10. ECOLOGY

10.1 INTRODUCTION

This chapter reports the assessment of the ecological effects of the proposed 150 turbine Viking Wind Farm development on Mainland, Shetland. The scope of the ecological assessment includes habitats, flora and fauna but excludes potential effects on birds, which are considered separately in Chapter 11.

Supporting data are found in the following appendices:

Appendix 10.1 Phase 1 habitat survey report and target notes;

Appendix 10.2 National Vegetation Classification report and survey record sheets;

Appendix 10.3 Rare plants survey;

Appendix 10.4 Otter survey (confidential - restricted distribution);

Appendix 10.5 Freshwater pearl mussel survey;

Appendix 10.6 Fish survey;

Appendix 10.7 Freshwater macro-invertebrate survey;

Appendix 10.8 Qualifications and experience of individuals contributing to the Ecology Chapter;

Appendix 10.9 Summary Viking Habitat Management Plan; and

Appendix 10.10 Summary of scoping responses relating to non-avian ecology.

The ecological surveys were carried out by Aquaterra Ecology, BMT Cordah Ltd, Celtic Environment Ltd, EnviroCentre Ltd, Highland Ecology and Waterside Ecology. The qualifications and experience of all those involved in surveying and producing the technical reports, upon which this chapter is based, are provided in Appendix 10.8.

Commonly used acronyms are bracketed after the first instance of full words and are then used normally in the text from that point onwards. Technical terms, not commonly used by the general public, are defined when used.

10.2 SCOPE OF ASSESSMENT

10.2.1 Study area

The ecological study area considered in the desk and field surveys encompasses the section 36 application boundary which is approximately 18,700ha (corresponding to the Phase 1 habitat area Figures 10.02-10.06). Of this overall area the proposed development will occupy only approximately 314ha, which is approximately 1.68% of the planning application area. This figure is based on the calculation of: 10m wide strips for single access/construction tracks (which will be about 6m wide when finished); 16m wide strips for double tracks (which will be about 12m wide when finished); borrow pits and laydown areas with buffers of 5m around them; and a standard allowance of 0.2ha per turbine (which

allows space both for the foundations and for the crane pad). The buffers allow for temporary ground disturbance during construction. The final area occupied by the development is in fact likely to be smaller than stated here, because this figure allows for the whole of the borrow pits "areas of search", only some of which will ultimately be excavated.

The 18,700ha study area can be divided into four quadrants: Delting, Collafirth, Kergord and Nesting (see Figure 1.1 in Volume 3) and these distinct geographical areas form the basis of the ecological assessments described in this chapter. The following numbers of turbines are proposed for the four quadrants: Delting 33 turbines, Collafirth 8 turbines, Kergord 47 turbines and Nesting 62 turbines, giving a total of 150. The total length of access tracks across the site is ca. 118km. A total of 97 stream crossings are planned for the four quadrants: 31 in Delting (3 of which already exist); 11 in Collafirth; 29 in Kergord (2 of which already exist) and 26 in Nesting (1 of which exists).

Terms of reference

The term 'receptor' is used commonly throughout the EIA process and is usually defined as an element in the environment affected by a development (e.g. a species or habitat). The term 'impact' is used commonly throughout the EIA process and is usually defined as a change experienced by a receptor (this can be positive, neutral or negative). The term 'effect' is used commonly throughout the EIA process and is usually defined as the consequences for the receptor of an impact.

10.2.2 Scoping and consultation

Scoping consultation was carried out for the Collafirth and Nesting quadrants in May 2004. The proposals for the Delting and Kergord quadrants did not undergo formal scoping at this time. In September 2005, prior to undertaking the field work, a scoping consultation meeting for the Delting and Kergord quadrants was held with Scottish Natural Heritage (SNH). This clarified the nature of the project and ensured that the proposed survey methods were suitable and appropriate. A summary of the scoping responses relating to non-avian ecology are given in Appendix 10.10 and a copy of full scoping responses is given at Appendix 5.1.

Given the close proximity and similarities of the two areas, the majority of the scoping responses received for the Collafirth and Nesting quadrants are considered relevant to the whole site. Additional consultations were subsequently held with SNH regarding the following potential receptors: rare Shetland plants and vegetation, otter and freshwater pearl mussel surveys.

A major part of the scoping process for the ecological impact assessment (EcIA) involved consultation with statutory and non-statutory bodies. The consultees that responded on nature conservation/ecology issues are listed below:

- Royal Society for the Protection of Birds (RSPB);
- Scottish Government (SG);
- Scottish Environment Protection Agency (SEPA);
- Shetland Anglers Association (SAA);
- Shetland Biological Records Centre (SBRC), data provision only;
- Shetland Islands Council (SIC); and
- Scottish Natural Heritage (SNH).

In January 2008, BMT Cordah on behalf of the Viking Energy Partnership issued a Scoping Report to Scottish Ministers and a formal scoping opinion was received in April 2008. All the non-avian ecology issues raised during scoping are addressed in this chapter.

10.2.3 Impacts to be assessed

The main construction and operational elements of the proposed Viking Wind Farm scheme which have the potential to impact on non-avian ecological receptors both during construction and operation are listed below:

- 150 turbines;
- Turbine foundations;
- Transformers;
- On-site cabling;
- Control/maintenance buildings;
- Substations;
- Grid connection infrastructure (subject to separate planning application & EIA);
- Temporary and permanent anemometers;
- Access tracks;
- Watercourse crossings;
- Borrow pits;
- Mobile plant operations/traffic;
- Crane hardstandings; and
- Construction compounds and lay-down areas.

A summary of the potential construction and operational impacts on ecology identified at scoping is outlined in Tables 10.1 and 10.2.

Impacts arising from the process of decommissioning have been scoped out of this assessment for two main reasons. Firstly, they are of a similar nature to construction issues, but of a smaller scale, shorter duration and will likely take place on hardened surfaces, avoiding semi-natural habitats; and secondly, the tools available and best practice guidance for decommissioning in 25 years time may be different to those now available. Consequently, issues pertaining to ecological impacts of decommissioning based on current best practice guidance will likely be superseded by best practice guidance available in the future.

The aim of ecological advice for decommissioning should be to ensure that up to date, best practice guidance of a high standard forms part of any decommissioning plan and that any plan is agreed with the relevant competent authorities and stakeholders before decommissioning takes place. General decommissioning plans are considered within Chapter 4 - Development Description.

Table 10.1 Potential Construction Impacts on Ecology

Activity	Potential impact	Nature	Duration	Permanence	Extent	Certainty	Frequency	Likelihood of significant impact
Mobile plant operations (e.g. cranes, excavators etc.) & traffic	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance & habitat fragmentation. Pollution & sediment release into water courses.	Adverse	Short-term to long-term	Temporary to permanent	Throughout development footprint area	Certain	Frequent	Likely
Borrow pit operations	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance & habitat loss & fragmentation. Pollution and sediment release into water courses.	Adverse	Short to medium term	Temporary and Permanent effects	Localised	Certain	Frequent	Likely
Tracks & stream crossings	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance & habitat loss & fragmentation. Pollution & sediment release into water courses. Changes in hydrology & chemistry leading to vegetation changes.	Adverse	Short-term	Permanent	Localised	Certain	Frequent	Possible
Cable laying	Direct habitat loss. Temporary noise. Vibration, movement, vegetation disturbance & habitat loss & fragmentation. Pollution & sediment release into water courses. Introduction of lines of drainage leading to habitat changes.	Adverse	Short-term	Permanent / temporary & reversible over medium term	Localised	Certain	Frequent	Likely
Construction compounds & lay-down areas	Direct habitat loss. Temporary overlaying vegetation habitat loss, disturbance & fragmentation. Pollution & sediment release into water courses.	Adverse	Short-term	Reversible over the medium term.	Localised	Certain	Continuous	Possible

Table 10.2 Potential Operational Impacts on Ecology (*in combination these effects could be significant)

Activity	Potential impact	Nature	Duration	Permanence	Extent	Certainty	Frequency	Likelihood of significant impact
Turbines in operation	Noise & movement	Adverse	Long-term	Reversible	Widespread	Certain	Frequent	Unlikely
Foundations	Habitat loss & impacts on peat hydrology; changes in vegetation.	Adverse	Long-term	Permanent	Localised	Certain	Continuous	Possible*

Tracks	Direct habitat loss, severance and fragmentation or overlaying of habitat & impacts on peat hydrology. Sediment release into water courses. Run off chemistry- potential changes to vegetation. Edge effects. Loss of life.	Adverse	Long-term	Permanent	Widespread	Certain	Continuous	Possible*
Recreation i.e. unauthorized recreational use of tracks	Disturbance through noise and trampling e.g. motorbikes, walking, dogs etc. Litter. Loss of life.	Adverse	Long-term	Reversible	Localised along tracks	Uncertain	Occasional	Unlikely
Cables	None	Neutral	Long-term	Reversible	Existing roads	Certain	Continuous	Unlikely
Anemometers	None or alteration of habitat	Adverse	Long-term	Reversible	Very localised	Uncertain	Unknown	Possible*
Sub-stations	Removal or loss of habitat	Adverse	Long-term	Reversible	Very localised	Certain	Continuous	Possible*
Borrow pits	Changes to habitat	Adverse or Beneficial	Long-term	Permanent	Localised	Certain	Continuous	Possible*
Road improvements	Disturbance and other unknown	Adverse	Long-term	Unknown	Localised	Uncertain	Unknown	Possible
Crane pads & lay-down areas	Habitat loss or damage	Adverse	Long-term	Permanent or Reversible	Localised	Certain	Continuous	Possible*

10.3 POLICY AND LEGISLATIVE CONTEXT

The assessment of effects on ecological receptors in this chapter (made under The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000) is considered in the context of relevant policies and guidance outlined in Table 10.3. The relevant legislation includes the Wildlife and Countryside Act 1981 (and subsequent amendments); the Conservation (Natural Habitats, etc.) Regulations 1994; and the Nature Conservation (Scotland) Act 2004.

Table 10.3 Relevant natural heritage policies and guidance

Document	Source	Context
Structure Plan 2000	SIC	Natural heritage policies relevant to renewable energy development include: Policies SP NE4-NE8 covering nature conservation & biodiversity; Policy SP NE4 covering protection of international designated sites; Policy SP NE5 encouraging management of features of the landscape important for wild flora & fauna; Policy SP NE6 covering protection of national designated sites; Policy SP NE7 covering protection of habitats & species of interest at an international, national & local level; and Policy SP NE8 covering protection of locally important sites.
Local Plan 2004	SIC	The Local Plan seeks to promote sustainable development, & to ensure the conservation of the most important areas of the natural environment. The Plan takes a hierarchical approach to providing appropriate protection of designated sites. Several policies within the Plan support these overall aims: Policy LP NE10 covers impacts of applications for planning permission on the environment; Policy LP NE13 covers delivery & implementation of the LBAP; and Policy LP NE16 covers the protection of trees, groups of trees & areas of woodland. Policy LP ENG8 directs that commercial generation of power from renewable energy proposals adjacent to internationally or nationally protected sites should not have a significant adverse effect on the area.
NPPG 14: Natural Heritage	Scottish Executive	Sets out the policy consideration in relation to Scotland's natural heritage; summaries the statutory obligations in relation to the conservation of natural heritage; explains, as part of wider policy framework, how natural heritage objectives should be reflected in development plans; describes the role of planning system in safeguarding sites of national & international importance; provides guidance on the approach to be adopted in relation to local & non-statutory designations; & draws attention to the importance of safeguarding & enhancing natural heritage beyond the boundaries of designated sites.
SPP 6: Renewable Energy Developments	Scottish Executive	Defines factors to be taken into account when considering policies for renewable energy developments or applications for planning permission; includes considerations regarding designated & non-designated sites.
PAN 58 Environmental Impact Assessment	Scottish Government	Covers legislative background to EIAs, EIAs in Scotland, the process of EIA, environmental studies and impact assessment, the evaluation of environmental information by planning authorities and implementation through the planning decision. It also includes further sources of information, guidance and advice on EIAs.
PAN 60 Planning for Natural Heritage	Scottish Government	Covers good practice in relation to conservation & natural heritage in Scotland. It covers the protection of biodiversity, designated sites & the wider natural heritage, with the provision that all development effects can be material considerations in the planning process. It includes the provision that full regard should be given to the natural heritage in development control, & that mitigation is required for any adverse effects.
UK Biodiversity Action Plan	Defra	The UK government's response to meeting the targets of the 1992 Rio Convention on Biological Diversity. The UK BAP comprises 436 action plans, covering priority species & habitats of conservation concern, some of which are present in Shetland.
Scottish Biodiversity Strategy	Scottish Biodiversity Forum	Sets out a 25 year strategy for the conservation & enhancement of biodiversity in Scotland. The SBS is supported by five strategy implementation plans which set out targets & actions for the first three years of the strategy.

Shetland Local Biodiversity Action Plan (LBAP)	Various partners	The Shetland LBAP (called the Living Shetland LBAP) is available on line through the SIC link: http://www.shetland.gov.uk/conservation/SIC-NaturalHeritage.asp. There are four objectives of the Living Shetland LBAP: i) Encourage local communities to work in partnership to evaluate the biodiversity of their areas, so as to agree priorities; ii) Develop habitat, species, sector & area-based local action plans; iii) Promote biodiversity as a key component of sustainable development in Shetland; & iv) Raise awareness through education & training of the need & responsibilities for biodiversity conservation & enhancement at a local level. The list of sector, habitat & species action plans within the Living Shetland LBAP includes the following potentially relevant plans. Sectoral: agriculture & roadsides. Habitats: freshwater, ungrazed areas & woodlands. Species: Arctic char, merlin, red-throated diver, skylark, bumblebees, farmland birds, hawkweeds & waders.
Supplementary Planning Guidance 2003	SIC	SIC adopted as draft locational guidance, a report entitled '*Planning for Wind Energy in Shetland*'. It addressed the need for a land use planning strategy to guide large scale wind energy developments. It examined the possible environmental effects of such development & outlined the process by which proposals would be considered. In particular, it dealt with the safeguards that would need to be in place were the Council to place itself in the position of both co-developer & planning authority (as is now the case with the Viking proposal). The paper referred to the established policies contained in the approved Shetland Structure Plan. In considered that it would be prudent to concentrate development in a particular area or areas of the islands rather than disperse them more widely. The guidance proposed a preferred area for large scale wind farm development. This was based on a consideration of Structure Plan & Local Plan policies; on some knowledge, gained from potential developers, of likely technical parameters & preferences; & on preliminary discussions with SNH. The boundaries of the proposed area were, deliberately, not defined precisely, in recognition of the need for further site investigation. However, on the basis of a preliminary analysis, the preferred areas did not impinge on any major area of nature conservation interest. It was nevertheless recognised that substantial further work would be required if the detailed implications of development were to be properly examined. Planning for Wind Energy in Shetland was intended only to provide locational guidance in general terms. However, the land area proposed for the Viking Wind Farm corresponds well with the 'preferred area' identified in the SIC locational guidance document.

10.4 METHODOLOGY

10.4.1 Overview

This section describes the methodology used to assess the significance of potential environmental impacts of the proposed development upon the ecological receptors of the site, omitting avian interest which is examined in depth in Chapter 11. The methodology uses best practice guidance and professional judgement to:

- Identify and value the nature conservation interest of the site in a transparent and systematic manner, establishing levels of interest/importance for its main ecological features;
- assess the likely magnitude of potential impacts of the development on each feature of nature conservation interest or importance; and
- assess the significance of ecological impacts in relation to the level of ecological interest or importance and impact magnitude.

This approach, commonly known as 'ecological impact assessment' was carried out following best practice guidance from the Institute of Ecology and Environmental

Management (IEEM, 2006). The scope of the assessment was informed by responses from consultees gathering during scoping (see Section 10.2.2). The assessment included the following stages:

- Baseline Survey and Assessment - identification of the ecological features to be assessed;
- evaluation of the ecological features identified;
- identification of development activities likely to cause significant impacts;
- prediction and characterisation of ecological impacts: Predicting and describing likely impacts;
- defining mitigation, including prevention, reduction and compensation for any significant adverse effects; and
- assessing the ecological significance of residual impacts (after mitigation has been taken into account).

10.4.2 Baseline Assessment - identification of ecological features to be assessed

The baseline assessment was developed in two phases. The first was a desk study and consultation with relevant parties and data sources. The second was targeted field survey work of the likely sensitivities identified.

(a) ***Desk Study and Consultation***

The desk study included a review of existing information on the study area. Information was gathered during consultation from SNH, SG, SEPA, SAA, SBRC and SIC. The following main sources of information were also extensively referred to:

- National Biodiversity Network (NBN) Gateway website, http://www.searchnbn.net/
- The Scottish Blanket Bog Inventory: The Shetland Islands – Characterisation of blanket bogs using Landsat Thematic Mapper. SNH Commissioned Report;
- Scottish Biodiversity List (SBL);
- Shetland Local Biodiversity Action Plan (Shetland LBAP);
- Shetland Natural Heritage Futures. SNH (2001);
- UK Biodiversity Action Plans (UK BAP); and
- A Naturalist's Shetland. J Laughton Johnston (1999).

Any existing biological records for species or habitats of note were reviewed to identify potentially important ecological receptors within the study area. Where initial data collection or consultation indicated that specialist surveys were necessary, these were undertaken in consultation with the relevant statutory agencies.

(b) ***Field survey methods – flora***

The field survey work was completed by carrying out a Phase 1 habitat survey and NVC survey across the study area and targeted protected and rare species surveys. The field

surveys were carried out between 2005 and 2008 by teams of suitably qualified and highly experienced consultants (Appendix 10.8).

Phase 1 habitat survey

The Phase 1 habitat survey was carried out over the study area, which includes all four quadrants. The survey was completed according to the standard Phase 1 methodology described in *Handbook for Phase 1 Habitat Survey* (JNCC, 1993). Target notes were recorded to describe any valuable or interesting ecological features identified during the survey and locations were recorded on the Phase 1 maps (Appendix 10.1). Target notes included information on species composition, habitat structure and condition, land management practices, records of UK BAP priority species, habitats too small to map and transitional or mosaic habitats. Nomenclature for higher plants follows Stace (1997) and Smith (2004) for mosses.

