Kergord Access Track

Viking Energy Wind Farm LLP

Environmental Appraisal Report

| V1.3

28 June 2016

viking energy

Harnessing Shetland's natural resources

Kergord Access Track

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1. Introduction

1.1 Background Information

Viking Energy Wind Farm LLP, described in Section 1.3 and hereafter referred to as VEWF, submitted an Environmental Statement (ES) and Section 36 application (under the Electricity Act 1989) in May 2009 to construct a 150 turbine wind farm (Viking Wind Farm, hereby referred to as 'the wind farm') on Mainland Shetland, Scotland. An Addendum to the ES was submitted in September 2010 for a revised proposal reducing the number of turbines to 127. Subsequently a further reduced layout of 103 turbines was consented, under Section 36 of the Electricity Act 1989, on 04 April 2012. The granted consent was challenged following a Judicial Review in 2013 however, and the consent was reaffirmed in February 2015.

The Viking Wind Farm consent included provision for an access track extending from the B9075, running northwards from a junction immediately west of the existing crossing, over the Burn of Weisdale. VEWF are proposing a revision to the alignment of this approved track, hereafter referred to as the Kergord Access Track or the proposed development. This revision will avoid having to strengthen the existing B9075 crossing over the Burn of Wiesdale, which would require significant and lengthy road closures, thereby minimising disruption to road users of the B9075.

The Kergord Access Track comprises approximately 2km of access track, extending from a new junction that will be created with the B9075, east of the Burn of Weisdale and the existing unclassified road, to the location of the converter station at Upper Kergord. Figure 1.1 shows the location of the proposed development while Figure 1.2 shows the detailed alignment of the proposed Kergord Access Track, as required by Scottish Hydro Electric Transmission Limited (SHETL) to facilitate the construction of a converter station platform in advance of the main wind farm construction work.

The application for the converter station and its platform, to enable transmission of electricity generated by the wind farm, is being progressed separately by SHETL and as such is not considered further in this report.

1.2 Purpose of this Report

This Environmental Appraisal Report (EAR) is submitted on behalf of VEWF, to support the planning application for the revision of the consented Kergord Access Track for the Viking Wind Farm. A review of the planning policy context in relation to the proposed development is provided in Appendix A. The proposed revision to the Kergord Access Track does not require an Environmental Impact Assessment (EIA), as determined through consultation with Shetland Islands Council (SIC) and confirmed on receipt of a screening response from SIC (Section 2.1)

This EAR details the findings of a targeted environmental appraisal focusing on the potential environmental effects of the proposed development. Those aspects of the environment that were considered most likely to be affected by the proposed development have been assessed in detail in Chapter 4 of this report. These include:

- Ecology;
- Ornithology; and
- Geology, Hydrogeology and Hydrology, including peat management.

A high level of assessment of other aspects identified as potentially likely to be affected by the proposed development are discussed in Chapter 5 of this report. These include:

- Landscape and Visual Considerations;
- Cultural Heritage;
- Traffic and Transport; and
- Noise and Air Quality.

It has been concluded that the development will have limited effects on these aspects of the environment.

The report identifies mitigation measures to reduce the impact of potential environmental effects and is informed by data collated from site visits, desk studies, relevant legislation, policies and guidance.

The aims of this document are to:

- set out the description of and justification for the revised access track;
- present baseline environmental information on the location of the proposed development;
- provide an assessment of potential effects; and
- set out any recommended mitigation.

1.3 Viking Energy Wind Farm LLP (VEWF)

VEWF (the developer) is a joint venture between Viking Energy Shetland LLP and SSE Viking Ltd, between whom a 50:50 general partnership has been established in Scotland in accordance with the Partnership Act 1890. Further information is provided below with regard to both parties.

1.3.1 Viking Energy Shetland LLP

Viking Energy Shetland LLP was established in 2012 and is majority controlled by a subsidiary of Shetland Charitable Trust. Viking Energy Shetland LLP's interest in the project was previously held by Viking Energy Ltd, now called SCT Renewables Ltd. Viking Energy Limited was formed in 2003 to represent Shetland Islands Council (SIC)'s interests in large-scale wind energy development in Shetland. The company was tasked with investigating and developing the Viking Wind Farm as an investment opportunity for the Shetland community, addressing the Council's strategic objectives of sustainable development and economic diversification. In 2009 SIC sold its ownership of Viking Energy Ltd to Shetland Charitable Trust.

1.3.2 SSE Viking Ltd

SSE Viking Limited is a subsidiary of SSE plc (SSE). The SSE group is the leading generator of renewable energy in the UK, with over 3,300MW of renewable electricity generation capacity (including wind, hydro and biomass) and a significant portfolio of renewable energy projects in construction, with consent, or in development across the division in the UK and the Republic of Ireland.

SSE's portfolio features a number of significant renewable energy projects including the construction of two of Europe's largest wind farms: the 350MW Clyde onshore wind farm located in the Upper Clyde Valley of Scotland, and the 504MW Greater Gabbard offshore wind farm located off the Suffolk coast of England.

1.4 Jacobs UK Ltd

Jacobs UK Ltd has been commissioned by VEWF to provide environmental support and to prepare the Environmental Appraisal Report for the proposed development. This EAR has been produced by Jacobs with input from RPS Group Plc for Ecology (Section 4.1) and Geology, Hydrogeology and Hydrology (Section 4.3) and Natural Research Power for Ornithology (Section 4.2).

Jacobs is one of the world's largest and most diverse providers of professional technical services, including scientific and specialty consulting as well as all aspects of engineering and construction, operations and maintenance. Jacobs has extensive experience in undertaking and coordinating environmental assessments, with the ability to draw on professional input from an integrated team of approximately 750 environmental specialists located in the UK. Jacobs is an Institute of Environmental Management and Assessment (IEMA) Registered EIA Quality Mark Company.

Jacobs is experienced in all stages of the assessment process from feasibility studies, site selection, site investigation, consents/approvals and construction phases through to facility operation, post construction monitoring and environmental management. Jacobs' Environment Assessment team has involvement in a wide

variety of renewable energy and road infrastructure projects, with the latter ranging from minor improvement works to nationally important road schemes.

2. Consultation

2.1 Environmental Screening

In February 2014 VEWF submitted a screening request to SIC to determine whether a formal Environmental Impact Assessment (EIA) would be required for the Kergord Access Track. Schedule 2 of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 lists developments which may or may not require an EIA depending on the likelihood that the development will have significant effects on the environment by virtue of factors such as its nature, size or location.

In relation to roads infrastructure, category 10(e) of Schedule 2 of the EIA Regulations lists:

"Construction of roads (unless included in Schedule 1), where 'the area of works exceeds 1 hectare'".

In their screening response, dated 27th February 2014, SIC confirmed that it was unlikely that the proposed development would have significant impacts in terms of the EIA Regulations, and that an application would not require to be subject to a formal EIA.

2.2 Pre-application Consultation with Shetlands Islands Council

On 25th July 2013, VEWF met with Shetlands Islands Council (SIC) to discuss and review five different route options of the Kergord Access Track. It was agreed to proceed with an application based on the proposed development described in Section 3 (Description of Proposed Development). The proposed design would also require a new watercourse crossing over the Burn of Weisdale avoiding the need to replace the existing crossing on B9075 and the requirement for road closure.

Subsequent meetings with SIC have confirmed the planning application process and that Road Construction Consent, as detailed within the National Roads Development Guide (2014), is not required for the planning application for the Kergord Access Track.

2.3 Other Consultation

Throughout 2015 and early 2016, further meetings and discussions have taken place between VEWF, SEPA and SNH which are summarised in Table 2.1.

Table 2.1 Consultee Comments

Summary of Consultation	VEWF Response/Action undertaken
Scottish Natural Heritage (SNH), letter, 22nd August 2013	
SNH asked that potential impacts of the proposed development on otters be reassessed.	Otter surveys were carried out along watercourses within 250m of all infrastructure on 1st and 2nd November 2015.
SEPA	
During a meeting on 22nd June 2015, SEPA confirmed they would not comment on the merits of the application until a planning application was received. SEPA referred to the scoping response for the proposed Sandwater Road (B9075) Upgrade, which although subject to a separate planning application, highlighted the following concerns which should be addressed in the Kergord application as well. This response included request to consider:	Pollution prevention has been considered in Section 4.3(Geology, Hydrogeology and Hydrology) of this EAR. Groundwater dependent terrestrial ecosystems (GWDTEs) have been identified from the Phase 1 Habitat and National Vegetation Classification (NVC) surveys. The proposed development will not disrupt or have a significant effect on wetlands. A draft Peat Management Plan (PMP) has been prepared for the proposed development (Appendix K).

Summary of Consultation	VEWF Response/Action undertaken
• pollution prevention; • disruption to wetlands; and • disturbance and re-sue of excavated materials. A teleconference between SEPA, SSE and Jacobs on 21st April 2016 further discussed the options for reuse of peat on site.	This identifies the volume of peat that will be excavated and options for reuse and/or disposal. The PMP will be further developed at the detailed design stage, in agreement with SEPA, SIC and VEWF and the final agreed version would be implemented by the contractor.

3. Description of Proposed Development

3.1 Site Description

The area surrounding the proposed development is rural. Land alongside the B9075 and the unclassified Upper Kergord Road is predominantly rough grazing with peat and heather moorland (Figure 1.1 and 1.2).

There are some isolated properties at Setter, located on the hillside approximately 500m west of the proposed development, along the B9075. There is also a property and farm outbuildings at Upper Kergord, south of the northern section of the proposed development.

The unclassified road to Upper Kergord runs approximately 1.5km northwards, from a junction with the B9075, approximately 70m east the B9075 Burn of Weisdale crossing. The junction and road are shown on Photographs 1 and 2.

Photograph 1: B9075/Upper Kergord Junction

Photograph 2: Unclassified Road to Upper Kergord, from the B9075 Junction

The Burn of Weisdale runs north to south, adjacent to the proposed development and is shown in Photograph 3. There is a new crossing proposed 570m from the junction with the B9075, where the burns width is approximately 2m. The Burn of Weisdale flows under the B9075 before reaching Weisdale Voe, approximately 5km south of the proposed development.

Photograph 3: Burn of Weisdale

3.2 Access Track Layout

A number of alignment options were considered and discussed at a site meeting with SIC on 25th July 2013, and at a subsequent meeting with SIC planning department and roads department on 21st August 2013. As shown on Figure 1.2, the option progressed proposes a new junction with the B9075 and a new track extending 2,090m before it re-joins the existing track.

The proposed development for which planning permission is sought will comprise:

- new junction and access from the B9075;
- formation of approximately 2,090m of new permanent track;
- a new watercourse crossing over the Burn of Weisdale; and
- a temporary construction compound.

3.3 Access Track Design

The proposed development will be an 'excavated' design, and a typical road cross section is shown on Figure 3.1. This will require the topsoil and peat to be stripped to expose a suitable foundation horizon on which to build the track. The track will be constructed to 8m width (6m wide plus two 1m verges) by laying and compacting crushed stone to the required level, finished with a bitumen surface and bound. The upper soil/peat horizon, together with any vegetation, will be placed to one side for later reinstatement, if appropriate.

There is 'at-grade' junction with the B9075 as part of the proposed development. The detailed design of the junction will be undertaken to comply with Shetland Islands Council (as the Roads Authority) standards and provide for the axle load configurations associated with the wind turbine component delivery vehicles, wind turbine erection cranes and the grid transformer delivery vehicles. Sight lines will be determined based on the design class of the adopted B road and in agreement with Shetland Islands Council.

3.4 Water Crossings

The crossing will be designed to accommodate the flow from the 1:200 year + climate change storm event and will be designed in accordance with current best practice and SEPA guidance. All crossings of minor watercourses, burns and drains will utilise a typical culvert structure as shown in Figure 3.3. Licensing requirements for water course crossing construction are discussed in Section 4.4.

3.5 Temporary Construction Compound

The Temporary Construction Compound (TCC) will include all site accommodation and welfare facilities, bunded fuel tanks and other liquid storage areas with segregation, bunded refuelling areas, general and protected storage areas, vehicle parking, security, lighting and services, communications and laboratory/testing or holding facilities, signage, pedestrian and vehicular circulation routes, and safety barriers.

The compound will be free draining with oil interceptors and contain a bunded area for maintaining vehicles and plant, or other pollution control measures, as appropriate/required to protect existing water courses and private water supplies.

The typical construction activities associated with the TCC are detailed below:

- Stripping of any topsoil / peat and careful stockpiling of this material as per Construction Environment Management Plan (CEMP) requirements.
- Excavating the remaining superficial soil materials and stockpiling of this material on the surrounding undisturbed area in accordance with CEMP requirements.
- Installation / construction of temporary surface water drainage in accordance with CEMP requirements.

- Laying and compacting crushed rock in layers to form a hardstanding. Crushed rock material will be site won from local excavations and have a low fines content to reduce the risk of sediment contamination.
- Delivery of offices, mess area, toilets and associated infrastructure on flat bed lorries.
- Erection of offices, mess area, toilets, and installation of all bunded areas to contain generator and fuel stores.
- Erection of fencing around the perimeter of the main TCC.

Following the completion of all construction activities, the TCC shall be reinstated according to the methods set out in the outline CEMP.

Toilets during the construction phase will be chemical toilets or soakaway, depending on ground suitability and discussion with SEPA. The waste will be emptied on a regular basis by a registered waste disposal contractor. Toilets will be located within the TCC areas.

All areas of the site including accommodation areas shall be kept clean and tidy with a regime of good housekeeping established to facilitate mobility of personnel and plant/equipment around the site and eliminate potential hazards and environmental pollution.

A proposed layout of the TCC is shown on Figure 3.4.

3.6 Vehicle Movements and Material Import Volumes

Aggregate will be imported to the site for road construction. The source of aggregate has not been confirmed at this stage, but is expected to be sourced from local quarries as detailed in Table 3.1. The likely haul route to site will be the A970 and B9075 from the west, or the A971 and B9075 from the east, depending on the quarry location(s).

It is anticipated that approximately 15,000m^3 of aggregate will be required and transported to site in standard HGV Tipper vehicles carrying around 10m^3 of aggregate per vehicle. This would result in around 30 return vehicles movements per day, assuming a 5 day week and 12 week construction programme.

Within the Shetland Council region there are a number of minerals and quarries, as outlined in Table 3.1.

Table 3.1 Quarries Located in the Shetland Islands Council Region

Active Quarries	Island	Distance to site (km)
Setter Quarry (Bressay) HU 503 418 Hill of Setter, Tulloch Developments Buildingstone	Shetland Mainland	8km
Aith Gravel Pit HU 336 543 Bixter, G M Johnson Decorative aggregate	Shetland Mainland	12km
Staneyhill Quarry HU 447 422 Lerwick, M K Leslie Ltd. Construction fill, graded sand & Gravel	Shetland Mainland	17km
Brindister Quarry HU 436 369 Lerwick, Garriock Borthers Ltd. Crushed rock aggregate, roadstone, high specification roadstone, construction fill	Shetland Mainland	18km
Scord Quarry	Shetland Mainland	18km

Active Quarries	Island	Distance to site (km)
HU 412 140 Scalloway, Shetland Island Council Coated roadstone and Roadstone		
Scatsta HU 383 724 Scatsta, EMN Plant Ltd. Crushed rock aggregate	Shetland Mainland	24km
Sullom Mine Quarry HU 341 729 Clothister hill, Garriock Brothers Ltd. Crushed Rock Aggregate	Shetland Mainland	26.5km
Symbister Ness HU 533 622 Symbister, G & R Aggregates Crushed rock aggregate	Whalsay	29km
Manns Quarry HU 461 903 West Sandwick, Victor Jamieson Ltd. Mortar manufacture	Yell	46km
Setters Quarry (Baltasound Unst) HP 638 109 Haroldswick, Sandisons (Unst) Ltd. Crushed rock aggregate	Unst	75km

It is the VEWF's intention to source as much of the materials locally as possible, although, due to European Union competition regulations, it is not possible to prescribe the sources of material. Given the above, however, it can reasonably be inferred that there is likely to be an adequate supply of aggregate from local sources.

3.7 Construction Phase

The proposed construction phase of the Kergord Access Track is anticipated to be completed over a period of approximately 12 weeks. All relevant statutory legislation policies and guidance will be complied with during construction. In particular this will include:

- Water Framework Directive (2000/60/EC) (WFD) and associated legislation;
- SEPA Policy No. 19: Groundwater Protection Policy for Scotland (SEPA, 2009);
- SEPA Pollution Prevention Guidelines (PPGs);
- Development on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (Scottish Renewables and SEPA, 2012);
- CIRIA C650 (2005) Environmental Good Practice on Site; and
- CIRIA C532 (2001): Control of Water Pollution from Construction Sites.

Construction mitigation and environmental protection measures will also be implemented with cognisance of the Viking Wind Farm CEMP and the outline CEMP for the Kergord Access Track, located in Appendix L of this EAR, applying principles and mitigation measures as relevant to the works associated with the proposed development.

The existing track will remain in situ and the responsibility of SIC as this road will continue to provide access to houses.

3.8 Operation and Maintenance

It is anticipated that the operation and maintenance of the new track will be the responsibility of SSE.

4. Environmental Appraisal – Affected Aspects

4.1 Ecology

4.1.1 Introduction

RPS was commissioned by Scottish and Southern Energy Renewables (SSER) and the Viking Energy Wind Farm (VEWF) to complete vegetation, otter, fisheries and macro-invertebrate surveys in support of this EAR and the associated planning application. The detailed information collated during these assessments is presented in the Technical Appendices supporting this document. The outcome of the surveys is summarised within this section of the EAR and was used to assess the potential effects of the construction and operation on the important ecological features identified within the area surrounding the proposed development. Ornithology is addressed in Section 4.2.

In summary, the surveys completed in relation to ecology are:

- Phase 1 Habitat surveys following Joint Nature Conservation Council (JNCC) 2010 guidance along the length of the track and within a surrounding buffer of 200m of all infrastructure;
- National Vegetation Classification (NVC) surveys following Rodwell 1991, 1992, 2000, 2006 along the length of the track and within a surrounding buffer of 200m of all infrastructure;
- the identification of groundwater dependent terrestrial ecosystems (GWDTEs) as described by SEPA (2014);
- otter surveys for field signs as described Bang & Dahlstrøm (2001) along watercourses within 250m of all proposed infrastructure;
- fish habitat assessment surveys 500m downstream and 200m upstream of all water-crossing locations based on protocols described by Hendry and Cragg-Hine (1997), SEPA (2010) and Summers et al. (1996);
- fish population assessment surveys 500m downstream and 200m upstream of all water-crossing locations using fully and semi-quantitative methods as described by Scottish Fisheries Co-ordination Centre (SFCC 2007); and
- macro-invertebrate surveys of the Burn of Weisdale and associated tributaries at two sampling locations following standard kick-sampling methods outlined by SEPA (2001) and UKTAG (2008).

4.1.1.1 Legislation and Guidance

Table 4.1.1 below outlines the international, national and local legislation and guidance relevant to potential ecological features present in proximity to the proposed development. This legislation and guidance has been considered during the targeted environmental assessment to identify and assess the effects of the proposed development on important ecological features, and will ultimately inform the level of mitigation required to offset effects (if any are identified).

Table 4.1.1 – Relevant Policy and Legislation

Policy or Guidance
International
The Habitats Directive European Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') was adopted in 1992 in response to the Bern Convention. The Habitats Directive requires Member States to maintain habitats listed on Annex I at favourable conservation status through the creation of a network of Special Areas of Conservation (SACs). Fauna listed on Annex 2 of the Directive may similarly be used as a designating feature for the network of SACs.
National

Policy or Guidance
Conservation of Habitats and Species Regulations 2010. These regulations consolidate the habitat and bird regulations for England and Wales. However, they also apply to Scotland in regards to specific activities including Section 36 applications under the Electricity Act 1989 where a Natura 2000 site may be affected. In practice, the updated 2010 regulations are very similar to the initial Conservation (Natural habitats, &c.) regulations 1994 which transposed the Habitats Directive into national law in terms of how consent applications are assessed with respect to Natura sites.
The Wildlife and Countryside Act 1981 (as amended) The Wildlife and Countryside Act 1981, as amended by the Nature Conservation (Scotland) Act 2004, provides protection to a range of species and habitats (e.g. water voles (*Arvicola amphibius*))Enhanced protection is provided for species listed on Schedule 5 making it an offence to kill, injure or take such an animal. It is also an offence to damage, destroy or obstruct access to any place used for shelter or breeding. Schedule 6 of the Act provides protection to listed animals from prohibited forms of capture. Any works which may potentially cause disturbance to these species requires prior consultation with SNH.
Wildlife and Natural Environment (Scotland) Act 2011. This act amends the Wildlife and Countryside Act 1981 in the following ways: • introduces new wildlife offences and wildlife management requirements (mainly with respect to wild birds, deer and hares); • strengthens protection of badgers; • makes changes to the licensing system for protected species; and • introduces a new regime for regulating invasive and non-native species.
Scottish Planning Policy (2014) The policy states that planning authorities should seek benefits for species and habitats from new developments including the restoration of degraded habitats, and where peat and other carbon rich soils are present, applicants should assess the likely effects associated with any development work.
Scottish Biodiversity Strategy (2012) This updates the UK Biodiversity Action Plan (UKBAP) and provides focus for actions to 2020 and a response to current international targets. The Scottish Biodiversity List now includes all species within Scotland previously included within the UKBAP.
SEPA Regulatory Position Statement - Developments on Peat (2010) The document sets out SEPA's position on the waste management issues arising from the generation of waste peat as a result of developments on these soil types.
Scottish Renewables and SEPA - Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste (2012) This guidance seeks to provide assistance regarding issues that may arise during developments on peat and how these should be dealt with in regards to the Waste Management Licensing (Scotland) Regulations 2011. The document also sets out guidance on the re-use of peat for the purposes of habitat enhancement and creation.
Good Practice during Wind Farm Construction (2013) SNH, SEPA and FCS updated guidance on best practice regarding construction in upland landscapes.
Local
Shetland Local Development Plan (2014) The plan sets out the Council's land use strategy which recognises existing developments, promotes sustainable economic growth and conserves Shetland's natural and built environment. The plan is supported by a number of relevant documents including guidance on on-shore wind and natural heritage.
Shetland Local Biodiversity Action Plan (LBAP) The Shetland LBAP, titled 'Living Shetland', identifies local habitats and species and seeks to promote actions

Policy or Guidance
to preserve these.

4.1.1.2 Ecological Background

The Kergord Access Track runs from the B9075 at Weisdale, north along either side of the Burn of Weisdale to Upper Kergord. Please see Figure 1.1 for the context of the proposed development on a landscape scale and Figure 1.2 for a plan of the proposed development.

The area lies on relatively acidic semi-pellites, quartzites and psammites. Two bands of crystalline limestone run through the wider area; one north from Sand Water and the other up the Kergord Valley.

