main Construction Compound.

8.4.9 On the basis that the detailed drainage design will ensure pre-construction run-off rates are maintained there are not considered to be any significant impacts on the water environment further to those identified during the construction phase for the consented Viking Energy Wind Farm and proposed varied development. This also applies for the Main Construction Compound.

8.4.10 The potential risk of the release of sediment from the compound during the operational phase is substantially lower than during construction because of the decreased levels of ground disturbance. As such, spills of chemicals of fuels shall constitute the primary source of risk during the operational phase of the compound (servicing the construction of the wider Viking Wind Farm). Plans for the Main Construction Compound include a bunded generator and bulk fuel storage tank (positioned on an impervious base and draining to an oil-interceptor). Both the generator and bulk fuel store would have integrated secondary-containment with a minimum bund capacity of no less than 110% of maximum tank capacity.

8.4.11 The magnitude of a pollution incident, without mitigation in place, is medium, leading to potential moderate adverse and significant effect.

Effects on Watercourses: Watercourse Crossings

Construction Effects (pre-mitigation) – Main Construction Compound

8.4.12 No watercourses are identified as crossing the site on 1:25,000 scale OS mapping. It would therefore be expected that only crossings of minor water features could would be required. It is expected that these could include crossings of a drain adjacent to the A970, field drains and smaller surface water channels or 'hags' eroded into peat soils on the route of the proposed access track.

8.4.13 It is therefore expected that such works would not require specific licensing and would be authorised under General Binding Rules (GBRs). These represent a set of mandatory rules which cover specific low risk activities. Activities complying with the rules do not require an application to be made to SEPA, as compliance with a GBR is considered to be compliance with an authorisation.

8.4.14 It is highly likely that the method of construction of watercourse crossings will be circular culverts - embedded into the channel to allow the natural bed to re-establish and, where appropriate, as defined by the ECoW, making provision for mammals adjacent to the culvert. Where a circular culvert is utilised, it is assumed that neither natural bed material, or water velocity nor depth are critical other than in the purely hydraulic sense as is the case with crossings described above.

8.4.15 Were adequate provision is not made for the conveyance of water across the site there is the potential for areas of peat to dry. While there is risk that interruption of surface water supplies across peat soils may lead to drying out, the scale of the crossings is such that sensitivity to construction activity is considered medium to low. Furthermore, given the scale of works required to install culverts the magnitude of impact to receptors is considered small. Therefore, the overall potential significance of construction of watercourse crossings prior to mitigation is considered to be minor to negligible.

Summary of effects

8.4.16 Overall, when assessing the proposed varied development, assuming no further mitigation is implemented, the magnitude of potential impacts of the potential watercourse crossings are minor and not significant.

Operational Effects

8.4.17 Watercourse crossings on the site will provide a means of hydraulic conveyance across the proposed access track following standard design guidance. After instalment as described in the construction phase assessment, and the establishment of flows across the site it is not expected that there will be any significant impact on receiving areas.

8.5 Mitigation

8.5.1 Were mitigation not implemented, it has been identified that there is the potential for a major adverse and significant effect as a result of potential sedimentation and a major adverse and

significant effects as a result of chemical pollution. Design principles outlined in the Construction Environmental Management Plan (CEMP) and the wind farm's Construction Site Licence, Pollution Prevention Plan (CSL PPP) will be implemented by the contractor in accordance with the relevant best practice guidance on pollution prevention and mitigation, namely SEPA's Guidance for Pollution Prevention[9]. Mitigation detailed below draws on best practice as outlined in the CEMP and CSL PPP being prepared for the consented Viking Energy Wind Farm and incorporates specific best guidance practice. Key mitigation measures to be put in place are summarised below.

Mitigation of Potential Increases in Downstream Sediment Loads

8.5.2 During construction works areas of soil may be exposed at the site of the construction compounds and substation / control building construction footprints. Clean up-slope run off and run off from the exposed construction area will be kept separate and appropriate silt mitigation measures will be deployed.

8.5.3 Clean runoff (i.e. non-silty surface water flow, including that which has not passed over any disturbed construction areas) would be kept separate from potentially contaminated water from construction areas as afar as possible. Where required, interceptor ditches and other drainage diversion measures would be installed immediately in advance of any excavation works in order to collect and divert clean runoff away from construction disturbed areas.

8.5.4 Silt laden runoff will be captured and directed via berms or ditches towards specially constructed sediment control structures. Sediment control structures may comprise a series of settlement ponds with additional incorporated filtration measures where required. The number, location and dimensions of settlement ponds, plus requirements for flow attenuation measures will depend on the volume of water requiring treatment, silt load characteristics, topography and access constraints to be defined in detail by the contractor.

8.5.5 Drains will be constructed to a gradient of less than 2˚ where possible in order to slow flows , prevent erosion of the drain base and sides, and encourage establishment of terrestrial and aquatic vegetation where possible. Where this is not possible, sufficient flow attenuation measures will be installed. The width and depth of constructed drainage channels will be minimised as far as practical in order to reduce ground disturbance, excavation footprint (and hence volume of excavated materials) and also disruption of local hydrology as far as possible.

8.5.6 Check dams or silt traps will be installed at regular intervals within any clean water or dirty water cut off ditches to slow flow velocities allowing the settlement of coarser sediment and the prevention of scouring. The number and location of check dams will be dependent on the slope, flow and volume of water and arranged such that the top of the downhill check dam will be at the same level as the bottom of the uphill.

Mitigation of Potential Chemical Pollution

8.3.18 With respect to potential impacts from the release of pollutants (including the release of silt, sediments and soil) to the water environment, the CEMP and CSL PPP includes the following controls:

- Precautions will be taken to ensure the protection of watercourses and groundwater against pollution, silting and erosion during Watercourse Crossing construction operations.
- Any material or substance which could cause pollution, including silty water, will be prevented from entering surface water drains or watercourses by the propitious use of and appropriate placement of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate.

[9] Guidance for Pollution Prevention (January 2017) Works and Maintenance In or Near Water. GPP5, Version 1.2, February 2018, published by NetRegs –URL: http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (accessed 21/8/18)

- Any silty water generated on site will be settled out as much as possible through drainage mitigation measures (silt traps etc) and channelled into vegetated areas 50m (unless otherwise agreed with the ECoW) from watercourses to allow the settlement of solids.
- Unless otherwise agreed with the ECoW, all refuelling will be carried out in designated locations, 50 metres away from water courses. Irrespective of the buffer distance and location of refuelling, drip trays and spill kits will be available in accordance with standard best practice across the construction industry. This is achieved for generators and bulk fuel tanks through a proposed central location on the Main Construction Compound.
- Unless otherwise agreed with the ECoW, areas of waste, oil / fuel / chemical storage and permanent refuelling will be located 50m from watercourses or drainage paths. Such storage areas will be appropriately sited to prevent the downward percolation of contaminants to natural soils and groundwater.
- Fuel, oils and chemicals will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity.
- Site compounds, parking areas and turning areas and vehicle and equipment washing areas are to be sited at least 50m from water courses.
- All waste and stockpiled materials will be stored in designated areas and isolated from any surface drains and a minimum of 50 metres away from watercourses, although where this is not possible, a suitable location shall be agreed with the ECoW.
- The use of cut-off ditches, silt fences, silt traps and drainage to vegetated areas will be employed as required / appropriate in areas of excavation, exposed soils, stockpiling, dewatering and plant and wheel washing.
- A Personnel Site Induction will make specific reference to required pollution prevention measures.
- All works will be carried out in accordance with best practice and will aim to prevent deterioration in the ecological status of surface waters and to avoid compromising the restoration potential of such waters.
- In the event of a pollutant spillage on site, the material will be contained (using an absorbent material such as sand or soil or commercially available booms) and, where significant or affecting a watercourse, SEPA notified immediately using the emergency hotline number (0800 80 70 60).