Phase 2 NVC survey

An NVC survey was carried out over the proposed physical line of the development i.e. tracks, turbines and infrastructure and an additional 100m buffer zone beyond the turbine envelope, access routes and potential borrow pit locations. It was agreed with SNH that a 100m buffer strip would be surveyed each side of tracks and turbine infra-structure i.e. a 200m wide buffer was surveyed along proposed track lines.

Field survey was carried out according to the NVC methodology outlined in *Rodwell J. S. British Plant Communities Vols. 1 – 5* (Cambridge University Press, 1990, 1991, 1992, 1995) and using the methodology described in the *Handbook for Phase 1 Habitat Survey* (JNCC, 1993). Surveyors walked over the proposed layout following a route designed to allow visibility of all habitats present within buffer zones. Each vegetation type encountered was mapped onto field maps at 1:10,000. All areas were mapped to NVC sub-community level wherever possible and at least to community level when the vegetation did not easily fit any of the documented sub-communities. Where it was not possible to map areas as an NVC community (e.g. house and garden, quarry or other habitats not covered by the NVC) then Phase 1 habitat survey codes were used instead. For further details on methodology see Appendix 10.2.

Rare plant survey

The NVC survey (as detailed above), although undertaken within the recommended timeframe, was considered relatively early in terms of timing (especially in such a northern location) and was expected to result in a potential bias towards early flowering species. It was therefore considered prudent to undertake a further survey towards the end of the summer in order to record a full species list from each of the communities or areas highlighted in NVC target notes as potentially containing rare or threatened species in a national or regional (Shetland) context. For further details on methodology see Appendix 10.3.

(c) ***Field survey methods - fauna***

All of Shetland's terrestrial non-avian vertebrates are non-native species, having been introduced by humans, either deliberately or accidentally (Laughton Johnston, 1999). This makes assessing the conservation value of Shetland's non-avian vertebrates unusual, but relatively straightforward. Consultee responses highlighted the presence of otter and subsequently an otter survey was carried out across the site.

Most of Shetland's freshwater vertebrates are native species (Laughton Johnston, 1999) and so based on consultee responses, a fish survey was carried out across the site in all catchments where potential development work was likely to be carried out. Consultees highlighted two main invertebrate sensitivities to be targeted by surveys: freshwater macro-invertebrates and freshwater pearl mussels.

Otter

Consultations with SNH resulted in a definition of the otter survey area and an agreement of the appropriate survey methodology to be used (Appendix 10.4).

The principal aim of the study was to determine the distribution of otters within the study area by monitoring the presence of their signs, and from these results determine whether or not the development posed a significant threat to the local otter population and, if necessary, advise on mitigation measures.

In summer 2008, during prolonged periods of suitable weather, watercourses within the study area were systematically searched for signs of otter by a team of experienced otter surveyors, who are very familiar with otter ecology and research in Shetland. The assessment focused on the main water bodies and watercourses in and around the proposed development area, targeting sites most likely to be used by otters visiting or passing through. In addition the proposed turbine sites located close to these water bodies were examined. The survey consisted of a 50m corridor around the water bodies and a 100m radius around each turbine. In addition, areas of interest not included in the detailed study area, but where evidence of otters might be found, e.g. under road bridges, along rivers and at lochs, were also included in the survey.

Freshwater pearl mussel

Watercourses within the study area were surveyed for the presence of freshwater pearl mussels in summer 2008 using a standard survey methodology. On the basis that no documented previously known freshwater pearl mussel populations were known to exist within the proposed Viking Wind Farm development area, survey effort was directed towards establishing the status (presence or absence) of freshwater pearl mussels in every watercourse potentially affected by the development (within 50m of watercourses with salmonids). Potential suitability was based on a combination of known historical sites, suitable topography and habitat requirements of freshwater pearl mussels. For further details on methodology see Appendix 10.5.

Freshwater macro-invertebrate survey

Watercourses within the study area were surveyed in summer 2008 using standard appropriate survey methodologies for the presence of macro-invertebrates. Survey effort was directed towards providing:

- A description of the macro-invertebrate community including species level identification in most major taxonomic groups;
- BMWP (Biological Monitoring Working Party) and ASPT (Average Score Per Taxon) scores as an assessment of water quality;
- Indices of acidity: Water Chemistry Status and Index of Acidity;
- Quantitative sampling to assess invertebrate abundance and to provide a measure of biodiversity and productivity; and
- A description of the environmental variables at each monitoring site including depth, width, flow, substrate profile, estimates of in-stream vegetation and canopy cover.

For further details on methodology see Appendix 10.7.

Fish survey

Watercourses within the study area were surveyed in summer 2008 using a standard methodology (The Scottish Fisheries Co-ordination Centre Electric Fishing Protocols) for the presence of all freshwater fish species. The fish survey was designed to describe the distribution and abundance of fish species at catchment level within streams that (i) will have turbines constructed within the catchment and/or (ii) will be crossed by new access tracks. Correction factors were applied to data from single run survey sites. Site locations were chosen both to provide information on the distribution of fish and to provide a baseline for future monitoring. For further details on methodology see Appendix 10.6.

10.4.3 Evaluation of Ecological Features

The important ecological receptors identified in the baseline studies were evaluated following best practice guidelines (IEEM, 2006), but have been slightly modified in relation to significance/value terms used, especially with regard to non-native species in a Shetland context. The important ecological receptors define the nature conservation interest or value of the development site and must be valued to provide, as far as possible, an objective and transparent basis for assessing the impacts of the proposed development.

Determining the ecological value of a receptor or particular feature involves making use of available data (known status and distribution of habitats and species), ecological knowledge of the habitat or species, best practice guidance, expert advice (through consultation) and professional judgement. As evaluations can vary greatly depending on the geographic scale used, the value of each ecological receptor should be determined within a defined geographical context i.e. international, UK, national, regional, local or site (i.e. within the development site boundary). For the purpose of this assessment, Shetland is defined as a bio-geographic region. Key factors included in the evaluation are given below.

(a) ***Legislation and Policy: protected status of species, and site designations***

Some sites have already been assigned a level of nature conservation value or geographical significance through a conservation designation. A list of UK nature conservation designations can be found on the Protected Sites Designations Directory (http://www.jncc.gov.uk/page-1527). Where species are afforded special legal protection at a national or international level, this is also taken into account. Examples of the types of geographic value or significance attached to designated sites, habitats and protected species are given in Table 10.4. It is generally more difficult to judge a level of importance for study areas or sites with no existing designations than it is for those designated (where an assessment has already been made).

Table 10.4: Examples of the geographic value or significance of designated sites, habitats and species

Level	Site Designations	Habitats & Protected Species
International	Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Biosphere Reserves, World Heritage Sites & Ramsar sites.	Important populations of species protected under the Conservation (Natural Habitats, &c.) Regulations 1994 "*European Protected Species*". Any regularly occurring population of (or habitat containing) an internationally important species that is Critically Endangered, Endangered or Threatened in the UK.
UK/National	Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) & National Parks.	Important populations of species protected under the Wildlife & Countryside Act 1981 (Schedule 1 bird, Schedule 5 animal, or Schedule 8 plant). Important populations of species listed as Priority species under the UK BAP. Important viable* areas of habitats listed as Priority habitats under the UK BAP designated or worthy of designation.
Regional	Regional Parks. Nature reserves that do not meet the criteria for designation as an NNR or SSSI. Important semi-natural or ancient woodland sites (e.g. >0.25ha in extent).	Large areas of valuable habitat identified in the relevant SNH Natural Heritage Futures. Large areas of viable* habitat with a significance greater than local level, but not sufficient for SSSI designation. A significant assemblage of nationally or regionally scarce species, but not sufficient for SSSI designation.
Local	Sites of Importance for Nature Conservation (SINCs), Local Nature Reserves (LNRs), semi-natural or ancient woodland sites (e.g. <0.25ha in extent).	Priority species & habitats listed under the LBAP. Habitat areas that contribute towards important local habitat networks.
Low	No designations.	Common, often anthropogenic habitats or common, frequently ruderal or alien** species.

* Sites worthy of designation with habitats and/or species interest at any level must have a 'viable area' of habitat. Viability means that the area should be sufficient to maintain the interest in adequate condition through appropriate management.

**It can be argued that the main value or importance of an alien species lies in its removal from a site. This is particularly likely to be the case in the future with the forthcoming European Strategy on Invasive Alien Species.

(b) ***Existing status***

The existing status or condition of a habitat or species includes its rarity (at a defined geographic scale) and trends in habitat condition/extent or population size. The existing baseline status of a habitat or species might be poor or degraded, in which case trying to maintain its current baseline status might not be a desirable conservation objective. Therefore, existing status is an important consideration within the impact assessment process.

The UK BAP status of any habitat or species is also taken into account (i.e. contents of any relevant habitat or species action plans, see http://www.ukbap.org.uk). The values of habitats and plant communities are measured against published selection criteria, where available, including *Guidelines for the Selection of Biological SSSIs* (NCC 1989) and Annex III of the EC Habitats Directive. However, the valuation process assumes data are available on comparable sites, so that assessments or ranking of importance can be made. In many circumstances, this wider information or context (at a suitable geographical scale) is often not available for non-designated features thus making assessment difficult or open to different interpretations.

(c) ***Potential value***

Where sites or species are currently being positively managed for conservation or are otherwise subject to conservation plans or proposals, it may be appropriate to consider their potential as well as current ecological value.

(d) ***Ecological function***

Habitats and species may be of value for the function they perform. For example, some species may be an important food for others, e.g. fish for otters; or they perform an important function. Riparian trees, for example, provide stability to river banks and contribute to functioning habitat networks.

(e) ***Non-ecological value: socio-economic and landscape values***

Habitats and species may also have significant socio-economic value, providing recreational opportunities, health benefits, wildlife watching, hunting or fishing. Habitats also have an important role to play in providing attractive landscapes and screening developments. These values are outwith the scope of the ecological evaluation and are considered in Chapter 17, Socio-Economic Assessment and Chapters 8 and 9, Landscape Character and Visual Impact.

10.5 BASELINE CONDITIONS

10.5.1 Context

The study area is on Mainland Shetland. It comprises the four quadrants (Delting, Collafirth, Kergord and Nesting), split north to south by the A970 and east to west by Olna Firth and the B9071 (Figures 1.1 and 10.2-10.6). The study area is 18,700ha in total, which includes the 314ha area upon which the proposed physical development will actually take place. The area covers hilly terrain, with several large lochs and numerous watercourses. Although the

study area is upland in character, it ranges from sea-level at the coast to a maximum of 281m above sea-level inland. The topography of the study area varies considerably between gently sloping grassland and moorland (e.g. Valley of Kergord) to steep sided, occasionally rocky terrain (along Kames ridges, Scalla Field) and undulating blanket bog (e.g. Muckle Hill).

A relatively small number of upland habitats and vegetation communities are present and occur in complex patterns in relation to topographic features and corresponding depths of peat. The majority of the study area is blanket bog, which ranges from good to poor condition in terms of activity. The wet oceanic climate and impermeable nature of the majority of underlying geology means that peat is present throughout most of the site, with associated lochans and small burns.

The main land-uses are sheep grazing and peat cutting and these have modified the habitats significantly across the site, for example through drainage. Heathland (wet and dry moorland) covers the steeper slopes and exposed ground with acid grassland forming isolated patches throughout the site where grazing pressure is high, or erosion has occurred. There are lowland meadows and pastures near settlements at the periphery of the study area. Small areas of tree planting are found around Kergord.

10.5.2 Desk study

(a) ***Designations***

There are no statutory conservation designations within the area where the proposed physical development will actually take place. Two SSSIs lie within the wider study area, with three further SSSIs lying just beyond the edge of the wider study area. Two SACs and nine further SSSIs lie within 5 kilometres of the study area boundary, six of which are designated for their ecological interest (Table 10.5 and Figure 10.01). The other three SSSIs on the margin of the survey area (Voxter Voe and Valayre Quarry, Clothister Hill Quarry and The Ayres of Swinister) are designated for their geological features and are not considered within this chapter.

Table 10.5: Designated sites within and around the proposed development area

Location	Name	Notified Feature/Qualifying Interest
Within the 18,700ha study area	Burn of Lunklet SSSI (1.4ha site)	Hawkweeds, including the largest population of Shetland hawkweed *Hieracium zetlandicum*, which is endemic to the islands. Occurs on banks of the burn, along with a possible new unknown species.
	Kergord plantations SSSI (6.45ha site)	Broadleaved, mixed & conifer woodlands (planted between 1910-20).
Outside study area, but close to boundary	Sandwater SSSI (38.3ha)	Mesotrophic loch with breeding waterfowl & extensive wetland vegetation. Also geological features.
	Dales Voe SSSI (5.2ha)	Saltmarsh plants & feeding area for wading and nesting birds.
	Burn of Valayre SSSI (5.85ha)	Un-grazed relict scrub vegetation – rose *Rosa spp*, rowan *Sorbus aucuparia*, eared willow *Salix aurita* & honeysuckle *Lonicera periclymenum*.
Within 5km of the study area	Sullom Voe SAC Approximately 500 m northwest of the study area	European priority interest: Coastal lagoons – Sullom Voe is the only Scottish example of a ria (known locally as a 'voe') & is the northernmost site selected for large shallow inlets & bays. It supports a northern-boreal (arctic) population of marine life which is not represented elsewhere in the UK. Other European interests: Large

Location	Name	Notified Feature/Qualifying Interest
		shallow inlets, bays & reefs.
	Yell Sound Coast SAC Approximately 400 m northeast of the study area	European interests: Otter – Shetland supports otter at a very high density in comparison to the rest of Europe, & the Yell Sound area has the highest density. It is believed to support more than 2% of the UK otter population & contains large areas of suitable resting & feeding habitat. Common seal *Phoca vitulina* – The Yell Sound area supports the northernmost colony of common seal in the UK & greater than 1% of the population can be found here, using it as a haul-out & foraging site.
	Yell Sound SSSI	Nationally & internationally important breeding population of otter.
	Laxo Burn SSSI	Hawkweeds.
	Catfirth SSSI	Ungrazed relict & limestone vegetation – hazel *Corylus avellana*, rowan.
	Loch of Clouster SSSI	Relic scrub & tall herb & fern vegetation on islands.
	Loch of Girlsta SSSI	Mesotrophic loch with Arctic char *Salvelinus alpinus*.
	Muckle Roe Meadows SSSI	Hawkweeds.

(b) ***Vegetation and habitats***

Existing available information indicated that mosaics of blanket bog and limited upland vegetation communities, especially heathland and moorland, are to be expected. Wet flushes, pools, wet channel and burns, lochans and lochs are frequent in some areas. Deep peat habitats of varying condition have developed in the upland areas due to the wet oceanic climate. Lower down the slopes grassy swards (especially acid grassland) dominate areas closer to human habitation, some providing pasture.

(c) ***Otter***

Otter records from the National Biodiversity Network (NBN) Gateway show 56 records of otter from the Shetland Otter Survey Database in the 10km grid squares HU35, HU36, HU45, HU46 and HU47 that encompass the study area. Twelve of these records exist at six locations within the study area (in Delting and Kergord quadrants). SBRC advised that the otter records it holds for the area are predominantly along the coastal strip, the area preferred by otters.

(d) ***Freshwater pearl mussels***

In 2002, a chance finding by a local crofter of live freshwater pearl mussels on Mainland Shetland led to the discovery of a reproductively viable freshwater pearl mussel population in atypical peat dominated fen habitat (Cosgrove and Harvey, 2005). The freshwater pearl mussel is not known to occur in the Viking study area, but the species was identified by SNH during scoping work as potentially occurring at the site due to the aquatic habitats present.

(e) ***Fish***

Records from the NBN Gateway and other information sources such as Laughton Johnston (1999) indicate that a limited native freshwater fish fauna occurs in Shetland, some of which species are expected to be present within the study area (Table 10.6).

Table 10.6: Occurrence of freshwater vertebrates in mainland Shetland

Species	Shetland history	Known or likely occurrence within study area
Brown/sea trout *Salmo trutta*	Ubiquitous across mainland Shetland. Some stocking has recently taken place.	Present in burns and lochs within study area.
Atlantic salmon *S. salar*	Occasionally present. Unclear whether salmon present are wild fish or have escaped from fish-farms.	Potentially present within study area.
Rainbow trout *S. gairdneri*	Non-native species stocked in lochs for game fishing.	Presence in lochs within study area unclear.
Arctic char	Only known from Loch of Girlsta.	Unknown within study area.
Eel *Anguilla anguilla*	Formerly widespread, but fastest declining UK vertebrate.	Likely to be present within study area.
Three-spined stickleback *Gasterosteus aculeatus*	Widespread except in the most acidic & peaty lochs.	Likely to be present within study area.
Nine-spined stickleback *Pungitius pungitius*	Single record from 10km square HU50.	Unknown within study area.
Lamprey species *Lampetra* spp. or *Petromyzon marinus*	Theoretically present but recent national survey (Watt & Ravenscroft, 2005) found no evidence of occurrence in catchments surveyed & little suitable habitat.	Presence unlikely within study area.
Flounder *Platichthys flesus*	Widespread in lower reaches of accessible rivers.	Likely to be present within lower, accessible parts of study area.

(f) ***Other species records***

Laughton Johnston (1999) provides a species list of terrestrial vertebrates from Shetland, some of which are expected to be present within the study area (Table 10.7).