The vast majority of the survey area and wider landscape is covered by blanket bog; the exceptions being the steeper, dryer eastern slopes of Scalla Field and Whaa Field, the shallower substrates bordering the Burn of Weisdale, and the few acid and base rich flushes dotted through the area.

The Upper Kergord area was subject to intensive agricultural improvement in the 1950s and 1960s. This converted a large area of blanket bog into pasture for sheep grazing. A considerable amount of drainage work appears to have been undertaken with lime and fertiliser added and, in places, surface seeding. Agricultural improvement is also evident along the Burn of Weisdale. It is also apparent that some drains have been cut into the blanket bog vegetation in places, although these do not appear to be recent.

In addition to the surveys undertaken for the proposed development ecology surveys of the area were completed as part of the Viking Wind Farm Section 36 application. Reports and data from these have been used for reference in this EAR where applicable to provide additional background information regarding important ecological features.

4.1.2 Approach and Methods

Detailed methods for each of the surveys listed within section 4.1.1 are included within the Appendices B – E associated with this EAR. Methods followed standard recognised guidance as stated. If methods deviated from guidance, the reasoning behind this is documented within the relevant Appendix, however any such deviation would be for the purpose of increasing the robustness of the survey and the associated data. Limitations of each survey are also stated within the relevant document, although none were identified which might affect the conclusions of the subsequent targeted environmental assessment.

4.1.3 Baseline Conditions

4.1.3.1 Desk Study

Detailed desk based surveys and reviews of historical data for habitats, otters, fish and macro-invertebrates are included within the relevant Appendices associated with this Chapter (Appendices B-E). Survey results for sensitive species are presented in the Confidential Annex.

There is one designated nature conservation site approximately 1.1km east of the proposed development; Sandwater SSSI (35.87ha in size). It is notified as an example of a mesotrophic loch and for its open-water transition fen (extensive beds of common club-rush (*Schoenoplectus lacustris*)). The Sandwater SSSI condition was assessed by SNH in 2004 as being ‘Favourable, maintained’.

4.1.3.2 Field Surveys

The following section summarises the findings of each survey and the detailed information reported in each of the Appendices.

4.1.3.2.1 Vegetation surveys

Table 4.1.2 and 4.1.3 below detail the Phase 1 habitats and National Vegetation Classification (NVC) communities identified across the vegetation survey area (Figure 4.1). Detailed descriptions of these, the species recorded during the surveys and the quality of the blanket bog habitats are given within Appendix B. The potential for each NVC community to be categorised as a GWDTE (SEPA, 2014) is given in Table 4.1.4 along with relevant conservation designations. Tables 4.1.2-4.1.4 show the results of the Phase 1, NVC and GWTDE surveys and assessment in the context of the route of the proposed development.

Table 4.1.2 – Phase 1 habitat types present in the Kergord access track survey area

Phase 1 Habitat Type	Phase 1 Alphanumeric Code	Area (ha)	Percentage Coverage of Survey Area
Blanket Bog	E1.6.1	58.2	35.0%
Semi – Improved Acid Grassland	B1.2	46.2	27.8%
Wet Modified Bog	E1.7	23.9	14.4%
Improved Grassland	B4	15.8	9.5%
Dry Dwarf Shrub Heath	D1.1	9.9	5.9%
Unimproved Acid Grassland	B1.1	4.6	2.8%
Built-Up Areas	J3	3.1	1.9%
Acidic Flush	E2.1	1.2	0.7%
Marshy Grassland	B5	1.1	0.6%
Running Water	G2	0.8	0.5%
Wet Dwarf Shrub Heath	D2	0.6	0.4%
Wet Heath/Acid Grassland Mosaic	D6	0.6	0.3%
Basic Flush	E2.2	0.4	0.2%
Notes: Total survey area is approximately 166ha			

Table 4.1.3 – NVC communities present in the Kergord access track survey area

NVC Community	NVC Alphanumeric Code	Area (ha)	Percentage Coverage of Survey Area
M17 *Trichophorum cespitosum – Eriophorum vaginatum* blanket mire	M17	55.7	33.5%
U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland community	U4	47.5	28.6%
M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire	M19	22.4	13.4%

NVC Community	NVC Alphanumeric Code	Area (ha)	Percentage Coverage of Survey Area
H10 *Calluna vulgaris – Erica cinerea* heath	H10	9.3	5.6%
U6 *Juncus squarrosus – Festuca ovina* grassland	U6	8.5	5.1%
MG7 *Lolium perenne – Trifolium repens* leys	MG7	7.6	4.6%
U5 *Nardus stricta – Galium saxatile* grassland	U5	3.6	2.1%
N/A	Roads	3.1	1.9%
M15 *Trichophorum cespitosum – Erica tetralix* wet heath community	M15	2.5	1.5%
M6 Carex echinata – *Sphagnum recurvum/auriculatum* mire	M6	2.3	1.4%
M23 Juncus effusus/acutiflorus – *Galium palustre* rush-pasture	M23	1.5	0.9%
N/A	Water	0.8	0.5%
H9 *Calluna vulgaris – Deschampsia Flexuosa* heath	H9	0.7	0.4%
U2 *Deschampsia Flexuosa* grassland	U2	0.5	0.3%
M10 *Carex dioica – Pinguicula vulgaris* mire	M10	0.4	0.2%
M25 *Molinia caerulea – Potentilla erecta* mire	M25	<0.1	<0.1%

Table 4.1.4 – NVC communities present within the survey boundary and their relevant conservation designations

NVC Code	NVC Community	Annex 1 Biotope Code	Annex 1 Biotope Name	Scottish Biodiversity List Code	GWDTEs Potential (High/ Moderate/ None)
M17	*M17 Eriophorum vaginatum – Trichophorum germanicum mire*	7130	Blanket bogs	H1, H3	None
U4	*U4 Festuca ovina – Agrostis capillaris – Galium*	-	-	H3	None

NVC Code	NVC Community	Annex 1 Biotope Code	Annex 1 Biotope Name	Scottish Biodiversity List Code	GWDTEs Potential (High/ Moderate/ None)
	saxatile grassland community				
M19	*M19 Calluna vulgaris – Eriophorum vaginatum blanket mire*	7130	Blanket bogs	H1, H3	None
H10	*Calluna vulgaris - Erica cinerea heath*	4030	European dry heaths	H1, H3	None
U6	*U6 Juncus squarrosus – Festuca ovina grassland*	-	-	H3	Moderate
M19	*M19 Calluna vulgaris – Eriophorum vaginatum mire*	7130	Blanket bogs	H1, H3	None
U5	*Nardus stricta – Galium saxatile grassland*	-	-	H3	None
M15	*Trichophorum germanicum – Erica tetralix wet heath*	4010/7130	Northern Atlantic wet heaths with *Erica tetralix*/Blanket bogs	H1, H3	Moderate
M23	*M23 Juncus effusus/acutiflorus – Galium palustre rush-pasture*	-	-	H1, H3	High
M6	*Carex echinata-Sphagnum fallax/denticulatum mire*	-	-	H1, H3	High
Water	-	-	-	H1, H3	None
H9	*Calluna vulgaris – Deschampsia flexuosa dry heath*	4030	European dry heaths	H1, H3	None
U2	*Deschampsia flexuosa grassland*	-	-	H3	None
M10	*M10 Carex dioica – Pinguicula vulgaris mire*	H7230	Calcium-rich spring water fed fens	H1, H3	High

NVC Code	NVC Community	Annex 1 Biotope Code	Annex 1 Biotope Name	Scottish Biodiversity List Code	GWDTEs Potential (High/ Moderate/ None)
M25	*M25 Molinia caerulea – Potentilla erecta mire*	7120/7130	Degraded raised bog, Blanket bog	H1, H3	Medium

4.1.3.2.2 Otter surveys

All watercourses within 250m of the proposed route of the revised Kergord Access Track were surveyed for signs of otters. Similarly, historical records of otter presence in the area for the past 15 years (2000 – 2015) were sought from Shetland Biological Record Centre (SBRC).

A single record of otter presence was found for the period 2000-2015 (SBRC data search) within the 12km2 area in which the development is situated.

The results of the SBRC data search and field surveys are described in the Confidential Annex.

4.1.3.2.3 Fish Habitats and Population Surveys

Fish habitat suitability and fish population surveys were completed along the Burn of Weisdale and the lower reaches of its tributaries; the Burn of Swirtars, the Burn of Scallafield and the Burn of Droswall. Appendix D details the results of these surveys. The following points summarise the finding of these surveys:

- The lower reaches recorded the greatest variability of habitat type with no one habitat dominating.
- Population surveys within the Burn of Weisdale were repeat surveys of the locations previously assessed in 2008 (WE1 – WE3) (Locations described in Table 2 of Appendix D). Trout were recorded at all locations surveyed. An adult sea trout was caught at WEI1, the most upstream site, demonstrating that all three survey sites are accessible to migratory salmonids.
- Salmon were present only at WEI3 with two year classes present.
- Despite the limited quantity of suitable habitat for eels, individuals were captured at all locations during the 2015 surveys.
- WEI3 had the greatest number of eels present and this is likely to reflect the greater amount of stable cover present at this location.

4.1.3.2.4 Macro-invertebrate Abundance Surveys

Macro-invertebrate surveys conducted for the Kergord Access Track along the Burn of Weisdale found the following key points:

- Invertebrate communities of the Burn of Weisdale and tributary largely consisted of common and widespread species typical of Scottish upland or rural watercourses and no rarities were identified.
- The invertebrate community, dominated by Ephemeroptera, Plecoptera and Trichoptera indicates that the water quality is good.
- Abundance, and diversity of macro-invertebrates as measured by taxon richness, was generally moderate. Macro-invertebrate communities may be depauperate as a result of Shetlands geographic isolation.
- The Average Score Per Taxon (ASPT) index indicated fair to good water quality with no significant organic pollution. This index may be affected by the low diversity of Shetland freshwater macro-invertebrates;
- The Water Chemistry Status was Class 1 indicating circum-neutral water chemistry and the Index of Acidity was Class II indicating slightly acidic conditions. Buffering is moderate and the watercourses are not significantly acidified.

- The Burn of Weisdale and tributary reach the Water Framework Directive (WFD) required standard of good for both the ASPT and the number of differing taxa (NTAXA) parameters of the WFD ecological status class; and
- Overall the invertebrates, environmental variables and indices were similar in 2015 to the previous survey of 2008, indicating that the invertebrate communities are stable, and the water quality, invertebrate communities and productivity of the Burn of Weisdale and tributary should support sustainable salmonid populations if other environmental factors are suitable.

4.1.4 Assessment of Effects

The sections above explain the scope, survey methods and results used to assess ecological features within the development area (i.e. the baseline). This following section explains how the significance of effects on these is assessed.

Assessing the significance of effects on ecological features is a staged process, using the 2016 CIEEM guidelines. A significance matrix is also included for this EAR (although not part of the CIEEM guidelines) because it is considered useful, adding clarity and consistency, which compliments professional judgement used to assign significance of effects through reasoned argument.

4.1.4.1 Assigning the Importance of Ecological Features

Determining the conservation importance of ecological features within the study area is the first step in the assessment process, and is undertaken in a systematic way using criteria that determine whether it is of international, national, regional, local or negligible significance.

The term for the ecological feature affected at the site is 'Important Ecological Feature' (or IEFs). The criteria for valuing the conservation importance of each ecological feature is outlined in Table 4.1.5.

4.1.4.2 Magnitude of Effect

The potential effects on each IEF are determined through understanding how each of these responds to the proposed development (Table 4.1.6). The elements used to define the scale of the effect of a development include determining:

- the potential duration, whether short-term (< 5 years), medium-term (5 - 15 years) or long-term (15 – 25 years or longer);
- timing and frequency, whether the effects will be timed at a sensitive period, or the frequency will alter the effects;
- reversibility, whether the effects will be reversible in the short to medium term;
- confidence in predictions, whether the predicted effect is certain/near certain (>95%), probable (50% - 95%), unlikely (5% - 50%), or extremely unlikely (<5%) to occur;
- potentially whether the effect will affect the long-term viability of a habitat or population of species; and
- whether there are any cumulative effects that may affect the long-term integrity of the ecosystem(s) at the site.

Any potential cumulative impacts arising from other development proposals within a distance that may affect the ecological resource or multi-faceted impacts on any single ecological receptor are also considered.

4.1.4.3 Significance of Effect

The significance of the potential effects on each IEF is determined by considering the value of each nature conservation interest and the degree to which it may be affected (the effect magnitude) by the proposed development, i.e. by using Tables 4.1.5 and 4.1.6 below. These are described as Major, Moderate, Minor and Negligible. This is presented as a matrix (Table 4.1.7).

Table 4.1.5 Criteria for Valuing the Conservation Importance of Ecological Receptors on Site

Conservation Value	Examples
International	Habitats or species that form part of the cited interest within an internationally protected site, such as those designated under the Habitats Directive (Special Areas of Conservation - SACs), the Birds Directive (Special Protection Areas - SPAs) or other international convention (e.g. Ramsar site). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in an international context such that the site is likely to be designated as an SAC/SPA or proposed SAC/SPA. Presence of habitats or species listed within the EC Habitats Directive on either Annex 1 or 2 respectively, where legislation states that all areas of representative habitat, or individuals of the species should be protected.
National	Habitats or species that form part of the cited interest within a nationally designated site, such as a Special Site of Scientific Interest (SSSI), or a National Nature Reserve (NNR). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national context for which the site could potentially be designated as an SSSI. Presence of UK Biodiversity Action Plan habitats or species, where that action plan states that all areas of representative habitat, or individuals of the species should be protected.
Regional	Habitats or species that form part of the cited interest of a Local Nature Reserve, or some local-level designated sites depending on specific site conditions. A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being of nature conservation value up to a district or county context. Presence of Local Biodiversity Action Plan habitats or species, where that action plan states that all areas of representative habitat, or individuals the species should be protected.
Local	Habitats or species that form part of the cited interest of a local-level designated site and may be designated as a non-statutory Local Nature Conservation Sites (LNCS) or the equivalent, e.g. Local Wildlife Site, Sites Important for Nature Conservation (SINC). A feature (e.g. habitat or population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.
Negligible	Common place feature of little or no habitat/historical significance. Loss of such a feature would not be seen as detrimental to the ecology of the area.

Table 4.1.6 Defining the Magnitude of Effect on Valued Ecological Receptors

Magnitude	Definition
Total/Near Total	Would cause the loss of all or a major proportion of a habitat or numbers of a species' population, or cause sufficient damage to immediately affect long-term viability.
High	Major effects on the feature/population which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. For example, more than 20% habitat loss or long-term damage, or more than 20% loss of a species' population.
Medium	Effects that are detectable in short and medium-term but which should not alter the long-term viability of the feature/population. For example, between 10-20% habitat loss or 10-20% reduction of a species' population.
Low	Minor effects, either of sufficiently small-scale or of short duration to cause no long-term harm to the habitat/population. For example, less than 10% loss or damage.
Neutral	A potential impact that is not expected to affect the habitat/population in any way.

Table 4.1.7 Significance of the Effects Defined by the Relationship between the Nature Conservation Value and Effect Magnitude

Effect Magnitude	Receptor Sensitivity				
	International	National	Regional	Local	Negligible
Total/Near Total	Major	Major	Major	Moderate	Minor
High	Major	Major	Major- Moderate	Moderate	Minor
Medium	Major	Major – Moderate	Moderate	Moderate – Minor	Minor
Low	Moderate – Minor	Moderate – Minor	Moderate – Minor	Minor	Minor
Neutral	None/Negligible				

The significance of impacts can be two-way: either adverse or beneficial. The two extremes are:

- major adverse effects on a feature of at least national nature conservation value. In this case, mitigation measures to offset the impact would be required; and
- major benefits for a feature or population.

Effects or residual effects are considered to be significant under the Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations) if they are at a level of Moderate or Major (i.e. “a likely significant effect”). For the purposes of this EAR these criteria will continue to be applied with those categories shaded darkest in Table 4.1.7 above. Some categories of nature conservation value and effect magnitude may vary in the level of significance effects depending on the circumstances which is why some of the cells in Table 4.1.7 have two levels within them. This allows for professional judgement to be applied when identifying the level of significance. Effects that are neutral or minor are not considered significant with respect to the EIA Regulations.

Given the distance of the Sandwater SSSI from the proposed development (approximately 1.1km), with no hydrological pathway linking the area of the proposed development to the SSSI, the site has been scoped out from further assessment.

4.1.5 Construction Effects

4.1.6 Habitats

For the purposes of assessing effects of the Kergord Access Track on habitats, the quantity of habitat affected either through direct loss beneath the footprint of the track and the associated earthworks, or through wider indirect measures such as alterations to the hydrological integrity of the habitat must be considered.

For the purpose of this assessment the following criteria and terminology have been applied:

- Permanent Habitat Loss – this is defined as the footprint of the Kergord Access Track (width 8m) and the predicted associated earthworks. Although the earthwork will be reseeded and spoil from track construction will follow good practice guidance in terms of reinstatement, in reality the vegetation will be at best highly degraded and so will be defined as permanently lost.
- Permanent Change – this is defined as where the 8m footprint of the track is within 15m of the surrounding vegetation and the earthworks are not present within this area, the track will have a direct impact on the vegetation. This will be through draw down of the watertable associated with the surrounding habitats and vegetation and will likely cause a permanent alteration in the species able to tolerate the altered environmental conditions.
- Temporary Change – this is defined as areas outwith the earthworks or 15m buffer surrounding the footprint of the track where a 5m buffer has been applied to take into account potential temporary effects to the habitats surrounding the development. This will include but is not exclusive to tracking of vehicles to access construction areas and storage of spoil prior to reinstatement. With time it is expected that habitats within this buffer area will recover to their pre-construction state.
- Table 4.1.8 below shows the predicted effect of construction of the track to habitats, their conservation value, the predicted magnitude of the potential effect and the overall unmitigated significance of the effect by development to the habitat as defined by Table 4.1.5 to 4.1.7 above.

Table 4.1.8 – NVC communities present in the Kergord access track survey area, their predicted direct and indirect habitat loss and the predicted effect of the track to these

NVC Community	Permanent Habitat Loss (ha)	Area of Permanent Effect (ha)	Area of Temporary Effect (ha)	Total Habitat Loss (ha)*	Conservation Status of Habitat	Magnitude of Potential Effect	Predicted Unmitigated Significance of Effect**
U4 Festuca ovina – Agrostis capillaris – Galium saxatile grassland community	2.47	2.34	0.97	5.78	National	Low	Moderate – Minor (Minor)
M17 *Trichophorum cespitosum – Eriophorum vaginatum* blanket mire	1.51	1.67	0.81	3.99	International	Low	Moderate – Minor (Moderate)
M19 Calluna vulgaris – Eriophorum	0.29	0.31	0.17	0.77	International	Low	Moderate – Minor (Minor)

NVC Community	Permanent Habitat Loss (ha)	Area of Permanent Effect (ha)	Area of Temporary Effect (ha)	Total Habitat Loss (ha)*	Conservation Status of Habitat	Magnitude of Potential Effect	Predicted Unmitigated Significance of Effect**
vaginatum blanket mire							
MG7 *Lolium perenne* leys and grassland	0.10	0.35	0.13	0.58	Local	Low	Minor
U6 *Juncus squarrosus – Festuca ovina* grassland	0.08	0.11	0.07	0.26	National	Low	Moderate – Minor (Minor)
M6 *Carex echinata – Sphagnum recurvum/ auriculatum* mire	0.01	0.01	0.01	0.03	International	Low	Moderate – Minor (Minor)

Notes:

*Habitat loss similar predicts an area of 0.05ha will be lost of the watercourses in the development area. In reality this is the area which will be spanned by watercrossings and consequently is not included within the above assessment. Similarly, 0.26ha of the existing road running to Upper Kergord will be incorporated into the construction of the proposed access track.

** For those communities where two potential categories of effect are reached through the assessment process, professional judgement is applied, the results of which are given in brackets.

For a number of the predicted unmitigated effects of significance, professional judgement has been applied where two separate categories are available. This is based on the quality of the habitat present (as described in Appendix B: Habitat Survey Report 2015), many of which are poor due to impacts from historical and current anthropogenic influences.

Surveys similarly noted the potential for NVC communities to be reliant on groundwater influences. Figure 4.4 shows those with the potential to be moderately or highly reliant on these. The alignment of the proposed development has sought to minimise the effect to these, and the presence of the existing Upper Kergord Track and the B9075 means that severance of groundwater flow throughout the area has already occurred and many of those communities with the potential to be reliant on groundwater flow are in fact existing in isolation from the development area. The M10 *Carex dioica – Pinguicula vulgaris* mire community known to be highly ground water dependent and was noted at a number of locations within the habitat survey area. These are of high conservation value in the context of Shetland, however they are located to the south of the exisiting B9075 and so are hydrologically independent from the proposed developement area.

A small quantity of NVC community M6 *Carex echinata – Sphagnum recurvum/auriculatum mire* will be lost to the footprint of the development totalling 0.03ha. The potential hydrological severance within in this area could cause a further 0.36ha of this habitat downslope of the track to be affected if suitable construction methods are not employed to enable the continuation of the area's hydrological regime.

Two further areas of U6 *Juncus squarrosus – Festuca ovina* grassland will also be affected by construction of the proposed development. The area of U6 which the track crosses in the north of the proposed development may have the groundwater flow interfered with downslope of the development if suitable construction methods are not utilised. The area of U6 which is crossed in the south of the development is unlikely to be groundwater

dependent due to the topography of the area, and as such no further effect out with predicted habitat loss is foreseen.

The unmitigated effect significance as stated in Table 4.1.8 for all communities takes into account the potential impact on GWDTEs, with effect significance to both these communities predicted as Minor using professional judgement.

More generally only the M17 *Trichophorum cespitosum – Eriophorum vaginatum* blanket mire community is predicted to have a significant unmitigated effect (moderate) under the Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations).

4.1.7 Otters

Using Table 4.1.5, otters on Shetland are assessed as being of international importance due to their inclusion on Annex 2 of the Habitats Directive. The Yell Sound Coast Special Area of Conservation (SAC) approximately 15km to the north of the development is designated for its otter population which was last assessed in 2012 and found to be in an unfavourable condition. Otters within their territories can travel of upwards of 30km in search of prey and thus there is the potential for individuals associated with this site to pass through the development area via the Burn of Weisdale, linking with watercourses between the Loch of Strom in the south and Olna Firth and Sullom Voe in the north.

Desk based data for the species records few sighting of the species in the area surrounding the proposed development, but given the sparsely populated area by local residents and the crepuscular nature of the species, this is unsurprising. Field surveys results are presented in the Confidential Annex.

Given that only a single major watercrossing is proposed within the proposed development crossing the Burn of Weisdale, and the majority of the construction works is situated at least 30m from watercourses (the distance by which SNH deem a disturbance license for development is required), disturbance if no mitigation is implemented with regards to the species is likely to be minor. As such the unmitigated significance of the effect caused by the construction of the Kergord Access Track to otters is predicted as Moderate – Minor, with professional judgement applied downgrading this to Minor.