In addition, it is recommended that best practice is followed where concrete and cement are used in construction or where materials are stored. Fresh concrete and cement is highly alkaline and corrosive, and can be lethal to aquatic life. The use of wet concrete in and around watercourses will be minimised and carefully controlled.

8.3.19 Additionally, during the working life of the construction compound the following measures shall be implemented:

- Construction traffic access would be restricted wherever possible, and the number of vehicle movements limited as much as possible. Land surrounding the immediate construction area would be fenced off or otherwise demarcated to prevent inadvertent intrusion from construction plant. This would help to limit soil disturbance and consequently reduce the potential for erosion.
- Only emergency maintenance to construction plant will be carried out on site, in one designated area, on an impermeable surface well away from any watercourse or drainage, unless vehicles have broken down necessitating maintenance at the point of breakdown, where special precautions will be taken.

- Silt traps and sediment attenuation ponds will be inspected (i.e. weekly) and cleared regularly (as defined by weekly checks) to ensure they remain fully operational and effective. Silt fences and mats shall be utilised to ensure minimum sediment runoff from stockpiles.
- To prevent any downgrading of water quality status from excellent/good status post-development, runoff flow and loading should be kept to pre-development levels.
- Watercourses, culverts and drainage ditches will be inspected and cleared regularly to prevent blockages and remove the risk of flooding.
- On-site welfare facilities will be adequately designed and maintained to ensure all sewage is disposed of appropriately. This may take the form of an onsite septic tank with soakaway, or tankering and offsite disposal depending on the suitability of the site for a soakaway and agreement with SEPA.
- All relevant staff personnel will be trained in both normal operating and emergency procedures, and, be made aware of highly sensitive areas on site. The staff training, and implementation of site procedures will be overseen by the Contractor's Site Environmental Representative and the Environmental Clerk of Works to ensure that these measures are carried out effectively to minimise the risk of a pollution incident.

8.3.20 A Peat Management Plan (PMP) will be implemented to outline the approach to managing peat during the construction phase in accordance with guidance from SEPA[10],[11]. A PMP will be developed based on the most recent surveying carried out and used to inform the Peat Landslide Risk Assessment (Technical Appendix 2.3 to this EIA). The PMP will consider the management of peat excavated from the Main Construction Compound, albeit, to ensure parity and a consistent approach, this shall be incorporated into the wider (pre-construction) wind farm PMP.

8.4 Good Practice Measures

8.4.1 Water emissions resulting from the operational development are anticipated to be limited to surface water, and very small quantities of waste water from the site welfare facilities. The site would be designed to ensure that surface water runoff does not exceed the pre-development volume or rate of run-off. Access tracks would be designed to be semi-permeable and to act in a similar manner to a Sustainable Drainage System (SuDS), allowing some infiltration of surface water through the track surface. In addition, there would be a trackside drainage system installed during construction, where appropriate, incorporating measures to attenuate the flow and provide for physical filtration and infiltration of surface water. It is noted that given the widespread presence of peat and high-water table, infiltration is likely to be limited for the majority of the site. Runoff from areas of hardstanding is expected to infiltrate locally on unsurfaced areas and SuDS features designed into the compound layout.

8.4.2 With respect to foul water generated by welfare facilities on site, good practice will be followed according to SEPA Guidance PPG04: Treatment and Disposal of Sewage. Owing to the location of the site it is not expected that connection to a mains sewerage network will be available. It is expected that sustainable septic systems (waterless toilets or septic tanks) must be installed and maintained appropriately. Due to the sensitivity of peat soils underlying the site, conditions are unlikely to be suitable for the use of a soakaway. All sewage collected from within septic systems will be transported from the site by tanker at an appropriate frequency and disposed of by an appropriately licensed contractor into the local foul water sewer system.

[10] Scottish Environment Protection Agency. 2010. Regulatory Position Statement – Developments on Peat.

[11] Scottish Renewables, Scottish Environment Protection Agency. 2012. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste – Version 1

8.4.3 Decommissioning of the construction compound will follow best practice to be specified in the CEMP such that the site is reinstated to the same or better condition following the period of operation for which the compound is instated.

8.5 Residual Effects

8.5.1 With the proposed mitigation in place the potential residual impacts on the soil and water environment would not be considered significant for the proposed development of the Main Construction Compound. Following decommissioning, the site shall be restored to same or better condition and as such no residual effects of the construction compound are expected.

8.6 Summary and Conclusions

8.6.1 A summary of the potential effects on hydrology, hydrogeology and geology is provided in Table 8.5, which also provides a comparison of the potential effects identified for consented Viking Wind Farm with the effects identified for the proposed varied development.

8.6.2 Mitigation as described in this chapter will be implemented through a CEMP as implemented by contractors in relation to the development of the Main Construction Compound. Based on indicative measures as outlined above, it is considered that the activities with potential to affect the soil and water environment would be appropriately managed with no significant effects identified.

Table 8.5: Summary of Effects					
Receptor	**Potential Effect Identified for Consented Viking Wind Farm**	**Potential Significant Effect Identified**	**Mitigation / Good Practice Controls**	**Means of Implementation**	**Residual Effect / Difference**
Construction					
Soils and peat	Modification of water table around cut tracks and excavations.	Modification of water table around cut tracks and excavations.	Drainage management proposals to ensure groundwater flow and hydraulic continuity is maintained.	CEMP to be submitted to and approved by the LPA / SEPA to be secured by an appropriately worded planning condition. CSL PPP regulatory requirement under CAR.	Minor not – significant /
GWDTE	Not assessed	Disruption and interruption to groundwater flow, causing alteration/change in the quality or quantity of and/or the physical or biological characteristics of GWDTE. Surveyed habitat areas noted to be rainwater dependent and therefore not groundwater dependent.	Drainage management proposals to ensure groundwater flow and hydraulic continuity is maintained.	CEMP to be submitted to and approved by the LPA / SEPA to be secured by an appropriately worded planning condition. CSL PPP regulatory requirement under CAR.	Minor – not significant /
Surface water run-off volume	Modification to surface water run-off and impediment to flows.	Impact on runoff volumes and rates and fluvial morphology through the alteration of drainage patterns.	Drainage management proposals to ensure pre-construction rates / volumes of run-off maintained. The drainage management works would be supervised by the Ecological Clerk of Works (ECoW).	CEMP and CSL PPP, including detailed watercourse crossing proposals, to be submitted to and approved by the LPA / SEPA to be secured by an appropriately worded planning condition.	Minor – not significant/
Water quality	Erosion and sedimentation of watercourses.	Impact on water quality and fluvial morphology associated with sediment-laden runoff or impacts on bank integrity.	Drainage management proposals to ensure water quality is maintained through use of good practice silt mitigation.	CEMP and CSL PPP, including detailed watercourse crossing proposals, to be submitted to and approved by the LPA / SEPA to be secured by an appropriately worded planning condition.	Minor – not significant/