Table 10.7: Occurrence of terrestrial vertebrates in mainland Shetland

Species	Shetland history	Known or likely occurrence within study area
Amphibians: Common frog *Bufo bufo* Common toad *Rana temporaria*	Common toad was introduced several times but did not become naturalised. Common frog was introduced on at least 3 occasions & has become widely established across mainland Shetland.	Common frog is present in wet/damp areas within study area.
Bats (at least 7 species)	Non-breeding vagrants to Shetland.	Not present, but could occur as a vagrant.
Lagomorphs: Rabbit *Oryctolagus cuniculus* Brown hare *Lepus capensis* Mountain hare *Lepus timidus*	Brown hare is now extinct in Shetland, but both rabbit & mountain hare are widespread across mainland Shetland.	Rabbit and mountain hare are widespread within the study area.
Rodents: Field mouse *Apoldemus sylvaticus* House mouse *Mus musculus* Black rat *Rattus rattus* Brown rat *R. norvegicus*	No post 1990 records of black rat. Remaining species common across mainland Shetland.	Field mouse, house mouse & brown rat likely to be present (perhaps locally) within study area.
Carnivores: Fox *Vulpes vulpes* Stoat *Mustela erminea* Ferret-polecat *M. putorius* x *M. furo* Mink *M. visom* Otter *Lutra lutra*	Fox & mink are probably extinct on Shetland. Stoat & ferret-polecat are widespread across mainland Shetland. Otters were formerly considered native, but are now considered likely to have been introduced by the Vikings.	Stoat & polecat are widespread throughout study area. Detailed survey of otter (a European Protected Species) carried out across the study area. Otter study found a 'holt' site which may have been used by fox.
Hedgehog *Erinaceus europaeus*	Introduced in 1860 & is now common & widespread across mainland Shetland	Hedgehog is widespread within study area.

Species records from the NBN Gateway and the SBRC were used to identify any likely species of national conservation significance within the study area. The SBRC does not hold any non-avian protected species records for the site other than otter, but provides records for a number of species of national conservation significance including lichens, bryophytes, flowering plants and invertebrates (Table 10.8).

Table 10.8: Species of national conservation significance occurring within study area

Species	Type	Status	Grid ref	Habitat	Quadrant
Saussurea alpina (Alpine saw-wort)	Flowering plant	Restricted to 3 sites in Shetland	HU 3833 6027 HU 3836 6019 HU 3835 6020 HU 3833 6026	On flushed stony slope above Smerla Water	Kergord
Hieracium klingrahoolense	Flowering plant	Endemic to Shetland	HU 363 668	Burn of Skelladale, bankside	Delting
Hieracium subtruncatum	Flowering plant	Endemic to Shetland	HU 3695 6931 HU 3698 6928 HU 3750 6908 HU 3723 6911 HU 3732 6909	Burn of Valayre, bankside	Delting
Hieracium zetlandicum	Flowering plant	Endemic to Shetland	HU 371 573	Burn of Lunket SSSI bankside	Kergord
Catapyrenium cinereum	Lichen	Nationally rare	HU 366 636	Compact cushions on loose material/bedrock	Kergord
Fuscidea cyathoides var. sorediata	Lichen	Nationally rare	HU 366 636	On rock in moorland/poor grassland	Kergord
Lecidea diducens	Lichen	Nationally rare	HU 425 728	On quartz boulder	Delting
Schaereria fuscocinerea	Lichen	Near threatened	HU 425 728	On standing stone	Delting
Hygrocybe calyptraeformis	Fungi	Vulnerable	HU 456 588	In heather near Burn of Brunnafirth	Nesting
Pseudobryum cinclidioides	Bryophyte	Nationally rare	HU 4440 6732	Swining Burn	Collafirth
Eudonia alpina	Moth	Nationally rare	HU 41 64	Locally common in mainland Shetland	Collafirth
Carsia sororiata anglica (the Manchester treble-bar)	Moth	Nationally scarce (a widespread, locally frequent & probably under-recorded northern species)	HU 43 67 HU 41 66 HU 45 68 HU 41 64	(Widespread in bogs & mosses elsewhere)	Collafirth
			HU 44 61 HU 44 57 HU 45 59 HU 44 56 HU 45 56		Nesting

10.5.3 Field surveys

(a) ***Vegetation/habitat surveys (Phase 1 and NVC)***

During April and May 2008 the Nesting and Collafirth quadrants were surveyed to Phase 1 level by Highland Ecology. This was to ensure compatibility with the quadrants Kergord and Delting, which were surveyed by Highland Ecology in September 2005, and particularly to evaluate the blanket bog resource in terms of its condition and activity.

A total area of 15,835ha was surveyed to Phase 1 level covering all four quadrants (Figures 10.02-10.06). The peripheral coastal areas which form part of the wider section 36 application boundary were not surveyed. Target notes were recorded during the Phase 1 habitat survey (Appendix 10.1).

The NVC survey was carried out covering the area directly impacted by the proposed development i.e. proposed line of the tracks, turbines and infrastructure etc, and an additional 100m buffer zone beyond the turbine envelope, access routes and borrow pits. The following sections outline the habitat classifications attributed to the site as a result of the survey.

Blanket bog/mire

Blanket bog (mire) is the dominant vegetation type over the whole survey area. It occurs on peat over 50cm in depth and usually at least 2m deep. The vegetation is characterised by a range of species, the most frequent or constant vascular species being *Calluna vulgaris*, *Trichophorum cespitosum*, *Erica tetralix*, *Eriophorum vaginatum* and *Eriophorum angustifolium*. Unlike blanket bog throughout much of the rest of Scotland *Molinia caerulea* is absent. *Sphagnum* moss species, mainly *Sphagnum papillosum* and *Sphagnum capillifolium*, are usually at least patchily prominent in blanket bog and often form extensive continuous carpets in the wettest stands. In some drier blanket bog *Sphagnum* plays a reduced role and *Racomitrium lanuginosum* is very prominent.

The blanket mire comprises three extensive different NVC mire communities or sub-communities (M17a, M17b and M19), with other more localised and patchier mire communities within the overall matrix (M1, M3, M6, M15), along with acid grassland and dry heath (U6, H10). Blanket bog was graded from 5 (continuous, good condition vegetation with very little erosion) through to 1 (more or less completely eroded except for dry and continually eroding fragments of deep peat). A description of the criteria used to assign ranking is provided below:

Active verses inactive blanket bog assessment criteria (Phase 1 and NVC)

Grading system 1 to 5 used as follows (vegetated shallow peat = U6/Cv acid grassland/heath and/or substrate in hag bottoms):

1) More or less totally inactive, poor condition, 80-100% bare peat (or vegetated shallow peat)

Widespread bare peat, substrate or wet heath or acid grassland on very shallow soil. Very little cover, if any, of *Sphagnum*. Current erosion of remaining peat block edges and surfaces. May be occasional fragments of remnant blanket bog but these not of any great size and usually eroding further.

2) Largely inactive, 50%-80 bare peat (or vegetated shallow peat)

A large part of the area consists of bare peat, substrate or wet heath/grassland derived from former deeper peat. >50% bare surface or shallow peat. Within this there might be some areas of active peat formation, either as existing blocks of un-eroded blanket bog or as new active accumulation in the bottom of hags. These are not usually extensive. Condition may

well be unfavourable (i.e. not recovering, or declining) due to ongoing erosion and/or trampling or grazing effects.

3) Intermediate, widespread larger scale peat erosion, 20-50% bare peat (or vegetated shallow peat)

Typically a mosaic or patchwork of active and inactive areas, difficult to class as 2 or 4. There may be widespread hagging and bare peat or substrate, bare peat often in networks up to several metres wide. 20-50% bare peat surfaces or sparse re-vegetation. There might also be small areas of new build-up of mire species, most importantly *Sphagnum* spp. U6a with *Sphagnum* building up on it. Small patches of M17a and M1. These areas may be in current unfavourable condition due to trampling or they may be favourable and seen to be recovering. If exactly 50%-50% then judge by amount of re-vegetating surfaces vs. bare peat.

4) Areas of broadly intact bog with smaller scale but frequent bare peat erosion, 5-20% bare peat (or vegetated shallow peat)

A large proportion of ground supports typical mire and peat-forming species, notably *Sphagnum* spp., though it may naturally not be prominent in the drier blanket bog types. Hags and bare peat etc. usually present and frequent, covering 5-20% of the ground as very frequent channels within peat but not usually wide or deep, e.g. 0.5 to 2m. Blanket bog may be continuing to erode in parts but better re-vegetating bare peat surfaces are more widespread here, along with areas of active building of *Sphagnum* etc. (U6a, M17a, M1) which can occupy hag bottoms, hollows and naturally damned channels in the peat. May be recoverable with reduced grazing.

5) More or less fully active, good, stable condition blanket bog, $<5\%$ bare peat overall

Widespread deep peat with little hagging and erosion, although there will usually be at least some. Continuously vegetated over large extents with typical mire species. In wetter stands there will be extensive unbroken *Sphagnum* carpets. Drier stands (e.g. M17b) may quite naturally have much less *Sphagnum* but here there will be extensive cover of *Racomitrium lanuginosum* and *Cladonia* spp. lichens and other typical associates. Where there are pools these will usually be well-vegetated with *Sphagnum cuspidatum* and/or *S. denticulatum* or *S. fallax* and typical vascular associates.

Figures 10.07-10.11 show the distribution of the blanket bog activity rankings in each of the four quadrants along the line of the proposed tracks, anemometers and turbines and clearly shows that blanket bog activity varies considerably across the proposed site.

Nesting: (Figure 10.07) has many areas of highly eroded and fragmented bog, as well as intermediate activity within the 200m survey corridor. There are also large tracts of mostly intact and active bog across significant lengths of the proposed layout.

Delting: (Figure 10.08) is dominated by highly eroded and fragmented bog, as well as intermediate activity within the 200m survey corridor in the SW, but mostly intact and active bog across significant lengths of the remaining proposed layout.

Kergord: (Figure 10.09) is dominated by mainly intact and active bog across most areas. However, there are some notable exceptions, such as around Upper Kergord and the Mid Kame ridge, where the proposed track line is across areas of highly eroded and fragmented bog, as well as intermediate activity.

Collafirth: (Figure 10.11) is dominated by intact and active bog across almost the entire area.

Wet and dry dwarf shrub heath

Dwarf shrub heath, along with acid grassland, is a community of shallower (i.e. less than 50cm deep) peat. It can be found commonly forming mosaics in areas of eroded and fragmented blanket bog as well as within more intact blanket bog where the peat thins over knolls or banks. It can also be found on more extensive slopes of shallower peat.

Dry heath can be found on the very steepest slopes and also within stretches of eroding blanket bog where it can resemble alpine heath over broad ridges and summits. It is usually completely dominated by *Calluna vulgaris*, although there can also be a little sparse *Vaccinium myrtillus* or *Erica cinerea*. Dry heath is composed of the following NVC communities: H10a, H10b, H10c, H12a and H12c.

Wet heath vegetation occurs on less well-drained, shallow, acid peats (< 50cm) thus is found on sloping banks around knolls. It is found throughout the survey area on gently to moderately sloping ground. The characteristics of wet heath are a combination of ericoids, notably *Calluna vulgaris* but also *Empetrum nigrum*, *Erica tetralix* and *E. cinerea* along with other mire species such as *Trichophorum cespitosum*, *Eriophorum angustifolium* and *E. vaginatum*. *Sphagnum* can be present but it is usually much more patchy than in blanket bog. Wet heath is composed of the following NVC communities: M15a, M15b, M15c and M15d. Due to a history of heavy grazing the heaths are frequently grassy in nature and occur in intimate mosaics with acid grassland.

Acid grassland

Acid grassland occurs throughout the survey area and is common in mosaics with dwarf shrub heath. It can be found in areas of eroding blanket bog and also in more uniform extents on steeper slopes with a heavy grazing history. It is also found in enclosed fields around the edges of the survey area.

Various species can predominate. In areas of fragmented blanket bog the sward is usually *Juncus squarrosus*-dominated, although occasionally *Nardus stricta* can be the dominant species. These rushes and grasses are joined by a host of other grasses, notably *Festuca vivipara*, *Anthoxanthum odoratum*, *Agrostis canina* and *Deschampsia flexuosa*. Acid grassland in the study area is composed of the following NVC communities: U4a, U4b, U5b, U6, U6a and U6b.

Other habitats

Other less extensive habitats are present within the survey area:

Acid flushes (NVC communities M6b and M6c) are frequent, in usually linear stands, through most blanket bog and areas of heath where it occupies ‘soakaways’ and seepage zones. *Juncus* spp. and several mire species occur over a carpet of *Sphagnum fallax* and/or *S. denticulatum*. This NVC community M23 occurs as small isolated stands over the survey area.

More base-rich flushes (NVC community M10) have a suite of species unique to them including a diversity of sedges such as *Carex panicea*, *C. viridula* ssp. *oedocarpa* and the bryophytes *Scorpidium scorpioides*, *S. revolvens* and *Campylium stellatum* along with *Pinguicula vulgaris*. These flushes usually occur as small linear stands or patches and can be quite frequent in areas of eroded blanket bog where the substrate has become exposed and shallow surface peats are irrigated by waters which have been subject to influence from rock materials.

Other fragmentary or rare habitats found in the survey area are marshy grassland, oligotrophic standing waters, streams and water courses and calcareous grassland (NVC community CG10a).

There is a small number of scattered woodland plantations containing mixed coniferous and broadleaved trees to the south-east of the Kergord quadrant. There are approximately 6.8ha of woodland in total.

Table 10.9 Construction and operational impacts on habitats in the Nesting quadrant

	Construction impacts				Operational impacts			
Habitat	**Hectares of habitat lost**	**% of development site**	**% of Nesting affected**	**% of total Viking area affected**	**Hectares of habitat lost**	**% of development site**	**% of Nesting affected**	**% of total Viking area affected**
Dry heath	0.50ha	0.5%	0%	0%	0.34ha	0.4%	0%	0%
Acid flush	0ha	0%	0%	0%	0ha	0%	0%	0%
Acid grassland	3.52ha	3.3%	0.1%	0.02%	3.14ha	3.6%	0.1%	0.02%
Blanket bog/mire	90.45ha	84.8%	2.7%	0.58%	74.44ha	84.4%	2.2%	0.48%
Dry heath grassland mosaic	0.74ha	0.7%	0%	0%	0.51ha	0.6%	0%	0%
Bare peat	4.97ha	4.7%	0.1%	0.03%	4.07ha	4.6%	0.1%	0.03%
Quarry	1.37ha	1.3%	0%	0.01%	1.33ha	1.5%	0%	0.01%
Poor semi-improved grassland	0ha	0%	0%	0%	0ha	0%	0%	0%
Wet heath	0.45ha	0.4%	0%	0%	0.30ha	0.3%	0%	0%
Wet heath grassland mosaic	4.65ha	4.4%	0.1%	0.03%	4.03ha	4.6%	0.1%	0.03%
Total	**106.63ha**	**100%**	**3.2%**	**0.69%**	**88.15ha**	**100%**	**2.7%**	**0.57%**

Table 10.10 Construction and operational impacts on habitats in the Kergord quadrant

	Construction impacts				Operational impacts			
Habitat	**Hectares of habitat lost**	**% of development site**	**% of Kergord affected**	**% of total Viking area affected**	**Hectares of habitat lost**	**% of development site**	**% of Kergord affected**	**% of total Viking area affected**
Dry heath	0.39ha	0.4%	0%	0%	0.28ha	0.3%	0%	0%
Acid flush	0.28ha	0.3%	0%	0%	0.24ha	0%	0%	0%

Acid grassland	7.2ha	7.4%	0.1%	0.05%	6.19ha	7.6%	0.1%	0.04%
Blanket bog/mire	80.09ha	81.3%	1.2%	0.52%	66.14ha	80.7%	1.0%	0.42%
Dry heath grassland mosaic	7.08ha	7.2%	0.1%	0.05%	6.55ha	8%	0.1%	0.04%
Bare peat	0ha	0%	0%	0%	0ha	0%	0%	0%
Quarry	0ha	0%	0%	0%	0ha	0%	0%	0%
Poor semi-improved grassland	0.05ha	0%	0%	0%	0.03ha	0%	0%	0%
Wet heath	0ha	0%	0%	0%	0ha	0%	0%	0%
Wet heath grassland mosaic	3.43ha	3.5%	0.1%	0.02%	2.45ha	3%	0%	0.02%
Total	**98.59ha**	**100%**	**1.4%**	**0.64%**	**81.87ha**	**100%**	**1.2%**	**0.53%**

Table 10.11 Construction and operational impacts on habitats in the Delting quadrant

	Construction impacts				**Operational impacts**			
Habitat	**Hectares of habitat lost**	**% of development site**	**% of Delting affected**	**% of total Viking area affected**	**Hectares of habitat lost**	**% of development site**	**% of Delting affected**	**% of total Viking area affected**
Dry heath	3.93ha	5.8%	0.1%	0.03%	3.84ha	6.8%	0.1%	0.03%
Acid flush	0ha	0%	0%	0%	0ha	0%	0%	0%
Acid grassland	2.38ha	3.5%	0.1%	0.02%	1.72ha	3%	0.1%	0.01%
Blanket bog/mire	50.66ha	75.2%	1.7%	0.33%	41.43ha	73.4%	1.4%	0.27%
Dry heath grassland mosaic	0.04ha	0.1%	0%	0%	0.02ha	0%	0%	0%
Bare peat	0ha	0%	0%	0%	0ha	0%	0%	0%
Quarry	0ha	0%	0%	0%	0ha	0%	0%	0%
Poor semi-improved grassland	0ha	0%	0%	0%	0ha	0%	0%	0%
Wet heath	10.37ha	15.4%	0.3%	0.07%	9.43ha	16.7%	0.3%	0.06%
Wet heath grassland mosaic	0ha	0%	0%	0%	0ha	0%	0%	0%
Total	**67.38ha**	**100%**	**2.3%**	**0.43%**	**56.44ha**	**100%**	**1.9%**	**0.36%**

Table 10.12 Construction and operational impacts on habitats in the Collafirth quadrant

	Construction impacts				**Operational impacts**			
Habitat	**Hectares of habitat lost**	**% of development site**	**% of Collafirth affected**	**% of total Viking area affected**	**Hectares of habitat lost**	**% of development site**	**% of Collafirth affected**	**% of total Viking area affected**
Dry heath	0ha	0%	0%	0%	0ha	0%	0%	0%

Acid flush	0ha	0%	0%	0%	0ha	0%	0%	0%
Acid grassland	4.23ha	19.1%	0.2%	0.03%	3.91ha	20.7%	0.2%	0.03%
Blanket bog/mire	17.33ha	78.2%	0.7%	0.11%	14.65ha	77.5%	0.6%	0.09%
Dry heath grassland mosaic	0.05ha	0.2%	0%	0%	0.02ha	0.1%	0%	0%
Bare peat	0ha	0%	0%	0%	0ha	0%	0%	0%
Quarry	0ha	0%	0%	0%	0ha	0%	0%	0%
Poor semi-improved grassland	0.23ha	1%	0%	0%	0.15ha	0.8%	0%	0%
Wet heath	0.31ha	1.4%	0%	0%	0.19ha	1%	0%	0%
Wet heath grassland mosaic	0%	0%	0%	0%	0ha	0%	0%	0%
Total	**22.15ha**	**100%**	**0.9%**	**0.14%**	**18.91ha**	**100%**	**0.8%**	**0.12%**

(b) ***Rare plant survey***

During August 2008, a targeted rare plant survey was carried out within the 100m buffer zone extending from the location of the tracks, infrastructure and turbine locations (resulting in a 200m wide corridor) by an experienced EnviroCentre Ltd botanist, with a specialism in lower plants (Appendix 10.3).