4.1.8 Watercourses, Fish and Macro-Invertebrates

Fish species identified as present within the Burn of Weisdale and the associated tributaries are sea trout, salmon and European eel (Appendix D). Both sea trout and salmon are listed within Annex 2 of the EC Habitats Directive and so for the purpose of this EAR are assessed as of international importance via Table 4.1.5 above.

Eels are not listed within the EC Habitats Directive, however due to historic persecution there has been a widespread decline in numbers throughout Europe. As such, all member states were required to produce an Eel Recovery Plan in 2007 (Council Regulation no 1100/2007). Marine Scotland Science completed this in 2008. Given this European interest in the species, for the purpose of this EAR the species are assessed as of international importance via Table 4.1.5 above.

Populations of all species appear to be stable with data collected in 2008 for the Viking Wind Farm's planning application consistent with that of the 2015 surveys. The Burn of Weisdale and a number of the associated tributaries contain suitable habitats for all stages of the life cycles of the fish species present with the exception of eels where suitable habitat was limited.

Potential effects of the proposed development to watercourses and their associated biota include disruption to stream beds during construction of water crossings, sedimentation and silt loading, or pollution caused by machinery such as oil spills.

Disruption to streambeds and habitat loss during watercrossing construction has the potential to decrease habitat suitability for the species present, particularly within the Burn of Weisdale, including a loss of or decrease in spawning habitats. This in turn may decrease the abundance of the species and their utilisation of the watercourses.

Construction related pollution events similarly have the potential to affect fish species present both through discharge of sediment/silt to the watercourse from construction works or via hydrocarbon pollutants from machinery. Such pollution events have the potential to affect both prey abundance in terms of macro-invertebrate availability, and viability of eggs within the watercourses from increased silt loading and decreased oxygenation. Both factors may reduce to abundance of fish species present in the watercourses or their ability to utilise them.

Given the potential effects described above, the unmitigated effects to fish are predicted at worst to be of a low magnitude as habitat loss (if any occurred) would be localised and of a small scale. Similarly, pollution events would be short in duration (if any occurred) and unlikely to affect the overall nature of the watercourse or macro-invertebrate population.

Given the international status of the fish species and the predicted low magnitude of any construction related effect, the overall significance of the unmitigated effect of the development during the construction phase is assessed as Moderate – Minor.

4.1.9 Operational Effects

4.1.10 Habitats

Operational effects to habitats surrounding the proposed access track are predicted to be two-fold. In the initial 18 months of the utilisation of the access track during the period in which the wind farm will be constructed, traffic use is likely to be increased with the potential of heavy construction plant using the track. Following this construction period, traffic will be limited to occasional use by wind farm maintenance vehicles and as such potential effects substantially reduced.

Habitats surrounding the access track are predominately listed on Annex 1 of the Habitats Directive and as such are of international importance. During the construction period of the development potential pollution events are increased due to the volume and type of traffic using the track. Pollution may be in the form of increased sediment run off from the track surface during periods of heavy rainfall, increased dust release during periods of dry weather, or the increased risk of oil or fuel spills which might affect habitats. The magnitude of the effect of these events is predicted to be short in duration however such events might be regular if suitable mitigation is not implemented. The effect magnitudes are assessed as low during this period with the overall effect significance during this period therefore assessed as Moderate – Minor.

Following the construction period of the wind farm, track use is predicted to be limited to minor use by wind farm maintenance vehicles or maintenance to the track itself. As such the quantity of habitat which is likely to be lost or altered on a permanent or temporary basis is minimal. Any effect on habitats during track maintenance works is predicted to be of a negligible magnitude. Consequently, the significance of any effect caused to habitats during the operational phase of the access track is assessed as Negligible.

4.1.11 Otters

Operational effects on the otter population associated with the surrounding area are thought to be minimal. Otters by their nature are crepuscular or nocturnal and as such will be utilising the watercourses in vicinity of the development during periods when the access track is not in use. As such, disturbance to the species and the potential for road related fatalities is deemed to be negligible. Maintenance of the access track and associated watercrossings will be required occasionally during the lifetime of the development. Such activities will predominately be away from areas of otter activity and will predominately be completed during daylight hours. It is highly unlikely maintenance will be required to watercrossing structures, however if required, the disturbance to any individual utilising the area is likely to be of a short duration.

Otters are listed on Annex 2 of the Habitats Directive and are a designating feature of the Yell Sound Coast Special Area of Conservation (SAC) approximately 15km to the north of the development; the species for the purposes of this assessment is therefore noted as of international importance. The magnitude of effect of any operational maintenance work to the access track upon otters is predicted to be negligible; consequently the significance of the effect to the species is assessed as Negligible.

4.1.12 Watercourses, Fish and Macro-Invertebrates

Operational effects on the watercourses surrounding the access track may include increased hydrocarbon and silt/sedimentation release from wind farm construction related traffic using the track during the initial operational period of the wider wind farm development. Deposits of this nature have the potential to build up on the surface of the carriageway which may in turn be washed into surrounding watercourses during periods of persistent rainfall. This heavy traffic utilisation is predicted to last for approximately 18 months whilst the wind farm is constructed, following which the access track will be used for maintenance work by lighter vehicles on a less frequent basis.

Increased silt/sedimentation loading has the potential to affect the viability of spawning habitat for fish species, clogging the fine gravel used by fish for laying eggs, decreasing the oxygen flow through these areas and the viability of any eggs in place. Increased minerals associated with such sediment loading along with dissolved and particulate organic carbon can alter the buffering capacity of the watercourse, this in turn altering pH and decreasing the suitability to key species of both fish and macro-invertebrates.

The initial 18 month period of the operational phase of the access track is predicted to be the busiest due to this coinciding with the construction phase of the wind farm, and as such the period when the potential for the greatest effects to the watercourses and aquatic fauna might occur. The assessment of potential effects is therefore based on this period as a worst case scenario.

All fish species found to be present within the watercourses in proximity to the access track are listed or noted in European legislation (see Section 4.1.5 (C) for further details) and are therefore assessed as of international importance. Due to the likely heavy use of the track during the construction period of the wind farm, the potential of pollution events occurring which may affect the watercourse and the associated species are raised during this period.

During this initial 18 month construction period the unmitigated magnitude of effect of any pollution related incident is predicted as low, as despite the potential increased risk of a pollution event occurring, the duration and time scale of recovery is predicted as short. Consequently, the worst case scenario is that the unmitigated significance of the effects to fish, macro-invertebrates and the watercourses as a whole is Moderate - Minor.

4.1.13 Decommissioning Effects

Effects to all valued ecological receptors identified in Section 4.1.5 for the construction phase of the development are predicted to be of a similar or reduced magnitude and significance during the decommissioning phase. An update to this assessment will be completed prior to decommissioning commencing to ensure all receptors are appropriately accounted for, and where applicable, additional suitable mitigation implemented.

4.1.14 Mitigation

Under the Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations) mitigation of effects is required if these are predicted at a level of Moderate or Major (i.e. “a likely significant effect”) on any valued ecological receptor. As documented in the above Sections (4.1.5 – 7), Important Ecological Features which the proposed development may potentially have an unmitigated likely significant effect upon are:

- Effects to the M17 *Trichophorum cespitosum – Eriophorum vaginatum* blanket mire community during construction of the proposed development.
- Effects on fish populations, habitats, macro-invertebrates and watercourses during the construction period of the development.
- Effects on fish populations, habitats, macro-invertebrates and watercourses during the initial operation period of the development.

All other effects are predicted as minor; however industry standard good practice guidance with regards to each IEF will be followed throughout all stages of the development to decrease the potential significance of these effects further.

Where appropriate, relevant mitigation measures will be implemented through Construction Method Statements, Environmental Protection Plans, Peat Management Plans and Construction Environmental Management Plans. These will be prepared in consultation with, and to the satisfaction of Shetland Islands Council, SEPA and SNH, and submitted for their approval.

Further proposals relating to pollution prevention are given in the Section 4.3 of this document.

4.1.14.1 **Blanket Mire Habitats**

The following specific mitigation will be implemented to reduce the effects of the proposed development to blanket mire habitats, along with mitigating for the loss of habitats (both permanent and temporary) during the construction of the development to minor:

- Demarcation of a working footprint for the development will be implemented to ensure minimal disruptions to habitats are achieved. All vehicle movements will stay within this marked footprint.
- A suitably qualified Ecological Clerk of Works with experience of construction in the peatland environment will be employed to advise the developer on best practice and compliance with environmental legislation.
- Mitigation for the loss of all habitats is included within the Viking Wind Farm Habitat Management Plan which will run for the 25 year lifespan of the wind farm development. The plan details the blanket bog restoration which will be completed to offset predicted effects from all construction related activities associated with the wind farm (included this proposed development), providing enhancement over and above these requirements for the wider benefit of the Shetland landscape.

4.1.14.2 **Watercourses, Fish and Macro-Invertebrates**

The following specific mitigation measures will be implemented to reduce the potential significance of effects of the access track during the construction and operational stages of its lifetime to watercourses and their associated fauna to minor.

Mitigation to protect the Burn of Weisdale watercourse and its sensitive ecological features such as control of pollution and sedimentation include best practice techniques outlined in Section 4.3 (Geology, Hydrogeology and Hydrology) along with those adopted within the outline CEMP (Appendix L). The document will be finalised prior to construction commencing to ensure robust mitigation is in place to protect all aquatic features.

A programme of water quality monitoring will be undertaken pre, during and for a three year period post construction to provide a baseline of water quality and to subsequently document water quality during potential periods of risk. Feedback from the monitoring programme will determine if Sustainable Drainage System (SuDS) measures incorporated during the construction and operational phase of the development are adequate or if additional measures are required to adequately protect the watercourses and associated IEFs.

A survey of the fish and macro-invertebrate populations will be completed during the construction phase and annual monitoring will be conducted for the subsequent three year period post construction of the access track. This will update the information gathered in support of this Planning Application. These will document any alteration to populations or abundance of fish or macroinvertebrates, or alterations to habitats associated with these IEFs.

All vehicles using the access track will be maintained in good condition and inspected to prevent oil leaks and to avoid risk of pollution. Spill kits will also be kept within vehicles to help control pollution in the event of a leak or spillage.

With the implementation of the above mitigation, the effects to watercourses, fish and macro-invertebrates are considered to be of low magnitude and of minor significance.

4.1.15 Conclusions

The ecology section of this document has assessed the likely significance of effects of the development with regard to important habitats and species at the site. By applying effective mitigation measures, the residual

effects of this development are assessed as being minor and therefore not significant in terms of the EIA Regulations.

4.2 Ornithology

4.2.1 Introduction

This section identifies the ornithological sensitivities in the area potentially affected by the proposed development and assesses the effects it would have on bird populations. The chapter also considers how effects on birds can be avoided or reduced through mitigation measures.

This section of the report was prepared by Natural Research Projects Ltd (NRP) on behalf of Viking Energy Wind Farm (VEWF) and is supported by the following technical appendices:

- Appendix F: Baseline Bird Surveys Technical Report.
- Appendix G: Ornithology Assessment Methods.

4.2.2 Approach and Methods

The assessment follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 and government guidance on the implementation of the EU Birds and Habitats Directives (SERAD 2000). The criteria used to evaluate ornithological receptors, identify potential effects and their magnitude, assess the effects' significance, recommend mitigation and assess the residual effects are detailed in full in Appendix G.

Where there is a potential effect on a bird population that forms part of the qualifying interest of an internationally or nationally designated site (or where such designation is proposed), i.e. Ramsar site, Special Protection Area (SPA) or a site that would meet the criteria for international or national designation, so far as possible, effects are judged against whether the proposed development could significantly affect the site population and its distribution. Where bird populations are not protected by a SPA designation (i.e. where the population does not meet the criteria for international designation), then judgement is made against a more general expectation that the proposed development would not have a significant adverse effect on the overall population, range or distribution; and that it would not interfere significantly with the flight paths of migratory birds. In assessing the effects, consideration is given to the national, regional and local populations of the species. Trivial or inconsequential effects are excluded.

The guidance consulted and methods used to characterise and assess potential effects on bird populations are described in Appendix G.

4.2.3 Baseline Conditions

Baseline surveys were undertaken in 2015 to inform the assessment of potential effects of the proposed development on birds. The survey methods and the survey area (Figure 1 of Appendix F) are described in full in Appendix F while survey results are presented in the Confidential Annex. The areas where birds could be potentially affected by the proposed development (i.e. the site buffered to 1km) have also been previously covered by surveys undertaken as part of EIA studies for the Viking Wind Farm. The areas and years of survey coverage and relevant results from these previous surveys are also described in Appendix F.

Effects on bird species are examined in the context of regional populations. In line with SNH guidance the relevant regional bird population has been defined by the geographic extent of Natural Heritage Zone 1 (NHZ 1), which comprises the Shetland Islands and Fair Isle. The population sizes and conservation status of species relevant to the assessment are summarised in Table 4.2.1. Within NHZ 1 whimbrel is currently considered to have an unfavourable conservation status; all other species of relevance to the proposed development are considered to have a favourable regional conservation status.

No part of the proposed development lies within a site designated for its ornithological interest as a SPA, a Site of Special Scientific Interest (SSSI) or Ramsar site.

Table 4.2.1: The size, Nature Conservation Importance and conservation status of Shetland breeding bird populations (number of pairs) for species breeding locally to the proposed development

Species	Shetland population estimate (pairs)	Nature Conservation Importance[1]	Conservation status	Source
Red-throated diver	407	High (Schedule 1, Annex 1)	Favourable	Dillon *et al.*, 2009; Eaton *et al.*, 2015
Whooper swan	*ca*. 9	High (Schedule 1, Annex 1)	Favourable	Shetland Bird Report, 2009; Eaton *et al.*, 2015
Merlin	20-25	High (Schedule 1, Annex 1, BOCC Red list)	Unfavourable UK, Unfavourable Shetland	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Dunlin	1,700	High (Annex 1)	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Oystercatcher	3,350	Low	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Snipe	3,450	Low	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Redshank	1,170	Low	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Lapwing	1,740	Moderate (BOCC Red list)	Unfavourable UK, Shetland probably Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Golden plover	1,450	High (Annex 1)	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Ringed plover	800-1000	Moderate (BOCC Red list)	Unfavourable UK, Shetland probably Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Curlew	2,300 - 3,975	Moderate (BOCC Red list)	Unfavourable UK, Shetland probably Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Whimbrel	ca. 290	High (Schedule 1)	Unfavourable	Jackson, 2009; Eaton *et al.*, 2015
Common sandpiper	44	Moderate (>1% of regional population)	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
Arctic skua	Was ca. 500 in 2000 Probably now <250 pairs	Moderate (BOCC Red list)	Unfavourable (JNCC report 71% decline for UK for 2000-2014)	Pennington *et al.*, 2004; Eaton *et al.*, 2015; JNCC (2015)
Great skua	6,874	Low	Favourable	Pennington *et al.*, 2004; Eaton *et al.*,

Species	Shetland population estimate (pairs)	Nature Conservation Importance[1]	Conservation status	Source
				2015
Greylag goose	at least 500 (increasing)	Low	Favourable	Pennington *et al.*, 2004; Shetland Bird Reports; Eaton *et al.*, 2015
Arctic tern	24,716	High (Annex 1)	Favourable	Pennington *et al.*, 2004; Eaton *et al.*, 2015
[1] Categories of Nature Conservation Importance are defined in Appendix G,				

4.2.1 Potential Effects

The construction of the Kergord Access Track is predicted to lead to two types of effect on birds; those arising from construction disturbance and those arising from habitat loss or change. These are described in greater detail in Appendix G and summarised below.

4.2.1.1 Construction disturbance

Birds may be disturbed by construction activity and noise, causing them to alter their behaviour. Birds can show a wide variety of behavioural responses to disturbance, ranging from avoidance of the area affected to temporary interruption of their normal activities such as feeding, nest attendance and chick rearing. Disturbance can also lead to indirect effects such as increasing the likelihood of nest predation, preventing prospective birds settling to breed in an area or causing settled pairs to leave an area; both these amount to displacement. Disturbance can also lead to reduced breeding success or breeding failure.

Disturbance effects on birds arising from the proposed development will occur both during the construction of the track and, at a reduced level, thereafter during its day to day use. Disturbance during the construction stage would last approximately 10 weeks and thus the temporal magnitude is categorised as short term.

Once construction of the proposed development is completed the source of disturbance will be reduced greatly and will be limited to the vehicle traffic and occasional pedestrians using the track. The great majority of the anticipated vehicle traffic will be in connection with the Viking Wind Farm and associated electricity converter station. Initially (2018 to 2021) the traffic will be relatively high due to wind farm and converter station construction activities. Thereafter, through the wind farm operation stage (2021 to approx. 2041), traffic is expected to reduce to very low levels of just a few vehicle movements per day.

Baseline surveys showed that several species of high or moderate Nature Conservation Importance that breed in Central Mainland Shetland do not breed sufficiently close to the proposed development to be plausibly at risk from construction disturbance, namely red-throated diver, merlin, whooper swan, dunlin, Arctic skua and Arctic tern. Therefore no disturbance effects are predicted for these species.

Territories of two species categorised as having high Nature Conservation Importance are predicted to be affected by disturbance, one of whimbrel and one of golden plover (Table 4.2.2 and Table 4.2.3). For these species a single territory is well below 1% of the regional population total, and therefore the spatial magnitude of these impacts is categorised as negligible (Table 4.2.3).

Territories of three species categorised as having moderate Nature Conservation Importance are predicted to be affected; five of lapwing, seven of curlew and one of common sandpiper (Table 4.2.2). The number of lapwing and curlew territories affected is well below 1% of the regional total, and therefore the spatial magnitude of these impacts is categorised as negligible (Table 4.2.3).

For common sandpiper, the single territory potentially affected by disturbance represents approximately 2% of the assumed regional (NHZ 1) population, estimated to be just 44 pairs (Pennington *et al*., 2004). The baseline survey results indicate that the single territory at risk of disturbance is not occupied annually (Confidential Annex), so in some years there would be no potential for disturbance. Furthermore common sandpiper has a relatively high tolerance of human activity and has been found successful nesting within less than 10m of a busy public highway in Central Mainland Shetland (D Jackson personal observation, June 2013). Taking all these factors into consideration, the potential disturbance effect on common sandpiper is categorised as short term and negligible magnitude. It should be noted that the common sandpiper territory that could be affected by the proposed development is the same territory potentially affected by the B9075 Sandwater Road project (subject to a separate application).

The potential disturbance effects on all avian receptor populations of high or moderate Nature Conservation Importance are rated as short-term in duration and of zero or negligible magnitude. Without mitigation, the effect of construction disturbance on these species is determined to be of negligible significance and therefore is judged to be not significant for the purposes of the EIA regulations. Nevertheless disturbance of breeding whimbrel would potentially be in contravention of the Wildlife and Countryside Act (as amended) and therefore mitigation is proposed to address this matter (refer to Section 4.2.6).

Table 4.2.2: Predicted potential for disturbance of breeding birds by the proposed development's construction activities

Species	Disturbance risk category [1]	Territories at high risk[2]	Territories at moderate risk[3]	Territories at negligible risk[4]
Red-throated diver	High	0	0	0
Whooper swan	High	0	0	0
Merlin	High	0	0	0
Dunlin	Low	0	0	0
Oystercatcher	Low	8	0	7
Snipe	Low	1	3	3
Redshank	Moderate	3	1	1
Lapwing	Moderate	3	2	0
Golden plover	Moderate	1	0	0
Curlew	Moderate	6	1	7
Whimbrel	Moderate	0	1	2
Common sandpiper	Low	1 (not present every year)	0	0
Arctic skua	Moderate	0	0	0
Great skua	Moderate	0	0	0
Greylag goose	Moderate	2	0	0

Numbers are based on results from 2015 surveys, except for common sandpiper which is based on information from all years with available survey data.

1 Disturbance risk categories are defined in Appendix G.

2 Territories considered to be at high risk are those for which the distance between the site boundary and the nominal territory centre is less than 100m (oystercatcher, common sandpiper and snipe) or less than 200m (all other species).

3 Territories considered to be moderate risk are those for which the distance between the site boundary and

Species	Disturbance risk category [1]	Territories at high risk[2]	Territories at moderate risk[3]	Territories at negligible risk[4]
the nominal territory centre is between 100 and 200m (oystercatcher, common sandpiper and snipe) or between 200 and 300m (all other species). 4 Territories considered to be at negligible risk are all other territories with a nominal centre lying within 500m of the site boundary.				

Table 4.2.3. The potential effect of construction disturbance on breeding birds

Species	Territories at High risk (Table 4.2.2)	Territories at Moderate risk (Table 4.2.2)	No. of pairs potentially displaced or having reduced breeding success[1]	% of regional population affected (approx.)	Spatial magnitude category
Red-throated diver	0	0	0	0%	Negligible
Whooper swan	0	0	0	0%	Negligible
Merlin	0	0	0	0%	Negligible
Dunlin	0	0	0	0%	Negligible
Oystercatcher	8	0	8	0.2%	Negligible
Snipe	1	3	2-3	<0.1%	Negligible
Redshank	3	1	3-4	0.3%	Negligible
Lapwing	3	2	4	0.2%	Negligible
Golden plover	1	0	1	<0.1%	Negligible
Ringed plover	0	0	0	0%	Negligible
Curlew	6	1	6-7	0.3 %	Negligible
Whimbrel	0	1	0-1	0.3%	Negligible
Common sandpiper	1 (not present every year)	0	0-1	0 to ca. 2%	Negligible
Arctic skua	0	0	0	0%	Negligible
Great skua	0	0	0	0%	Negligible
Greylag goose	2	0	2	0.3%	Negligible
Arctic tern	0	0	0	0%	Negligible
[1]It is assumed that all pairs breeding in high risk territories and half the pairs breeding in moderate risk territories would be adversely affected, either by displacement or by reduced breeding success (see Appendix G).					

4.2.1.1 Habitat loss and change

The works required in the construction of the road and the construction compound will inevitably mean that some habitat is disturbed and will change in character, either temporarily or permanently. Habitat loss and change is predicted to affect 4.49ha of ground, comprising approximately 1.67ha that will become the mostly unsealed track, 1.83ha of adjacent earthworks and a 1.00ha construction compound. Following construction the

areas affected by earthworks and the construction compound will be revegetated as closely as possible to baseline conditions. However, for the purpose of this assessment, the areas affected by earthworks and the construction compound are considered to be a permanent loss of habitat.

Breeding bird territories and foraging areas that overlap the proposed development will be at potential risk from habitat loss or change (Table 4.2.4). As the construction works affect only a relatively narrow (on average approx. 15m wide) strip of ground and because individual bird territories are relatively large (typically at least several hectares) in most cases only a relatively small proportion of the territories that overlap the proposed development would be affected by habitat loss or change. The exception to this is one territory each of curlew, lapwing and oystercatcher which substantially overlap the construction 1ha compound and therefore a relatively high proportion of these three territories would be affected by habitat loss or change.