Table 8.5: Summary of Effects					
			The drainage management works would be supervised by the Ecological Clerk of Works (ECoW).		
Water quality	Pollution	Effects on water quality from pollution associated with chemical contaminated runoff / pollution.	The baseline review of PWS identified no potential hydrological connection to PWS. All runoff to be treated in accordance with SuDS principles. Best practice will be followed with regards to the isolation and positioning of potentially contaminative oils, fuels or chemicals. Petrol interceptors and spill kits will be utilised where chemical spillage is a possibility. In order to address any minor residual risk, a rapid response plan would be developed, which will ensure the rapid delivery of tankered water to those users affected and maintain this supply until problems are remedied.	CEMP to be submitted to and approved by the LPA / SEPA to be secured by an appropriately worded planning condition. CSL PPP regulatory requirement under CAR	Minor – not significant/
Operation					
Soils and peat	Modification of surface and groundwater flows.		On-going maintenance for all proposed drainage measures on the site, particularly including water crossings and sustainable drainage features designed to manage water quality and runoff rate.	CEMP and CSL PPP	Minor – not significant/
GWDTE	Not assessed	Disruption and interruption to groundwater flow, causing alteration/change in the quality or	None necessary	CEMP	Minor – not significant/

Table 8.5: Summary of Effects					
		quantity of and/or the physical or biological characteristics of GWDTE.			
Surface water run-off / site drainage	Modification to surface water run-off and impediment to flows.	Impact on runoff volumes and rates and fluvial morphology through the alteration of drainage patterns.	On-going maintenance for all proposed drainage measures on the site, particularly including water crossings and sustainable drainage features designed to manage water quality and runoff rate.	CEMP and CSL PPP	Minor – not significant/
Water quality	Erosion and sedimentation of watercourses.	Impact on water quality and fluvial morphology associated with sediment-laden runoff or impacts on bank integrity.	On-going maintenance for all proposed drainage measures on the site, particularly including water crossings and sustainable drainage features designed to manage water quality and runoff rate.	SEMP and CSL PPP	Minor – not significant/
Water quality	Pollution	Effects on water quality from pollution associated with chemical contaminated runoff / pollution.	On-going maintenance for all proposed drainage measures on the site.	SEMP and CSL PPP	Minor – not significant/

Glossary and Abbreviations

Abbreviation	**Expanded Term / Definition**
SNH	Scottish Natural Heritage
PWS	Private Water Supply
SEPA	Scottish Environmental Protection Agency
GWTDE	groundwater dependent terrestrial ecosystems
CEMP	Cite Environmental Management Plan
CSL PPP	Construction Site Licence – Pollution Prevention Plan
RBMP	River Basin Management Plans
BGS	British Geological Society
NVC	National Vegetation Classification
SuDS	Sustainable Drainage System
ECoW	Environmental Clerk of Works

9. CULTURAL HERITAGE AND ARCHAEOLOGY

Executive Summary

A desk-based study and walkover survey have been carried out in order to identify heritage assets that may be affected by the proposed development. These studies have also informed an assessment of the potential for currently unknown archaeological remains to survive within the proposed development area.

There are no recorded heritage assets within the proposed development area. It is considered that the proposed development lies in an area of low archaeological potential. Potential construction impacts will be mitigated through a programme of archaeological works, to be agreed with Shetland Regional Archaeological Service.

The combination of the proposed development and the Viking Wind Farm will not result in a cumulative effect on heritage assets.

9.1 Introduction

9.1.1 This chapter reports on the likely significant effects with respect to the historic environment associated with the construction, operation and decommissioning of the proposed development, as described in Chapter 2: Development Description.

9.1.2 This chapter is supported by:

- Figure 9.1 which is referenced in the text where relevant.

9.1.3 The objectives of this assessment are to:

- Describe the location, nature and extent of any known heritage assets or areas of archaeological potential which may be affected by the proposed development;
- Provide an assessment of the importance of these assets;
- Assess the likely scale of any impacts on the historic environment posed by the development;
- Outline suitable mitigation measures to avoid, reduce or offset significant adverse effects; and
- Provide an assessment of any residual effects remaining after mitigation.

9.1.4 A heritage asset (or historic asset) is any element of the historic environment which has cultural significance. Both discrete features, and extensive landscapes defined by a specific historic event, process or theme, can be defined as heritage assets; and assets may overlap or be nested within one another.

9.1.5 Designated assets include Scheduled Monuments, Listed Buildings, World Heritage Sites, Conservation Areas, Inventory Gardens and Designed Landscapes, Inventory Historic Battlefields and Historic Marine Protected Areas. Other assets may also be locally designated through policies in the Local Plan.

9.1.6 The majority of heritage assets are not designated. Some undesignated assets are recorded in Historic Environment Records or Sites and Monuments Records (HERs/SMRs) maintained by local authorities and other agencies. However, many heritage assets are currently unrecorded, and the information contained in HERs and SMRs is not definitive, since they may include features which, for instance, have been entirely removed, or are of uncertain location, dubious identification, or negligible importance. The identification of undesignated heritage assets is therefore to some extent a matter of professional judgement.

9.2 Methodology

Scope of the Assessment

9.2.1 The cultural heritage assessment has been carried out in the following stages:

- Desk-based study leading to the identification of heritage assets potentially affected by the proposed development;
- Definition of baseline conditions, based on results of the desk-based study and visits to assets;
- Assessment of the importance of heritage assets potentially affected by the development;
- Identification of potential impacts on heritage assets, informed by baseline information and site visits;
- Proposal of mitigation measures, to eliminate, reduce or offset adverse effects;
- Assessment of the magnitude of residual effects;
- Assessment of the significance of residual effects, broadly a product of the asset's importance and the magnitude of the impact; and
- Assessment of cumulative effects.

Study Areas

9.2.2 The Cultural Heritage Inner Study Area (CHISA) corresponds to the proposed development area, as indicated by the redline boundary on Figure 9.1. Within this area, all heritage assets are assessed for construction and operational effects.

9.2.3 The Cultural Heritage Outer Study Area (CHOSA) is a 1 km buffer from the CHISA. This area has been included to inform the potential for previously unrecorded archaeology in the CHISA and the potential for assets in this area extending into the CHISA and being affected by the proposed development.

Consultation

9.2.4 Impacts on setting of cultural heritage assets were scoped out during the informal pre-application consultation process. This chapter therefore does not consider potential impacts on the setting of cultural heritage assets.

9.2.5 Formal consultation has not been undertaken. The Shetland Regional Archaeological Service was made aware of the proposed development and the scope of works when approached for Historic Environment Record data.

Baseline Conditions

Desk Study

9.2.6 The baseline for the CHISA has been informed by a comprehensive desk-based study, based on all readily available documentary sources, following the Chartered Institute for Archaeologists' (CIfA) 'Standard and Guidance for historic environment desk-based assessment'. The following sources of information were referred to:

- Designation data downloaded from the Historic Environment Scotland (HES) website on 15.04.19;
- 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 Shetland Amenity Trust Historic Environment Record (HER), data received 21.05.19;
- 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;
- Relevant internet resources, including Pastmap and Canmore;
- Viking Wind Farm EIA and FEI reports; and
- Readily available published sources and unpublished archaeological reports.

Field Study

9.2.7 A walkover survey of the CHISA was carried out on 28 May 2019, guided by Ordnance Survey mapping and a handheld GPS system. The purpose of the survey was a visual inspection of the proposed development area and environs, with the aim to identify any previously unrecorded cultural heritage assets, and to gather information about current site conditions relevant to the assessment.

Assessment of Effects

9.2.8 Effects on the historic environment can arise through direct physical impacts or indirect impacts:

- Direct physical impacts describe those development activities that directly cause damage to the fabric of a heritage asset. Typically, these activities are related to construction works and will only occur within the application site.
- Indirect impacts 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; or changes to the setting of a building may affect the viability of its current use and thus lead to dereliction.

9.2.9 Cultural heritage constraint areas, if identified include an appropriate buffer around known heritage assets. Constraint areas can be treated as a 'trigger' for the identification of potential direct impacts: they represent areas within which works may lead to direct impacts of more than negligible significance on known heritage assets.