A total of 91 flowering plants and 85 algae, moss and liverwort species were recorded during the survey from the locations and communities highlighted during the NVC survey. None of the species recorded was included amongst those in the list of rare or otherwise notable species in Shetland, with exception of one taxon: *Taraxacum*. Two (micro-)species attributable to this genus were located. Although both populations were indeterminate on account of the absence of flowering parts, one has been assumed to be a widespread and common taxon (*T. faeroense*), although the other is indeterminate. No other notable species or taxa (in a local, national or international context) were encountered during the survey and the species in each location were generally found to be common and widespread.

As a consequence of these findings and those of the earlier NVC survey, there is no evidence of rare or otherwise notable plant species within the habitats and locations directly influenced by the proposed wind farm and its infrastructure. The most notable location, in terms of its species composition and limited extent, is an area of limestone outcrop (HU 41978 61507) which is outside of the footprint of the actual development and this is also the case for the more acidic rock outcrop vegetation (HU 39179 57674). In both of these cases, the potential for impacts to arise is naturally reduced by their upstanding and water-shedding nature.

(c) ***Otter survey***

During June-July 2008, an otter survey was carried out within proposed study area using an SNH agreed methodology by Celtic Environment Ltd using a team of three experienced otter surveyors. The survey involved traversing the agreed study area (broken down into 5 main areas), looking for evidence of otter presence. Particular attention was given to those areas that might be used by otters, e.g. burns and lochans (Table 10.13).

Table 10.13 Otter study areas, including details of the burns and lochs surveyed

Area	Location	Burns surveyed	Lochs surveyed
1	NW of Weisdale	Smerlawater, Lambawater, Lunklet, Varthoull, Red, Truggleswater, S. Burrafirth, Marrofieldwater	Marrofield Water, Lamba Water, Maa Water, Truggles Water, Loch of Lunklet, Smerla Water
2	Valleys of Kergord and Petta Water	Pettawater, Weisdale, Kirkhouse, Kergord, Wester Filla, Sandwater	Petta Water, Sand Water
3	Nesting	Grunnafirth, Forse, Moowater, Quoys, Flamister, Quinni	Moo Water, Loch of Skellister, South Black Water, Houlland, Grunna Water, Black Water, Bellister, Quinni Loch
4	Voe - Laxo	Seggie Burn and tributaries, Green, Gross Water, Mill, Laxo, Seawater	Laxo Water, Gossa Water, Sea Water, Loch of Voe
5	N & W of Dales Voe	Scatsta, Westerbutton, Easterbutton, Laxobigging, Stonewall, Mooorfield, Small burns draining into head of Dales Voe	Mill Loch (Voe)

When any evidence for otters was found, the location of all spraints, holts and areas of other signs/activity was recorded. It was considered impractical to expect an otter survey to encompass the whole wider study area of the proposed development. Rather it was agreed to limit the area to those features most likely to be used by otters - lochs and streams, and to examine in detail the habitat in the immediate vicinity of the turbines, proposed roads and associated infrastructure (Appendix 10.4), i.e. surveys took place within a 100m radius of each proposed turbine location and 50m either side of proposed access tracks, in order to identify otter presence and in particular the location of any breeding holts.

The survey found a general paucity of otter signs with only 78 being found throughout the study area. Of these, 29 contained fresh spraint, evidence of recent use, while 14 had only 'remains', suggesting that there had been no use of these for some weeks/months. No holts were found. A high proportion of signs (69%) were found close to the coast (<500m distant). Only two sites, both containing only 'remains' and in the area of Nesting, were found within the area potentially 'disturbed' by the proposed physical development.

In addition to the five areas surveyed, an examination was made of the road bridges and culverts surrounding the proposed turbine area and the coasts (Table 10.14). Of the 25 bridges and culverts surveyed, 13 contained evidence of otter presence, with six containing signs of fresh otter activity. The structures with most activity were those bridges that were closest to the sea.

Table 10.14: Details of the bridges and culverts examined as part of the wider otter survey

Road	Details	Bridge location	Results*
B9016	Voxter Voe	Burn of Valayre	2o
		Helligill Burn	nil
	Sullom Voe	Houb of Scatsta	nil
		Burn of Scatsta	1f, 2o
	Garths Voe	North Burn	2m
A968	Firths Voe	Burn from Bordigarth Loch	nil
	Dales Voe	Head of Voe	nil
A970	Olna Firth	Mill Burn	2f
		Loch of Voe Burn	1o

B9075	Sand Water	Burn of Pettawater	nil
	Weisdale Voe	Burn of Weisdale	nil
B9071	Olna Firth	Burn of Kirkhouse	nil
	Gon Firth	Burn of Smerlawater	remains
		Burn of Voxter	2o
	E Burra Firth	Burn of Lunklet	nil
B9075	Cat Firth	Burn of Flamister	2f
		Burn of Quoys	remains
		Houlland	1f,1m,1o
	W Skellister Voe	Burn of Grunnawater	nil
		Burn of Skellister	2f
	S Nesting Water	Blackwater	nil
	Dury Voe	Burn of Grunnafirth	remains
	Laxo Voe	Laxo Burn	2vf, 1m
B9071	Laxo Voe	Seggie Burn	1m, 2o

* spraints categorised as very fresh (vf), usually deposited within last 24 hours, fresh (f), usually deposited within last 48-72 hours, medium (m) ca. 1-2 weeks old, old (o), > 2 weeks old.

The lack of otter holts in the current survey can, at least in part, be accounted for by the seasonality of breeding. If such dens are being used in the study area, then these are likely to be natal holts - with few or any signs at their entrances and consequently difficult to find.

The current survey confirms that otters move inland from the coasts, travelling up streams and across lochs. Most of the activity, however, appears to be restricted to sites close (<500m) to the sea. This does not mean that the species is not moving further inland, rather on such trips the individuals are travelling relatively quickly, and are not defaecating regularly along their travel routes. This is reflected by the fact that most of the inland sites contained only one or two spraints. At least six were associated with small pools and/or waterfalls – locations where fish were likely to congregate and offer feeding stations for the otters.

The lack of evidence of otter presence recorded during the survey suggests the population is not widely dispersed throughout the Viking study area, and, therefore, it is assumed to be at a relatively low density.

(d) ***Freshwater pearl mussel survey***

During May and July 2008, 47 watercourse sections within the proposed Viking study area were surveyed using a standard methodology for the presence of freshwater pearl mussels by EnviroCentre Ltd, using a team of two experienced freshwater pearl mussel surveyors. No live or dead freshwater pearl mussels were found in any of the watercourse sections surveyed (Appendix 10.5).

Freshwater pearl mussel habitat suitability assessments were divided into three broad categories: (i) Unsuitable, (ii) Partly suitable (occasional patches of marginal or suitable habitat), and (iii) Suitable (see Table 10.15). Small patches of potentially suitable habitat along with host salmonid fish were present in some reaches surveyed. Most burns sections surveyed held habitat that was completely unsuitable for freshwater pearl mussels. Only one watercourse, the Burn of Truggles, held plenty of potentially suitable pearl mussel habitat.

Table 10.15 Freshwater pearl mussel habitat assessment within Viking study area.

Viking watercourse	Habitat	Habitat partly	Habitat

	unsuitable	suitable	suitable
Burn of Oxnabool (Burn of Laxobigging)	X	(X)	
Burn of Easterbutton		X	
Burn of Skelladale tributarires	X		
Burn of Moorfield	X		
Stenswall	X		
Seggie Water		X	
Unnamed burn at Easter Scord	X		
Wester Filla Burn tributary	X		
Easter Filla Burn	X		
Thomas Jamieson Burn	X		
Gossawater Burn	X	X?	
Burn of Crookadale		X	
Gill Burn	X		
Burn of Quoys	X		
Unnamed Loch Skellister inflow burn	X		
Burn of Forse		X	
Burn of Grunnafirth	X		
Unnamed Quinni Loch inflow burn	X		
Burn of Forse	X		
Red Burn	X		
Burn of Truggles			X
Burn of Atlascord	X		
Unnamed Maa Water inflow burn	X		
Unnamed Lamba Water inflow burn	X		
Burn of Droswall	X		

The 47 watercourses searched during this survey were all relatively shallow and easily accessible in terms of depth, with no sections too deep to survey using standard shallow-water survey methods. Based on these findings, obtained under ideal surveying conditions, freshwater pearl mussels appear to be absent from the sections of watercourses surveyed within the Viking study area.

(e) ***Fish survey***

During fish surveys conducted by Waterside Ecology on 11 catchments during late August and early September 2008 the following findings were made. Five species were identified in the 11 streams surveyed: European eel, Atlantic salmon, brown/sea trout, three-spined stickleback and flounder (Table 10.16). Trout were present in all catchments surveyed, and fry (age, 0+) density varied greatly between and within catchments (Table 10.17), but parr (age, ≥ 1 year) density in most was fair or good by national standards (National Rivers Authority fish classification). Trout abundance at several sites was affected by the presence of stocked fish. These were not always identifiable in the field.

Salmon were present in only two catchments and densities were poor. Parr were identified in Burrafirth catchment but fry were absent, suggesting sporadic spawning. Both fry and 1+ parr were present in the Laxo catchment, but numbers were low and distribution restricted.

Table 10.16. Species occurrence by catchment

Catchment	Survey sites (n)	Eel	Trout	Salmon	3-spined stickleback	Flounder

Laxobigging	8	X	X			
Skella Dale	4		X			
Wester Filla	2		X			
Laxo	13	X	X	X	X	
Grunnafirth	5	X	X			
Crookadale	3	X	X			
Quoys	7	X	X			X
Kirkhouse	3		X			
Sandwater	3	X	X		X	
Weisdale	3	X	X			
Burrafirth	15	X	X	X		X

Table 10.17. Mean density of trout and salmon by catchment (correction factors applied)

Catchment	**Density Estimate (fish.100m^2)**			
	Trout		**Salmon**	
	0+	1++	0+	1++
Laxobigging	12.0	14.8	0.0	0.0
Skella Dale	4.4	12.8	0.0	0.0
Wester Filla	103.8	17.1	0.0	0.0
Laxo	38.5	14.1	0.5	0.5
Grunnafirth	6.4	12.0	0.0	0.0
Crookadale	20.8	9.0	0.0	0.0
Quoys	1.6	7.6	0.0	0.0
Kirkhouse	11.0	6.6	0.0	0.0
Sandwater	23.8	4.3	0.0	0.0
Weisdale	18.0	20.2	0.0	0.0
Burrafirth	21.8	9.4	0.0	0.9

The survey streams sustain a limited array of species. Given that only a small number of sites were surveyed in each catchment, it is possible that some species may have been missed. However, it is very unlikely that any species not listed in Table 10.6 are present in any of the streams. The most likely species to have been overlooked would be eels, three-spined stickleback and flounder. Eels occur at very low densities and their absence from survey sites in the Skelladale, Wester Filla and Kirkhouse catchments cannot be assumed to indicate their complete absence from these systems. Similarly, occasional flounders and three-spined sticklebacks may occur in the lower reaches of any of the streams, as these species occupy saltwater as well as freshwater habitats.

Based on data recorded in the NBN Gateway, salmon were previously recorded in the Burn of Weisdale, Burn of Sandwater, Burn of Kirkhouse, Laxo Burn, Burn of Grunnafirth and Burrafirth catchments. The lower reaches of the Burns of Weisdale and Sandwater were not included in the present survey, due to their distance from any proposed wind farm development activity. The potential presence of small numbers of Atlantic salmon in the lower reaches of these two streams cannot be discounted. In contrast, it is probable that the recent survey would have identified the presence of salmon in the Kirkhouse and Grunnafirth catchments were they there. Salmon may have been extirpated from these streams or may always have been sporadically present. Furthermore it has not been possible to ascertain whether salmon were stocked into any of the streams in the past either deliberately, for instance using excess farmed fry, or accidentally through escapes of farmed salmon. While it cannot be determined on the basis of available information that these two populations (Laxo

and Burrafirth) are truly wild (not based on farmed escapes), from a conservation perspective this should be assumed to be the case.

(f) ***Freshwater macro-invertebrate survey***

Freshwater macro-invertebrate surveys were conducted by Aquaterra Ecology in 2008. Freshwater macro-invertebrate community species composition is influenced by a wide range of factors. Amongst those factors, macrophyte and canopy cover were considered in detail and a summary is described below. Other variables were examined and are reported upon in Appendix 10.7.

Macrophytes and Canopy Cover

A characteristic feature of the watercourses in the Viking study area was the lack of canopy cover at all sites. The absence of riparian woodland allows light into the burns promoting growth of macrophytic in-stream vegetation where other factors are suitable. Macrophyte cover varied from 2% in the Burn of Flamister and Burn of Lunklet to 65% in the Burn of Weisdale (mean 26%).

The main constituent of the macrophyte cover was either vascular plants, bryophytes or algae. Vascular plants were prominent at Laxo Burn (with 30% cover of *Juncus* spp. and *Potamogeton* spp.) and Burn of Pettawater (with 60% cover of *Myriophylum alterniflorum*, *Iris pseudocarus* and *Caltha palustris*). The open structure of *Myriophylum* can provide good attachment points for invertebrates including the pupal stages of *Simulidae*.

The most widespread and abundant bryophyte was *Fontinalis antipyretica*, with smaller amounts of *Platyhypnidium riparioides* and *Scapania undulata*. *Fontinalis* had 40% coverage at North Burn and 50% coverage at Burn of Pettawater. Mosses provide a microhabitat within the riffle and have a proportionately different invertebrate community to uncovered areas.

Significant algal cover was found at several sites, 50% at burn of Weisdale, 40% at Wester Filla Burn and Burn of Crookadale, and 30% at Burn of Kirkhouse. The growth and subsequent decay of algae can be a significant organic input to the system.

The watercourses were open and bank-side vegetation consisted mainly of herbaceous vascular plants. The input of organic matter from bank-side vegetation is an important source of food for invertebrates in all watercourses. In small watercourses, such as the majority of the Viking study area burns, bank-side dominated input is proportionately higher than for larger watercourses. This input of organic (leaf) litter provides the detritus that many invertebrates feed on, including *Baetis rhodani* which is abundant in many of the Viking study area burns.

Freshwater macro-invertebrate communities

The groups recorded from each kick sample and the numbers of invertebrate species present in the samples are shown in Appendix 10.7. One important characteristic of the Viking study area watercourses was the low biodiversity of the invertebrate communities. The main reason for this is probably the isolation of Shetland. Low diversity was present in most groups, only one species of *Ephemeroptera* (mayflies) was present, two genera of *Plecoptera* (stoneflies) and seven species of *Trichoptera* (caddis flies). Many of the taxa associated with the fast

flowing well-oxygenated water of riffles on the Scottish mainland were absent. These included the *Plecoptera* families *Perlidae* and *Perlodidae*, the *Ephemeroptera* family *Heptageniidae* and the riffle beetles *Elmidae*. Interpretation of the invertebrate community data in Shetland has therefore to be viewed with some caution, in particular when used for the generation of biotic indices. Full detail of the invertebrate communities present is provided in Appendix 10.7. In general the invertebrate communities present were indicative of clean watercourses with good water quality and a small degree of organic enrichment.

10.5.4 Evaluation of nature conservation interest

Sections 10.5.4a-h identify and evaluate the features of nature conservation interest that are known to be present in the area potentially, directly or indirectly affected by the development. Section 10.5.4i summarises these evaluations. According to the IEEM guidance, legal protection is separate from the conservation evaluation of species and habitats. Evaluations of ecological features or resources are determined within a defined geographic context (e.g. international, national, regional, local). The socio-economic values of, and impacts on, ecological features (such as fisheries) should also be assessed and these are considered in Chapters 17, Socio-Economic and 19, Recreation and Tourism.

(a) ***Evaluation of vegetation/habitat interest***

Blanket bog/mire

Legal conservation protection: Active blanket bog (i.e. bog supporting a significant area of peat-forming vegetation) is listed as a Priority habitat on Annex 1 of the EC Habitats Directive and therefore the habitat is of international importance. Blanket bog is also a Priority habitat in the UK BAP and the component communities are Priority habitats on the Scottish Biodiversity List. The *Sphagnum* rich vegetation communities found on peat within the Viking study area (e.g. M1, M17a, M17b and M19) fall within these definitions.

Previous and current erosion is an important aspect of the blanket bog resource and special attention was given to the activity, i.e. current active build-up of peat, in different areas of the Viking study area. Section 10.5.3 (a) identifies how this activity was scored and Figures 10.07-10.11 illustrate the rating across the study area. It is clear the blanket bog habitat varied considerably in its activity across the four quadrants, with a mosaic of more or less totally inactive, largely inactive, intermediate, broadly intact and mainly active and more or less fully active resource.

Most of the degraded and inactive areas are within and through the survey area, mainly around broad summit crests and ridges and are principally due to a combination of trampling from sheep grazing and natural erosion from the elements. The general grazing impact is intensive to moderate over most of the site with the effect of widespread vegetation and habitat change and localised erosion.

Assessing the value or significance of the blanket bog resource in the Viking study area is not straight forward due to a number of factors. Firstly, the quality or activity of the blanket bog varies spatially across the site and very much depends upon which area is being looked at (for example the proposed track, anemometer and turbine layout in Collafirth is almost entirely on top of intact and active blanket bog, whereas in Nesting it is on much more

variable activity). Secondly, the blanket bog resource within the study area is not designated at all. Management varies across the site, but impacts on blanket bog from grazing, drainage and peat cutting are evident in many areas.