Any nests or young chicks present in the parts affected by habitat loss and change during the construction phase are likely to be destroyed or killed. Adult birds and older chicks are likely to move away and thus unlikely to be killed, but these individuals could be disadvantaged by the reduced availability or quality of favoured feeding areas. Thus birds attempting to nest or rear chicks within the area directly affected by habitat loss and change would be less likely to breed successfully.

No breeding territories of red-throated diver, merlin, whimbrel, golden plover, dunlin, Arctic tern and Arctic skua, categorised as having high or moderate Nature Conservation Importance are predicted to be effected by habitat loss or change:. Furthermore, no wintering whooper swans are predicted to be affected by habitat loss or change.

The breeding territories of three species having moderate Nature Conservation Importance are predicted to be adversely effected by habitat loss and change; one territory of lapwing, two of curlew and, in years when present, one of common sandpiper (Table 4.2.4). For lapwing and curlew the number of breeding territories potentially affected by habitat loss and change is well below 1% of the regional total (Table 4.2.4). Therefore, on this basis alone the magnitude of this impact for these species is categorised as negligible.

For common sandpiper, the single territory potentially affected represents approximately 2% of the assumed regional population. However, the baseline survey results for all years indicate that this territory is not occupied annually, so in some years there would be no potential for an adverse effect. Furthermore, this species commonly selects disturbed or partly vegetated ground as a foraging habitat and therefore it is considered likely that this territory would remain viable for breeding both in the short term and beyond. Taking all these factors into consideration, the habitat loss and change effect on common sandpiper is categorised as negligible magnitude. It should be noted that the common sandpiper territory that could be affected by the proposed development is the same territory potentially affected by the B9075 Sandwater Road project (subject to a separate planning application).

The potential habitat loss or change impact on all avian receptor populations of high or moderate Nature Conservation Importance is rated as permanent in duration and of zero or negligible magnitude. Therefore the predicted impact on all species is judged not significant for the purposes of the EIA Regulations.

Table 4.2.4: The estimated number of breeding territories that would be subject to potentially adverse levels of habitat loss or change

Species	No. of territories predicted to be affected by habitat change	% of regional population affected	Magnitude category
Oystercatcher	5	0.2%	Negligible
Snipe	0	0%	Negligible
Redshank	1	<0.1%	Negligible
Common sandpiper	0-1 (not present annually)	0 to 2%	Negligible

Species	No. of territories predicted to be affected by habitat change	% of regional population affected	Magnitude category
Lapwing	1	<0.1%	Negligible
Golden plover	0	0%	Negligible
Curlew	2	<0.1%	Negligible
Whimbrel	0	0%	Negligible
Greylag goose	2	0.2%	Negligible

4.2.1 Cumulative Effects

'Target' species for cumulative impact assessment were taken to be those species of high conservation importance and for which there was some indication of a potential impact as a result of the proposed development that may be exacerbated cumulatively. Target species were therefore limited to whimbrel and golden plover. The only predicted effect from the proposed development on these species is construction disturbance, and this is predicted to affect a single territory of each.

The only other projects currently within or having gone through the planning system that is considered potentially to impact on these species are the Viking Wind Farm and the B9570 Sandwater Road upgrade. The proposed development is closely connected with and lies adjacent to these two projects.

The same single whimbrel and golden plover territories potentially affected by the Kergord Access Track are also predicted to be affected the Viking Wind Farm through the construction of the converter station in Upper Kergord. Therefore, no cumulative impact is anticipated with the Viking Wind Farm.

The single whimbrel and golden plover territories potentially affected by the Kergord Access Track are different to the two to three whimbrel territories and two golden plover territories predicted to be affected by Sandwater Road upgrade. Therefore, the disturbance effects from these two projects on the regional populations of these species would be additive. However, the mitigation measures described for these projects under their respective Bird Protection Plans would prevent disturbance of these species. Thus no cumulative impact is anticipated due to the proposed mitigation measures.

4.2.2 Mitigation

Mitigation is required to prevent disturbance to breeding bird species listed on Schedule 1 of the Wildlife and Countryside Act (as amended), as disturbance of these species when breeding is prohibited. Whimbrel is the only Schedule 1 species predicted to be affected by disturbance. Mitigation is also desirable to reduce disturbance to other species of high or moderate Nature Conservation Importance, in particular golden plover as this species is listed on Annex 1 of the EU Birds Directive.

A Bird Protection Plan (BPP) will be drawn up before construction commences that describes the measures that will be deployed to manage disturbance of breeding birds of high or moderate Nature Conservation Importance, in particular whimbrel. In consultation with SNH, the BPP will identify the type, timing and location of activities that are likely to disturb these species and their nests and young, and if necessary identify appropriate temporary protection zones and other measures to prevent or reduce disturbance. The BPP will be informed by survey work conducted by an experienced ornithologist in the period leading up to and throughout construction work.

The single whimbrel territory predicted to be potentially affected by construction disturbance lies a little to the north of the extreme north end of the site (see Figure 2 in Appendix F). The distance between the nominal centre of this territory and the closest part of the proposed development (i.e. the track) is greater than the threshold distance of 300m considered appropriate for identifying territories at potential risk of disturbance from construction activities (see Appendix F). Thus disturbance sources along the track and up to about 50m away

are not predicted to cause disturbance to this whimbrel territory. However, this territory centre is less than 300m from the site boundary (effectively a 100m buffer around the proposed track) and hence it is identified as being at potential risk, i.e. activity within the site and close to the boundary could potentially lead to disturbance. Should a there be an occupied whimbrel territory at approximately the same location during the construction period, mitigation to prevent disturbance could be achieved by exclusion of activity from those parts of the site that are less than 300m from the territory centre whilst the birds are present (typically early May to end of July). If the territory was in the same place as in 2015 (which is considered likely), this would result in a very small exclusion zone affecting only the outer 50m at the far north end of the site. Although possible, it is considered unlikely that this whimbrel pair would attempt to breed closer to the proposed development due to the limited distribution in these parts of suitable nesting habitat.

Although no mitigation is required to address habitat loss and change impacts, in keeping with good practice, measures will be undertaken to reduce negative effects on birds arising from habitat loss and change e.g. minimising the footprint of the proposed development in sensitive blanket bog habitat and restoring damaged habitat to good condition for birds. The measures aimed at reducing adverse effects of habitat loss and change on bird species will be devised in conjunction with the measures aimed at restoring the conditions of habitats of high ecological or conservation value (Section 4.1: Ecology). SNH will be consulted over habitat restoration methods.

4.2.3 Conclusions

Assessment of the potential for the proposed development to adversely impact regional bird populations shows that the predicted effects on all species will be short term in duration and of negligible magnitude (Table 4.2.5) and therefore are judged not significant for the purposes of the EIA Regulations.

Measures to manage disturbance are required to achieve compliance with the Wildlife and Countryside Act 1981 (as amended) with regard to breeding whimbrel (a Schedule 1 species) and are desirable for other species of high or moderate Nature Conservation Importance.

Table 4.2.5: Summary of predicted effects on birds

Species	Disturbance impact		Habitat loss/change impact	
	Magnitude	Significance[1]	Magnitude	Significance[1]
Red-throated diver	Negligible	Negligible	Negligible	Negligible
Merlin	Negligible	Negligible	Negligible	Negligible
Whooper swan	Negligible	Negligible	Negligible	Negligible
Dunlin	Negligible	Negligible	Negligible	Negligible
Oystercatcher	Negligible	Negligible	Negligible	Negligible
Snipe	Negligible	Negligible	Negligible	Negligible
Redshank	Negligible	Negligible	Negligible	Negligible
Common sandpiper	Negligible	Negligible	Negligible	Negligible
Lapwing	Negligible	Negligible	Negligible	Negligible
Golden plover	Negligible	Negligible	Negligible	Negligible
Ringed plover	Negligible	Negligible	Negligible	Negligible
Curlew	Negligible	Negligible	Negligible	Negligible
Whimbrel	Negligible	Negligible	Negligible	Negligible
Arctic skua	Negligible	Negligible	Negligible	Negligible
Great skua	Negligible	Negligible	Negligible	Negligible

Species	Disturbance impact		Habitat loss/change impact	
	Magnitude	Significance[1]	Magnitude	Significance[1]
Greylag goose	Negligible	Negligible	Negligible	Negligible
Arctic tern	Negligible	Negligible	Negligible	Negligible
[1]The determination of significance is explained in Appendix G.				

4.3 Geology, Hydrogeology and Hydrology

4.3.1 Introduction

RPS was commissioned to undertake a Geology, Hydrogeology and Hydrology assessment of the construction and operation of the proposed upgrade and realignment of the Kergord Access Track.

This chapter assesses the likely significant effects on near surface geology, groundwater and surface water resources expected as a result of the construction and operation of the proposed development. The specific objectives of the assessment were to:

- identify the baseline environment;
- describe the likely significant effects;
- describe any mitigation measures required to avoid or reduce significant effects; and
- assess the significance of residual effects.

This assessment is supported by the following appendices:

- Appendix H: Catchment Descriptors;
- Appendix J: Peat Slide Hazard Risk Assessment (PSHRA); and
- Appendix K: Peat Management Plan.

4.3.2 Scope of Assessment

4.3.2.1 Study Area

The study area was defined as land at and within a 1km buffer of the proposed development, as shown in Figure 4.6. However, there is potential for the proposed development to impact on the hydrology of waterbodies with downstream connectivity to the study area, including the Burn of Droswall and Burn of Weisdale. Such potential effects have also been considered within this assessment.

4.3.2.2 Consultation

The consultation responses relevant to this assessment are summarised in Table 4.3.1.

Table 4.3.1 Issues Identified During Scoping

Consultee	Summary Response	Comment/Action Taken
Scottish Environmental Protection Agency (SEPA) 22.08.2013	SEPA would encourage the final layout and design of the road to stay within the footprint of the existing road as much as possible in order to limit the potential effects on the environment.	This has been considered as part of the design of the proposed development.
	The EAR should include information	In the event that a detailed drainage

Consultee	Summary Response	Comment/Action Taken
	showing the proposed drainage of the road. The new road should be provided with at least two levels of SuDS treatment.	scheme is required, design of SuDs will be agreed between VEWF, SIC and SEPA at the detailed design stage.
	A site survey of existing water features and a map of the location of all proposed engineering activities in the water environment should be included in the EAR.	See Figure 4.7.
	The applicant should identify all aspects of site work that might impact upon the environment, potential pollution risks associated with the proposals and identify the principles of preventative measures and mitigation.	See Section 4.3.6 (Potential Effects) and Section 4.3.7 (Mitigation).
	Information should be provided on all watercourse crossings (new and replacement), which should follow best practice design.	See Figures 3.2 and 3.3.
	Flood risk needs to be considered as part of the Environmental Assessment due to potential impacts on the watercourses crossed by the road.	See EAR Section 4.3.6 (Potential Effects) Section 4.3.7 (Mitigation).
	Where the proposed infrastructure will impact upon peatlands, a detailed map of peat depths should be submitted. An overall approach of minimisation of peatland disruption should be adopted.	See Appendix K Peat Management Plan.
	To address the risk of groundwater disruption, a list of groundwater abstractions both within and outwith the site boundary, within a radius of i) 100m from roads, tracks and trenches and ii) 250m from borrow pits and foundations should be provided.	See EAR Section 4.3.6 (Potential Effects) Section 4.3.7 (Mitigation).
	Where water abstraction is proposed, the ES should refer to this and details should be provided if a public or private source will be used.	None proposed.

4.3.3 Methodology

The geology, hydrogeology and hydrology assessment will be conducted in accordance with the following legislation, policies and guidelines:

- EC Water Framework Directive (2000/60/EC);

- EC Groundwater Directive (2006/118/EC);
- EC Urban Waste Water Treatment Directive (91/271/EEC);
- EC Nitrate Directive (91/676/EEC);
- Dangerous Substances Directive (2006/11/EC); and
- Freshwater Fish Directive (2006/44/EC).

The principal legislation for water quality is provided by the Water Framework Directive (WFD). The aim of the WFD is to protect and enhance the quality of surface freshwater (including lakes, rivers and streams), groundwater, Groundwater Dependent Terrestrial Ecosystems (GWDTEs), estuaries and coastal waters. Historically, a range of inconsistent European legislation covered different aspects of water management but the WFD introduced a holistic approach which aims to provide greater protection to the hydrological environment.

The assessment takes into account the following legislation and policy:

- Scottish Planning Policy 2014;
- Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (Scotland) Act 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- PAN 61 Planning and Sustainable Urban Drainage Systems;
- PAN 79 Water and Drainage;
- SEPA Controlled Activities Regulations: A Practical Guide;
- SEPA Policy No. 19: Groundwater Protection Policy for Scotland v3 (November 2009);
- SEPA Policy No. 26: Policy on the Culverting of Watercourses;
- SEPA Pollution Prevention Guidelines as relevant;
- SEPA Position Statement PS-06-02 Culverting of Watercourses;
- SEPA Position Statement - Developments on Peat, February 2010;
- Forestry Commission Forests & Water Guidelines, Fourth Edition;
- Scottish Executive (2000) River Crossings and Migratory Fish: Design Guidance. A Consultation Paper;
- The Water Supply (Water Quality) (Scotland) Regulations 2001; and
- Private Water Supplies (Scotland) Regulations 2006.

All proposed access track water crossings would require authorisation under Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR).

In addition, the assessment has been undertaken cognisant of the following CIRIA guidance for development:

- CIRIA C502 Environmental Good Practice on Site (2002);
- CIRIA C515 Groundwater Control – Design and Practice;
- CIRIA C697 The SUDS Manual (2007);
- CIRIA C532 Control of Water Pollution from Construction Sites;
- CIRIA C648 Control of Water Pollution from Linear Construction Projects; and
- CIRIA C689 Culvert Design and Operation Guide (2010).

4.3.3.1 **Baseline Conditions**

The methodology for baseline characterisation comprised a combination of a review of the previously submitted Viking Wind Farm (2009) and desk based study of publicly available information listed in the reference section, and review of the geology, hydrogeology and hydrology baseline report prepared by ENVIRON (2013).

The main steps in the baseline characterisation were as follows:

- describe surface water hydrology, including watercourses, springs and ponds;
- identify existing catchment pressures;
- identify all private drinking water abstractions and public water supplies within 1km of the proposed development;
- identify any flood risks;
- describe the hydromorphological conditions of watercourses;
- collect information relating to recreational and fisheries resources;
- collate historic hydrological flow and flooding data for the immediate area and main downstream watercourses;
- collect soil, geological and hydrogeological information;
- confirm surface water catchment areas and watersheds; and
- confirm the extent and nature of peat deposits across the study area.

4.3.3.2 **Desk Study**

The desk based analysis considered the following sources of information:

- Ordnance Survey (OS) mapping at 1:50,000 and 1:10,000 scale;
- British Geological Survey, 1:50,000 mapping;
- Institute of Hydrology, Flood Estimation Handbook;
- Sandwater Phase 1 Habitat Survey and NVC Report;
- SIC records of private water supplies;
- SEPA records on CAR authorisations;
- SEPA baseline water quality and water body;
- SEPA Indicative River and Coastal Flood Map);
- Viking Wind Farm Environmental Statement; and
- Viking Wind Farm Environmental Statement Addendum.

The water quality of Scotland's rivers is classified by SEPA. This classification scheme assesses the quality of aquatic ecosystems within rivers, lochs, estuaries and coastal waters and the extent to which they have been adversely affected.

The condition of each river, loch, estuary and coastal water is assigned a 'status' of high, good, moderate, poor or bad. Water bodies classified as high or good status are considered to provide healthy ecology which deviates only slightly from natural conditions and can support a wide range of uses such as recreation, fishing and drinking water supply. Water bodies classified as moderate, poor or bad are representative of adversely affected ecology and the range of uses which can be supported is reduced.

Water body data sheets have been published by SEPA containing details of current water body classification, current pressures on the water body, measures to address these and classification objectives for 2015, 2021 and 2027.

4.3.3.3 Field Survey

A comprehensive site walkover survey was undertaken in July 2013 by Jacobs in order to confirm the findings of the desk-based study and to identify any omissions. The locations of existing watercourse crossings along the proposed development were identified.

RPS has reviewed the finding of the desk study and field survey, which has informed the production of a hydrological constraints map (Figure 4.7) to enable the identification of potential likely significant effects with reference to the proposed development as described in Chapter 3 (Description of Proposed Development).

A ground investigation, comprising peat probing and peat coring, was undertaken to ascertain peat depth in the vicinity of the proposed development. This informationinformed a preliminary peat landside hazard risk assessment (PLHRA) and the preparation of a draft Peat Management Plan (PMP). These documents are provided as Appendices J and K respectively, and the results, where relevant, incorporated in this assessment.

4.3.3.4 Assessment of Effects

Effects on geology, hydrogeology and hydrology are described as positive, neutral or adverse. In describing a potential effect and residual effect, consideration has been given to its duration, and geographical scale, sensitivity and magnitude, which have been defined as follows:

- the duration of an effect can be described as: short to long term, permanent or reversible;
- the geographical scale of an effect refers to the zone of influence. Geographical scale could be described as: local, county level e.g. Shetland Islands, regional e.g. northern isles, national, global;
- the sensitivity of the receptor is described with reference to Table 4.3.2 ; and
- the size or magnitude of each impact is determined as a predicted deviation from the baseline conditions during construction, operation and decommissioning with reference to Table 4.3.3.

4.3.3.5 Sensitivity/Importance

The sensitivity or value of a hydrological receptor or attribute is largely determined by its quality, rarity and scale.

The determination of value or sensitivity takes into account the scale at which the attribute is important. This can be defined as being at a local level (e.g. on site or immediately adjacent); district level (beyond the site boundary but within the district); county level (e.g. Weisdale); regional level (e.g. Shetland Island); national (e.g. Scotland) or international level (e.g. United Kingdom).

The definitions set out in Table 4.3.2 below have been followed in the consideration of sensitivity for this project. This table takes into account guidance provided in Table 2.1 and A4.3 of the Design Manual for Roads and Bridges (DMRB) (Highways Agency et al., 2009) and the authors professional judgement.

Table 4.3.2 sets out the criteria used to define the sensitivity of water resource receptors.

Table 4.3.2 Sensitivity of Water Resource

Sensitivity of Receptor	Criteria
High	• EC Designated Salmonid/Cyprinid fishery • Surface water WFD class 'High' • Scottish Government Drinking Water Protected Areas • Aquifer providing regionally important resource such as abstraction for public water supply, abstraction for private water supply supplying more than 10m^3/day for human consumption or serves

Sensitivity of Receptor	Criteria
	more than 50 persons or supporting a site protected under EC or UK habitat legislation/species protected by EC legislation • Protected Bathing Water Area
Medium	• Surface water WFD class 'Good' or 'Moderate' • Aquifer providing water for agricultural or industrial use or for individual household private water supply supplying less than $10m^3$/day for human consumption or serves less than 50 persons.
Low	• Surface water WFD class 'Poor' • Unproductive strata • Sewer

4.3.3.1 Magnitude of Effect

Table 4.3.3 sets out the criteria used to define the magnitude of change to water resource receptors.

Table 4.3.3 Magnitude of Change

Magnitude of Effect	Criteria
High	Total loss of ability to carry on activities. Impact is of extended temporal or physical extent and of long term duration (i.e. approximately 50 years duration).
Medium	Loss or alteration to significant portions of key components of current activity. Impact is of moderate temporal or physical extent and of medium term duration (i.e. less than 20 years).
Small	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken. Impact is of limited temporal or physical extent and of short term duration (i.e. less than 2 years).
No change	No alteration/change detectable in the quality or quantity of controlled waters and/or to the physical or biological characteristics of surface waters.

4.3.3.1 Significance of Effect

The final significance of the residual effects upon the baseline environment is defined as a function of the sensitivity of receptors and the magnitude of change, as presented in Table 4.3.4. Moderate or Major effects are deemed significant in terms of the EIA Regulations; while Minor, Negligible or No change are considered to be not significant. Differentiations between categories and thus, the final significance ratings, are based upon professional judgement.

The assessment of residual effects takes account of the design of the proposed development as described in Chapter 3 (Description of Proposed Development), the implementation of construction mitigation measures set out in Appendix L, which forms the basis of engineering design principles, the draft Peat Management Plan (Appendix K), and mitigation set out in this chapter.

Table 4.3.4 Significance of Effects

Magnitude / Sensitivity	High	Medium	Low	No change
High	Major	Major	Minor	No change
Medium	Moderate	Moderate	Minor	No change
Low	Minor	Minor	Negligible	No change

4.3.3.2 Peat Landslide Hazard Risk Assessment (PLHRA)

A PLHRA (Appendix J) was undertaken. The study area was divided into 100m chainage blocks and a peat landslide susceptibility score allocated for the following primary and secondary factors for each block. The primary factors assessed included surface slope angle and peat thickness. The secondary factors assessed included: sub-stratum and peat interface; peat strength; hydrology; evidence of peat instability and rainfall and climate. Both primary factors are fundamental for producing a peat slide and have therefore been allocated a greater weighting in relation to the hazard score.

In addition to the susceptibility score, each 100m chainage block was also given an exposure score based on the proposed development's proximity to receptors within the surrounding area. These scores are combined together to give the overall Peat Slide Score and Risk Assessment Rank. The intention is to provide a means of comparing the 100m chainage blocks across the study area and to prioritise mitigation. The detailed methodology used for the PLHRA is set out in Appendix J.

4.3.3.3 Limitations to the Assessment

The assessment is primarily based on publicly available data sources including, but not limited to: SEPA, Met Office, Local Authority and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages. It is considered that the individual data items provided are robust. RPS has assumed that all data is correct. However, no independent checks have been undertaken on the information provided.

The assessment is limited by a lack of:

- flow data for watercourses and drainage channels;
- water quality data for specific locations; and
- details on any temporary constructions within the study area.

Overall a moderate to high level of certainty has been applied to the study.

4.3.4 Baseline Conditions

4.3.4.1 Topography and Land Use

The proposed development is located primarily on an area of non-plantation open ground rising from 20m AOD at its southern extent to between 100m and 110m AOD at the centre. Elevations then fall to 70m AOD at the northern extent (Figure 4.6). The proposed development falls within the watershed catchment of the Burn of Weisdale and Burn of Droswall.

The immediate surroundings of the proposed development are characterised by modified bog subject to grazing and grassland with a number of drains.

4.3.4.2 Precipitation

Standard annual average rainfall (SAAR) for the Site has been determined as 1339mm, derived from the Flood Estimation Handbook (FEH) CD-ROM. Rainfall in Scotland varies from under 800 mm per year on mainland eastern Scotland, in areas such as Fife, to over 3000mm per year on the mainland Western Highlands.