9.2.10 Potential impacts on unknown heritage assets are discussed in terms of the risk that a significant effect could occur. The level of risk depends on the level of archaeological potential combined with the nature and scale of disturbance associated with construction activities and may vary between high and negligible for different elements or activities associated with a development, or for the development as a whole.

Mitigation Measures and Identification of Residual Effects

9.2.11 Proposed mitigation measures are described in paras 9.5.1 – 9.5.2. The preferred mitigation option is always to avoid or reduce impacts through design, or through precautionary measures such as fencing off heritage assets during construction works. Impacts which cannot be eliminated in these ways will lead to residual effects.

9.2.12 Adverse effects may be mitigated by an appropriate level of survey, excavation, recording, analysis and publication of the results, in accordance with a written scheme of investigation (SPP paragraph 150 and PAN2/2011, sections 25-27). Archaeological investigation can have a beneficial effect of increasing knowledge and understanding of the asset, thereby enhancing its archaeological and historical interest and offsetting adverse effects.

Criteria for Assessing Sensitivity of Receptors

9.2.13 Cultural heritage impact assessment is concerned with effects on cultural significance, which is a quality that applies to all heritage assets, and as defined by Historic Environment Scotland (Environmental Impact Assessment Handbook, SNH & HES 2018, Appendix 1 page 175) relates to the ways in which a heritage asset is valued both by specialists and the general public; it may derive

from factors including the asset's fabric, setting, context and associations. This use of the word 'significance', referring to the range of values we attach to an asset, should not be confused with the unrelated usage in EIA where the significance of an effect reflects the weight that should be attached to it in a planning decision.

9.2.14 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 undesignated assets, the professional judgement of the assessor (Table 9.1). Assets of national importance and international importance are assigned a high and very high level respectively. Scheduled Monuments, Inventory Gardens and Designed Landscapes, Inventory Historic Battlefields and Historic Marine Protected Areas are, by definition, of national importance. The criterion for Listing is that a building is of 'special architectural or historic interest'; following HES's Designation Policy and Selection Guidance (DPSG, April 2019, Annex 2), Category A refers to 'buildings of special architectural or historic interest which are outstanding examples of a particular, period, style or building type', Category B to 'buildings of special architectural or historic interest which are major examples of a particular, period, style or building type', and Category C to 'buildings of special architectural or historic interest which are representative examples of a particular, period, style or building type'. Conservation Areas are not defined as being of national importance and are therefore assigned to a medium level. Any feature which does not merit consideration in planning decisions due to its cultural significance may be said to have negligible heritage importance; in general, such features are not considered as heritage assets and are excluded from the assessment.

Table 9.1 Criteria for Assessing the Importance of Heritage Assets

Importance of the Asset	Criteria
Very high	World Heritage Sites and other assets of equal international importance.
High	Category A Listed Buildings, Scheduled Monuments, Inventory Gardens and Designed Landscapes, Inventory Historic Battlefields, Historic Marine Protected Areas and undesignated assets of national importance.
Medium	Category B Listed Buildings, Conservation Areas, and undesignated assets of regional importance.
Low	Category C Listed Buildings and undesignated assets of lesser importance.

9.2.15 Cultural significance is assessed in relation to the criteria in DPSG Annexes 1-5, which are intended primarily to inform decisions regarding heritage designations, but may also be applied more generally in identifying the 'special characteristics' of a heritage asset, which contribute to its cultural significance and should be protected, conserved and enhanced according to SPP paragraph 137. Annex 1 is widely applicable in assessing the cultural significance of archaeological sites and monuments, for instance, while the criteria in Annex 2 can be used in defining the architectural or historic interest of buildings, whether listed or not.

Criteria for Assessing Magnitude of Change

9.2.16 The magnitude of an impact is a measure of the degree to which the cultural significance of a heritage asset will be changed by the proposed development (SNH & HES 2018, Environmental Impact Assessment Handbook, Appendix 1, para 42).

9.2.17 Magnitude is assessed as high/medium/low/negligible, and adverse/beneficial, or 'No Impact', using the criteria in Table 9.2 as a guide. In assessing the effects of a development, it is often necessary to take into account various impacts which affect an asset's significance in different ways, and balance adverse impacts against beneficial impacts. For instance, there may be adverse

impacts on an asset's fabric, offset by a beneficial impact resulting from archaeological investigation. There may also be beneficial impacts arising from a proposed development which would not otherwise occur in a 'do-nothing' scenario; a heritage asset that might otherwise degrade over time could be preserved or consolidated as a consequence of a development. The residual effect is an overall measure of how the asset's significance is reduced or enhanced.

Table 9.2 Criteria for Assessing the Magnitude of Impacts on Heritage Assets

Magnitude of Impact	Guideline Criteria
High beneficial	Changes to an asset resulting in considerable enhancement of cultural significance. Or: Preservation of an asset where it would otherwise suffer considerable loss of cultural significance in the do-nothing scenario.
Medium beneficial	Changes to an asset resulting in moderate enhancement of cultural significance. Or: Preservation of an asset where it would otherwise suffer moderate loss of cultural significance in the do-nothing scenario.
Low beneficial	Changes to an asset resulting in a slight enhancement of cultural significance. Or: Preservation of an asset where it would otherwise suffer slight loss of cultural significance in the do-nothing scenario.
Negligible beneficial	Changes to an asset resulting in a very slight enhancement of cultural significance. Or: Preservation of an asset where it would otherwise suffer very slight loss of cultural significance in the do-nothing scenario.
No Impact	The asset's cultural significance is not altered.
Negligible adverse	Changes to an asset resulting in a very slight loss of cultural significance.
Low adverse	Changes to an asset resulting in a slight loss of cultural significance.
Medium adverse	Changes to an asset resulting in a moderate loss of cultural significance.
High adverse	Changes to an asset resulting in a considerable loss of cultural significance.

Significance Criteria

The significance of an effect (EIA 'significance') on the cultural significance of a heritage asset, resulting from a direct or indirect physical impact, or an impact on its setting, is assessed by combining the magnitude of the impact and the importance of the heritage asset. The matrix in Table 9.3 provides a guide to decision-making but is not a substitute for professional judgement and interpretation, particularly where the asset importance or impact magnitude levels are not clear or are borderline between categories. EIA significance may be described on a continuous scale from negligible to major; it is also common practice to identify effects as significant or not significant, and in this sense major and moderate effects are regarded as significant in EIA terms, while minor and negligible effects are 'not significant'.

Table 9.3 Criteria for Assessing the Magnitude of Impacts on Heritage Assets				
Assets importance	**Magnitude of Impact**			
	High	**Medium**	**Low**	**Negligible**
Very high	Major	Major	Major or moderate	Negligible
High	Major	Major or moderate	Moderate or minor	Negligible
Medium	Major or moderate	Moderate or minor	Minor	Negligible
Low	Moderate or minor	Minor	Negligible	Negligible

Assumptions and Limitations

9.2.18 Based on the results of the survey and assessment, it is considered that sufficient information exists to judge the archaeological potential of the CHISA and to make a reliable assessment of the potential direct and operational impacts of the proposed development. No limitations to this assessment have been identified.

9.3 Baseline Conditions

Current Baseline

Geology

9.3.1 The bedrock geology of the CHISA is metamorphic Granite Gneissose of the Colla Firth Permeation and Injection Belt. This rock type was originally igneous rocks formed by intrusions of silica-rich magma which was later altered by metamorphism. The superficial geology of the CHISA is Peat formed of organic accumulations (http://mapapps.bgs.ac.uk/geologyofbritain/home.html, accessed 05.06.19).