Using the examples of the geographic value or significance of designated sites and habitats in Scotland outlined in Table 10.4 suggests that the large area of 'viable' habitat within the wider study area has a significance greater than local value, but not sufficient for SSSI designation. In such a well studied area as Shetland if the value of the blanket bog was recognised to be of national or international significance, the Viking area would be expected to be designated a SSSI or SAC and it clearly is not. Therefore, the over-all blanket bog resource within the Viking study area is certainly of *Regional* value.

However, there are many areas of undesignated, good quality, blanket bog throughout Scotland, some of which are considered of much greater value than designated sites. It could also be argued that the outlying Shetland blanket bog should be considered of *National* value due to Shetland having the northernmost large tract of this habitat in the UK and the Viking study area holds one of the few large areas occurring on an island. Although the blanket bog vegetation on Shetland is not quite as rich as it often is further south on the mainland, it is composed of a very typical range of species and is, away from eroding areas, in relatively good condition. The absence of *Molinia caerulea* and general low presence of *Erica tetralix*, for example, gives this vegetation its own character and potentially a reason to be regarded as local variants of the NVC blanket bogs types described. In addition, the IEEM guidelines highlight that undesignated sites should be considered more highly if their geographical position warrants it. Therefore, the over-all evaluation of the Viking study area with regard to blanket bog is best described as of *Regional* possibly *National* value.

Wet and dry dwarf shrub heath

Legal conservation protection: North Atlantic wet heaths with *Erica* (all subtypes) are listed as habitats of European Importance being listed on Annex 1 of the EC Habitats Directive, and therefore the habitat is of international importance. Upland heath is very widespread and common habitat in Scotland and is listed as a Priority habitat under the UK BAP and its component communities are priority habitats on the SBL.

The general grazing impact is intensive to moderate over most of the Viking site and it is known to be a major factor in the composition of the vegetation in Shetland. Due to heavy grazing pressure, the wet and dry heaths in the Viking study area are frequently grassy in nature and occur in intimate mosaics with acid grassland. *Sphagnum* can be present, but it is usually more patchy than in blanket bog and can often be found trampled by grazing animals.

Using the examples of the geographic value or significance of designated sites and habitats in Scotland outlined in Table 10.4 suggests that the value of wet and dry heath is either local or regional. If the value of the wet and dry heath resource was of national or international significance, parts of or all of the study area would be expected to be designated a SSSI or SAC and it is not. To reach regional significance, '*a large area of 'viable' habitat within the wider study area has a significance greater than local level, but not sufficient for SSSI designation*'. Furthermore, it should contain '*a significant assemblage of nationally or regionally scarce species, but not sufficient for SSSI designation*'. Despite covering a large area, the heavily grazed (relatively poor) condition of most of the upland heath resource and

the lack of a significant assemblage of nationally or regionally scarce species means the current Viking wet and dry heath habitat resource is considered to be of *Local* value.

Acid grassland

Legal conservation protection: None.

Acid grassland occurs throughout the survey area and is common within mosaics with wet and dry heaths, as well as within areas of eroding blanket bog. None of the acid grassland communities present has international or national interest and they are widespread and common across Shetland. Consequently, the acid grassland is considered to be of *Local* value.

Base-rich flushes

Legal conservation protection: None.

Base-rich flushes (M10) are an important component of vegetation across the Viking study area because they support a completely different suite of species in an overwhelmingly acid landscape. The Shetland flushes are generally low in number of indicator species and are not particularly good examples of the vegetation type. However, the richer ones were target noted. M10 type flushes are frequent throughout Scotland, much more so in areas where there is some basic rock where they can then be very rich. None of the base-rich flushes present has international or national interest. Consequently, they are considered to be of *Local* value.

Other terrestrial habitats

Legal conservation protection: None.

Of the other vegetation communities and fragments present at the proposed Viking site, none occurs in sufficiently large area or is of sufficient importance to warrant anything other than being considered of *Local* value.

Aquatic habitats (standing open and running freshwaters)

Legal conservation protection: Water Framework Directive. Standing open water is also a Priority habitat in the UK BAP and the component communities are Priority habitats on the SBL.

Most of the oligotrophic bodies of standing open water (lochs, lochans and bog pools) are integral to the blanket bog habitat and therefore, as a combined resource, are evaluated as such, i.e. of *Regional* value. The ecological evaluation of the running waters is slightly more complex, in that the burns or stream catchments surveyed were indicative of clean watercourses with good water quality and a small degree of organic enrichment. These watercourses provide habitats for otter and salmonids, but themselves contain low biodiversity in terms of macro-invertebrate communities present. Since these watercourses are also integral to the blanket bog habitat (and other locally important habitats), as a combined resource they can be evaluated as such, i.e. of *Regional* value.

(b) ***Evaluation of plant species interest***

Legal conservation protection: None.

None of the species recorded during the rare plant survey is included amongst those in a list of rare or otherwise notable species in Shetland (Scott *et al.,* 2002), with the exception of one taxon: *Taraxacum*. No other notable species (in a local, national or international context) were encountered during the survey within the 100m buffer zone extending from the location of the tracks, infrastructure and turbine locations (resulting in a 200m wide corridor) and the species in each location were generally found to be common and widespread. Therefore, the plant species resource in the Viking study area is considered to be of *Local* value.

(c) ***Evaluation of otter interest***

Legal conservation protection: The otter is protected under international legislation as a European Protected Species. Otter is also a Priority species in the UK BAP.

The well studied Shetland otter population is considered to be internationally important (Conroy, 1998), despite being a non-native species to the islands. The current survey (Appendix 10.4) found a general lack of evidence of otter presence within the Viking survey area, suggesting the otter population is not widely dispersed throughout the proposed development area and therefore it is assumed to be at relatively low density. The evidence from the current study supports an evaluation of the site with regard to the otter population as being of *Local* value. However, the authors (Appendix 10.4) highlight limitations and assumptions with the standard survey techniques used, in particular the difficulty in finding natal holts. These limitations suggest that otter use of the study area might have been under-estimated. If this were the case, then evaluation regarding the otter population within the Viking study area might increase to *Regional* value.

In such a well studied area as Shetland if the evaluation of the otter population in the Viking study area was of national or international value, the Viking area would be expected to be designated a SSSI or SAC and it is not. Therefore, the over-all evaluation of the Viking study area with regard to the otter population is of *Local* possibly *Regional* value.

(d) ***Evaluation of terrestrial vertebrate interest***

Legal conservation protection: The Wildlife and Countryside Act 1981 as amended, provides protection against certain methods of trapping and killing some terrestrial mammal species.

During other species surveys, the following terrestrial vertebrates were recorded within the study area: rabbit, mountain hare, polecat, stoat, hedgehog and common frog. All six are introduced non-native species. IEEM do not provide guidance on determining the value of non-native species, so professional judgement and general guidance from the Invasive Non-native Species Framework Strategy for Great Britain (Defra, 2008) is used. This suggests an evaluation of *Low or No* conservation value of these species within the Viking study area. As a consequence of this *Low or No* valuation, these non-native species are not considered valuable ecological receptors and so they are not subject to further evaluation, assessment and consideration within this chapter.

Following the logic of the Defra strategy it could be argued that the main conservation value of these species populations would be in their control, removal or eradication from the study

area (and Shetland in general). However, this is beyond the scope of this wind farm assessment.

(e) ***Evaluation of terrestrial invertebrate interest***

Legal conservation protection: None.

Desk-studies suggest that two terrestrial invertebrates of conservation importance occur within the study area: *Eudonia alpina* and *Carsia sororiata anglica* (the Manchester treble-bar moth). *Eudonia alpine* is a locally common moth in mainland Shetland and *Carsia sororiata angelica* is a nationally widespread moth, locally frequent or common and probably an under-recorded northern species. For under-recorded species, it is difficult to put their presence within the study area into wider geographical (e.g. Shetland) context. Therefore it is not clear which is the most appropriate evaluation of moth interest in the study area, but the Viking population of both species is probably of *Local* value.

(f) ***Evaluation of freshwater pearl mussel interest***

The current survey (Appendix 10.5) found no evidence of freshwater pearl mussels within the surveyed reaches of the study area. Aside from the Burn of Truggles, very little apparently suitable freshwater pearl mussel habitat was found in the watercourse reaches that would be potentially impacted by the proposed development. However, the presence of some suitable in-stream habitats and salmonid species in some locations means that although no evidence was found of existing populations of freshwater pearl mussels, the potential exists (at least in theory) for freshwater pearl mussels to naturally colonise and become established (or re-established if they were formerly present). Whilst some reaches lower down in catchments were not searched for freshwater pearl mussels, without evidence to the contrary, freshwater pearl mussels are likely to be absent in the study area and are therefore not subject to further evaluation, assessment and consideration within this chapter.

(g) ***Evaluation of fish interest***

Legal protection: Atlantic salmon is protected under Annex II of the Habitats and Species Directive, the Bern Convention and the UK BAP. Salmon and trout are protected under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

The fish survey (Appendix 10.6) found evidence of five species of fish within the Viking survey reaches. The presence of Atlantic salmon in two watercourses, the Laxo and Burrafirth must be considered in the wider context of the rarity of the species in Shetland. Salmon are occasionally recorded in some streams. While it cannot be determined on the basis of available information that these two populations are truly wild (and not based on fish farm escapes), this should be assumed to be the case and therefore the evidence supports an evaluation of *Regional* value.

Although the genetic structure of Shetland's sea trout populations is not known, on the basis of current knowledge of stock structure, it is probable that the trout stocks of each stream should be evaluated as of *Local* value. The combined stocks within the four wind farm quadrants, when taken together, would be of *Regional* value in terms of the likely genetic diversity they represent (both in migratory and non-migratory form).

The populations of the three remaining species (eel, three-spined stickleback and flounder) on a catchment basis should be considered of *Local* value.

(h) ***Evaluation of freshwater macro-invertebrate interest***

Legal protection: None.

The invertebrate communities present in the study area watercourses consisted mainly of common and widespread species and no rarities were found (Appendix 10.7). Diversity was found to be low which may be a result of Shetland's isolation but this is not certain. In general communities were typical of those found in moderately clean and well-oxygenated water. The relative proportions of invertebrate groups indicated no significant organic enrichment. Where enrichment was indicated it is likely to be the result of natural inputs. Abundance and biomass of invertebrates appeared to be low to moderate in all watercourses.

ASPT scores indicated that the water quality of the watercourses was fair or good. Water Chemistry Status Scores indicated that the watercourses were either slightly acidic or circum-neutral. Overall the water quality, invertebrate communities and productivity should support sustainable salmonid populations if other environmental factors are suitable. Based on this evidence the evaluation of the freshwater macro-invertebrate interest within individual watercourses within the development area is considered to be of *Local* value.

(i) ***Summary evaluation of the nature conservation interest***

The proposed Viking site mainly comprises blanket bog and mire communities of *Regional* possible *National* value in varying grades of activity, including large areas of intact and active blanket bog, but the vegetation has also been modified by peat cutting, drainage and grazing over large areas. Other widespread terrestrial habitats such as wet or dry heaths and acid grassland are considered to be of *Local* value and are heavily or moderately grazed. A range of other habitats, mostly in small patches or in mosaics with the main habitats occur around the site and these are considered to be of *Local* value. Standing open and running freshwaters are considered integral to the blanket bog habitat and when combined, the resource is considered to be *Regional* value.

Non-avian species of conservation importance within the Viking study area include otter, assessed to be of *Local* value based on existing evidence. All other terrestrial vertebrates present within the study area are introduced, non-native species and are assessed to be of *Low or No* value and are not subject to further consideration. The assessment of terrestrial invertebrate interest suggests that two moth populations of *Local* value are present. The freshwater invertebrate communities present in the Viking watercourses consist mainly of common and widespread species and no rarities were found, so they were assessed to be of *Local* value.

Brown/sea trout are present in several watercourses and water bodies and are individually assessed as being of *Local* value. However, the combined stocks when taken together would be of *Regional* value in terms of the likely genetic diversity they represent. Atlantic salmon were recorded in two watercourses, but the proximity of salmon fish farm cages raises some questions as to the origin and therefore evaluation of wild Atlantic salmon at the Viking site. However, due to their rarity in Shetland these are considered to be of *Regional* value until evidence to the contrary is available.

10.6 IMPACTS EVALUATION

10.6.1 Predicting and Characterising Ecological Impacts

Development activities likely to impact on the ecological features are identified and summarised in Table 10.1 and 10.2 and described in section 10.2.4. Following best practice guidance (IEEM, 2006), the likelihood of an impact occurring and an estimate of the confidence in the prediction of ecological effects are given. Impacts may be:

- Predictable or unpredictable;
- Direct or indirect;
- Positive (beneficial) or negative (harmful);
- Temporary or permanent;
- Short, medium or long-term;
- Immediate or delayed;
- Certain or uncertain;
- Avoidable or unavoidable;
- Reversible or irreversible;
- Localised or widespread;
- Small or large;
- Individual or cumulative; and
- Significant or of no consequence.

(a) ***Impact magnitude***

Impacts on ecological receptors may be positive, neutral or negative. The characteristics of an impact involve several factors such as magnitude (e.g. number of individuals killed or displaced by an activity, or hectares of habitat lost), extent (the area over which the impact occurs), duration (the time over which impact occurs), reversibility (whether impact is temporary or permanent) and its timing or frequency. A reversible (temporary) impact is one from which spontaneous recovery is possible or for which effective mitigation is possible and an enforceable commitment to undertake this mitigation has been made. An irreversible (permanent) impact is one from which recovery is not possible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. Timing of an action can also have a big effect on its impact. Finally, a level of confidence (e.g. certain, probable, possible or unlikely) should be attached to both the occurrence of a predicted impact and the assessment of its ecological effect. Magnitude refers to the 'size' or 'amount' of a predicted impact and is usually characterised as 'high' (fundamental large change to the distribution, population or status is an important receptor, resulting in a long-term or permanent change), moderate (detectable change in distribution, population or status of an important receptor, resulting in a temporary change), minor (small-scale, local or short-term change in an important receptor) or negligible (no noticeable change in an important receptor).

(b) ***Impact significance***

Consideration of the above magnitude issues helps to determine the likely significance of a potential impact. IEEM (2006) describe a significant impact as '*a positive or negative impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species* (i.e. receptor) *within a defined geographical area*'. The importance level of the receptor then defines the geographical terms of reference at which predicted impacts may be considered significant, e.g. an impact on a habitat evaluated to be of regional value is either significant or not at the regional level. Nevertheless, predicted impacts at lower levels can and do occur.

A particular weakness in the IEEM guidance relates to the evaluation of non-native species and evaluating impacts upon them. For example, there is no guidance on the valuation to attach to a non-native species, such as otter in a Shetland context, and evaluating any potential impacts upon it. Professional judgement will necessarily be used, in light of relevant legislative requirements and values attached by consultees.

The concept of integrity is usually only applied to sites and ecosystems and has been defined by the Scottish Executive (2000) for designated sites as '*The coherence of its* (a site) *ecological structure and function across its whole area, that enables it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified'*. Further details are provided about favourable condition. This guidance has been developed particularly with Natura 2000 sites and to a lesser extent SSSIs in mind. Its applicability to non-designated wider countryside areas or features, within an era of rapid climate change, has not been fully explored.

In this assessment an ecologically significant impact is defined following IEEM guidance. IEEM (2006) recommends that the concept of conservation status is used to determine whether potential impacts are likely to be ecologically significant, using the following definitions:

- '*For habitats, conservation status is determined by the sum of the influences acting on the habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival or its typical species within a given geographical area*'.
- '*For species, conservation status is determined by the sum of the influences acting on the species concerned that may affect its long-term distribution and abundance of its populations within a given geographical area'*.

Conservation status may be evaluated for any defined study area at any defined level of ecological value. The extent of the area used in the assessment relates to the geographical level (scale) at which the feature is considered important (see section 10.5.4).

(c) ***Mitigation, Compensation and Enhancement***

Findings from the baseline surveys and the predicted impacts were used to inform proposed mitigation measures to avoid, reduce and compensate for any negative impacts identified. Wherever possible, enhancement and mitigation measures have been incorporated into the scheme layout and design process (Chapters 3 and 4). Habitat compensation and enhancement issues are explored in greater detail within the Viking Habitat Management Plan (Appendix 10.9) and Section 10.7.

(d) ***Limitations of the assessment***

Although a great deal of work has gone into identifying and defining the main sensitivities and important receptors across the site, it is quite possible that some species were overlooked despite liaising with local consultees and using recommended best practice survey methodologies. Nevertheless, this report identifies the probable value of the study area in non-avian conservation terms, based upon consultation responses, desk study and survey work undertaken. It does not describe the total ecological composition of the study area.

(e) ***Assumed design, management and mitigation***

The following design, management and mitigation measures are assumed:

- Site infrastructure design and layout to minimise impacts on habitats of highest sensitivity, with particular reference to blanket bog, burns, lochs and wet flush habitats, as far as possible;
- Final locations of site infrastructure to be micro-sited in relation to sensitive habitats to minimise impacts, with particular reference to blanket bog, burns, lochs and wet flush habitats;
- Demarcation of defined working areas during construction phase to prevent unnecessary entry to and disturbance of habitats and sensitive features of conservation importance;
- All machinery and heavy plant brought into the site to be thoroughly cleaned prior to use;
- Adoption of best practice techniques of track and turbine base construction to ensure that drainage patterns and water quality within the study area are maintained (see Chapters 14, Soil and Water and 15, Roads and Traffic); habitat continuity and faunal commuting routes at stream crossings are not disrupted; materials appropriate to site geology are used in construction; and to minimise 'habitat take';
- Adoption of best practice techniques in compound and lay-down areas to ensure that stored materials (including fuel, concrete etc.) do not contaminate or pollute soils or watercourses (see Chapter 14, Soil and Water);
- Adoption of best practice techniques in borrow pits to ensure any pumped drainage water is settled prior to any discharge to the study area watercourses (see Chapter 14, Soil and Water).
- Early restoration of all road batters, waste peat mounding, turbine bases, site compounds and borrow pits to minimise effects due to soil or peat exposure and erosion and to optimise the chances of successful use of rescued live plant material. Use of appropriate plant material native to, and preferably collected in, the locality of the proposed works.