There is also a SEPA rain gauge and river flow gauging station situated at Weisdale Mill approximately 2.5km downstream (1.6km south) of the proposed development. Monthly rainfall totals (mm) have been proved by SEPA from January 2003 to December 2012. From these data an annual average rainfall of 1320mm has been derived. Data from November 2007 were missing and was replaced by an average of all other monthly maxima for the months of November within the dataset. This annual average rainfall for January 2003 to December 2012 is within the range of values for SAAR extracted from the FEH which were derived between 1961 and 1990.

4.3.4.3 Geology, Hydrogeology and Soils

The superficial deposits and hard geology are described below and summarised in Table 4.3.5.

Table 4.3.5 Site Stratigraphy (British Geological Survey, 2013)

	Unit	Age	Typical Description
Superficial	Peat	Recent	An accumulation of variable thickness of dark brown, partially decomposed vegetation.
	Alluvium	Quaternary	Hill wash/stream deposits of clay, silt and stone.
	Devensian glacial till	Quaternary	Clays, sand and gravel formed during ice age conditions.
Hard	Weisdale Limestone Member	Neoproterozoic Era	Metalimestone with bands of calcsilicate-rock
	Weisdale Limestone Member	Neoproterozoic Era	Quartzite And Semipelite

4.3.4.3.1 Superficial Deposits

British Geological Survey mapping (BGS), shown in Figure 4.8, indicates that superficial deposits cover the majority of the proposed development area with only a few small localised areas mapped as having no superficial deposits. These localised areas are generally around stream beds and ridges and summits of local hills. Peat is the most extensive superficial deposit mapped across the study area, and covers approximately 60% of the proposed development area. The remaining development area is shown to be underlain by Devenian Till deposits (comprising clay, sand and gravel) and is mapped within the norther extent of the proposed development area.

4.3.4.3.2 Solid Geology

BGS mapping indicates that the solid geology of the study area comprises metamorphosed sedimentary rocks, which forms part of the Walls Boundary Fault (WBF) zone (see Figure 4.9).

4.3.4.3.3 Hydrogeology

The BGS hydrogeological mapping shows that the proposed development overlies a ‘Low Productivity Aquifer’ which has small yields where fractured near surface and form springs locally.

Drift deposits consisting of glacial and periglacial deposits are relatively thin and discontinuous. As such, they have limited storage potential. Boulder clay or solifluction deposits are likely to form the impermeable layer on which many of the lochs and lochans are formed. The crystalline meta-sedimentary bedrock does not have a significant weathered horizon and as a result groundwater is likely to be restricted to fractures and joints only to a depth of a few metres below surface. Groundwater may also be found associated with the WBF and other minor faults in the area. Some formations can locally yield water supplies in sufficient amounts for private use.

Groundwater within peat is generally perched on less permeable underlying geology or drift. Where the peat is thick and located in areas of low relief, as observed on valley floors and saddles in elevated areas, it provides baseflow to local streams. While peat aquifers in some areas have sufficient storage to ensure perennial flow, flow in the majority of peat aquifer-fed watercourses are ephemeral and restricted to periods during, and immediately following, prolonged wet weather.

In lower-lying areas of lesser relief and where peat is relatively thin, the groundwater generally occurs at shallow depth. Groundwater may rise above the surface for short periods following extended rainfall. These areas are often defined by the presence of sphagnum species on the site surface.

In relation to vulnerability, the groundwater in the vicinity of the proposed development is predominantly classed as 4d ('Vulnerable') (BGS, 2004). Class 1 areas are designated by SEPA as having the lowest risk of groundwater pollution and Class 5 the highest. This classification reflects the low permeability and low groundwater storage capacity of the metamorphic and igneous bedrock combined with the very variable soil and drift cover, meaning that any contaminant could potentially enter groundwater rapidly but would be slow to disperse or dilute once in the aquifer. In areas with deep peat, the peat would act as a barrier to the entry of contaminants into the groundwater although it would also serve to restrict access of water into the bedrock for dilution purposes.

SEPA's River Basin Management Plans (RBMPs) scheme shows the proposed development to overlie the Shetland Groundwater Body which is classified by SEPA as being a Drinking Water Protection Zone (DWPZ). SEPA has classified this water body as having an overall status of Good with High confidence in 2008. The quality and quantity of the groundwater have both been classified as Good with High confidence in 2008. There is no trend for pollutants for this water body.

4.3.4.4 Surface Hydrology and Site Drainage

4.3.4.4.1 Surface Water Features

There are a number of watercourses draining the proposed development, the major streams tending to run north, with minor tributaries flowing west to east and east to west orientation due to the topography of the area, as summarised below.

4.3.4.4.2 Burn of Weisdale Catchment

The east of the proposed development lies within the Burn of Weisdale catchment as shown in Figure 4.10. This catchment is bound between the parallel north-south ridges of West Kame and Mid Kame, known as the Valley of Kergord. The Valley of Kergord is a glaciated 'u-shaped' valley feature which collects drainage from both slopes, with runoff draining to the south. The total catchment area is approximately 13.17km^2 (1317 hectares).

The Valley of Kergord presently contains a number of channels such as the Burn of Kergord, the Burn of Droswall and the Burn of Swirtas. These streams meet to become known as the Burn of Weisdale. The Burn of Weisdale flows on to the south, meeting Weisdale Voe at the settlement of Weisdale approximately 5km downstream of the proposed development.

The relatively impermeable nature of the geology (and low water bearing capacity of the underlying bedrock) and low potential for rainfall infiltration means that the river flow is dominated by surface water inputs rather than baseflow. Further catchment descriptors are provided in Appendix H.

There are areas along the Burn of Weisdale which are designated within SEPA's Indicative Flood Map as being land at risk of flooding from rivers. The Indicative Flood Map shows the possible extent of flooding from rivers and/or the sea and primarily focuses on the 200 year flood event (an event with a 0.5% chance of occurring any year) in line with Scottish Planning Policy. The Inidcative Flood Map provides a national assessment of the extent of flooding which may be experienced from rivers and/or the sea. The areas of flood risk within the proposed development follow the Burn of Weisdale and are medium to high risk.

There is a weir located at Weisdale (HU39470 53000). This structure will influence flow regime in this catchment. There is a SEPA rain gauge and river flow gauging station situated at Weisdale Mill on this catchment. This is discussed further below.

SEPA has classified the Burn of Weisdale as having an overall status of Moderate with High confidence in 2008 with overall ecological status of Moderate and overall chemical status of Pass. SEPA has set environmental objectives for this water body over future RBMP cycles so that sustainable improvements to its status can be made over time.

SEPA has identified that diffuse source pollution caused by livestock farming contributes to this water body's failure to meet good ecological status or potential. The future objectives for the Burn of Weisdale are to maintain the Moderate ecological status through the 2015 RBMP cycles and to improve the status to Good through the 2021 cycle.

Weisdale Voe, the tidal water downstream of the Burn of Weisdale catchment, has been classified as having an overall status of Good with High confidence in 2008 with overall ecological status of Good and overall chemical status of Pass.

The current status of Weisdale Voe meets the requirements of the WFD, thus SEPA must ensure that no deterioration from Good status occurs, unless caused by a new activity providing significant specified benefits to society or the wider environment. The future objectives for Weisdale Voe are, therefore, to maintain the Good ecological status through the 2008, 2015 and 2021 RBMP cycles.

4.3.4.4.3 Burn of Droswall

The west of the proposed development lies within the Burn of Droswall catchment as shown in Figure 4.10. The Burn of Droswall is present within the catchment to the west of Weisdale Burn. This watercourse flows in a general north to south orientation before joining the Burn of Weisdale close to the B9075.

The relatively impermeable nature of the geology (and low water bearing capacity of the underlying bedrock) and low potential for rainfall infiltration means that the river flow is dominated by surface water inputs rather than baseflow. Further catchment descriptors are provided in Appendix H.

The Burn of Droswall flows southward from the Upper Kergord to reach Weisdale Burn, approximately 1.5km south of the proposed development. The proposed development also passes across a number of unnamed watercourses and drains.

There are areas of land around the southern section of the Droswall Burn that are at risk of fluvial flooding.

The proposed development track will cross the Burn of Droswall on one occasion.

4.3.4.5 Watercourse Crossings

An existing watercourse crossing was identified associated with the proposed location of the Kergord Access track. The B9075, which crosses the Burn of Weisdale will allow for existing drainage provisions within the area to be assessed.

A number of crossings are present on the existing unnamed road that leads part of the way into the Upper Kergord Valley. No profile details of these road crossings/culverts have been supplied.

An existing concrete box culvert is present within the application area, assumed to have been installed as a consequence of the construction of access track to Upper Kergord. The culvert is thought to restrict channel flows during high intensity rainfall events leading to a backing up on the upstream face. Once channel capacity is reached water would flow out following the surrounding contours re-entering the channel a short distance from the downstream culvert face.

Runoff from the road itself is assumed to discharge directly to surrounding vegetation along long stretches of the road. However, in some areas, downstream ditches were observed which connected with cross drains and downstream waterbodies. It is not clear if these ditches have been engineered or have been caused by erosion.

4.3.4.6 Flow Characteristics

The SEPA river flow gauging station situated at Weisdale Mill is a velocity-area station, opened in 2002 to obtain continuous flow data for Shetland. The gauging station details describe the watercourse as having steep banks at the gauge location which contain the majority of flows. The bed is described as being gravel and small boulders with consistent depth. It is reported that there can be weed growth in the summer; therefore, a second rating curve has been developed by SEPA to calculate flows in weedy conditions. The gauging station details confirm that there is a fish hatchery nearby which abstracts and discharges water although the rates of each are not given.

Table 4.3.6 presents the mean and peak flow estimates derived by SEPA based on gauged daily flow:

Table 4.3.6 Mean and Peak Flow Estimates for Burn of Weisdale (at Weisdale Mill Gauging Station)

Flow Scenario	Flow Rate
Mean Flow	0.639m^3/s
95% Exceedance (Q95)	0.042m^3/s
70% Exceedance (Q70)	0.122m^3/s
50% Exceedance (Q50)	0.227m^3/s
10% Exceedance (Q10)	1.355m^3/s

The ratio of peak flow from observed data and estimates from catchment descriptors at the Weisdale Mill gauge have been used to calibrate peak flow estimates from catchment descriptors for the Burn of Weisdale and the Burn of Sandwater at the location of the proposed development.

Table 4.3.7 sets out the estimate of 95th Percentile Exceedance Flow (Q95) for Weisdale Mill from observed data and from catchment descriptors and provides the ratio of difference between the two. This is the 10 day average flow exceeded by 95% of 10 day average discharges as defined in Low Flow Estimation in Scotland (Gustard et al, 1987).

Table 4.3.7 Ratio of Observed Flow (m^3/s) and Catchment Descriptor Derived Low Estimate (m^3/s) at Weisdale Mill

	Observed Flow Estimates	Catchment Descriptor Flow Estimates	Ratio
Q95*	0.042	0.025	1.68
* As set out in Institute of Hydrology Report 101 (Low Flow Estimation in Scotland)			

Table 4.3.8 sets out the Q95 and the Mean Annual Flood (Qbar) estimates for the Burn of Weisdale. This is the Mean of Annual Maximum Flood Flows as defined in Estimating Flood Flows for Small Catchments (1994). These have then been adjusted according to the ratio in Table 4.3.7.

Table 4.3.8 Calibrated Peak Flow Estimates (m^3/s) for Burn of Weisdale at Kergord

	Burn of Weisdale Peak Flows	
	Catchment Descriptor	Adjusted
Q95*	0.012	0.21
QBAR**	5.72	10.07

4.3.4.7 Water Quality

The WFD came into force in December 2003 and is implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003. A key objective of this Directive is the achievement of 'good ecological status' (as a minimum) of all natural water bodies by 2015.

To achieve this, a move towards a risk-based classification system (SEPA 2008a) was adopted. This risk-based system highlights additional issues such as stream morphology and existing artificial structures. However, chemical water status for Shetland streams have yet to be established under the new system.

As part of the original Viking Wind Farm ES (2009), Mouchel undertook a water quality assessment for a number of catchments which fall within the development study area. Mouchel agreed with SEPA that the former 2006 River Water Quality Classification system, using a 5 point scale to define water quality as being 'Excellent' (A1), 'Good' (A2), 'Moderate' (B), 'Poor' (C) and 'Seriously Polluted' (D) (SEPA 2008b) was most appropriate. This system excludes issues such as obstructions in streams within the overall classification.

As part of this study, samples were collected from streams in December 2008 and January 2009. These samples were analysed for the parameters used by SEPA in their 2006 chemical classification of water quality. Those pertinent to the proposed development have been extracted from the report and outlined below.

- Burn of Weisdale 2006 SEPA Class A2 Equivalent to 2006 SEPA Class A1
- Burn of Pettawater 2006 SEPA Class A2 Equivalent to 2006 SEPA Class A1

Catchment water quality within the proposed development study area is assessed as Excellent to Good.

4.3.4.8 Artificial Land Drainage

Given that the proposed development is characterised by wet modified bog, it is considered unlikely that there will be any underground artificial land drainage assets within the proposed development. No such assets were observed during the site walkover.

4.3.4.9 Water Supplies

Information provided by Site Investigation Services (UK) Limited, on behalf of Scottish Water, was used to identify the mains supply route and asset locations (valves) which are shown in Figure 4.11. There is a mains supply located south of the existing B9075 which generally follows the route of the road, although it deviates from the road for a 500m stretch between the Burn of Weisdale and Sand Water Loch. The locations of four of the assets were confirmed during site visits undertaken by ENVIRON (2013). Accesses to the remaining two assets were restricted and therefore unable to be fully identified during site visit.

Information supplied by the Environmental Health & Trading Standards Department at SIC has confirmed that there are no Private Water Supplies (PWS) within the study area for the proposed development. This is consistent with the information provided by Scottish Water, which confirms the presence of a mains supply in the study area. There is only one PWS within a 5km radius of the proposed development located in close proximity to Hellister (grid reference HU393496) approximately 5km south. The council has reported that the PWS comprises a reservoir tank, fed by various springs which supplies four properties, two of which are vacant. The zone of contribution for the springs would be limited to the Hill of Hellister immediately to the east of the

PWS which is, therefore, not in hydraulic connectivity with the proposed development. It is not therefore considered necessary to undertake a specific PWS Risk Assessment.

4.3.4.10 **Controlled Activities Regulations**

All appropriate Controlled Activities Regulations (CAR) licences would be submitted following engineering design and agreement with relevant stakeholders.

4.3.4.11 **Modifying Influences**

There is potential for climate change to impact on future baseline conditions. Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there may be greater pressures on PWS in summer months in the future. However, as mentioned previously, no PWS have been identified in hydraulic connectivity with the proposed development.

In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm event may also increase in volume and velocity.

Table 4.3.9 Summary of Sensitive receptors

Receptor	Sensitivity	Justification
Burn of Weisdale catchment	High	The Burn of Weisdale is classified as having an overall status of Moderate but discharges into the Weisdale Voe which is classified as having an overall status of Good.
Shetland Groundwater Body	High	The proposed development overlies the Shetland Groundwater Body which is classified by SEPA as being a Drinking Water Protection Zone (DWPZ), with the exception of the Solway and Tweed catchments and some intermediate areas in Dumfries & Galloway and the Borders, the whole of Scotland is designated as a DWPZ for groundwater. Therefore, the groundwater beneath the Site is considered to be of High Sensitivity.
Highly groundwater dependent terrestrial ecosystems (SEPA, 2014)	Moderate	The proposed development overlies areas of habitat which are deemed to be High GWDTE. These are deemed to be of local ecological value and are, therefore, of Moderate Sensitivity.
Moderately groundwater dependent terrestrial ecosystems (SEPA, 2014)	Low	These are deemed to have lower dependence on groundwater and, therefore, are considered to be of Low Sensitivity in terms of geology, hydrogeology and hydrology. Please see Ecology section 4.1 for details of habitats with the potential to be classified as GWDTEs along with the assessment of potential

Receptor	Sensitivity	Justification
		effects to these.

4.3.1 Potential Effects

The potential effects (i.e. in the absence of mitigation) are described in general terms in the following paragraphs, providing justification for the mitigation developed for the proposed development which is described in the following sections of the report. The significance of effects is not attributed in this section, but included under the residual effects (Section 4.3.9).

The proposed development represents an upgrade for the existing Upper Kergord Road and the construction of a new access track and linking this via a crossing over the Burn of Weisdale to the alignment of the access track consented as part of the Viking Wind Farm proposals. Part of the baseline conditions will already be characterised for the existing road, however with the construction of a new access track, there will be an increase in less permeable surfaces. During construction phase the use of HGV may cause soil compaction increasing the possibility of surface water runoff. Without an appropriate attenuation strategy, the increase in less permeable area and the potential for soil compaction due to vehicles may cause an increase in flood risk within the Burn of Weisdale catchment.

The proposed development will be constructed in accordance with relevant legislation and guidance, in particular the SEPA Position Statement on Culverting of Watercourses (2006) and Supporting Guidance on Sediment Management (2012). Therefore, there is potential for the operational phase of the proposed development to represent betterment on the baseline conditions as a result of the design of each proposed watercourse crossing to allow for free passage of fish and mammal species and to have sufficient capacity to pass the 1:200 year flood, and include an allowance for potential partial blockage and the potential effects of climate change.

4.3.1.1 Alteration of Natural Drainage Patterns and Runoff Volumes/Rates

During construction, in-channel or overland flow regimes can be altered through excavations, exposure of bare earth or rock, poor maintenance of drainage ditches or inappropriate water crossing design. This can impact on watercourses upstream and downstream of the proposed development and therefore affect flood risk, aquatic ecology and water resources.

Potential effects on flood risks may appear during the operation phase, affecting aquatic ecology and water resources by modifying surface water runoff responses to precipitation.

4.3.1.2 Pollution Impact from Silt-Laden Runoff

Potential increased erosion and transport of sediment to watercourses may appear during the construction phase. This can impact adversely on flood risks, aquatic ecology and water resources.

During operation, effects may include concentration of surface water flows as a result of poorly designed site infrastructure, leading to potential long term increases in erosion and sediment transport.

4.3.1.3 Chemical Contaminated Runoff/Pollution

During construction, accidental release of chemicals stored and used on-site could affect the water quality of receiving soils, groundwater and watercourses; therefore, impacting ecological and water resource receptors.

There would remain a potential risk of spills of hydrocarbons associated with vehicles during operation.

4.3.1.4 Groundwater Disruption

Changes to the soil interflow regime as a result of construction, excavation and foundation works, in particular associated with watercourse crossings, can lead to increased localised flood risks and alterations to downstream flow regimes.

There is also potential for works to cause long term alterations to soil interflow regimes of the Burn of Weisdale during operation.

4.3.1.5 Bank Integrity

Direct damage could occur to the banks of watercourses as a result of construction works and indirect effects could be caused as a result of alterations to natural drainage patterns or the sediment transport regime of the watercourse.

Permanent infrastructure should have little direct impact on bank integrity apart from at watercourse crossings where changes to fluvial morphology could occur. There could, however, be indirect impacts as a result of alterations to natural drainage patterns and sediment transport regimes during operation.

4.3.1.6 Peat Landslide Hazard Risk

The PLHRA (Appendix J) indicates that the alignment between chainage 0m to 2000m has been assessed as medium to high risk, with a section of very high risk located between 900m to 1000m. Between chainage 2000m to 2090m the site has been assessed as low risk. Approximately 1200m of the proposed development was assessed to present a medium risk of peat sliding (Table 4.3.10). The high risk areas have been allocated due to the sites' proximity to water bodies, greater peat thicknesses and surface slope angles.

Table 4.3.10 Overall Peat Slide Ranking

Peat Slide Susceptibility Rank	Chainage (m)
Very High	900 to 1000
High	100 to 200 500 to 600 700 to 800 800 to 900 1600 to 1700 1800 to 1900 1900 to 2000
Medium	0 to 100 200 to 300 200 to 300 300 to 400 400 to 500 600 to 700 1000 to 1100 1100 to 1200 1200 to 1300 1300 to 1400 1400 to 1500

Peat Slide Susceptibility Rank	Chainage (m)
	1500 to 1600 1700 to 1800
Low	2000 to 2090

These findings will be assessed in more detail following further targeted ground investigation and analysis, with consideration given to the construction methodologies and mitigation methods that are included in the PLHRA (Appendix J).

4.3.2 Mitigation

4.3.2.1 Mitigation during Construction

4.3.2.1.1 Alteration of Natural Drainage Patterns and Runoff Volumes/Rates

Consideration will be given to natural drainage paths within the catchment during development of the Drainage Management Plan (DMP), prior to construction commencing, to ensure they are not altered by the construction.

Where watercourses and ditches are to be crossed, new or upgraded culverts will be required to take the construction traffic. These will be carefully designed to accommodate the design axle loads of vehicles. Detailed culvert and water crossing design will be undertaken in accordance with industry good practice and sent to SEPA and/or SIC prior to commencement of construction, for review and acceptance.

4.3.2.1.2 Pollution Impact from Silt Laden Runoff

Should they be required, design of SuDs will be agreed between VEWF, SIC and SEPA at the detailed design stage with a view to minimising any change to the hydrology of the site or its surroundings, adopting sustainable drainage system (SUDS) principles wherever possible. Rainfall would be managed as close to its source as possible and would not be conveyed over long distances unless unavoidable.

Pollution control measures would be implemented with specific reference to the SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements', and incorporated within engineering design principles. At all locations where proposed infrastructure is in close proximity to a watercourse, appropriate silt entrapment measures would be provided.

All temporary stockpiles associated with construction will be located at least 50m from the edge of watercourses. All excavations will be backfilled as soon as practicable.

Soil compaction and disturbance will be controlled by limiting vegetation and soil stripping to essential areas only. Topsoil will be stripped and stored according to good practice guidelines prior to allowing excavation of sub-soils in order to preserve the soil resource. The movement of construction plant will be controlled and limited to defined areas, with tracking routes agreed by an Ecological Clerk of Works (ECoW) as part of the CEMP. To ensure that all drainage measures employed during the construction phase of the proposed development are maintained appropriately and remain effective, the performance of the drainage measures will be monitored. The construction works will follow good practice principles and adhere to the DMP to be produced by the Contractor(s). The drainage management works will then be supervised by the ECoW. All monitoring and supervision of the drainage management works will be recorded.

Prior to the commencement of construction works within an area of the site, an on-site inspection will be carried out by the Contractor(s) and the ECoW to identify specific sensitive features of the water environment and to confirm the design of appropriate silt mitigation measures. Subsequent checks of mitigation measures will be undertaken every in line with the agreed engineering design principles and specifically during or immediately following storm events or prolonged periods of heavy rainfall.

No discharge of water from settlement ponds or temporary stockpiling of excavated material will be allowed within 50m of any of the watercourses or water bodies identified within the site. The proposed development will be contoured such that silt-laden runoff is directed to discharge through settlement ponds or other appropriate attenuation and treatment at least 50m from the watercourses or water bodies.