9.3.2 The CHISA is on a relatively steep sloping hill side ranging in altitude from c.30 m to c.90 m AOD. The Inner Study Area is a rough grazing moorland.

Archaeological Background

9.3.3 There are no previously recorded cultural heritage assets within the CHISA of any date.

9.3.4 In the CHOSA the HER records two buildings (HER8043 and HER8044) on the shore of Sandwater (Fig 9.1) which were depicted as unroofed buildings on the 1st Edition Ordnance Survey Map but are no longer visible. It is probable that these were farmsteads or dwellings dating to the post medieval period.

9.3.5 The wider area of Shetland has a wealth of archaeological remains with the absence of population pressure and the limited amount of mechanised agriculture resulting in a high level of upstanding archaeology. Archaeological remains from prehistory, the medieval period through to the post-medieval and pre- Clearance agricultural and fishing communities survive throughout Shetland.

9.3.6 The CHISA is currently rough grazing, upland moorland. Historic maps would suggest that this land has been moorland from at least the post-medieval period.

Future Baseline

9.3.7 Future baseline (without the proposed development) would be expected to mirror the current baseline. There are no recorded cultural heritage assets within the CHISA and this would remain the case if no development occurred. Potential changes to the baseline would be the continued gradual growth of peat deposits or the degradation of peat deposits from weathering or peat

cutting. As a result, the current baseline is taken as a basis for the effects assessment presented here.

Identified Sensitive Receptors

9.3.8 There are no designated cultural heritage assets (scheduled monuments, listed buildings, inventory battlefields, inventory gardens and designed landscapes or conservation areas) within the Study Areas.

9.3.9 No undesignated cultural heritage assets have been recorded within the CHISA in the HER; nor were any upstanding cultural heritage assets identified during the walkover survey.

9.3.10 The HER does not record any undesignated cultural heritage assets in the CHOSA in the area immediately surrounding the CHISA which may have extended into the CHISA.

Archaeological Potential

9.3.11 The archaeological potential of the CHISA relates to the potential for the peat to contain environmental evidence. The environmental evidence contained within the peat would increase the knowledge of past environments on Shetland; as the CHISA is not in close proximity to any known cultural heritage assets any environmental evidence would not inform the knowledge of a particular asset.

9.3.12 There is also potential that the peat will mask previously unrecorded cultural heritage assets within the CHISA. The inland and relatively upland nature of the CHISA suggests that this would not have been an attractive area for habitation or agriculture within Shetland. The distribution of known cultural heritage assets in Shetland demonstrate a preference for coastal locations with visibility of the coast and lower coastal and valley locations.

9.3.13 It is therefore considered that there is low potential for previously unrecorded cultural heritage assets to survive subsurface within the CHISA.

9.4 Assessment of Effects

9.4.1 Any planned construction works that involve ground disturbance can result in physical impacts on known assets or buried archaeology. Groundworks will include cut and fill operations associated with the formation of the construction compound and access track.

Construction Effects

9.4.2 There are no previously recorded cultural heritage assets within the CHISA or in the neighbouring areas of the CHOSA. Therefore, no construction impacts on known cultural heritage assets will occur.

9.4.3 Impact significance cannot be meaningfully assessed for unknown assets as neither the sensitivity of the receptor nor the magnitude of effect is known. Consequently, only the likelihood of construction impact is considered here.

9.4.4 The potential for previously unrecorded assets to lie within the construction footprint and vulnerable to being affected by groundworks is considered to be low.

Operational Effects

9.4.5 No operational effects have been identified.

Cumulative Effects

9.4.6 The cumulative effects of the proposed development with the development of the Viking Wind Farm have been considered.

9.4.7 No cumulative construction impacts are predicted for known cultural heritage assets from the combination of the proposed development and the Viking Wind Farm. Furthermore, due to the nature of previously unrecorded cultural heritage assets likely to be found in this area, it is considered that there is no potential for cumulative construction impacts on previously unrecorded cultural heritage assets.

9.4.8 As there will be no operational impacts on cultural heritage assets as a result of the proposed development there is no potential for cumulative operational impacts to arise.

9.5 Mitigation

9.5.1 Any construction effects upon previously unrecorded cultural heritage assets will be mitigated through a programme of archaeological works to be agreed with the Shetland Regional Archaeological Service. This is likely to include the provision of a contractors' guide-lines document and a 'tool-box talk' which will be produced as part of the mitigation for the Viking Wind Farm and will inform the contractors of what to look out for and who to contact if any potential anomalies are identified. A professional archaeologist will be available to check any anomalies and carry out further archaeological works as appropriate.

9.5.2 No impacts have been identified on known cultural heritage assets therefore no further mitigation is proposed.

9.6 Residual Effects

9.6.1 No construction or operational impacts on known cultural heritage assets are predicted; therefore, there will be no residual effects on known cultural heritage assets.

9.6.2 Impacts on currently unrecorded subsurface archaeological remains may occur during the construction phase. The programme of archaeological works would identify any significant unrecorded remains and allow for effects upon them to be mitigated by avoidance and preservation in situ where possible, or otherwise by excavation and recording. Any adverse effect on an asset's archaeological interest, due to the loss of in situ archaeological remains, would be offset to some extent by the beneficial effect on its archaeological interest due to the increase in understanding resulting from archaeological investigation. The risk of significant effects on unrecorded archaeological remains is judged to be low; however, the overall residual effect taking into account mitigation, is highly unlikely to be more than minor and adverse and therefore not significant.

9.6.3 Following mitigation, the residual impact on the environmental data contained in the peat is unlikely to be more than of negligible adverse significance. The programme of archaeological works would add to the environmental data record for Shetland.

9.7 Summary and Conclusions

9.7.1 Potential effects of the proposed Main Construction Compound upon cultural heritage assets resulting from its construction operation and cumulative effects have been considered.

9.7.2 No construction effects on known cultural heritage assets are predicted.

9.7.3 There is low potential for the construction phase to impact on previously unrecorded cultural heritage asset in the CHISA. A programme of archaeological works will be agreed with the Shetland Regional Archaeological Service to mitigate such effects through preservation by record.

9.7.4 No operational effects on cultural heritage assets were identified.

9.7.5 No cumulative effects on cultural heritage assets were identified.

List of Figures

9.8 References

Viking Wind Farm Archaeology and cultural heritage chapter, Environmental Statement (2009)

Viking Wind Farm Archaeology and cultural heritage chapter, Environmental Statement Addendum (2010)

Glossary and Abbreviations

Glossary	
Term	**Definition**
Scheduled Monuments	A scheduled monument is a nationally historic building or site that is included in the Schedule of Monuments kept by Historic Environment Scotland. The particular significance needed to define the monument as of 'national' importance may be established in terms of one or more of the following: a) It contributes significantly to our understanding or appreciation of the past or has the potential to do so. It may do so in itself, or as part of a monument type, or as a geographical group of related monuments. b) It retains structural, architectural, decorative or other physical remains to the extent that it makes a significant contribution to our understanding or appreciation of the past. The remains can be upstanding fabric, evidence of buried archaeological structures and deposits, scatters of artefacts or a combination of these. c) It is a rare example of a monument type when assessed against current knowledge of Scotland's history, archaeology and/or architecture, and of the region in which the monument is found. d)It is a particularly representative example of a monument type when assessed against knowledge of Scotland's history, archaeology and/or architecture and of the region in which the monument is found. e) It has research potential which could significantly contribute to our understanding or appreciation of the past. f) It makes a significant contribution to the landscape and/or our understanding of the historic landscape. This may include the relationship of the monument to other monuments or natural features in the landscape, and/or the significance of its setting in understanding the monument or the monument type. g) It has significant associations with historical, traditional, social or artistic figures, events, movements and/or practices that are of national importance. (DPSG, 2019 Annex 1).
Category A listed building	Buildings of special architectural or historic interest which are outstanding examples of a particular period, style or building type (DPSG, 2019 Annex 2).
Category B listed building	Buildings of special architectural or historic interest which are major examples of a particular period, style or building type (DPSG, 2019 Annex 2).
Category C listed building	Buildings of special architectural or historic interest which are representative examples of a particular period, style or building type (DPSG, 2019 Annex 2).
Inventory Gardens and Designed Landscapes	The inventory includes gardens and designed landscapes of national importance. Sites are assessed for their: a. Artistic interest; b. historic interest; c. horticultural interest; d. architectural interest; e. archaeological interest; f. scenic interest; and g. nature conservation interest (DPSG, 2019 Annex 3).
World Heritage Sites	World Heritage Sites are cultural and/or natural sites considered to be of 'Outstanding Universal Value', which have been inscribed on the World Heritage List by the World Heritage Committee. (ICOMOS 2017).