Once the peripheral (buffer) areas affected by construction have been restored, the area that will be covered by hardcore or concrete or turbines, or will consist of a quarried ground (i.e. borrow pit), will amount to about 252ha, or approx. 1.35% of the planning application area.

10.6.2 Impacts on designated sites

There are two nature conservation designated sites within the Viking study area: the Burn of Lunklet SSSI (1.4ha designated for endemic hawkweed species) and the Kergord plantations SSSI (6.45ha designated for broadleaved, mixed and conifer woodlands). Neither of these designated sites lies within the area directly proposed for development.

(a) ***Negative construction impacts***

Impact magnitude, extent and duration

Potential ecology construction impacts are defined in Table 10.1 as those caused by the following activities: mobile plant operations and traffic, cable laying, construction compounds and lay-down areas, excavation operations related to turbine bases and borrow pits. These potential direct impacts amount to direct habitat loss, disturbance to habitats, habitat fragmentation and severance, alterations in habitat due to changes in hydrology and water chemistry, some temporary disturbance to fauna during the period of construction and sediment release into water courses. Since construction impacts will be away from both the Burn of Lunklet SSSI and the Kergord plantations SSSI, the magnitude of predicted direct impacts on the conservation features of these nationally important designated sites during construction is evaluated as being *negligible* with no significant impacts predicted. Potential negative secondary construction impacts on downstream designated sites such as the Burn of Lunklet SSSI are considered under 10.6.2.c Secondary impacts.

(b) ***Negative operational impacts***

Impact magnitude, extent and duration

Potential ecology operational impacts are defined in Table 10.2 as those caused by the on-going operation of the following activities: turbines, foundations, tracks, cables, anemometers, sub-stations, borrow pits, road improvements, crane pads and lay-down areas. Since on-going and operational impacts will be away from both the Burn of Lunklet SSSI and the Kergord plantations SSSI, the magnitude of predicted impacts on the conservation features of these nationally important designated sites during operation is evaluated as being *negligible* with no significant impacts predicted.

(c) ***Negative secondary impacts***

Impact magnitude, extent and duration

The following secondary or indirect construction impacts could potentially occur and affect the important natural heritage features of designated sites.

Pollution or sedimentation of water courses caused by construction activities

Summary of potential construction pollution or sedimentation impacts on designated sites:

Parameter	**Assessment**
Extent	Burn of Lunklet SSSI
Magnitude	Negligible on designated features
Duration	Short-term = event

	Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

The Burn of Lunklet SSSI is well away from any direct impacts from the wind farm construction and operation. However, the upper catchment will have significant work associated with track and turbine construction. It is possible that if pollution runoff occurred in the upper catchment, pollutants or sedimentation runoff materials (most likely peat) would be washed downstream and enter the Burn of Lunklet SSSI.

The important designated feature of the Burn of Lunklet SSSI is the range of endemic hawkweed species growing on the river banks. If pollution or sedimentation runoff occurred, it is unlikely that it would impact on the important features of the SSSI as these are not within the watercourse, but on banks that are inaccessible to grazing. Therefore, any predicted impact, whilst adverse to water quality of the Burn of Lunklet, would not threaten the SSSI features or site integrity and therefore is considered to be of *negligible* magnitude with no significant impacts predicted. Runoff and pollution issues are addressed further in Chapter 14 Soil and Water.

Introduction of non-native species caused by contaminated heavy plant during construction

Summary of potential introduction of non-native species impacts on designated sites:

Parameter	**Assessment**
Extent	Burn of Lunklet SSSI
Magnitude	Negligible
Duration	Medium-term
Reversibility	Probably reversible
Frequency	One-off?
Probability	Unlikely

The flora and fauna of Shetland has been significantly impacted by the (deliberate and accidental) introduction of non-native species. One of the vectors through which such species potentially get introduced and established is the introduction of seeds and other reproductive materials on the tracks, wheels and underside of heavy plant machinery brought in, uncleaned and contaminated, from other locations. Since some of the equipment needed to construct the proposed wind farm will likely come from outside Shetland, the possibility exists for reproductive materials from non-native plants to be introduced to the development area.

The Burn of Lunklet SSSI is away from any direct impacts from the wind farm construction and operation. However, the upper catchment will have significant work associated with track and turbine construction. It is possible that reproductive materials from non-native

plants could become detached from machinery and eventually disperse downstream, colonise and establish within the Burn of Lunklet SSSI.

The important conservation features of the Burn of Lunklet SSSI are the range of endemic hawkweed species growing on the river banks. If non-native plant species dispersal occurred and entered the Burn of Lunklet SSSI, it is possible that it would impact on the important features of the SSSI. To ensure this does not occur, all heavy plant machinery brought into the development site will be thoroughly cleaned to prevent any site contamination with non-native plant material (as per 10.6.1. (b) Assumed design, management and mitigation). Therefore, the threat posed by contamination of designated sites with non-native reproductive plant material is considered very unlikely to occur and therefore to be of *negligible* magnitude with no significant impacts predicted.

(d) ***Negative cumulative impacts***

Because all the impact magnitude assessments are *negligible* and no significant impacts are predicted, no significant negative cumulative impacts are predicted for designated sites.

(e) ***Positive construction, operational and secondary impacts***

No positive construction, operational and secondary impacts on designated sites are predicted.

No significant impacts on non-avian features of designated sites during construction and operation are predicted. The conservation status of the designated sites will not be significantly affected during construction and operation of the Viking Wind Farm.

10.6.3 Impacts on habitats

Impacts on terrestrial and aquatic habitats are discussed in this section and have been determined by overlaying the proposed wind farm design layout on to the habitats map. A series of design, management and mitigation measures have been incorporated into development of the wind farm (see section 10.6.1 (e)), including scope for mitigation through the micro-siting of the infrastructure prior to construction. The following assessment of impacts upon habitats assumes these measures will be incorporated and implemented fully. If this is not done, the magnitude and significance of predicted impacts on habitats and associated species will likely be greater.

(a) ***Negative construction impacts***

Potential construction impacts on non-avian ecology are defined in Table 10.1. If during the construction of the turbines and ancillary structures (substations, power lines and roads etc.) appropriate protection measures are not implemented then there is a potential danger of:

- Direct habitat loss/disturbance;
- Severance and habitat fragmentation;
- Disturbance due to vibration or movement;
- Damage to water courses by sedimentation of streams;

- Chemical and oil pollution; and
- Changes in hydrology and soil chemistry leading to vegetation changes.

Terrestrial habitats affected directly by predicted construction impacts in each of the four quadrants are listed in Table 10.18. The largest area of habitat directly affected during construction will be 238.5ha of blanket bog (of all activities), followed by 17ha of acid grassland. Smaller areas of wet and dry heath, semi-improved grassland and mosaics of heath and grassland will also be negatively affected.

Table 10.18. Area of terrestrial habitat affected directly by predicted construction impacts

Habitat category	Nesting	Kergord	Delting	Collafirth	Site total
Blanket bog/mire	90.45ha	80.09ha	50.66ha	17.33ha	**238.53ha**
Dry heath	0.5ha	0.39ha	3.93ha	0ha	**4.82ha**
Wet heath	0.45ha	0ha	10.37ha	0.31ha	**11.13ha**
Acid grassland	3.52ha	7.2ha	2.38ha	4.23ha	**17.33ha**
Semi-improved grassland	0ha	0.05ha	0ha	0.23ha	**0.28ha**
Dry heath grassland mosaic	0.74ha	7.08ha	0.04ha	0.05ha	**7.91ha**
Wet heath grassland mosaic	4.65ha	3.43ha	0ha	0ha	**8.08ha**

Direct terrestrial habitat loss

Summary of potential direct construction habitat loss impacts:

Parameter	Assessment
Extent	Site wide, but also downstream beyond site boundary
Magnitude	Blanket bog/mire = 238ha Moderate Heaths (wet & dry) = 16ha Low Acid grassland = 17ha Low Semi-improved grassland = 0.3ha Low Heath/grassland mosaics = 16ha Low
Duration	Long-term
Reversibility	Mainly irreversible
Frequency	One-off

Probability	Certain

The main construction impacts causing habitat loss are likely to be creation of borrow pits, cabling (including cable trenching), tracks and construction compounds. Cabling would run adjacent to the tracks and is likely to be located in the zone of habitat loss/change caused by the creation of the tracks. The area occupied by individual borrow pits will be determined following further site investigation work, but it is estimated to vary between 2,000m^2-17,700m^2 for each of the 14 borrow pits.

It is clear that the majority of the habitat lost underneath proposed tracks and associated cables, anemometer and turbine layout is on intermediate fragmenting/eroding bog or mostly intact and active bog (Table 10.18). It is not possible to attribute proportions of bog lost of particular activity ratings because micro-siting (within 50m (or 100m in exceptional circumstances) either side of tracks etc) will be used to move tracks etc to avoid the most sensitive habitats and this will necessarily be carried out on the ground and not as a desk-based exercise. The blanket bog activity rating figures provide the opportunity in many areas to avoid the most sensitive, intact and active blanket bog areas through micro-siting. However, in some areas, especially Collafirth but also significant parts of Delting, Nesting and Kergord there is little scope for moving off intact and active areas of blanket bog. The 238ha of blanket bog predicted to be lost or otherwise affected during construction constitute approximately 1.5% of the total Viking study area.

For each of the other habitats present (heaths, acid and improved grassland etc.), predicted habitat loss or damage (summarised in Table 10.18) during construction constitutes $<1\%$ of the total Viking study area. In other words, very small areas of other habitats are likely to be lost as a consequence of wind farm construction.

A floating method of access track construction is proposed where peat depths exceed 1.0m. Water discharging from the surface of the track may cause an increase in habitat wetness in adjacent areas or may drain along the track if any subsequent subsidence occurs. Ponding may occur against the upslope side of mounding created from waste peat from excavations also leading to an increase in habitat wetness and potentially bog pool formation where the change is permanent. This change may be less damaging than drying of the open cut peat surfaces, created during track construction or from current site management practices.

There is high potential for the disturbance or disruption of hydrological regimes of blanket bogs during track construction. Trackside drains may disrupt existing drainage patterns, intercepting existing drainage patterns, potentially causing the drying out of habitats in some areas and erosion and scouring at discharge points. Other wind farm infrastructure, such as temporary compounds, turbine bases and borrowpits also has the potential to intercept surface water flows and peatland hydrology. This is considered in detail in Chapter 14 Soil and Water.

These impacts are negative, but insufficient to affect the integrity of any habitat types. Impacts potentially affecting peatland/blanket bog hydrology are specifically addressed in Chapter 14 Soil and Water. The magnitude of construction impacts on habitats are therefore assessed as likely to be *moderate* for active blanket bog, which is the most widespread habitat affected and *low* for other habitats including wet and dry heath, semi-improved grassland, acid grassland and heath/grassland mosaics.

Severance

Summary of potential construction severance impacts on habitats:

Parameter	Assessment
Extent	Site wide
Magnitude	Low
Duration	Long-term
Reversibility	Reversible
Frequency	Single event
Probability	Possible

Severance describes the loss of continuity between habitats which ultimately results in the isolation of habitat patches or fragmentation of discrete populations of species associated with those habitats. In the context of the Viking Wind Farm, there is the potential for severance of both terrestrial and aquatic habitats across the site.

Bridges and culverts have the potential to block aquatic habitats and impede movements of associated species (e.g. otters and fish). As part of the design process, otter and fish 'friendly' designs (with appropriate mammal ledges to provide routes for passing through water-course crossings) have been considered and built into the design plan process to ensure severance of watercourses does not occur. Consequently the magnitude is assessed as likely to be *low* and no significant impacts are predicted for aquatic habitats.

Tracks and roads have the potential to separate terrestrial habitats and impede movements of associated species. The average width of all new proposed tracks and roads is 6m (for single width tracks) and 12m (for double width tracks). There is no evidence that any of the important ecological receptors associated with the Viking habitats would find a 6-12m track a physical barrier, causing severance and preventing movement between habitat patches. Therefore the magnitude is assessed as likely to be *low* for terrestrial habitats and no significant impacts are predicted. However, the roads and tracks might act to sever or impede the hydrology of blanket bog/mire systems. This could directly and indirectly degrade peatland systems, with resultant impacts on surface habitats. The Viking scheme layout has been designed and planned with this concern in mind. Chapters 14, Soils and Water and 15, Roads and Traffic consider and assess potential impacts on peatland hydrology in detail.

Construction or improvement of culverts and bridges at the 97 crossing points will result in a permanent loss of a small area of riparian habitat (unlikely to exceed 15m in length at each crossing site). Thus the magnitude of habitat loss impacts on aquatic habitats is assessed as *low* and no significant impacts are predicted.

Pollution or sedimentation of aquatic habitats

Summary of potential construction pollution or sedimentation impacts on aquatic habitats:

Parameter	Assessment
Extent	Site wide, but also

	downstream beyond site boundary
Magnitude	High
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14 Soil and Water and in Appendix 14.6), it is unlikely that a serious pollution incident would occur during construction. The main sources of pollution are likely to be siltation (from peat sediment), fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. Such episodes can lead to a sudden pulse of pollutant, which, if not readily contained, might enter the aquatic environment and could affect habitats and associated species directly.

Based on the freshwater macro-invertebrate survey data, communities were typical of those found in moderately clean and well-oxygenated water. ASPT scores indicated that the water quality of the watercourses was also fair or good. Thus, the baseline conditions of the Viking study area aquatic habitats can be considered to be reasonable to good, and any serious pollution event would likely have a *high* magnitude and significant adverse impact upon these habitats in at least the short-term.

(b) ***Negative operational impacts***

The potential operational impacts on habitats are similar to those predicted during construction, namely:

- Direct habitat loss or disturbance;
- Disturbance due to vibration or movement;
- Damage to water courses by sedimentation of streams;
- Chemical and oil pollution; and
- Changes in hydrology and soil chemistry leading to vegetation changes.

Terrestrial habitats affected directly by predicted operational impacts in each of the four quadrants are listed in Table 10.19. The largest area of habitat directly affected during operation will be ca 197ha of blanket bog (of all activity), followed by 15ha of acid grassland. Smaller areas of wet and dry heath, semi-improved grassland and mosaics of heath and grassland will also be negatively affected.

Table 10.19. Area of terrestrial habitat affected directly by predicted operational impacts

Habitat category	Nesting	Kergord	Delting	Collafirth	Site total
Blanket bog/mire	74.33ha	66.14ha	41.43ha	14.65ha	**196.66ha**
Dry heath	0.34ha	0.28ha	3.84ha	0ha	**4.46ha**
Wet heath	0.3ha	0ha	9.43ha	0.19ha	**9.92ha**
Acid grassland	3.14ha	6.19ha	1.72ha	3.91ha	**14.96ha**
Semi-improved grassland	0ha	0.03ha	0ha	0.15ha	**0.18ha**
Dry heath grassland mosaic	0.51ha	6.55ha	0.02ha	0.02ha	**7.1ha**
Wet heath grassland mosaic	4.03ha	2.45ha	0ha	0ha	**6.48ha**

Direct terrestrial habitat loss

Summary of potential direct operational habitat loss impacts:

Parameter	Assessment
Extent	Site wide, but also downstream beyond site boundary
Magnitude	Blanket bog/mire = 197ha Moderate Heaths (wet & dry) = 14ha Low Acid grassland = 15ha Low Semi-improved grassland = 0.2ha Low Heath/grassland mosaics = 14ha Low
Duration	Long-term
Reversibility	Irreversible
Frequency	One-off
Probability	Certain

The majority of the habitat permanently lost underneath operational infrastructure is on mostly intact and active bog or intermediate fragmenting/eroding bog (Table 10.19). The habitat will actually be lost during construction, but some habitats affected will be restorable, so the data in Table 10.19 are the final predicted figures for direct habitat lost during operation of the Viking Wind farm.

As discussed under construction impacts, it is not possible to attribute exact proportions of bog lost of particular activity ratings because micro-siting (within 100m either side of tracks etc) will be used where possible to move tracks etc to avoid the most sensitive habitats (such as high activity blanket bog, base-rich flushes etc.) and this will necessarily be carried out on

the ground and not as a desk-based exercise. However, the GIS (computerised mapping) data exist that would allow blanket bog activity proportions to be calculated for sections of tracks where the activity rating was homogeneous within 100m either side of track lines, i.e. where no scope exists to avoid active blanket bog.

The 197ha of blanket bog predicted to be permanently lost during construction constitutes approximately 1.3% of the total Viking study area. Each of the other predicted operational habitat losses constitutes less than 0.1% of the total Viking study area.

These impacts are negative, but insufficient to affect the integrity of any habitat types. Impacts potentially affecting peatland/blanket bog hydrology are specifically addressed in Chapter 14, Soil and Water. The magnitude of operational impacts on habitats are therefore assessed as likely to be *moderate* for active blanket bog, which is the most widespread habitat affected, and *low* for other habitats including wet and dry heath, semi-improved grassland, acid grassland and heath/grassland mosaics.

Pollution or sedimentation of aquatic habitats

Summary of potential operational pollution or sedimentation impacts on aquatic habitats:

Parameter	**Assessment**
Extent	Site wide, but also downstream beyond site boundary
Magnitude	High
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14, Soil and Water, and in Appendix 14.6), it is unlikely that a serious pollution incident would occur during operation of the Viking Wind Farm. The main sources of pollution are likely to be siltation (from peat sediment), fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in maintenance vehicles. During the operation of the wind farm, few storage facilities capable of causing a serious pollution incident will remain on site. Such episodes can lead to a sudden pulse of pollutant which, if not readily contained, might enter the aquatic environment and could affect habitats and associated species directly.

Based on the freshwater macro-invertebrate survey data, communities were typical of those found in moderately clean and well-oxygenated water. ASPT scores indicated that the water quality of the watercourses was also fair or good. Thus, the baseline conditions of the Viking study area aquatic habitats can be considered to be reasonable to good and any serious pollution event during operation of the wind farm would likely have a *high* magnitude and significant adverse impact upon these habitats in at least the short-term.