Further details regarding the drainage design measures are set out below.

4.3.2.1.3 Clean Water Diversion

At all construction works areas, greenfield run-off (i.e. non-silty surface water flow that has not yet passed over any disturbed construction areas) would be kept separate from potentially contaminated water from construction areas where possible. Where appropriate, interceptor ditches and other drainage diversion measures would be installed, immediately in advance of any excavation works, to collect and divert greenfield run-off away from construction disturbed areas.

In accordance with industry guidance, ditches would follow the natural flow of the ground with a generally constant depth to ditch invert. They would have shallow longitudinal gradients and they would intercept any greenfield surface water run-off immediately upstream of any construction works areas. This would allow clean surface water flows to be transferred independently through the works without mixing with construction drainage. This would also reduce the flow of water onto any exposed areas of rock and soil, thereby reducing the potential volume of silt-laden run off requiring treatment.

Discharge points (for clean run-off water) will be located at sufficient distance (minimum of 50m) from any watercourses to allow adequate infiltration or settlement of suspended solids prior to any discharged surface run-off potentially entering watercourses.

4.3.2.1.4 Drainage Channels

Where possible, drains will be constructed so that the gradient does not exceed 2% in order to prevent rapid runoff rates, concentration of flow, erosion of the drain base and sides, and encourage establishment of terrestrial and aquatic vegetation where possible. The drainage channels will be checked regularly during the construction phase to ensure that the channels' side slopes remain stable and to ensure that debris is removed from the base of the channels. If instability is noted within the banks or bed of a drainage channel, appropriate erosion prevention measures will be implemented.

Temporary check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within any clean water or dirty water cut off ditches to reduce the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent scouring of the drainage channel itself.

Silt traps will be installed where required (and where practical for maintenance purposes) at intervals along drainage channels. Silt traps will also be constructed at the inlet and outlet of any pipe culverts to prevent the pipes becoming blocked and prevent erosion at the inlet and outlet points.

Check dams and silt traps will be maintained and monitored on a regular basis. Sediment will be removed before it reaches one half the original dam height or silt trap depth. Where check dams become fully laden with silt they will be replaced.

4.3.2.1.5 Settlement Ponds

Silt-laden run-off will be captured and directed via berms or ditches towards specially constructed sediment control structures for use during the construction phase. Additional filtration measures may include flow attenuation measures such as weirs, rock bars and/or anchored and embedded straw bales within ponds or between series of ponds.

The use of synthetic liners within settlement ponds will be avoided, where practical, in order to reduce the impacts from disturbance of silt during liner removal and reinstatement of ponds on completion of construction.

Any introduced or artificial materials required for temporary erosion or silt mitigation controls, such as silt fencing, straw bales, sand bags etc. will be removed upon completion of construction works.

Final discharge from any settlement pond will be over vegetated ground and away from surface water bodies (minimum distance 50m). Silt fences or other flow attenuation measures may be required at the discharge point to aid dispersal and prevent build-up of settled solids, which could be subject to remobilisation.

Settlement ponds will be designed and constructed with sufficient capacity for settlement and to allow contingency for unexpected increased rainfall events. Contingency measures will include additional capacity within an existing pond, or identification of additional areas within the vicinity which may be suitable for creation of additional ponds.

In the event that the natural or excavated ground profile in any area of the site does not lend itself easily to construction of an adequate settlement pond, water will be directed towards a sump area prior to being pumped away to a suitable settlement pond(s) or vegetated area with adequate silt mitigation measures well away from sensitive habitats or watercourses.

Silting of settlement ponds would take into consideration access requirements for reinstatement and maintenance (for example: periodic silt removal, expansion of ponds or incorporation of additional silt mitigation measures, etc.). Additional temporary silt mitigation measures will be provided during maintenance and reinstatement activities, as required.

Where water depth within settlement ponds has the potential to exceed 0.5m, the perimeter of the ponds will be demarcated by safety fencing and appropriate warning signs. The Contractor will discuss and agree the location of lagoons and other drainage mitigation measures with the ECoW prior to associated works taking place.

4.3.2.1.6 Soil Storage and reuse

Site management plans and strategies will direct the location of any temporary soil storage areas such that erosion and run-off is limited, leachate from the stored material is to be controlled and ensure stability of the existing ground is not affected.

Surface water interceptor ditches (up slope), down slope drainage collection systems, containment berms (embedded where appropriate), and appropriate drainage mitigation measures may be required.

The Contractor, in conjunction with their ECoW will carefully select the locations and design the spoil storage requirements whether temporary or permanent, including methods for reinstatement works and incorporated drainage elements. Such design shall be prepared and agreed in consultation with the ECoW and Contractor(s) prior to works commencing.

4.3.2.1.7 Peat Storage and Reuse

Reuse of removed peat is explained in the PMP (Appendix K). It is estimated that approximately 86,500m^3 of peat would be excavated for the proposed development. Of this it is anticipated 49,700m^3 (i.e. 57% of the total) will be suitable for re-use on site, and in line with guidance (Scottish Renewables and SEPA, 2012), such as dressing off and reinstating peat on the slopes and road verges and as soon as practicable for hardstanding areas. There are also likely to be opportunities for further reuse of peat material in habitat restoration across the Viking Wind Farm site. This will be subject to further investigation and in accordance with the relevant legislation and guidance.

Accordingly, it is expected that the volumes of peat generated can be re-used and excess peat volumes minimised such that there will be no need for peat to be disposed of off-site. Further details of anticipated peat reuse are included in the PMP.

4.3.2.1.8 Chemical Contaminated Runoff/Pollution

As set out previously, pollution control measures would be implemented with specific reference to the SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements', and incorporated within the engineering design principles. At all locations where proposed infrastructure is in close proximity to a watercourse, appropriate pollution spill kits would be provided.

All fuel and other potential contaminative chemicals would be stored in accordance with good practice procedures (Pollution Prevention Guidelines 2013), including a designated fuelling site located at a safe distance from existing watercourses (at least 10 metres). Fuel storage would be in accordance with good practice guidance and relevant legislation, with impermeable bunded containers/areas designed to capture any leakage, whether from a tank or from associated equipment such as filling and off-take points, sighting gauges.

Oil booms and soakage pads would be maintained in construction compounds and spill kits kept in all vehicles to enable a rapid and effective response to any accidental spillage or discharge. Construction staff would be trained in the effective use of this equipment.

Construction vehicles and plant would be regularly maintained and all maintenance, fuelling and vehicle washing will be undertaken on appropriate impermeable surfaces away from watercourses in order to minimise risks of leaks to soil and surface waters.

Care would be taken to ensure that the batching of concrete for watercourse crossings uses good practice measures. Freshly mixed concrete and/or dry cement powder would not be allowed to enter any watercourse. This shall be ensured by:

- locating concrete batching or wash out areas at least 50m from watercourses - the batching area would adjacent to the temporary construction compound;
- concrete wagons would only be permitted to wash-out into specifically designed wash-out areas and predetermined at agreed locations site wide;
- the drivers would be informed at their site induction of the location of the designated wash-out areas;
- loads would be managed and assessed with regards to the size of vehicle and ground conditions whilst keeping at appropriate speed limits to avoid spillage;
- tools and equipment would not be cleaned in watercourses. Should it be necessary to clean tools and equipment on-site, this will be done in the predetermined wash-out areas; and
- wash out areas would be continually monitored and findings recorded to ensure effluent levels do not spill over into the environment.

There will be no unauthorised discharge of foul or contaminated drainage from the site either to groundwater or any surface waters, whether direct or via soakaway. Sanitary facilities will be provided and methods of disposal of all waste will be governed by the appropriate Regulations and Legislation.

4.3.2.1.9 Groundwater Disruption

Potential disruption to groundwater and soil interflows would largely be mitigated where possible through appropriate engineering design of the works. Excavation works would be undertaken in accordance with PAN 50. The condition of GWDTEs on-site would be assessed by the ECoW during and post-construction in comparison with baseline conditions. There are no groundwater abstractions within 250m of excavations.

The finalised preconstruction engineering design principles will include plans to minimise potential problems related to dewatering such as:

- dewatering progressively in cells;
- reducing the inflow of water by sealing worked surfaces;
- leaving effective filter layers between aquifers;

- managing spoil mounds and slope stability in line with industry good practice; and
- ensuring inert fill is used for backfilling purposes, where required.

4.3.2.1.10 Bank Integrity

Micro-siting considerations for the road layout, construction vehicles and construction working areas would, where practicable, maintain a minimum stand-off distance of 50m from the edge of watercourses. In the event that construction activity is required within these limits detailed method statements and risk assessment would be developed by the main Contractor following SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements' and appropriate consultation will be undertaken with SEPA/SNH.

Temporary watercourse crossings may be required as part of construction. On sloping ground these watercourses would be crossed by tracked machines. Level water features would be crossed by placing bog mats across the feature to avoid any damage being caused to the bank or bed. Should any drainage ditches become damaged or blocked as a result of construction vehicles crossing them, these would be repaired or cleared by construction staff immediately.

All permanent watercourse crossings will be designed to maintain hydraulic conveyance therefore, each watercourse crossing would have sufficient capacity to pass the 1:200 year flood, and include an allowance for potential partial blockage and the potential effects of climate change.

Detailed flow calculations will be undertaken by the contractor in order to inform detailed design and to inform CAR applications. Suitable crossing points will be confirmed as part of detailed design. For any new crossings, consideration will be given to any local variations in channel dimensions and to bankside conditions. Where feasible within micro-siting allowances, the narrowest locations will be selected and the stability of the channel banks will also be considered.

Splash boards and run-off diversion measures, including silt fencing adjacent and parallel to watercourses beneath bridges and at culvert crossings, will be used at all crossings during construction to prevent direct siltation of watercourses.

4.3.2.1.11 Peat Landslide Hazard Risk

The risk of peat landslide is not measured according to the sensitivity, magnitude and significance criteria that other receptors are assessed against. The conclusion of the PLHRA (Appendix J) is that approximately 2000m of the proposed development has a medium to very high risk of peat sliding. One area between chainages 900m to 1000m is at a very high risk of peat slide due to great peat thicknesses. This risk is caused by increased surface slope angles, greater peat thicknesses and proximity to minor tributaries.

In the event that the medium to high risk for peat slide is confirmed during the detailed pre-construction site investigation, mitigation measures should be implement by the assigned Contractor. These mitigation measures should include the following:

- adequate staff training to raise awareness of the risks and tell-tale signs of peat slides;
- develop methodologies to ensure that accelerated degradation and erosion of exposed peat deposits does not occur;
- regular monitoring, for example, instrumentation regular visual and survey observations; and
- development of an emergency plan and procedures in the event of a peat slide.

4.3.3 Monitoring

To ensure construction works are compliant with the agreed preconstruction engineering design principles and pollution prevention requirements, regular monitoring would be undertaken.

The assigned Contractor would be required to nominate a site representative who takes responsibility for implementation and monitoring of the Site Waste Management Plan (SWMP).

The Contractor's Environmental Site Representative checks the contents of the site waste and recycling skips on a weekly basis. Non-compliance will be highlighted at the weekly progress meeting and appropriate actions taken.

Monitoring of water quality will be carried out on selected watercourses; specific monitoring locations will be identified post-consent during the detailed design phase (pre-commencement of works). Surface water quality monitoring will be undertaken at the intervals as outlined in the agreed preconstruction engineering design principles.

A monthly monitoring report on the findings of the monitoring exercises will be prepared and provided within 1 week of receipt of analytical results.

Post construction surface water monitoring would continue for 3 months with samples retrieved on a monthly basis.

4.3.4 Residual Effects

4.3.4.1 Alteration of Natural Drainage Patterns and Runoff Volumes/Rates

4.3.4.1.1 Sensitivity of receptor

Watercourses in the study area are deemed to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be Low.

4.3.4.1.2 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.1.3 Significance of effect

Taking into account the measures integrated as part of the project outlined the engineering design principles the effects are considered to be of Negligible significance which is not significant in EIA terms.

4.3.4.2 Disruption to Artificial Drainage

4.3.4.2.1 Sensitivity of receptor

Artificial drainage systems in the study area are deemed to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be Low.

4.3.4.2.2 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.2.3 Significance of effect

Taking into account the measures that will be integrated as part of the project to be outlined in the engineering design principles the effects are considered to be of Negligible significance which is not significant in EIA terms.

4.3.4.3 Pollution Impact from Silt-Laden Runoff

4.3.4.3.1 Sensitivity of receptor

Water in the study area are deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be High.

4.3.4.3.2 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.3.3 Significance of effect

Taking into account the measures that will be integrated as part of the project outlined in the engineering design principles the effects are considered to be of Minor adverse significance which is not significant in EIA terms.

4.3.4.3.4 Chemical Contaminated Runoff/Pollution

4.3.4.3.5 Sensitivity of receptor

Watercourses in the study area are deemed to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be Low.

4.3.4.3.6 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.3.7 Significance of effect

Taking into account the measures that will be integrated as part of the project outlined in the engineering design principles the effects are considered to be of Negligible significance which is not significant in EIA terms.

4.3.4.4 Groundwater Disruption

4.3.4.4.1 Sensitivity of receptor

Groundwater has been assessed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be High.

4.3.4.4.2 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.4.3 Significance of effect

Taking into account the measures that will be integrated as part of the project outlined in the engineering design principles the effects are considered to be of Minor adverse significance which is not significant in EIA terms.

4.3.4.5 Bank Integrity

4.3.4.5.1 Sensitivity of receptor

River and watercourse banks in the study area are deemed to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be Low.

4.3.4.5.2 Magnitude of impact

The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

4.3.4.5.3 Significance of effect

Taking into account the measures that will be integrated as part of the project outlined in the engineering design principles the effects are considered to be of Negligible significance.

4.3.4.6 Peat Landslide Hazard Risk

The risk of peat landslide is not measured according to the sensitivity, magnitude and significance criteria that other receptors are assessed against. The conclusion of the PLHRA (Appendix J) is that there is approximately 1600m of the proposed development that have a medium to very high risk of peat landslide. However, it is considered that through additional ground investigation, analysis and the implementation of mitigation measures, the risks and subsequent impact of potential peat slides can be adequately controlled.

4.3.4.7 Peat Storage and Reuse

Given the numerous opportunities for reuse of peat on-site and within the wider wind farm as detailed in Appendix J (PMP), it is anticipated that all peat arising from excavations may be put to beneficial use. This would reduce the magnitude of effect to negligible and thus significance could be reduced to Neutral whether the sensitivity of impact is Low or High.

4.3.5 Cumulative Effects

The above sections have considered the implications of the proposed development and its potential effects in conjunction with the Viking Wind Farm development. The EIA Regulations state that proposed large scale developments should be assessed cumulatively with other relevant plans or projects. SNH 2012 guidance on cumulative impacts of wind farms (the only cumulative guidance available) states that "*we only seek cumulative impact assessments where it is considered that a proposal could result in significant cumulative impacts which could affect the eventual planning decision*".

The application of hydrological catchment assessment methodology enables a logical evaluation of the potential for cumulative effects on soil and water issues.

The two catchments encapsulated by the proposed development display limited development features. There are two pending developments including the proposed B9075 Sandwater Road realignment (pre-planning) and the consented Viking Wind Farm.

Each development would be progressed through the planning system and be required to demonstrate that either: there would be no significant adverse effects or, that impacts are practicably mitigated, in line with Scottish Planning Policy and associated guidance.

In addition, an assessment of the combined impacts should all development be progressed has been undertaken. Based on the requirement that each planning application has to mitigate adverse impacts to 'not significant' and incorporating individual flood risk, drainage and geological impact abatement measures, the combined cumulative impact has been determined to be low.

Without exception, no significant effects are predicted on geological, hydrogeological and/or hydrological important features. Consequently, there are no features where significant cumulative impacts are likely. Furthermore, given the numerous opportunities for reuse of peat on-site and within the wider wind farm as detailed in Appendix J (PMP), it is anticipated that all peat arising from excavations may be reused.

4.3.6 Statement of Significance

The impacts on hydrology and flood risk for the proposed development has been assessed in line with the relevant legislation, guidance, planning policy and technical documentation.

The assessment has indicated that there are no significant effects arising from the proposed development once the proposed mitigation measures are put in place.

5. Environmental Appraisal - other aspects

5.1 Introduction

This chapter provides an environmental appraisal of the environmental aspects that may be affected by the proposed development, but are unlikely to be significantly impacted.

5.2 Landscape and Visual Considerations

The Kergord Access Track would comprise approximately 2,090m of new track and a new junction and access from the B9075. A landscape and visual appraisal has been carried out to consider the effects of the proposed development on landscape and visual amenity and receptors within the 500m study area.

The Scottish Natural Heritage (SNH) document 'A Landscape Assessment of the Shetland Isles' (SNH, 1998) shows that the study area is nationally classified as falling within the D4 Peatland and Moorland Inland Valleys Landscape Character Area (LCA). The key characteristics of this LCA are large scale extensive moorland and peatland of a wild character encompassing the valley landform. Long distance views are contained by ridges, and while there are more extensive views along the valley floor, the landscape is generally enclosed and offers little diversity in colour and texture.

Within the study area a residential property at Upper Kergord, (approximately 225m south of northern end of the proposed development), and two residential properties at Setter, (approximately 450m west of the southern end of the proposed development), have been identified as visual receptors. Localised users of the B9075, including motorists and cyclists in the vicinity of the Burn of Weisdale would also be visual receptors. There is an aspirational core path route (ATWW03 – Setter to Lunklet, Weisdale) identified by Shetland Islands Council in 2008 which runs north from Setter along an existing track before heading eastwards towards Lamba Water. This route overlooks the Weisdsale valley and it would offer some views towards the proposed development.

The proposed development would be situated on the low ridge between the inland valleys of the Burns of Droswall and Weisdale. This area is typical of the Peatland and Moorland Inland Valleys LCA and comprises fields of rough grassland enclosed by post and wire fencing with a pattern of wider moorland ridges and watercourse valleys running north to south. There is an existing unclassified road, also running north to south, which provides access to the property at Upper Kergord from the B9075.

The southern part of the study area, to the south of the B9075, has been put forward as a Proposed Local Landscape Area (LLA), referred to as Proposed LLA 7: Weisdale, in the Shetland Local Development Plan (LDP) Supplementary Guidance Local Landscape Areas - Consultation Draft (Shetlands Islands Council, 2014). The adopted LDP policy NH4 states that purpose of the LLAs is: "to safeguard and enhance the character and quality of landscapes which are important or particularly valued locally or regionally" (Shetland LDP, Shetlands Islands Council, 2014).

Much of the new permanent track would be in cutting and it is intended that the top and bottom of cutting slopes would be rounded to integrate the proposed development into the existing landform. Areas disturbed by the works would be reinstated with native heath/grassland seed mixes with some reuse of the upper soil peat horizon and existing vegetation where practicable.

The construction phase would introduce activity and plant and machinery movement not typical to the LCA and this would slightly impact on the wild remote character of the area. There would also be some visual impacts within the study area experienced by the few localised visual receptors described above, resulting from construction activity. The construction phase would however, only last approximately 12 weeks and these effects would be temporary and not significant.

Once in operation the proposed development would be a relatively minor element within the large scale of the surrounding landscape. Being aligned broadly north to south it would follow the north to south pattern of topography, watercourses and the existing road to Upper Kergord as shown on Figure 1.1. While there would be some impact on topography and landscape character the scale of these would be minor and overall it is

considered that the proposed development would only result in a low level of adverse landscape effects during operation. It is also considered that the character and quality of the Proposed LLA 7: Weisdale to the south of the B9075 would not be materially affected by the proposed development.

The proposed development would be visible from much of the 500m study area, except from some areas close to the valley floor. The visual receptors described above would experience partial views of the proposed development. The design of the proposed development would however, be sympathetic to the existing landscape character and it is set partly in cutting and be seen in the context of the existing road to Upper Kergord and the B9075. Overall, it is considered that the visual effects of the proposed development would be of a localised and low level nature during operation.

5.3 Cultural Heritage

An assessment of the potential impacts on cultural heritage assets, and the potential significance of impact that the proposed development would have upon them, has been undertaken. A study area was defined as the footprint of the development and an area extending 200m in all directions from it. The following sources of information relating to the study area were consulted:

- Historic Environment Scotland PastMap website (Past Map, 2016).
- The cultural heritage chapter of the Viking Wind Farm Environmental Statement (Chapter 13, AOC Archaeology Group Ltd and VEWF, 2009 The sources consulted in the preparation of this document comprised:
    - Historic Scotland (Scheduled ancient monuments, listed buildings, and Designed Landscapes).
    - The Shetland Amenity Trust (Local Sites and Monuments Record Data).
    - The Royal Commission on the Ancient and Historical Monuments of Scotland (the National Monuments Record of Scotland; the Ordnance Survey Name Book, the Aerial Photographic Collection, various publications).
    - The National Map Library (early Ordnance Survey maps; early cartographic records of the area).
    - National Archives of Scotland.
    - Shetland Archives, Lerwick.
    - The Shetland Field Studies Group.
    - Nesting Local History Society.
    - Aerial Photographs held by the National Monuments Record of Scotland (NMRS) and the Sites and Monuments Record (SMR).
- The records of walkover surveys undertaken by AOC Archaeology, on behalf of VEWF, to identify and record any cultural heritage remains within the wind farm site. These surveys were undertaken from 26th September 2005 to 6th October 2005 and 2nd to 11th September 2008.
- The records of a walkover survey undertaken by AOC Archaeology, on behalf of VEWF, to identify and record cultural heritage remains within the site of the proposed upgrade of Sandwater Road (B9075), subject to a separate planning application expected to be submitted in Spring 2016. This survey was undertaken on 16th and 17th July 2013.
- Consultation with Shetland Amenity Trust, who provide an archaeology service on behalf of SIC, was also undertaken.

The scope and method of this assessment has been guided by PAN 1/2013: Environmental Impact Assessment (Scottish Government 2013), and the national planning policies on heritage, as published in SPP (Scottish Government, 2014), SHEP (2011) and PAN2/2011 (Scottish Government, 2011), as well as the local planning policies, outlined in the LDP.

No designated cultural heritage assets have been identified within the study area. A total of 25 undesignated cultural heritage assets have been identified within the study area. These are detailed in full in Appendix I and

their location in relation to the proposed development is illustrated on Figure 4.12. An assessment of the asset value and significance of impact is presented in Table 4.5.1.