Abbreviations	
Abbreviation	**Description**
CHISA	Cultural Heritage Inner Study Area
CHOSA	Cultural Heritage Outer Study Area
CIfA	Chartered Institute for Archaeologists
DPSG	Designation Policy and Selection Guidance
HER	Historic Environment Record
HES	Historic Environment Scotland
NCAP	National Collection of Aerial Photography
NRHE	National Record of the Historic Environment
SMR	Sites and Monuments Record
SNH	Scottish Natural Heritage
SPP	Scottish Planning Policy

10. SCHEDULE OF MITIGATION

10.1 Introduction

10.1.1 The purpose of this chapter is to summarise the mitigation measures proposed for the proposed development in each of the technical chapters to avoid, reduce, or offset the impacts which would otherwise give rise to significant residual environmental effects.

10.1.2 The main aim of the design process was to 'design out' potential for environmental effects as far as possible. This chapter does not summarise 'mitigation by design'.

10.2 Summary of Mitigation and Residual Effects

10.2.1 The predicted effects and mitigation measures have been compiled into Table 10.1. They are presented in the order in which they appear within this ES.

- Chapter 4 - Landscape and Visual Amenity;
- Chapter 5 - Ornithology;
- Chapter 6 - Noise;
- Chapter 7 - Ecology;
- Chapter 8 - Hydrology;
- Chapter 9 - Cultural Heritage and Archaeology;

Table 10.1: Summary of Mitigation and Residual Effects				
Topic	**Potential Likely Significant Effect (without mitigation)**	**Mitigation Measures**	**Effect**	**Residual Effect**
Chapter 4 - Landscape and Visual Amenity	**Formation of the Compound** Key landscape and visual impacts would be associated with the following activities and elements and are likely to be of approximately 6 month's duration, and therefore short-term: • Stripping of surface vegetation and temporary storage of any peat turves for later reinstatement of the decommissioned site; • Excavation and formation of uncharacteristically steep cut/tipped batters and consequent interruption of the gently sloping horizon; • temporary stockpiling of peat for backfilling of site during decommissioning works; • Excavation of cut-off ditches • Construction of temporary surfacing within the proposed development and access track; • Erection of site buildings and associate structures; and • Erection of security lighting.	**Formation of the Compound** A number of measures have been incorporated into the proposals that are intended to reduce potential landscape and visual impacts associated with this phase of the development. These include: • adoption of cut and fill to achieve a near balance of material at the site and the reduction of the amount of spoil requiring transportation and stockpiling; • avoidance, wherever possible of positioning perimeter fencing on elevated slopes that have potential to skyline the fencing in views from low lying receptor locations nearby; • preferential use of characteristic post and wire fencing as opposed to a more industrial character of fencing; • Use of darker muted colours for fencing so that it appears recessive when backclothed; • Establishment of a fenced construction site to restrict the working area and avoid incursion by plant, vehicles or materials into adjoining areas, thereby limiting the extent of disturbance associated with this phase of the development; • Concurrent construction and reinstatement works to minimise the amount of the site that is subject to disturbance at any one time and provide for its rapid "greening" to reduce the prominence of the site in views from adjoining receptor locations; • Reinstatement of disturbed ground around the proposed development and greening of the cut and formed batters with a medium-term moorland grass cover to reduce the visibility and prominence of these aspects of the site; • Formation of chamfered edges/sealed and vegetated edges to peatland abutting the excavation to avoid forming unsightly exposed peat edges that would be liable to drying with consequent changes to characteristic vegetation around the excavation edges; and	Reduce the level of significance	The LVIA which indicates that temporary significant effects, including some significant cumulative effects would be experienced from locations within the valley, but these would be located in close proximity to the proposed development and would be short to medium-term in duration and reversible. On this basis, the overall effect on the landscape and visual resource of the area is

Table 10.1: Summary of Mitigation and Residual Effects				
		• Adherence to agreed working times and adoption, as far as practicable, of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting.		not considered significant.
	Operational Compound Impact generators associated with the operational life of the proposed development would have a duration of around 5 years, and would include: • Potentially uncharacteristically steep excavated slopes and 'batters and interruption of the gently graded skyline; • Site surfacing and access track; • temporary offices and welfare facilities (including some 2 storey buildings with a maximum height of 7 m above ground level); • plant and car parking; • general material laydown/storage, including peat/peat turf storage; • waste management areas; • fuel storage and refuelling facilities; • temporary generation equipment and fuel storage; • use of uncharacteristic perimeter fencing; • general security lighting (designed to meeting good practice guidance on avoiding intrusive lighting); and • wheel wash facilities.	**Operational Compound** The position of the proposed development was selected, in part, to be low lying and to take advantage of the enclosure provided by the natural folds in the topography, thereby minimising its visibility from neighbouring receptor locations. The proposed development would be placed within an excavation thereby further reducing its visibility. In order to mitigate potential effects on the natural topography of the area, the adoption of less regular and slacker slopes is proposed that will avoid the appearance of uncharacteristic engineered slopes. Despite the enclosed position of the proposed development, it is possible that site buildings, which would form some of the tallest elements in the proposed development, are positioned at the eastern side of the proposed development, thereby avoiding skylining these elements in views from the A970 carriageway and adjoining landscape to the west. The colour selected for site buildings and structures will be selected according to whether they are skylined or backclothed by topography, skylined features being rendered with a pale grey, whilst backclothed elements would be rendered in a dark muted colour that would blend into the background. The adherence to agreed working times and adoption of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting both internal and external to offices and welfare buildings is also proposed in order to reduce potential impacts on the landscape and the amenity of receptors nearby at night. The continued management and upkeep of any reinstated land and landscaping is proposed in order to ensure the successful establishment of temporary grasslands, thereby reducing the impact of cut and formed slopes.	Reduce the level of significance	