(c) ***Negative secondary impacts***

Of all the habitats present at the Viking site, peatland habitats are the most likely to be indirectly affected by habitat modification caused by roads and tracks because of the particular importance of hydrology to blanket bog habitats.

Creation of cut faces through deep peat (e.g. where access tracks are excavated to the underlying mineral layer or excavations are made for turbine foundations) may give rise to a zone of drying peat behind them. There is little information available on the likely extent of this zone. Evidence suggests that it is likely to be less than 10m wide, due to the very low hydrological conductivity of peat. This can be seen in the narrow draw-down profile of peat drains for reclamation to agriculture and measurements of peat moisture content at differing distances from old and recent peat faces (Lewis Wind Farm ES 2004, Caithness and Sutherland Peatlands Management Strategy 2005, Hobbs 2006). However, this is complicated by the higher water transmission in the upper peat layer where the living blanket bog vegetation is rooted, potentially leading to a wider zone of influence on the surface bog vegetation. Therefore, a zone of influence 20m wide either side of tracks constructed by the cut method is assumed. For tracks constructed by the floating method the zone of influence is likely to be narrower as cut faces in the peat are not created.

The potential negative impacts this may cause have been recognised from the outset and by careful design planning, the proposed road and track layout has been designed to be as hydrologically neutral or positive as possible, significantly reducing the likely impacts of any secondary habitat modifications. Further details on peatland hydrology are provided in Chapter 14, Soil and Water. No significant secondary construction or operational impacts on habitats are predicted.

(d) ***Negative cumulative impacts***

Because all the impact magnitude assessments (except one) are low (moderate for blanket bog), no significant negative cumulative impacts are predicted for habitats.

(e) ***Positive construction, operational and secondary impacts***

No significant positive construction or operational impacts on habitats are predicted. However, significant positive management for several habitats is outlined in the Viking Habitat Management Plan.

Construction and operational habitat losses will cause an adverse impact, but insufficient to affect the integrity of any habitat types. The magnitude of construction and operational impacts on habitats is assessed as likely to be *moderate* for active blanket bog, which is the most widespread habitat affected, and *low* for all other habitats. If serious pollution incidents occur, high negative impacts on aquatic habitats during construction and operation of the Viking Wind Farm are predicted. However, standard mitigation and implementation of best practice pollution prevention measures will reduce the likelihood of such events. If these are carefully and fully adopted, no significant impacts on aquatic habitats are predicted.

10.6.4 Impacts on species

(a) *Negative construction impacts*

Otter

The otter survey work (Appendix 10.4) found a paucity of otter signs throughout the area, with most signs of activity (69%) found close to the coast. During the construction period there will be a number of operations (defined in Table 10.1) which, if not properly managed, could potentially affect the local otter population. In particular:

- Physical damage or loss of holts, resting sites and spraint sites;
- Damage to routes used by otters while crossing the Viking area;
- Damage to water courses by silting and blocking of streams;
- Disturbance caused by noise of construction;
- Chemical and oil pollution; and
- Road traffic mortalities.

Direct habitat loss

Summary of potential direct construction habitat loss impacts on otter:

Parameter	Assessment
Extent	Site wide
Magnitude	Low
Duration	Long-term
Reversibility	Irreversible
Frequency	One-off
Probability	Certain

Construction or improvement of culverts and bridges at the 97 crossing points will result in a permanent loss of a small area of riparian habitat (unlikely to exceed 15m in length at each crossing site). The survey (see Appendix 10.4) failed to find any holts or natal holts in current use within the study area, so the magnitude of loss of habitat for otters is assessed as *low* and no significant impacts are predicted.

Severance

Summary of potential construction severance impacts on otter:

Parameter	Assessment
Extent	Site wide
Magnitude	Low
Duration	Long-term
Reversibility	Reversible

Frequency	Single event
Probability	Possible

Severance describes the loss of continuity between habitats which ultimately results in the isolation or fragmentation of discrete populations of species. With regard to the Viking site, the bridges and culverts have the potential to impede otter movements at the 97 river and stream crossings and disrupt wide–ranging otter movements (e.g. from coast to coast). As part of the design process, otter 'friendly' designs (with appropriate mammal ledges to provide routes for passing through water-course crossings) have been considered and built into the design plan process (see Appendix 14.3 Stream Crossings) and so the magnitude is assessed as likely to be *low* and no significant impacts are predicted.

Disturbance

Summary of potential construction disturbance impacts on otter:

Parameter	**Assessment**
Extent	Site wide
Magnitude	Low
Duration	Short-term
Reversibility	Reversible
Frequency	Intermittent
Probability	Possible

Since construction will be on a phased programme, spread over a long period of time in areas not heavily used by otters, it is unlikely that large tracts of the development and adjacent land will be disturbed at the same time and so magnitude is assessed as low. Because otters are mobile animals, it is highly likely that should they experience any disturbance during construction operations they will be able to move to other adjacent areas for the duration of the work. Away from natal holt sites (none of which was found to be present), otters are known to be tolerant of human activity and become habituated to new features. For example, over the past quarter of a century, otters have regularly bred beneath one of the jetties as Sullom Voe Oil Terminal. The species also regularly uses the base of ferry terminals as holts and lying-up places. Thus, construction disturbance impact magnitude on otters, which is likely to be reversible, is assessed as *low* and no significant impacts are predicted.

Pollution or sedimentation of water courses

Summary of potential construction pollution or sedimentation impacts on otter:

Parameter	**Assessment**
Extent	Site wide, but downstream outside of site too
Magnitude	Moderate

Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14 Soil and Water and Appendix 14.6), it is unlikely that a serious pollution incident would occur during construction. The main sources of pollution are likely to be either fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. Such episodes can lead to a sudden pulse of pollutant, which, if not readily contained, might enter the aquatic environment and could affect otters directly, e.g. by coating fur with oil or indirectly through damage to the fish stocks. Any discharges of sediment, e.g. peat, could indirectly damage catchment fish stocks.

Any temporary reduction in water quality would potentially impact on fish populations, which might indirectly affect otters. However, the otter activity evidence suggests that otters rarely or only occasionally use the Viking water courses for feeding. Thus it is unlikely that pollution would impact significantly on otter foraging. However, surveys were only conducted at one time of year and otter use of streams for foraging was not established at other times of year. Therefore impact magnitude of a pollution incident is assessed as *moderate* and no significant impacts are predicted.

Road traffic mortality

Summary of potential construction road traffic mortality impacts on otter:

Parameter	**Assessment**
Extent	Localised
Magnitude	Low - single animal(s)
Duration	Short-term
Reversibility	Irreversible
Frequency	Low
Probability	Possible

Vehicular traffic on existing and new tracks will increase (from pre-construction baselines) during the construction of the wind farm and will mean that individual otters will have an increased possibility of being injured or killed by vehicles. However, the existing design mitigation measures, in particular the use of 'otter-friendly' tunnels and culverts and low vehicle speed limits should reduce greatly the likelihood of this happening. Because there are no data on otter numbers for the area, the impact of such injuries and deaths on the local population is not known. However, the impact magnitude is assessed as *low* for the local otter population and no significant impacts are predicted.

If serious pollution incidents occur, *moderate* negative impacts on otter populations during construction of the Viking Wind Farm are predicted. Otherwise, no significant impacts on otters during construction are predicted and the conservation status of otter will not be significantly affected during construction of the Viking Wind Farm. However, as otters are fully legally protected all measures must be taken to avoid harming them or their habitats during construction of the Viking Wind Farm.

Terrestrial invertebrates

Two moths of conservation importance, *Eudonia alpina* and *Carsia sororiata anglica* occur within the study area. During the construction period there will be a number of operations (defined in Table 10.1) which could potentially affect the local moth populations. In particular:

- Direct habitat loss.

The Manchester treble bar moth uses a wide range of habitats including gardens, field margins, calcareous grassland, heathland, moorland, woodland rides, sand dunes and soft rock sea cliffs, where its preferred food-plant, St John's-wort, is found (Waring and Townsend 2003). In Shetland, the only species of food-plant present is the Slender St John's-wort *Hypericum pulchrum,* which is frequent-abundant on grassy heathery banks often by streams, rock heaths and in granite debris (Scott and Palmer 1987). This food-plant is not localised and so the moth should be widespread over many areas of the Viking site and beyond.

Direct habitat loss

Summary of potential direct construction habitat loss impacts on *Eudonia alpina* and *Carsia sororiata anglica*

Parameter	Assessment
Extent	Site wide
Magnitude	Low
Duration	Long-term
Reversibility	Irreversible
Frequency	One-off
Probability	Certain

Construction of tracks, roads and turbine bases etc will result in a temporary loss of 314ha of habitat (1.68% of the planning area) and eventually a permanent loss of ca. 252ha of upland habitats (1.35ha of the planning area). Both of these widespread upland species should not be significantly affected by small areas of habitat loss because the vast majority of the site will remain undeveloped throughout construction (>98% of planning area). Therefore, the magnitude of potentially suitable upland habitat loss on *Eudonia alpina* and *Carsia sororiata anglica* is assessed as *low* and no significant impacts are predicted.

No significant impacts on important terrestrial invertebrates during construction are predicted. The conservation status of terrestrial invertebrates will not be significantly affected during construction of the Viking Wind Farm.

Freshwater macro-invertebrates

The freshwater macro-invertebrate survey work (Appendix 10.7) identified that the invertebrate communities present in the study area watercourses consisted mainly of common and widespread species, capable of supporting salmonid populations. During the construction period there will be a number of operations (outlined in Table 10.1) which, if not properly managed, could potentially affect the local freshwater macro-invertebrate populations. In particular:

- Damage to water courses by silting, chemical and/or oil pollution.

Pollution or sedimentation of water courses

Summary of potential construction pollution or sedimentation impacts on freshwater macro-invertebrates:

Parameter	Assessment
Extent	Site wide, but downstream outside of site too
Magnitude	High
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14, Soil and Water), it is unlikely that a serious pollution incident would occur during construction. The main sources of pollution are likely to be siltation, fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. Such episodes can lead to a sudden pulse of pollutant, which, if not readily contained, might enter the aquatic environment and could affect freshwater macro-invertebrates directly, e.g. by killing all individuals in the catchment downstream of the incident.

Any temporary, short-term reduction in water quality could impact on freshwater macro-invertebrates in the catchment. Most of the common and typical freshwater macro-invertebrate species have the potential to naturally recolonise once any temporary pollution impacts have disappeared; thus in the short-medium term impacts are likely to be reversible. However, because a single incident has the potential to wipe out the whole community in a catchment, the magnitude is assessed as *high* and significant impacts are predicted.

If serious pollution incidents occur during construction, significant negative impacts on freshwater macro-invertebrate populations during construction of the Viking Wind Farm are predicted. Otherwise, no significant impacts on freshwater macro-invertebrate populations during construction of the Viking Wind Farm are predicted.

Fish

The fish survey work (Appendix 10.6) identified two valuable ecological receptors present within the Viking study area: Brown/sea trout and Atlantic salmon. Brown/sea trout are present in all eleven Viking catchments surveyed, whereas salmon were recorded in only two catchments (Burrafirth and Laxo). During the construction period there will be a number of operations (outlined in Table 10.1) which, if not properly managed, could potentially affect the local trout and salmon populations. In particular:

- Damage to water courses by silting and blocking of streams (severance);
- Chemical and oil pollution; and
- Diffuse hydrological or hydro-chemical changes.

Severance

Summary of potential construction severance impacts on trout and salmon:

Parameter	**Assessment**
Extent	Site wide
Magnitude	Low
Duration	Long-term
Reversibility	Reversible
Frequency	Single event
Probability	Possible

Severance describes the loss of continuity between habitats which ultimately results in the isolation or fragmentation of discrete populations or species. Both migratory and non-migratory trout undergo spawning migrations and access to spawning areas should not be restricted. Although their movements may be of lesser magnitude than those of sea trout, artificial barriers that restrict movements can damage brown trout through population fragmentation leading to loss of genetic diversity and reduction in fitness. With regard to the Viking site, the bridges and culverts have the potential to impede and disrupt trout and salmon movements at the 97 river and stream crossings. As part of the design process (see Appendix 14.3, Stream Crossings), fish friendly bridge and culvert designs have been considered and built into the design and so the magnitude is assessed as likely to be *low* and no significant impacts are predicted.

Pollution or sedimentation of water courses

Summary of potential construction pollution or sedimentation impacts on trout and salmon:

Parameter	**Assessment**
Extent	Site wide, but downstream outside of site too
Magnitude	High
Duration	Short-term = event Short-medium term

	= recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14, Soil and Water, and in Appendix 14.6), it is unlikely that a serious pollution incident would occur during construction. The main sources of pollution are likely to be siltation, fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. Such episodes can lead to a sudden pulse of pollutant, which, if not readily contained, might enter the aquatic environment and could affect fish directly, e.g. by killing all fish in the catchment downstream of the incident.

Any temporary or short-term reduction in water quality would potentially impact on fish populations in the catchment. As both trout and salmon will have population cohorts at sea, each catchment has the potential to recover naturally once any temporary pollution impacts have disappeared and aquatic invertebrates recolonised. Thus, in the short to medium term impacts are likely to be reversible. However, the non-migratory trout forms with populations above impassable falls do not have this capacity to recover and so impacts on these are not necessarily reversible. Therefore, because a single incident has the potential to wipe out the whole population in a catchment, the magnitude is assessed as *high* and significant impacts are predicted. Diffuse hydrological and hydro-chemical impacts on watercourses are considered further in Chapter 14, Soils and Water.

If serious pollution incidents occur during construction, significant negative impacts on trout and salmon populations during construction of the Viking Wind Farm are predicted. Otherwise, no significant impacts on trout and salmon populations during construction of the Viking Wind Farm are predicted.

(b) ***Negative operational impacts***

Otter

During the operational period there will be a number of activities (outlined in Table 10.2) which, if not properly managed, could affect the local otter population. In particular:

- Disturbance caused by noise of wind farm operation and maintenance;
- Chemical and oil pollution (possibly siltation); and
- Road traffic mortalities.

Disturbance

Summary of potential operational disturbance impacts on otter

Parameter	**Assessment**
Extent	Site wide
Magnitude	Low

Duration	Long-term
Reversibility	Reversible
Frequency	Intermittent-constant
Probability	Possible

There are no scientific studies available to demonstrate how the otter might react to the operational noise of the wind farm turbines. However, it is unlikely that such a disturbance will constitute a significant threat to the species as it appears that individuals can tolerate and habituate to a great deal of disturbance around them without it affecting their behaviour. Thus, operational and maintenance disturbance impact magnitude is assessed as *low* and no significant impacts are predicted.

Pollution/sedimentation of water courses

Summary of potential operational pollution/sedimentation impacts on otter

Parameter	**Assessment**
Extent	Site wide, but downstream outside of site too
Magnitude	Moderate
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14 Soil and Water), it is highly unlikely that a serous pollution incident would occur during the operation of the wind farm. The main sources of pollution are likely to be siltation, fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. During the operation of the wind farm, few storage facilities capable of causing a serious pollution incident will remain on site. In the event of an accident, a sudden pulse of pollutant might, if not readily contained, enter the aquatic environment and could affect otters directly, e.g. by coating fur with oil, or indirectly through damage to the fish stocks.

Any temporary reduction in water quality could impact on fish populations, which might indirectly affect otters. Otter activity evidence suggests that otters rarely or only occasionally use the Viking water courses for feeding; thus it is unlikely that pollution would impact significantly on otter foraging and so impact magnitude of pollution during operation is assessed as low. However, surveys were only conducted at one time of year and otter use of streams for foraging was not established at other times of year. Therefore operational

impact magnitude of a pollution incident is assessed as *moderate* and no significant impacts are predicted.

Road traffic mortality

Summary of potential construction road traffic mortality impacts on otter

Parameter	Assessment
Extent	Localised
Magnitude	Low - single animal(s)
Duration	Short-term
Reversibility	Irreversible
Frequency	Low
Probability	Possible

Vehicular traffic associated with maintenance will slightly increase (from pre-construction baselines) during the operation of the wind farm and will mean that individual otters will have a slightly increased possibility of being injured or killed by vehicles at the site. However, the existing design mitigation measures, in particular the use of 'otter-friendly' tunnels and culverts and low vehicle speed limits should reduce greatly the likelihood of this happening. Because there are no data on otter numbers for the area, the impact of such injuries and deaths on the local population is not known; however, the impact magnitude is assessed as *low* for the local otter population and no significant impacts are predicted.

If serious pollution incidents occur, moderate negative impacts on otter populations during operation of the Viking Wind Farm are predicted. Otherwise, no significant impacts on otters during operation are predicted and the conservation status of otter will not be significantly affected during operation of the Viking Wind Farm. However, as otters are fully legally protected all measures must be taken to avoid harming them or their habitats during operation of the Viking Wind Farm.

Terrestrial invertebrates

No significant negative operational impacts are predicted.

Freshwater macro-invertebrates

During the operational period there will be a number of activities (outlined in Table 10.2) which, if not properly managed, could affect the local freshwater macro-invertebrate populations. In particular:

- Chemical and oil pollution (possibly siltation).

Pollution/sedimentation of water courses

Summary of potential operational pollution or sedimentation impacts on freshwater macro-invertebrates:

Parameter	Assessment
Extent	Site wide, but downstream outside of site too
Magnitude	High
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14, Soil and Water, and in Appendix 14.6), it is highly unlikely that a serous pollution incident would occur during the operation of the wind farm. The main sources of pollution are likely to be siltation, fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. During the operation of the wind farm, few storage facilities capable of causing a serious pollution incident will remain on site. In the event of an accident, a sudden pulse of pollutant might, if not readily contained, enter the aquatic environment and could affect freshwater macro-invertebrates populations directly.

Any temporary or short-term reduction in water quality could impact on freshwater macro-invertebrates in the catchment. Most of the common and typical freshwater macro-invertebrate species have the potential to recolonise naturally once any temporary pollution impacts have disappeared; thus, in the short to medium term, impacts are likely to be reversible. However, because a single incident has the potential to wipe out the whole community in a catchment, the magnitude is assessed as *high* and significant impacts are predicted.