Table 4.5.1 Cultural Heritage Assets within 200m of the Proposed Development

Asset Number	Asset Name	Type of Site	Source	Distance from proposed scheme (m)	Value
1	Weisdale	Crofting Township	Past Map	177	Local
2	Burn of Swirtars	Mill (Possible)	Past Map	133	Local
3	Burn of Weisdale	Buildings	2013 Walkover	187	Local
4	Weisdale	Croft	Past Map	152	Local
5	Kergord	Clearance Cairn (prehistoric)(Possible), Ditch (prehistoric)(Possible), Structure (post medieval)	Past Map	27	Medium
6	Old Sheepfold	Sheepfold	OS Map	45	Local
7	Burn of Weisdale	Ford	2013 Walkover	17	Negligible
8	Burn of Weisdale	Ford	2013 Walkover	41	Negligible
9	Burn of Weisdale	Ford	2013 Walkover	40	Negligible
10	Burn of Weisdale	Ford	2013 Walkover	29	Negligible
11	Burn of Weisdale	Ford	2013 Walkover	39	Negligible
12	Burn of Weisdale	Ford	2013 Walkover	54	Negligible
13	Enclosure	Enclosure or unroofed structure	2013 Walkover	27	Local
14	Burn of Weisdale	Buildings	2013 Walkover	156	Local
15	Burn of Weisdale	Bank (earthwork)(undated)	2013 Walkover	106	Negligible
16	Burn of Weisdale	Bank (earthwork)(undated)	2013 Walkover	63	Negligible
17	Burn of Weisdale	Building (undated)	2013 Walkover	63	Local
18	Burn of Weisdale	Structure	2013 Walkover	40	Local
19	Burn of	Ford	2013 Walkover	66	Negligible

Asset Number	Asset Name	Type of Site	Source	Distance from proposed scheme (m)	Value
	Weisdale				
20	Burn of Weisdale	Bank (earthwork)	2013 Walkover	81	Negligible
21	Burn of Weisdale	Bank (earthwork)	2013 Walkover	13	Negligible
22	Burn of Weisdale	Bank; Ditch; Boundary	2013 Walkover	51	Negligible
23	Burn of Weisdale	Bank (earthwork)	2013 Walkover	73	Negligible
24	Burn of Weisdale	Bank (earthwork)	2013 Walkover	29	Negligible
25	Burn of Weisdale	Bank (earthwork)	2013 Walkover	149	Negligible

While no physical impacts on any known cultural heritage assets have been identified, there is potential for impact during construction on unknown archaeological remains. To mitigate impacts on any archaeological remains that may be present, an archaeological watching brief is proposed during construction. Should significant archaeological remains be identified during a watching brief, further mitigation would be agreed with SIC's archaeological advisor to either preserve in situ or where this is not possible preservation by record. This would sufficiently mitigate the loss of the assets and avoid any significant archaeological effects.

5.4 Traffic and Transport

The effects of the construction phase on site access, including traffic and transportation associated with the Kergord Access Track have been considered. Given the very limited use of the proposed development during operation, for operation and maintenance of the converter station, traffic and transport impacts during operation have been scoped out of this assessment.

Access to the proposed development is taken from the B9075, approximately 500m east of Setter, 150m east of the crossing with the Burn of Weisdale and 60m east of the existing junction with the minor road to Upper Kergord. The B9075 is a single carriageway cross-country B-road with passing places, linking the A971 to the west of the proposed development with the A970 to the east.

During construction, vehicles will access the site to transport staff, construction materials (such as aggregates and bitumen road surfacing) and plant items. Potential construction effects of the proposal which have been considered are:

- increased traffic flows;
- changes to the traffic composition; and
- degradation of road surface.

Increased traffic flows, changes in the traffic composition and potential degradation of road surface are all issues that may result from the delivery of materials to site. As mentioned in Section 3.5 it is anticipated that approximately 15,000m^3 of aggregate will be required for road construction. Standard HGV Tipper carrying around 10m^3 of aggregate per vehicle will be used for delivery. This would result in approximately 30 return vehicles movements per day, based on a 5 day week and 12 week programme.

Aggregate will be sourced locally with all construction and operational HGVs required to use only approved access routes to site as established within a Construction Traffic Management Plan (CTMP), which the

contractor is required to prepare prior to construction. The CTMP will also consider the coordination of all other HGV deliveries to avoid days when aggregate deliveries are planned. The CTMP will also consider how to minimise staff trips to the site, through promotion of measures such as car sharing.

Information relating to key transport activities surrounding the construction phase will be publicised as part of the main wind farm construction programme through appropriate communication methods, such as posters, letters and emails.

Due to the temporary nature of the construction programme and low absolute numbers of vehicle movements, generated by the proposed development traffic and transport impacts are not considered to be significant. Furthermore, impacts will be mitigated through the measures contained within the CTMP.

5.5 Noise and Air Quality

5.5.1 Noise

Changes in noise due to the construction of the proposed Kergord Access Track where works may be in the vicinity of noise-sensitive receptors have been considered. Given the very limited use of the proposed development during operation, for operation and maintenance of the converter station, noise impacts during operation have been scoped out of this assessment.

There are a limited number of noise sensitive receptors in the surrounding rural location with no residential properties within 200m of the proposed development. The closest residential property is located at Upper Kergord, approximately 225m south of the northern most section of the proposed development and is currently unoccupied. There is also a group of residential properties at Setter, the nearest of which is approximately 450m west of the proposed development, along the B9075.

The noise environment in the area surrounding the site is expected to be characterised by ‘natural’ sources, such as wind disturbed vegetation, birds, animals and water flow noise. Vehicular traffic along the B9075 and the unclassified road to Upper Kergord may contribute to baseline ambient noise at residential properties within the vicinity of the site.

During construction, noise will be emitted by machinery and vehicles involved in the transportation and excavation of materials. Potential noise impacts associated with the construction work will be mitigated by applying best working practices as prescribed in BS 5228-1:2009+A1:2014 are followed. Such measures, as recommended in BS 5228-1:2009+A1:2014 and other good site practice mitigation techniques are described below.

5.5.1.1 Community Relations

The establishment and maintenance of good community relations will be a priority. This may include informing local residents on progress of the works by way of leaflet drops and/or public meetings and ensuring measures are put in place to minimise noise impacts. A designated contact telephone number during construction and agreed procedure for the contractor to investigate and report on complaints would be set up.

5.5.1.2 Training of Employees

Operatives will be trained to employ appropriate techniques to keep site noise to a minimum, and will be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

5.5.1.3 Execution of Works

Reasonably practicable measures to manage construction noise and vibration impacts that could be undertaken during these works include the following:

- The hours of working will be planned with potentially noisy operations works undertaken during core day time hours.

- Account would be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site. Prominent warning notices will be displayed and, where necessary, ear protectors will be provided.
- Noise will be controlled at source using inherently quiet plant where appropriate and also ensuring maintenance of all noise-generating equipment. For example, vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers and will be maintained in good, efficient working order. All major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- Machines in intermittent use will be shut down in the intervening periods between works or throttled down to a minimum.
- All ancillary plant such as generators, compressors and pumps will be positioned so as to cause minimum noise disturbance and although unlikely to be necessary, acoustic barriers or enclosures will be provided if required.
- On-site noise levels will be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. A method of noise measurement will be agreed prior to commencement of site works.

SIC and affected residents will be kept informed of the works to be carried out and of any proposed work outside normal hours. Residents would be provided with a point of contact for any queries or complaints.

The implementation of the above measures will mitigate potential adverse impacts associated with the construction works and residual noise effects will be short term in nature.

5.5.2 Air Quality

The rural location of the proposed development indicates local air quality is likely to be very good. Potential air pollutant sources include the short temporary effects from vehicular emissions and activities such as earthworks which can generate dust.

One criterion for identifying roads with a potential for significant traffic change is defined in the Environmental UK "Land-use Planning and Development Control: Planning for Air Quality" publication (2015). This states that an Air Quality Assessment should be conducted *"if the development will cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = vehicles >3.5t gross vehicle weight)"* and the following indicative criterion is met "*a change of HDV flows of more than 25 Annual Average Daily Traffic (AADT) within or adjacent to an Air Quality Management Areas (AQMA) or more than 100 AADT elsewhere."*

The Shetland Islands has no Air Quality Management Areas and the AADT numbers do not meet the specified 100 AADT criteria. Therefore an Air Quality Assessment is not required for the proposed development.

Furthermore effects from sources such as earth moving, aggregate transport and usage, and movement of vehicles on dry untreated surfaces which can all cause fugitive dust emissions are generally accepted to be minimal beyond a distance of approximately 200m and therefore impacts on receptors will be negligible. Best practice dust control measures are included within the outline CEMP (Appendix L), and will be adopted during construction to minimise the potential risk of dust being a nuisance to sensitive receptors.

6. Conclusions

Shetland Islands Council determined that the Kergord Access Track development would not require to be the subject of a formal Environmental Impact Assessment under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 and that an Environmental Statement would not be required to accompany the planning application. VEWF however committed to providing an environmental appraisal to support the planning application and this Environmental Appraisal Report considers the potential effects of the proposed Kergord Track upgrade on the environment.

The ecology section of this document has assessed the likely significance of effects of the development with regard to important habitats and species at the site. By applying effective mitigation measures, the residual effects of this development are assessed as being minor and therefore not significant.

Assessment of the potential for the proposed development to adversely impact regional bird populations shows that the predicted effects on all species will be short term in duration and of negligible magnitude and therefore are judged not significant. Measures to manage disturbance are required to achieve compliance with the Wildlife and Countryside Act 1981 (as amended) with regard to breeding whimbrel (a Schedule 1 species) and are desirable for other species of high or moderate Nature Conservation Importance.

The impacts on hydrology and flood risk for the proposed development have been assessed and concluded that there are no significant effects arising from the proposed development once the proposed mitigation measures are put in place.

An overall Peat Slide Ranking is for the development indicates that the alignment between chainage 0m and 2000m has been assessed as medium to very high risk, with 1200m being medium risk, 700m being high risk and 100m being very high risk. Stability will be assessed in more detail at the pre-construction stage once further targeted ground investigation and analysis has been undertaken. It is considered that through additional ground investigation, analysis and the implementation of mitigation measures, the risks and subsequent impact of potential peat slides can be adequately controlled.

It is estimated that approximately 86,500m3 excavated peat would be generated by the proposed development. Of this it is anticipated 49,700m3 will be suitable for re-use on site, and in line with guidance, such as dressing off and reinstating peat on the slopes and road verges as soon as practicable. There are also likely to be opportunities for further reuse of peat material in habitat restoration across the Viking Wind Farm site. This will be subject to further investigation and in accordance with the relevant legislation and guidance. It is expected that the volumes of peat generated can be re-used and excess peat volumes minimised such that there will be no need for peat to be disposed of off-site.

This report has also considered potential effects on landscape and visual receptors, cultural heritage, traffic and transport, noise and air quality and concluded there will be no significant effects as a consequence of the development. Appropriate construction mitigation measures have however been noted and will be implemented as outlined in the Construction Environmental Management Plan in Appendix L.

Overall, it is therefore concluded that the proposed development will not give rise to any significant or unacceptable environmental effects and is in accordance with the planning policy detailed in Appendix A. There is therefore no impediment to Shetland Islands Council approving the planning application.

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Appendix A. Planning Policy Context

Executive Summary

This appendix identifies the relevant planning policy considerations for the proposed development, as detailed in Chapter 3 of the Environmental Appraisal Report (Description of Proposed Development), including reference to national and local policies as well as other material considerations.

The proposed development is intended to support local transport policy objectives as part of a wider strategy to improve the efficiency of the network and assist in providing enhanced connectivity to deliver prosperity and connect communities within Shetland.

It is important to note that this text does not include an assessment of the Development's compliance with planning policy.

Introduction

This appendix provides an overview of the relevant national and local policy documents, and a summary of policies and objectives relevant to the proposed development as a whole.

The 'Town and Country Planning (Scotland) Act 1997' ['the 1997 Act'] (as amended by the Planning etc. (Scotland) Act 2006) ['the 2006 Act'] provides the framework for land use planning and the development of planning policy in Scotland. The '2006 Act' is an enabling Act; its purpose is to amend existing planning legislation and provide a mechanism for the delivery of a modernised planning system.

A key feature of the 2006 Act is the statutory role and application of the National Planning Framework (NPF). The third iteration of NPF, National Planning Framework 3 (NPF3)(2014), contains a statement of priorities and a strategy for the long term spatial development of Scotland. The approved NPF3 was published by the Scottish Government in June 2014 and identifies national developments including major renewables and strategic transport proposals. It also requires Scottish Ministers to include a statement of their reasons for considering a need for such developments.

The Scottish Government's influence on the planning system also extends to the production of Scottish Planning Policy (SPP), Circulars, Planning Advice Notes (PANs) and approval of strategic planning documents. Each of these policy documents is material to the development of local and regional policy and provides thematic guidance on planning for a broad range of land uses and developments.

Under the 1997 Act, each planning authority in Scotland has a responsibility to publish a development plan, the content of which is informed by national policy. The development plan forms the basis on which decisions about development and future land use are made, and incorporates the requirements of national planning policy within a strategic and local framework.

Following from amendments to the planning system in the 2006 Act, the development plan is comprised of a Strategic Development Plan (SDP) (prepared only for the four largest city regions) and a Local Development Plan (LDP) (prepared by each local authority for its area). For those authorities outside the city regions, as is the case in Shetland, the LDPs set out the area's strategic priorities and must be replaced every five years. LDPs are concise, map-based documents focusing on specific proposals for a time horizon of a minimum of 10 years (where they are also covered by an SDP) or 20 years (outwith SDP areas). To enable the LDP to remain concise, they are accompanied by a suite of supplementary guidance which will provide detailed policy and advice.

The Shetland Local Development Plan (LDP) (2014) was adopted by the Council on 26th September 2014 and is the established local planning policy for Shetland. It has been prepared to assist with the delivery of sustainable economic growth and the preservation of the natural and built environment of Shetland.

The Shetland Islands Council has also published Supplementary Planning Guidance (SPG) to, as noted above, accompany the LDP. As such the Development Plan documents of relevance to the proposed development are listed in Table A.1 below.

Table A.1: Development Plan Documents

Title	Document	Status
The Shetland Local Development Plan	Local Development Plan	Adopted September 2014
Onshore Wind Energy	Supplementary Guidance	Draft 2014
Natural Heritage	Supplementary Guidance	Draft 2012
Placemaking	Supplementary Guidance	Draft 2015

National Guidance

National Planning Framework 3 (NPF3) (2014)

The Scottish Government published NPF3 in June 2014. NPF3 is a statutory document and a material consideration in planning decisions.

NPF3 guides Scotland's spatial development over the next 20 to 30 years setting out strategic development priorities to support the Scottish Government's central purpose - to promote sustainable economic growth. One of the key drivers for the revision has been to emphasise place-making. It also focuses on the following four outcomes for Scotland:

- A low carbon place.
- A natural place to invest.
- A successful and sustainable place.
- A connected place.

NPF3 describes spatial priorities for change in improving connections. It states in paragraph 3.35 that:

"(it) has been estimated that the renewables sector could, by reaching its full potential, bring over 3,500 full-time equivalent jobs to the Western Isles, almost 2,900 to Shetland, and over 4,500 on Orkney by 2030. There is a need to plan for enough homes and infrastructure to accommodate this growth, delivering benefits for existing communities and supporting the creation of high quality places."

Scotland's Transport Future (2004)

The Government's vision and objectives for transport in Scotland are set out in the White Paper, 'Scotland's Transport Future' (Scottish Executive, 2004). This provides the policy framework for transport in Scotland with an overall aim to:

"…*promote economic growth, social inclusion, health and protection of our environment through a safe, integrated, effective and efficient transport system*" (Page 17).

Designing Streets: A Policy Statement for Scotland (2010)

The Scottish Government's Designing Streets policy statement is designed to ensure that

"…*good street design should derive from an intelligent response to location, rather than the rigid application of standards, regardless of context"* (Designing Streets, 2010).

It sets out the government's aspirations for design and the role of the planning system in delivering these through mechanisms such as Local Development Plans. The document is supported by National Roads

Development Guide (2014) to address the interface with other roads and considered a technical enabler to the document.

Scotland's Economic Strategy (2015)

The current Economic Strategy, published in 2015 states that the purpose of the Scottish Government is to create a more successful country, through increasing sustainable economic growth and tackling inequality. The Strategy was initially published in 2007, revised in 2011 in cognisance of the economic downturn and now updated in 2015. The update focuses on creating a more successful country, through increased competitiveness and sustainability of the Scottish economy. The strategy is based on the principle that investing in infrastructure is key to helping businesses to grow, innovate and create good quality employment opportunities.

The Strategy acknowledges the importance of Scotland's cities and towns as centres of growth and prosperity. In regards to investment in infrastructure the Strategy states that it

"*is key to driving long-term improvements in competitiveness and in creating opportunities for everyone in society to benefit from these improvements*" (Page 37).

National Transport Strategy (NTS) (2016)

The National Transport Strategy (NTS) (Scottish Government, January 2016) is a refresh of the 2006 NTS which considers Scotland's transport needs and sets out the long term vision for the country's transport policies. One of the key strategic objectives of the NTS is to improve journey times and connections, to tackle congestion and the lack of integration and connections in transport which impact on high level objectives for economic growth, social inclusion, integration and safety.

Paragraph 71 of the White Paper states that:

"*…in order to enhance Scotland's global competitiveness and to enable Scotland's economy to maximise its productivity, Scotland needs to ensure that it has a well-connected, sustainable transport network…Transport can help unlock the economic and regeneration potential of particular places. It can also ensure connections for people who live and work in more remote and rural areas*."

Scottish Planning Policy (SPP) (2014)

The current SPP was published in June 2014 and accompanies other documents including Planning Circulars and NPF3 as national land use planning guidance in Scotland. It directs the form and content of development plans, and is a material consideration in the assessment of planning applications. SPP sets out the core values and vision of planning set against the same four planning outcomes as NPF3 (3.4.2) and focus on creating a place which is sustainable, low carbon, natural, resilient and more connected. SPP sets out two principal policies; Sustainability and Placemaking and then outlines various subject policies. The principal and relevant subject policies contained in the consolidated SPP are summarised in Table A.2.

Table A.2: Scottish Planning Policy

Subject	SPP Paragraph	Summary
Introductory Sections	Paragraph 1 - 23	The introductory sections of the SPP set out a brief statement on the purpose of planning and detail the core principles that should underpin the modernised planning system. SPP states that successful operation of the planning system will only be achieved if all those involved commit themselves to engaging as constructively as possible in development planning and development management, so that the planning system contributes effectively to increasing sustainable economic growth.
Sustainability	Paragraph 24 - 35	The SPP's central purpose is to focus government and public services on creating a more successful country through increasing sustainable economic growth. This can be achieved through the planning system by supporting economically, environmentally

Subject	SPP Paragraph	Summary
		and socially sustainable places and responding to economic issues, challenges and opportunities. SPP states that policies and decisions should be guided by a number of key principles. These include: • supporting delivery of energy infrastructure; • supporting climate change mitigation and adaptation including taking account of flood risk activity; • protecting, enhancing and promoting access to cultural heritage, including the historic environment; • protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment; and • avoiding over-development, protecting the amenity of new and existing development and considering the implications of development for water, air and soil quality.
Placemaking	Paragraph 36 -57	Placemaking is a creative, collaborative process that includes design, development, renewal or regeneration of our urban or rural built environments. Planning should take every opportunity to create high quality places by taking a design-led approach through the joint consideration of the relationships between higher quality places. Placemaking is supported through, amongst others, optimising the use of existing resources, using land within or adjacent to settlements for a mix of uses, developing brownfield land and locating development where investment in growth or improvement would have most benefit.
Promoting Rural Development	Paragraph 74 -83	NPF sets out a vision for vibrant rural, coastal and island areas, with growing, sustainable communities supported by new opportunities for employment and education. To aid the delivery of this the planning system should: • in all rural and island areas promote a pattern of development that is appropriate to the character of the particular rural area and the challenges it faces; • encourage rural development that supports prosperous and sustainable communities and businesses whilst protecting and enhancing environmental quality; and • support an integrated approach to coastal planning. In relation to prime agricultural land, or land of lesser quality that is locally important, development should not be considered except where it is essential as a component of the settlement strategy or necessary to meet an established need, for example for essential infrastructure, where no other suitable site is available.
Valuing the Natural Environment	Paragraph 193 - 218	Advises that planning authorities should conserve and enhance international, national and locally designated sites and protected species, taking account of the need to maintain healthy ecosystems and work with the natural processes which provide important services to communities. Plans should address potential effects of development on the natural environment and authorities should apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence indicating that significant irreversible damage could occur.
Flood Risk and Drainage	Paragraph 254 - 268	Sets out a precautionary approach to flood risk from all sources by safeguarding flood storage and conveying capacity. Planning authorities are required to take into account probability of flooding and associated risks when determining planning applications and preparing development plans, and developers should take flood risk into account prior to committing to development.
Promoting Sustainable Transport and Active Travel	Paragraph 269 - 291	Sets out the planning policy on sustainable transport to optimise the use of existing infrastructure and reduce the need to travel by providing safe and convenient opportunities for walking, cycling and travel by public transport. Development plans and development management decisions should also take account of the implications of development proposals on traffic, patterns of travel and road safety.

The SPP places the need to tackle climate change as a key outcome, with Outcome 2 (a low carbon place) stating,

"*By seizing opportunities to encourage mitigation and adaptation measures, planning can support the transformational change required to meet emission reduction targets and influence climate change*" (Paragraph 19).

The SPP contains thematic policy on renewable energy and sets out the Scottish Ministers' commitment to increasing the amount of electricity generated from renewable sources. It reiterates the Scottish Government's target for 2020 supporting the transformational change to delivering energy, including the equivalent of 100% of electricity demand from renewable sources by 2020. Paragraph 155 of the SPP states that development plans should seek to ensure that an area's full potential for renewable energy is achieved, giving due regard to relevant environmental, community and cumulative impact considerations. Paragraph 156 states that strategic development plans should support national priorities and address cross-boundary issues.

An overview of other national planning policy and guidance is provided in Table A.3.

Table A.3: Other Relevant National Policy Guidance

Title	Description
Scotland's Historic Environment (SHEP) Policy - (December 2011)	This document has consolidated the previous SHEP series into one policy document. SHEP sets out Scottish Ministers' policies for the historic environment, provides greater policy direction for Historic Scotland and provides a framework that informs the day-to-day work of a range of organisations that have a role and interest in managing the historic environment. SHEP complements and has the same authority as the Scottish Planning Policy series and other relevant Ministerial policy documents, and is a material document in the statutory planning, EIA and Strategic Environmental Assessment (SEA) processes. It has been prepared and is published in parallel with SPP23 on the Historic Environment (October 2008).
Managing Change in the Historic Environment (October 2010)	This document explains how to apply the policies contained in SHEP and the Scottish Planning Policy.

In addition, Planning Advice Notes (PANs) support SPP and provide advice on good practice and other relevant information to planning authorities. A summary of PANs and relevant Planning Circulars which provide statements of Scottish Government policy and guidance on implementation and/or procedural change is shown in Table A.4.