Table 10.1: Summary of Mitigation and Residual Effects				
		The adoption of a tidy-site policy and management processes would ensure that the proposed development is kept in good order and does not deteriorate in condition or appearance.		
	Decommissioning of the Compound Key landscape and visual impacts would last for around 6 months, and would be associated with the following activities and elements: • Removal of all site structures and surfacing; • Backfilling of excavation and grading to existing levels utilising previously stockpiled spoil; • Placement of previously stockpiled peat and peat turves; • Infilling and reinstatement of cut-off ditches; and • Removal of site access track and any perimeter fencing; • Operation of site plant and security lighting.	**Decommissioning of the Compound** The level of impacts and effects occurring during the decommissioning of the site is anticipated to mirror that of its construction. In order to minimise potential effects during this phase of the proposed development, the following measures are proposed: • Concurrent demolition and removal of all of the proposed development features and elements, and backfilling/regrading of the proposed development and reinstatement works to minimise the amount of the site that is subject to disturbance at any one time and provide for its rapid "greening" and assimilation back into the wider landscape; • Ongoing management, maintenance of the reinstated compound and rectification/remediation of any defects or failures in landscaping works; and • Adherence to agree working times and adoption, as far as practicable, of the guidance in the Institute of Lighting Professionals 2011 Guidance Notes for the Reduction of Obtrusive Light (Ref. GN01:2011) in respect of fixed and mobile lighting.	Reduce the level of significance	
Chapter 5 - Ornithology	No Significant effects predicted	The EIA assessment predicts no significant effects and consequently no mitigation is required. The construction of the proposed development is planned to take place outside the bird breeding season, and therefore construction will not disturb breeding birds. However, in the unlikely event that construction phase overlaps the bird breeding season, then ahead of construction work starting, the development site buffered to 500m would be surveyed for breeding bird species. If this survey work finds species listed on Schedule 1 of the Wildlife and Countryside Act breeding sufficiently close to the development site that they could be disturbed by construction activity, the developer will instigate measures to prevent disturbance of the breeding site.	N/A	No significant residual effects predicted

Table 10.1: Summary of Mitigation and Residual Effects				
		In keeping with best practise, the developer will undertake construction work in ways that minimises damage to the peatland habitats surrounding the development site. Surrounding ground that is disturbed during construction (for example along access track verges) will be reinstated such that the natural vegetation is allowed to recover.		
Chapter 6 - Noise	Comparison of the predicted levels against the BS5228 Threshold Values for the closest NSRs across each of the modelled scenarios indicates that construction noise impacts are Not Significant. No cumulative significant effects are predicted.	No significant effects are predicted and consequently no mitigation is required. Notwithstanding the above, a number of best practice measures could be employed, as detailed within BS5228, which would help to minimise noise output and reduce noise effects from the proposed development. Examples of these are: • keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; • ensure that haulage vehicles would not arrive at or leave the site between 19.00 and 07.00 hours; • ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and 'smart' reversing alarms and be subject to programmed maintenance; • select inherently quiet plant where appropriate - all major compressors, pumps and generators would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use; • ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers; • instruct that machines would be shut down between work periods or throttled down to a minimum; • ensure regular maintenance of all equipment used on site, including maintenance related to noise emissions; • ensure that vehicles are loaded carefully to ensure minimal drop heights so as to minimise noise during these operations; and	N/A	No significant residual effects are predicted.

Table 10.1: Summary of Mitigation and Residual Effects				
		• ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.		
Chapter 7 - Ecology	**Effects on Sandwater SSSI** The impact magnitude of water pollution and dust into Sandwater SSSI during both compound construction and operation are both assessed as a maximum of Low. The effects would be likely to be of short-duration and while some habitat damage is possible there would not be likely to be any long-term/permanent harm to the SSSI. Due to the national importance of the SSSI, and its sensitivity, this would result in an effects significance of Moderate Adverse. **Effects of Vegetation** The effects of this vegetation loss are at least long-term (20 years+) and could be permanent. This would be likely to result in an effect significance of Negligible for the loss of the M17b community within the proposed development and an effect significance of between Moderate and Minor Adverse for the loss of the M19b community within the proposed development. Therefore, prior to the consideration of mitigation, the loss of the M19b vegetation would be considered significant under the EIA Regulations. **Cumulative Effects**	Best practice construction and operational environmental measures are assumed to occur to minimise all ecological/environmental impacts as much as possible and this will be managed through the Viking Energy Wind Farm Construction Environment Management Plan (CEMP), which the main contractor will be required to fully implement. There will also be a full-time Ecological/Environmental Clerk of Works (ECoW) working through Viking Energy who is independent and will be supervising all works. **Minimising the Risks of Pollution and Sedimentation** The Sandwater SSSI downhill from the proposed development will be treated, at all times, as being extremely sensitive to all forms of pollution. As well as the use of all applicable best practice techniques for the control of water on site, the CEMP and associated Construction Site Licence Pollution Prevention Plan (CSL PPP) will be fully adopted for all construction and initial operational works to ensure that water quality within and leaving the construction area is maintained. To control pollution and sedimentation risk as far as is possible, all water related issues will be mitigated at source, where they occur, within the proposed development. This is likely to include the use of constructed lagoons within the proposed development site to maximise sediment deposition and allow for temporary water storage. Everything possible will be done to ensure that water is of acceptable quality before it is allowed to leave the site using the latest best practice methods (e.g. the use of oil interceptors and impermeable hard stands for all generator and fuel supply areas and the use of adequate sized lagoons and controlled safe vegetation spread for dirty water). The control of dust on sites is straightforward but requires contractor commitment and is undertaken by damping down roads and parking areas regularly. The key to controlling dust is that during dry weather, normally in the summer/autumn and particularly if it is windy, damping down must be repeated at regular intervals during times when traffic is moving around. While this is standard good practice, it is important that sufficient plant and operators are tasked with this at short notice and again, every effort will be made to implement this for the proposed development. As well as	Reduced level of significance.	No significant residual effects are predicted.

Table 10.1: Summary of Mitigation and Residual Effects				
	Potential cumulative significant effects area also predicted for the above.	implementing such practices fully, the CEMP will help to ensure that regular monitoring occurs within the proposed development area to deal with any new issues which occur promptly and adequately. Previous experience has indicated that full implementation on site of a detailed CEMP helps to ensure that direct and indirect significant water pollution, sedimentation and dust impacts are avoided. **Construction Monitoring** During construction, continuous monitoring of the site and its immediate surroundings will take place. To ensure the full implementation of appropriate mitigation measures and monitoring requirements, an ECoW will be present on the site for the pre-construction, construction and restoration phase of the proposed development. The ECoW will monitor the EIA Report/CEMP compliance of all the proposed mitigation measures for ecology and environment. In addition to this, there is a specific Water Quality Management Plan (WQMP) for the construction of the Viking Energy Wind Farm. This regular water monitoring includes the Sandwater SSSI. Specifically, there are four sampling points detailed for Sandwater. Diatoms will be monitored, as well as hydrochemistry for the Sandwater SSSI. These monitoring points will be sampled and tested once a month pre and during construction of the wind farm (this monitoring for baseline conditions has already started), which will include for the proposed development. This will allow measures such as pH, conductivity, turbidity and alkalinity to be tested regularly, as well as other chemical parameters and will allow cumulative effects, as well as single pollution sources to be monitored. In addition, the ECoW can also test a more limited range of chemical determinants on an ad-hoc field sampling basis; these parameters include pH, conductivity and turbidity. **Habitat Reinstatement** Best practice techniques for vegetation and habitat reinstatement will be adopted and implemented in all areas of disturbed vegetation within the proposed main construction compound. Where vegetation is to be removed all vegetation turves will be carefully stripped and stored outside of the construction area and outside of any peat storage areas. Turves will be removed first in areas being used for peat and turf storage. This will be undertaken prior to any additional vehicle tracking across all such areas of		