If serious pollution incidents occur, significant negative impacts on freshwater macro-invertebrate populations during operation of the Viking Wind Farm are predicted. Otherwise, no significant impacts on freshwater macro-invertebrate populations during operation and maintenance of the Viking Wind Farm are predicted.

Fish

During the operational period there will be a number of activities (outlined in Table 10.2) which, if not properly managed, could potentially affect the local trout and salmon populations. In particular:

- Chemical and oil pollution (possibly siltation).

Pollution or sedimentation of water courses

Summary of potential operational pollution or sedimentation impacts on trout and salmon:

Parameter	Assessment
Extent	Site wide, but downstream outside of site too
Magnitude	High
Duration	Short-term = event Short-medium term = recovery
Reversibility	Reversible
Frequency	One-off?
Probability	Unlikely

Taking into account standard guidance and best practice pollution prevention measures (outlined in Chapter 14 Soil and Water and in Appendix 14.6), it is highly unlikely that a serous pollution incident would occur during the operation of the wind farm. The main sources of pollution are likely to be siltation, fuel oil and/or chemical discharges from storage facilities and/or escapes from damage to fuel tanks in vehicles. During the operation of the wind farm, few storage facilities capable of causing a serious pollution incident will remain on site. In the event of an accident, a sudden pulse of pollutant might if not readily contained, enter the aquatic environment and could affect fish directly.

Any temporary or short-term reduction in water quality could impact on fish populations in the catchment. As both trout and salmon will have population cohorts at sea, each catchment has the potential to recover naturally once any temporary pollution impacts have disappeared and aquatic invertebrates recolonised; thus, in the short to medium term, impacts are likely to be reversible. However, the non-migratory trout forms with populations above impassable falls do not have this capacity to recover and so impacts on these are not necessarily reversible. Therefore, because an incident has the potential to wipe out a whole population in a catchment, magnitude is assessed as *high* and significant impacts are predicted.

Diffuse hydrological and hydro-chemical impacts on watercourses are considered further in Chapter 14, Soils and Water.

If serious pollution incidents occur, significant negative impacts on trout and salmon populations during operation and maintenance of the Viking Wind Farm are predicted. Otherwise, no significant impacts on trout and salmon populations during operation and maintenance of the Viking Wind Farm are predicted.

(c) ***Negative cumulative impacts***

Otter

Because the impact magnitude assessments are *low* and no significant impacts are predicted, no significant negative cumulative impacts are predicted (unless serious pollution incidents occur when impact magnitude increases to *moderate*).

Terrestrial invertebrates

Because the impact magnitude assessments are *low* and no significant impacts are predicted, no significant negative cumulative impacts are predicted.

Freshwater macro-invertebrates

No significant negative impacts are predicted. However the magnitude of individual potential pollution or siltation impacts is considered *high* for affected catchments. If more than one catchment is affected by pollution or sedimentation, then significant negative cumulative impacts on freshwater macro-invertebrate populations are predicted.

Fish

No significant impacts are predicted. However, the magnitude of individual potential pollution or sedimentation impacts is considered *high* for affected catchments. If more than one catchment is affected by pollution or sedimentation, then significant negative cumulative impacts on trout and/or salmon populations are predicted.

(d) ***Positive construction and operational impacts***

Otter

Impact magnitude and significance

No significant positive construction or operational impacts are predicted.

Terrestrial invertebrates

Impact magnitude and significance

No significant positive construction or operational impacts are predicted.

Freshwater macro-invertebrates

Impact magnitude and significance

No significant positive construction or operational impacts are predicted.

Fish

Impact magnitude and significance

No significant positive construction or operational impacts are predicted.

10.7 MITIGATION

Mitigation seeks to:

- Avoid negative ecological impacts, especially those that could be significant to important receptors;
- Reduce negative impacts that could be avoided; and

- Compensate for any remaining significant impacts.

No significant impacts on designated sites, otter, terrestrial invertebrates, freshwater macro-invertebrates or trout and salmon are predicted but this assumes mitigation measures relating to the overall design of the planned works and the Method Statements prepared for construction are implemented fully. For example, these will include ensuring that there are no physical barriers to otter and fish movements at all times in all watercourses within the Viking study area as well as detailed pollution prevention measures, including contingency plans.

Moderate negative impacts on blanket bog habitats are predicted to occur, with negative construction impacts on 238.5ha predicted during construction, ultimately resulting in a permanent loss of 197ha of mixed activity blanket bog during operation of the wind farm and its associated infrastructure.

The following mitigation measures should reduce the potential impacts of wind farm construction and operation to an acceptable level. A full and detailed mitigation plan should be prepared with input from the site Ecological Clerk of Works prior to the start of construction work.

10.7.1 Pre-construction surveys

Pre-construction surveys will be carried out to mitigate against the potential destruction of, or disturbance to, previously undiscovered otter breeding holts. Otter use a large number of holts and resting places within their ranges and may use new breeding holts between the time of the recent survey and planned wind farm construction. A targeted survey should therefore be carried out immediately prior to commencement of construction works within a 200m buffer zone around proposed turbine and infrastructure locations. Since construction works will be phased, otter survey work will need to be similarly phased to coincide with relevant work schedules.

Should a breeding otter holt be discovered during the survey, the Scottish Government and SNH will be consulted immediately. An EPS (European Protected Species) licence is likely to be required for any construction work to continue, along with suitable mitigation or compensation works.

10.7.2 Work programming and awareness raising

As far as possible, all relevant works will be programmed to avoid periods of high sensitivity for protected species and this should be agreed with the SIC in consultation with SNH prior to commencement of works. However, it must be noted that a lack of significant daylight during winter months means that construction work will necessarily be targeted during the spring, summer and early autumn months and this will unavoidably coincide with some ecological sensitivities e.g. fish migration season. If additional surveys are required these will be undertaken with agreed methodologies and used to inform decisions relating to work scheduling.

Before any site works begin, ecological training and awareness raising of construction staff will be undertaken by the Ecological Clerk of Works. All new staff will undergo an ecological induction and be made aware of the ecological sensitivities on the site and (legal) implications of not complying with agreed working practices. To avoid and/or reduce the

likelihood of otter mortality and injury during construction and operation, provision should be made for on-site speed limits for construction and maintenance traffic.

10.7.3 Micro-siting of infrastructure and demarcation of exclusion zones

The potential for temporary disturbance to protected species (e.g. otter, salmon and trout) during construction will be minimised as far as possible, even though no significant impacts are predicted. As a matter of course, a 50m marked exclusion zone will follow all at-risk watercourses and water bodies, whenever possible. Where exclusion is not possible, such as at water crossing points, access to the watercourses by personnel and machinery will be kept to an absolute minimum.

Infrastructure will be micro-sited along the preferred route to avoid the most sensitive habitats wherever possible. Vegetation surveys undertaken (see paragraph 10.5.3 (a)) provide a 100m surveyed corridor on either side of turbines and infrastructure (such as tracks), potentially allowing the relocation of infrastructure to less sensitive habitats where available. For example, the small number of richer base-rich flushes scattered across the site have been target noted and impacts should be avoidable by micro-siting. The presence of a fully qualified independent Ecological Clerk of Works when laying down working routes will help to ensure that opportunities to avoid sensitive habitats during construction are identified and taken.

10.7.4 Control of pollution and sedimentation

Best practice techniques (see Chapters 14, Soil and Water and 15, Roads and Traffic) will be adopted for all construction and operational works to ensure that water quality within the study area is maintained, and to control and reduce pollution and sedimentation risk (e.g. fuel and concrete batching in lay-down and compound areas) as far as is possible.

Specially designed silt traps will be used to reduce potential impacts of sedimentation on downstream aquatic habitats. In emergency situations, if straw bales have to be used in drainage channels to prevent sedimentation downstream, these will be (temporarily) stock-fenced off to prevent grazing sheep from eating the straw and destroying the sedimentation traps.

Implementation of a detailed Environmental Management Plan (EMP), agreed with SEPA, should ensure that direct pollution and sedimentation impacts on watercourses and their associated species are avoided. However, the risks of a spill of fuel oil, although small, need to be addressed. It is therefore recommended that the EMP considers and incorporates contingency measures to deal with any oiled otters (and potentially birds) that might be affected by such a spill.

10.7.5 Watercourse crossings

In order to mitigate against the potential destruction of, or disturbance to, otter foraging areas, to facilitate otter movements across the site, to reduce the risk of otter road traffic injury or mortality, to protect salmon and trout spawning and nursery areas and to facilitate fish movements within catchments, the number of watercourse crossings has been kept to an absolute minimum. This has effectively reduced the proportion of (potentially suitable otter)

riparian habitat that would have been affected at the design stage, substantially mitigating the potential impact of watercourse crossings.

Where a water-crossing is unavoidable, best practice will be followed for any construction works, combined with appropriate hydrological mitigation (see Appendix 14.3.1 Stream Crossings). Although there was found to be a general lack of evidence of otter presence within the Viking survey area, best practice design for otters is being taken forward at all water-crossings. Where necessary, the otter-friendly engineering works described in the *Design Manual for Roads and Bridges* (Highways Agency 2008) will be adopted. This includes allowing for the easy and safe passage of otters under rather than over supported roads by leaving spaces for ledges and providing ramps at either end of bridges and culverts.

Where bridge crossings are impractical, and culverts are considered necessary, their design should allow for plenty of air space above water during times of flood, or if this is not possible, alternative and parallel tunnels to provide an alternative route for otters to move. The site-based construction and maintenance vehicle speed limit should also substantially reduce any potential impact for otter road traffic injuries and mortalities.

Watercourse crossings will be designed to allow free passage of salmonid fish. The recent surveys have provided evidence of trout in the upper reaches of many of the catchments within the Viking survey area; indeed some of the highest trout densities recorded during the present survey were in small, headwater areas and these habitats are important to the maintenance of trout populations. Both migratory and non-migratory trout undergo spawning migrations and require access to spawning areas. Therefore fish access to these areas will not be restricted.

10.7.6 Potential hydrological changes due to cabling, tracks and trackside drains

The potential for cable trenches to act as drains is recognised and will be avoided by back-filling with compacted excavated material, rather than more porous bedding. In areas where cabling trenches are on steeper slopes, clay bunds may be installed within the trenches at regular intervals to minimise groundwater flow downslope.

In order to limit the disruption to surface water flows caused by trackside drains, cross drains will be constructed at regular intervals to conduct this surface flow across the track where it will be discharged into the drainage system. The regular discharge points will limit the concentration of surface runoff and the diversion of flows between sub-catchments.

Floating track construction will be adopted with the aim of maintaining existing surface and sub-surface flows. Where possible, track construction will avoid compression of peat pipes by ensuring sufficiently low pressure from the tracks, maintaining maximum permeability by using large sized clean aggregate and installing small diameter pipe cross drains in the track base to aid percolation. There will be no mounding or spreading of waste peat in the track side areas where surface flows would be impeded. Further details of road and track design, waste peat and drainage are provided in Chapters 14, Soils and Water. Careful management will mitigate potential changes to hydrology and consequent changes to habitats and species distribution.

10.7.7 Habitat reinstatement

Best practice techniques of vegetation and habitat restoration will be adopted and implemented in areas of disturbed vegetation, such as track sides, borrow pits and waste peat and soil mounding. Early restoration of all disturbed areas will be undertaken to minimise the effects of soils and peat exposure erosion. Any plant material used in restoration techniques will be of local (Shetland) provenance and be appropriate for locations being restored. Re-instatement techniques, appropriate to Shetland, will be agreed in consultation with SNH before construction operations begin.

10.7.8 Borrow pit working

Borrowpit design and restoration will ensure that best practice is adopted and the sites are restored at the earliest possible date. Detailed restoration plans for each borrowpit will be produced separately and agreed in consultation with SNH before construction begins. Fourteen primary borrow pit sites have been identified (Table 1 in Appendix 14.2). These range in likely size from ca. 2,000 m^2 to 17,700 m^2. This provides a range of sites where restoration work (e.g. woodland restoration) can be carried out. For further details see Viking HMP.

10.7.9 Habitat mitigation and compensation

(a) ***Habitat compensation***

The only compensation considered necessary is for the predicted 197ha of blanket bog permanently lost as a consequence of the wind farm construction. A neutral response would seek a like for like replacement of predicted habitat loss. The compensation proposed in the HMP is for twice the area lost. Since many blanket bog areas are degraded and the baseline conditions suggest that current management practices will continue to degrade the habitat, damaged and degraded areas equal to twice the area lost will be protected and restored using specialist techniques. The planned work will include large scale field trials to test applicability and success of techniques and then inform the restoration of the degraded areas (see Appendix 10.9 Viking Habitat Management Plan).

(b) ***Habitat enhancement***

Once suitable restoration methodologies have been trialled and tested, the possibility exists to roll-out the compensation work to enhance other areas within the Viking study area (and potentially beyond). The Viking Energy partnership has given a significant financial commitment to achieve this over the life time of the wind farm.

Although no significant residual impacts on other important habitats and species are predicted, there remain a number of significant opportunities to enhance the Viking Wind Farm area for a range of important ecological receptors, outlined in Appendix 10.9. For example, during fish survey work, two existing man-made barriers were identified within the study area (and a third just outside). The removal or redesign of these would aid fish passage. By appraising these barriers, working with relevant stakeholders and removing impediments to fish movements, it will be possible to permit fish access all the way into the upper reaches of the catchments. This could have direct significant benefits to fish populations, and indirect benefits to otters and predatory birds. This would also provide increased recreational angling opportunities within these catchments.

Another opportunity exists to enhance watercourses by encouraging the regeneration of riparian vegetation and in particular, by establishing areas of native woodland, a habitat completely lost due to centuries of grazing. There is ample evidence that riparian habitat regeneration would directly benefit trout populations and associated species.

It is important to recognise that any habitat compensation and enhancement work needs to be agreed in consultation with land owners, crofters and their representatives. Therefore, whilst the defined compensation works should form part of planning conditions to specifically compensate for direct habitat loss, the additional habitat enhancement works are not necessary to compensate for losses. These enhancement opportunities and the commitment by the Viking Energy Partnership to deliver them exist due to the size and scale of the proposed development and the belief that the wind farm should achieve much more for ecology than neutral or no significant impact.

10.8 RESIDUAL EFFECTS

Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likely success of the mitigation, are factors to be considered against legislation, policy and best practice in determining the planning application.

The valued non-avian ecological receptors considered under residual impacts include all the designated sites, habitats and vegetation communities and species (otter, terrestrial invertebrates, freshwater macro-invertebrates, trout and salmon) identified within this chapter. No significant adverse residual impacts are predicted for these non-avian ecological receptors. For example, no significant impacts at a regional or national level are predicted to occur on the on the blanket bog of regional to national value. However, local adverse impacts, in terms of direct habitat loss to blanket bog of regional to national value will occur within the Viking study area. It is predicted that 197ha of blanket bog (of varying activity) will be lost or 'taken' after the construction areas have been restored and recovered. Such negative impacts cannot be mitigated by the measures outlined above.

Blanket bog, as a general habitat type, is protected under European legislation, and there is a growing body of opinion that new developments should deliver net ecological gain, rather than simply be designed to achieve mere damage limitation. Therefore, significant measures to deliver compensation and ecological enhancement have been included in the design of the Viking Wind Farm and are outlined within the Viking Habitat Management Plan (HMP). Please see Appendix 10.9.

To allow a clear distinction to be made between necessary compensation and desirable or 'aspirational' habitat enhancement measures, the HMP outlines a series of SMART (Specific, Measurable, Achievable, Realistic and Time-limited) compensation and enhancement objectives for blanket bog and other habitats and species that will be taken forward should the application receive consent.

10.9 MONITORING

Monitoring needs to take place on a range of ecological issues during construction, operation and decommissioning. To ensure the full implementation of appropriate mitigation measures, an independent and fully qualified Ecological Clerk of Works is necessary for each phase of the planned development.

In the Consultation Strategy previously considered by the Viking Energy Board, proposals were made to establish a group that would exercise environmental (not just ecological) oversight of the Viking Wind Farm. The group would provide environmental advisory and monitoring services and would be called the Shetland Windfarm Environmental Advisory Group (SWEAG).

A model exists in Shetland that can be readily adapted to fill this role. The islands have more than thirty years' experience of the development and operation of another major project, the oil terminal at Sullom Voe. The oil terminal was expected to have significant effects on the Shetland environment and the local authority was insistent that adequate steps be taken to reduce these effects to a minimum. These steps included action taken during the design, construction and operation of the terminal. It was recognised from the outset that the active participation of environmental organisations was essential, so an environmental advisory group, known as the Shetland Oil Terminal Environmental Advisory Group (SOTEAG), was established. SOTEAG also established a Monitoring Committee, the membership of which was selected on the basis of individual expertise rather than membership of particular organisations.

It is suggested that SWEAG should also set up a Monitoring Committee, with a remit broadly similar to that of the SOTEAG Monitoring Committee. However, although possible terms of reference for the Monitoring Committee are set out below, it is proposed that the selection of the membership of that Committee should be a matter for decision by SWEAG.

Proposed SWEAG Terms of Reference

It is suggested that the terms of reference for SWEAG should be as follows:

"SWEAG shall examine and advise upon the environmental implications of the Viking Wind Farm during project development, construction, site rehabilitation, commissioning, operation and decommissioning. SWEAG may, at its discretion, resolve to extend its remit to other wind farms, should it be invited to do so".

It is suggested that the terms of reference for the SWEAG Monitoring Committee should be as follows:

(a) To advise SWEAG on a monitoring strategy that will allow early detection of environmental change resulting from wind farm and associated developments during the constructional and operational phases.

(b) To define the requirements of monitoring programmes, to consider proposals to meet their requirements, and to make recommendations to SWEAG on their implementation.

(c) To initiate additional studies in relation to environmental damage and recovery in the event of a major incident.

(d) To interpret and assess the results of these programmes and other relevant information and report to SWEAG.

(e) To be alert to any future renewable energy developments in Shetland and provide early advice on appropriate monitoring programmes.

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