Table 10.1: Summary of Mitigation and Residual Effects				
		vegetation. It is likely that peat and turf storage will be required for up to 5 years and it is fully acknowledged that storage for this length of time will lead to degradation. Where possible, turves will be re-used locally within this period to save long-term storage e.g. for track edges. However, even if some vegetation dies and fresh colonisation is required, it will still provide an important fibrous protection to restored peat. Seeding (with an agreed seed mix) will also be used as necessary into the restored turf and peat. Similarly, surface peat (acrotelm) will be stored separately from deep peat (catotelm) and the two layers will be restored in the order they were excavated to try to ensure that surface peat is returned on top of deep peat. The depths to be excavated of different types of peat will be determined by the ECoW, depending on local circumstances, and agreed with the main contractor prior to the start of all stripping operations. All peat stripped for the main construction compound will be returned to ensure that similar depths of peat are restored to that present originally, with the underlying contours being replicated as closely as possible. Early reinstatement of disturbed areas will be undertaken where possible to minimise the effects of peat storage and maximise the success of turf reinstatement, should areas not be required for the whole operational period. Any seed that is necessary for reinstatement will be fully agreed with the ECoW prior to any use within the site. All reinstatement techniques, appropriate to the proposed development, will be detailed in the CEMP, and will all be implemented in consultation with the ECoW. **Habitat Compensation** There will be a loss of blanket bog habitat, at least into the longer-term, within the proposed main construction compound boundary in relation to the Proposed Development. The loss of up to 2.26ha of M19b - Calluna vulgaris-Eriophorum vaginatum blanket mire, Empetrum nigrum ssp. nigrum sub-community has been judged to be significant under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. Therefore, mitigation or compensation should be undertaken to minimise the level of this impact. A Habitat Management Plan, including for a blanket bog enhancement scheme, has been committed to for the main wind farm and includes for 260ha of damaged bog enhancement. This area is greater than the		

Table 10.1: Summary of Mitigation and Residual Effects				
		combination of the replacement areas required for all the wind farm's related infrastructure, including for the additional planning application areas. Over time, this enhancement of existing degraded bog habitat will aim to return it to actively accreting bog with the diversity of micro-habitats/plant communities that would support. This also provides compensation for the vegetation cumulative impacts reported in this assessment as well as the more intact M19b habitat within the proposed main construction compound.		
Chapter 8 - Hydrology	**Potential Effects on Surface Water Runoff and Water Quality** • major adverse and significant effect as a result of potential increases in downstream sediment loads; and • major adverse and significant effects as a result of chemical pollution.	Design principles outlined in the Construction Environmental Management Plan (CEMP) and the wind farm's Construction Site Licence, Pollution Prevention Plan (CSL PPP) will be implemented by the contractor in accordance with the relevant best practice guidance on pollution prevention and mitigation, namely SEPA's Guidance for Pollution Prevention. Mitigation detailed below draws on best practice as outlined in the CEMP and CSL PPP being prepared for the consented Viking Energy Wind Farm and incorporates specific best guidance practice. Key mitigation measures to be put in place are summarised below. **Mitigation of Potential increases in Downstream Sediment Loads** During construction works areas of soil may be exposed at the site of the construction compounds and substation / control building construction footprints. Clean up-slope run off and run off from the exposed construction area will be kept separate and appropriate silt mitigation measures will be deployed. Clean runoff (i.e. non-silty surface water flow, including that which has not passed over any disturbed construction areas) would be kept separate from potentially contaminated water from construction areas as afar as possible. Where required, interceptor ditches and other drainage diversion measures would be installed immediately in advance of any excavation works in order to collect and divert clean runoff away from construction disturbed areas. Silt laden runoff will be captured and directed via berms or ditches towards specially constructed sediment control structures. Sediment control structures may comprise a series of settlement ponds with additional incorporated filtration measures where required. The number, location and dimensions of settlement ponds, plus requirements for flow attenuation measures will	Reduced level of significance.	No significant residual effects are predicted.

Table 10.1: Summary of Mitigation and Residual Effects				
		depend on the volume of water requiring treatment, silt load characteristics, topography and access constraints to be defined in detail by the contractor. Drains will be constructed to a gradient of less than 2˚ where possible in order to slow flows, prevent erosion of the drain base and sides, and encourage establishment of terrestrial and aquatic vegetation where possible. Where this is not possible, sufficient flow attenuation measures will be installed. The width and depth of constructed drainage channels will be minimised as far as practical in order to reduce ground disturbance, excavation footprint (and hence volume of excavated materials) and also disruption of local hydrology as far as possible. Check dams or silt traps will be installed at regular intervals within any clean water or dirty water cut off ditches to slow flow velocities allowing the settlement of coarser sediment and the prevention of scouring. The number and location of check dams will be dependent on the slope, flow and volume of water and arranged such that the top of the downhill check dam will be at the same level as the bottom of the uphill. **Mitigation of Potential Chemical Pollution** With respect to potential impacts from the release of pollutants (including the release of silt, sediments and soil) to the water environment, the CEMP and CSL PPP includes the following controls: • Precautions will be taken to ensure the protection of watercourses and groundwater against pollution, silting and erosion during Watercourse Crossing construction operations. • Any material or substance which could cause pollution, including silty water, will be prevented from entering surface water drains or watercourses by the propitious use of and appropriate placement of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. • Any silty water generated on site will be settled out as much as possible through drainage mitigation measures (silt traps etc) and channelled into vegetated areas 50m (unless otherwise agreed with the ECoW) from watercourses to allow the settlement of solids.		

Table 10.1: Summary of Mitigation and Residual Effects				
		• Unless otherwise agreed with the ECoW, all refuelling will be carried out in designated locations, 50 metres away from water courses. Irrespective of the buffer distance and location of refuelling, drip trays and spill kits will be available in accordance with standard best practice across the construction industry. This is achieved for generators and bulk fuel tanks through a proposed central location on the Main Construction Compound. • Unless otherwise agreed with the ECoW, areas of waste, oil / fuel / chemical storage and permanent refuelling will be located 50m from watercourses or drainage paths. Such storage areas will be appropriately sited to prevent the downward percolation of contaminants to natural soils and groundwater. • Fuel, oils and chemicals will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity. • Site compounds, parking areas and turning areas and vehicle and equipment washing areas are to be sited at least 50m from water courses. • All waste and stockpiled materials will be stored in designated areas and isolated from any surface drains and a minimum of 50 metres away from watercourses, although where this is not possible, a suitable location shall be agreed with the ECoW. • The use of cut-off ditches, silt fences, silt traps and drainage to vegetated areas will be employed as required / appropriate in areas of excavation, exposed soils, stockpiling, dewatering and plant and wheel washing. • A Personnel Site Induction will make specific reference to required pollution prevention measures. • All works will be carried out in accordance with best practice and will aim to prevent deterioration in the ecological status of surface waters and to avoid compromising the restoration potential of such waters. • In the event of a pollutant spillage on site, the material will be contained (using an absorbent material such as sand or soil or commercially available booms) and, where significant or affecting a watercourse, SEPA notified immediately using the emergency hotline number (0800 80 70 60).		

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		In addition, it is recommended that best practice is followed where concrete and cement are used in construction or where materials are stored. Fresh concrete and cement is highly alkaline and corrosive, and can be lethal to aquatic life. The use of wet concrete in and around watercourses will be minimised and carefully controlled.		
Chapter 9 - Cultural Heritage and Archaeology	No construction or operational impacts on known cultural heritage assets are predicted.	• Any construction effects upon previously unrecorded cultural heritage assets will be mitigated through a programme of archaeological works to be agreed with the Shetland Regional Archaeological Service. This is likely to include the provision of a contractors' guide-lines document and a 'tool-box talk' which will be produced as part of the mitigation for the Viking Wind Farm and will inform the contractors of what to look out for and who to contact if any potential anomalies are identified. A professional archaeologist will be available to check any anomalies and carry out further archaeological works as appropriate. • No impacts have been identified on known cultural heritage assets therefore no further mitigation is proposed.	N/A	No significant residual effects are predicted.

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