Table A.4: Planning Advice Notes and Circulars

PAN	Title	Description
PAN 51	Planning, Environmental Protection and Regulation (Revised 2006)	Supports the existing policy on the role of the planning system in relation to the environmental protection regimes. This PAN also summarises the statutory responsibilities of the environmental protection bodies, as well as informing these bodies about the planning system.
PAN 60	Planning for Natural Heritage (2000)	Provides advice on how development and how the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourages developers and planning authorities to be positive and creative in addressing natural heritage issues. It complements the SPP, with examples of good planning practice in relation to natural heritage drawn from across Scotland highlighted in a number of case studies.
PAN 61	Planning and Sustainable Urban Drainage Systems (2001)	Provides good practice advice for planners and the development industry on the implementation of Sustainable Urban Drainage Systems (SUDS) (now referred to as Sustainable Drainage Systems in latest guidance) to aid the introduction of more sustainable developments.

PAN	Title	Description
PAN 65	Planning and Open Space (2008)	Provides advice on the role of the planning system in protecting and enhancing existing open spaces and providing high quality new spaces. The advice relates to open space in settlements: villages, towns and major urban areas.
PAN 69	Planning and Building Standards Advice on Flooding (2004)	Provides background information and best practice advice in support of SPP7 (Planning and Flooding), and the Technical Handbooks published by the Scottish Building Standards Agency that provide guidance for the Building (Scotland) Regulations 2004. This PAN focuses on the responsibilities of local authorities and developers in ensuring that future built development is not located in areas with a significant risk of flooding, including functional flood plains.
PAN 72	Housing in the countryside (2005)	Provides background for roads in rural areas and informs Local Development Plans Supplementary Guidance.
PAN 75	Planning for Transport (2005)	Aims to create greater awareness of how linkages between planning and transport can be managed. It highlights the roles of different bodies and professions in the process and points to other sources of information on the overlap of the two sectors.
PAN 78	Inclusive Design (2006)	Supports the Government's aim of promoting more equality in the areas where we live and work. The PAN aims to explain the importance of inclusive design, identify the nature of the problems experienced in designing inclusive environments and describe the legislative context. It also outlines the roles of the different stakeholders in delivering inclusive design and identifies the particular challenges of applying inclusive design to the historic environment.
PAN 79	Water and Drainage (2006)	Clarifies the role of the planning authority in setting the direction of development to inform the planning and delivery of new water infrastructure in a coordinated way. It explains the roles of Scottish Water and the Scottish Environment Protection Agency and encourages joint working in order to ensure a common understanding of capacity constraints and agreement on the means of their removal. It advises on the appropriateness of private schemes and the handling of Scottish Water developments.
PAN 3/2010	Community Engagement	The PAN provides advice to communities on how they can get involved and advice to planning authorities and developers on ways of effectively engaging with communities on planning matters. It advocates the use of 10 National Standards for the delivery of effective community engagement in land use planning, providing detailed advice on each standard as follows: Involvement; Support; Planning; Methods; Working Together; Sharing Information; Working with Others; Improvement; Feedback; and Monitoring and Evaluation.
PAN 1/2011	Planning and Noise	The PAN promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.
PAN2/2011	Planning and Archaeology	This PAN accompanies SPP, SHEP and the Managing Change in the Historic Environment Guidance Notes, which together set out the Scottish Ministers' policies for planning and the historic environment. It is intended to inform the day-to-day work of a range of local authority advisory services and other organisations that have a role in the handling of archaeological matters within the planning process.
PAN1/2013	Environmental Impact Assessment	PAN 1/2013 replaces the outdated PAN:58 and brings EIA guidance fully into line with the latest regulations. It contains new guidance on the integration of EIA procedures into the development management process, as a step towards more efficient and effective EIA.
Circular	Title	Description
3/2011	The Town and Country	This Circular provides guidance on the Environmental Impact Assessment (Scotland) Regulations 2011 which update the 1999 Regulations.

PAN	Title	Description
	Planning (Environmental Impact Assessment) (Scotland) Regulations 2011	

Local Planning Guidance

The Shetland Local Development Plan (2014)

The Shetland Local Development Plan (SLDP) is underpinned by the vision, derived from the Shetland Resolution (2004), with an overarching aim to:

"*Work together for a future that is better and brighter. In particular, we aim to create a secure livelihood, look after our stunning environment and care well for our people and our culture*." (SLDP, 2014. Page 14).

In terms of renewables and road projects, the proposed development would comply with the following aspirations of the plan, including:

- supporting new and existing sustainable economic opportunities, including employment, housing, transport, communications and community facilities;
- encouraging new development of good quality that is environmentally sensitive, accessible to all, utilises sustainable design techniques and low carbon or renewable energy technologies;
- supporting better access across the Islands, in particular supporting sustainable and active transport solutions, such as by foot, cycle and public transport, and enabling people to access services, employment and other opportunities; and
- ensuring policies reflect the Council's commitment to the Climate Change (Scotland) Act 2009 through encouraging measures to maintain good air quality, reduce carbon emissions and mitigate against or anticipate the effects of global climate change.

As noted in the Transport Section (Page 45) of the SLDP, the connectivity of the island is heavily reliant on the road network therefore the retention and improvement of this infrastructure is promoted in the SLDP, something which would broadly accord with the principle of the proposed development.

Table A.5: Shetland Policies

Policy	Description
GP1 Sustainable Development	Development will be planned to meet the economic and social needs of Shetland in a manner that does not compromise the ability of future generations to meet their own needs and to enjoy the area's high quality environment. Tackling climate change and associated risks is a major consideration for all development proposals. New residential, employment, cultural, educational and community developments should be in or adjacent to existing settlements that have basic services and infrastructure in order to enhance their viability and vitality and facilitate ease of access for all. This will be achieved through Allocations, Sites with Development Potential and Areas of Best Fit.
GP2 General Requirements for All Development	Applications for new buildings or for the conversion of existing buildings should meet all of the following General Requirements: a. Developments should not adversely affect the integrity or viability of sites designated for their landscape and natural heritage value. b. Development should not occur any lower than 5 metres Above Ordnance Datum (Newlyn) unless the development meets the requirements of Policy WD1. c. Development should be located, constructed and designed so as to minimise the use of

Policy	Description
	energy and to adapt to impacts arising from climate change, such as the increased probability of flooding; water stress, such as water supply; health or community impacts as a result of extreme climatic events; and a change in richness of biodiversity. d. Suitable water, waste water and surface water drainage must be provided. e. All new buildings shall avoid a specified and rising proportion of the projected greenhouse gas emissions from their use, through the installation and operation of low and zero-carbon generating technologies (LZCGT). The proportion of such emissions shall be specified in the council's Supplementary Guidance – Design. That guidance will also set out the approach to existing buildings which are being altered or extended, including historic buildings, and the approach to applications where developers are able to demonstrate that there are significant technical constraints to using on-site low and zero carbon generating technologies. f. Suitable access, car parking and turning should be provided. g. Development should not adversely affect areas, buildings or structures of archaeological, architectural or historic interest. h. Development should not sterilise mineral reserves. i. Development should not sterilise allocated sites as identified within the Shetland Local Development Plan. j. Development should not have a significant adverse effect on existing uses. k. Development should not compromise acceptable health and safety standards or levels. l. Development should be consistent with National Planning Policy, other Local Development Plan policies and Supplementary Guidance.
GP3 All Development: Layout and Design	All new development should be sited and designed to respect the character and local distinctiveness of the site and its surroundings. The proposed development should make a positive contribution to: • maintaining identity and character; • ensuring a safe and pleasant space; • ensuring ease of movement and access for all; • a sense of welcome; • long term adaptability, and • good use of resources. The Planning Authority may request a Masterplan and/ or Design and Access Statement in support of development proposals. A Masterplan should be submitted with applications where Major Development is proposed; Major Development is defined in the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009, Reg 2 (1). Further details for these requirements are set out in Supplementary Guidance.
NH1 International and National Designations	Any development proposal that is likely to have a significant effect on an internationally important site, (Special Area of Conservation (SAC), Special Protection Areas (SPA) or Ramsar Sites) and is not directly connected with or necessary to the conservation management of that site will be subject to an assessment of the implications for the site's conservation objectives. Development that could have a significant effect on a site will only be permitted where: • an appropriate assessment has demonstrated that it will not adversely affect the integrity of the site, or • there are no alternative solutions, and • there are imperative reasons of over-riding public interest that may, for sites not hosting a priority habitat type and/or priority species, be of a social or economic nature. Development that affects a National Scenic Area (NSA), National Nature Reserve (NNR) or a Site of Special Scientific Interest (SSSI) will only be permitted where: • it will not adversely affect the integrity of the area or the qualities or protected features for which it has been designated, or • any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance.
NH2 Protected Species	Where there is good reason to suggest that a species protected under the Wildlife and

Policy	Description
	Countryside Act 1981 (as amended), Annex IV of the Habitats Directive or Annex 1 of the Birds Directive is present on site, or may be affected by a proposed development, the Council will require any such presence to be established. If such a species is present, a plan should be provided to avoid or mitigate any adverse impacts on the species, prior to determining the application. Planning permission will not be granted for development that would be likely to have an adverse effect on a European Protected Species unless the Council is satisfied that: • the development is required for preserving public health or public safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment; and • there is no satisfactory alternative; and • the development will not be detrimental to the maintenance of the population of the European Protected Species concerned at a favourable conservation status in their natural range. Planning permission will not be granted for development that would be likely to have an adverse effect on a species protected under Schedule 5 (animals) or 8 (plants) of the Wildlife and Countryside Act 1981 (as amended) unless the Council is satisfied that: • undertaking the development will give rise to, or contribute towards the achievement of, a significant social, economic or environmental benefit; and • there is no satisfactory solution. Planning permission will not be granted for development that would be likely to have an adverse effect on a species protected under Schedules 1, 1A or A1 (birds) of the Wildlife and Countryside Act 1981 (as amended), unless the Council is satisfied that: • the development is required for preserving public health or public safety; and • there is no other satisfactory solution. Applicants should submit supporting evidence for any development meeting these criteria, demonstrating both the need for the development and that a full range of possible alternative courses of action have been properly examined and none found to acceptably meet the need identified.
NH3 Furthering the Conservation of Biodiversity	Development will be considered against the Council's obligation to further the conservation of biodiversity and the ecosystem services it delivers. The extent of these measures should be relevant and proportionate to the scale of the development. Proposals for development that would have a significant adverse effect on habitats or species identified in the Shetland Local Biodiversity Action Plan, Scottish Biodiversity List, UK Biodiversity Action Plan, Annexes I and II of the Habitats Directive, Annex I of the Birds Directive (if not included in Schedule 1 of the Wildlife and Countryside Act) or on the ecosystem services of biodiversity, including any cumulative impact, will only be permitted where it has been demonstrated by the developer that: • the development will have benefits of overriding public interest including those of a social or economic nature that outweigh the local, national or international contribution of the affected area in terms of habitat or populations of species; and • any harm or disturbance to the ecosystem services, continuity and integrity of the habitats or species is avoided, or reduced to acceptable levels by mitigation. Further guidance is provided in Supplementary Guidance - Natural Heritage. <u>Justification</u> The Council is legally obliged to further the conservation of biodiversity under the Nature Conservation (Scotland) Act 2004. Biodiversity means the variety of life. Biodiversity provides ecosystem services such as: • Soil formation and cycling of water. • Climate regulation. • Food, medicines and other materials. • Outdoor learning and recreation. • Spiritual uplift and restorative therapy. • An important part of our arts, cultures and traditions.

Policy	Description
NH4 Local Designations	Development that affects a Local Nature Conservation Site or Local Landscape Area will only be permitted where: • it will not adversely affect the integrity of the area or the qualities for which it has been identified; or • any such effects are clearly outweighed by social, environmental or economic benefits. More information and guidance can be found in: • Supplementary Guidance – Local Nature Conservation Sites. • Supplementary Guidance – Local Landscape Areas. <u>Justification</u> Local Nature Conservation Sites (LNCS) identify sites of nature conservation value at the local scale; they may have been selected for their biodiversity or geodiversity interest. The identification of these sites early in the planning process will allow for effective avoidance of unacceptable effects on the integrity of these sites, increasing the transparency of the process. Local Nature Conservation Sites have the potential to help the Council to identify and prioritise action for habitats and species, in support of the biodiversity duty, and as a contribution to implementing the UK Biodiversity Action Plan, Scottish Biodiversity Strategy and the Local Biodiversity Action Plan. The reason for designation of Local Landscape Areas is primarily to safeguard and enhance the character and quality of landscapes which are important or particularly valued locally or regionally. The creation of Local Landscape Areas can increase awareness of the distinctive character and special qualities of local landscapes and support outdoor recreation, physical activity and local tourism.
NH5 Soils	Development will only be permitted where appropriate measures are taken to maintain soil resources and functions to an extent that is considered relevant and proportionate to the scale of the development. Proposals that will have an unacceptable effect on soil resources and functions will only be permitted where it has been demonstrated that: • the development will have benefits of overriding public interest including those of a social or economic nature that outweigh the local, national or international contribution of the affected area in terms of its soil functions; and • any harm or disturbance to the soil resources and functions is avoided or reduced to acceptable levels by suitable mitigation. Evidence of the adoption of best practice in the movement of, storage, management, reuse and reinstatement of soils must be submitted along with any planning application. For certain scales of development a soil management plan will be required. This should demonstrate that risks to soils, such as unnecessary disturbance, degradation and erosion have been avoided. Further guidance is provided in Supplementary Guidance – Natural Heritage. <u>Justification</u> Soil formation processes involve long timescales and soils should be viewed as a finite and non-renewable resource. Soils are one of Shetland's greatest natural assets and are the heart of most terrestrial life. The Scottish Soil Framework sets out the many functions of soils, including: • providing the basis for food and other biomass production; • underpinning nationally and internationally valued rare habitats and sustaining biodiversity; • controlling and regulating environmental interactions, for example water flow and quality; • storing carbon; • maintaining the balance of gases in the air; • preserving cultural and archaeological heritage; • providing raw materials; and • providing a platform for buildings and roads. Soils fulfil important socio-economic and environmental roles; therefore it is important that Shetland's soils are managed sustainably, in order that they can retain the capacity to carry out their many vital functions.
NH7 Water Environment	Development will only be permitted where appropriate measures are taken to protect the

Policy	Description
	marine and freshwater environments to an extent that is relevant and proportionate to the scale of development. Development adjacent to a watercourse or water body must be accompanied by sufficient information to enable a full assessment of the likely effects. Where there is potential for the development to have an adverse impact the applicant/developer must demonstrate that: • there will be no deterioration in the ecological status of the watercourse or water body; • it does not encroach on any existing buffer strips and that access to these buffer strips has been maintained; and • both during the construction phase and after completion it would not significantly affect: o Water quality flows in adjacent watercourses or areas downstream. o Natural flow patterns and sediment transport processes in all water bodies or watercourses. <u>Justification</u> The Council has a duty to protect, and where possible improve, Shetland's water environment in its role as a responsible authority under the Water Framework Directive. It is a key objective of the Scottish River Basin Management Plan and the Shetland Area Management Plan that water bodies and watercourses achieve good ecological status and that there is no deterioration in the current ecological status. The water environment includes burns, rivers, ponds, lochs, wetlands, standing, tidal or coastal waters as well as groundwater. A water body is generally defined as still water e.g. lochs and ponds and a watercourse as moving water e.g. burns and rivers. The creation and maintenance of buffer strips can help reduce flooding in the surrounding landscape, allow for the maintenance of watercourses, reduce pollution from nearby developments and allow for a wildlife corridor to be maintained or established.
HE1 Historic Environment	The Council should presume in favour of the protection, conservation and enhancement of all elements of Shetland's historic environment, which includes buildings, monuments, landscapes and areas. <u>Justification</u> The historic environment includes ancient monuments, archaeological sites and landscapes, historic buildings, townscapes, gardens and designed landscapes and our marine heritage. The context and setting of historic features in the landscape and the patterns of past use are also part of the historic environment. The historic environment is a key part of Shetland's cultural heritage, enhancing regional and local distinctiveness and providing a sense of identity and continuity for communities. It contributes to economic growth, and can act as a catalyst for successful regeneration and community-building. It also contributes to sustainable development through the energy and material invested in older buildings, and their scope for adaptation and re-use.
ED1 Support for Business and Industry	The Council encourages the creation of sustainable economic development opportunities and business developments in accordance with General Policies (GP1, GP2, and GP3). Areas for business and industrial uses have been identified through the Plan process and are contained within Supplementary Guidance – Business and Industry. Residentially compatible development will be encouraged within settlements throughout Shetland in order to contribute to the development of strong, healthy, vibrant and sustainable rural communities. <u>Justification</u> The Plan has a key role to play in facilitating opportunities for sustainable economic growth in order to contribute to robust, thriving and diverse communities. By promoting and encouraging development opportunities, whilst protecting and enhancing Shetland's unique natural and historic environment the need and desire for sustainable economic development across Shetland is supported. Scottish Planning Policy highlights the importance of sustainable economic growth and diverse economies in rural areas.
TRANS1 Integrated Transport	The relationship between transport and land use strongly influences the pattern of development. The Shetland Local Development Plan and the Shetland Transport Strategy prepared by ZetTrans, Shetland's Regional Transport Partnership in association with external agencies, operators and providers should integrate different modes of transport to support sustainable economic growth and improve access to jobs and training, improve social

Policy	Description
	inclusion and well-being and develop healthy communities. The Council will support proposals that; 1. sustain and develop the economy of Shetland through maintaining an appropriate level of accessibility by road, sea and air; 2. support the provision and improvement of public transport services and information across Shetland in accordance with the approved spatial strategy; 3. reduce the need to travel through decentralisation of development opportunities, thereby reducing commuting; 4. promote awareness of travel options in order to limit traffic growth; 5. develop public transport corridors and promote innovative and flexible public transport usage; 6. develop facilities for walking and cycling as an alternative and healthy means of transport; 7. support an improved path network within and between settlements; 8. improve the human environment by promoting road design that meets the policy framework set out in Designing Streets and the six qualities of successful places as set out in Designing Places; 9. undertake selected road improvement, bridge or tunnel building or reconstruction projects where these can be justified by gains in terms of; long term funding, economic growth, safety, environment, accessibility, inclusion and integration; 10. improve and enhance access to Lerwick town centre and other existing settlements by all forms of transport.
WD3 SuDs	All development proposals that will give rise to surface water run-off should incorporate Sustainable Drainage Systems (SuDS). Further policy and guidance on the design and implementation of SuDS can be found in Supplementary Guidance Water and Drainage.
W5 Waste Management Plans and facilities in all new developments	Developers must submit an appropriate Site Waste Management Plan (SWMP), which demonstrates how the waste generated by the development during the construction phase will be dealt with, including how the materials will be reused, recycled and how any remaining waste will be disposed of, in accordance with the waste hierarchy. Adequate space must be provided for storage and collection of all waste and appropriate recycling facilities within the completed development.

Supplementary Planning Guidance

Shetland Local Development Plan, Draft Supplementary Guidance: Placemaking (2015)

The draft Supplementary Guidance on Placemaking was published by the Shetland Council in 2015 and is currently published for public consultation. Although not formally adopted as part of the development plan, the document supplements the SLDP (Policies GP1, GP2 and GP3) and is intended to be applicable to all types of development and their accompanying policies, including roads infrastructure (TRANS 1).

Section 9 of the Placemaking Guidance addresses road developments, quoting PAN 72;

"*Rural areas need design solutions and road standards which are appropriate to their character and setting*" (Placemaking Supplementary Guidance, Page 39).

The Supplementary Guidance is informed by, and seeks to deliver the principles, of Designing Streets guidance (see Paragraph 25 above).

Shetland Local Development Plan, Supplementary Guidance: Onshore Wind Energy (2014)

This guidance is specifically targeted to inform developers of onshore wind farms and not directly applicable to the proposed development however cognisance should be made to Page 21 of the SG which refers to access and states:

"*All proposals for windfarm development must comply with the access requirements as set out in the Shetland Islands Council Roads Department guidance document 'Windfarm Access Design Guide'.*"

This guidance is not publicly available, however consultation has been sought from the SIC Roads Department and compliance with this will be incorporated into the Planning Supporting Statement.

Shetland Local Development Plan, Supplementary Guidance: Natural Heritage (2012)

Supplementary guidance on Natural Heritage reflects and expands on the SLDP's Policies NH1 – NH6, of which Policy NH1 "International & National Designations" are applicable to the proposed development as it is situated within close proximity of an nationally designated SSSI. In regards to SSSI, the guidance states;

"Development that affects a National Scenic Area (NSA), National Nature Reserve (NNR) or a Site of Special Scientific Interest (SSSI) will only be permitted where:

- *it will not adversely affect the integrity of the area or the qualities or protected features for which it has been designated, or*
- *any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance." (Page 8)*

ZetTrans: Zetland Transport Partnership (2008)

Zetland is the Shetland Transport Strategy, the vision of the ZetTrans is:

"*To develop an effective, efficient, safe and reliable transport system for Shetland. The transport system will comprise an integrated network of accessible, and affordable internal, inter-island and external links, which will contribute to the development of a safe, healthy, vibrant and inclusive society, a diverse, successful and self-sufficient economy, and enhanced environmental quality*." (3.2. ZetTrans, 2008)

The objectives of the proposed development are consistent with the provisions of the ZetTrans vision. The proposed development will improve the connectivity of the existing road system within Shetland, which will contribute to the reduction of ongoing maintenance burden, in accordance with Road Scheme strategy described in 7.30 of ZetTrans.

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Appendix B. Habitat Survey Report 2015

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Appendix B
Kergord Access Track
Environmental Appraisal Report

Habitats Survey Report 2015

28 June 2016

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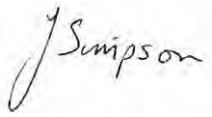
	Signature:			
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REPORT TEMPLATE

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CONTENTS

EXECUTIVE SUMMARY

RPS and Shetland Biological Records Centre (SBRC) were commissioned by the Viking Energy Wind Farm to update previously compiled vegetation assessments with additional survey data, through an area where it is intended to construct an access track for the proposed wind farm and converter station – the Kergord Access Track. The infrastructure will form part of the consented Viking Wind Farm.

The area concerned runs from the B9075 at Weisdale, north along either side of the Burn of Weisdale to Upper Kergord. Much of this area has previously been surveyed using the Phase 1 and National Vegetation Classification (NVC) methods in 2012. RPS and SBRC were tasked with verifying the interpretation of the vegetation, checking that there had been no change to the vegetation in the surveyed areas, and completing some gaps in that survey information. This report documents the updated results of these surveys, providing a detailed description of the habitats and communities present, and their current condition along the length of the proposed access track incorporating a 200m buffer.

The area lies on relatively acidic semi-pellites, quartzites and psammites. Two bands of crystalline limestone run through the wider area; one north from Sand Water and the other up the Kergord Valley. The peat depth over most of this limestone is so great that the bedrock has little influence on the surface vegetation but where the substrate is shallower the limestone exerts some influence, most notably a series of base rich (M10) flushes to the south of the B9075 just before the turn off to Upper Kergord.

The vast majority of the survey area and wider landscape is covered by blanket bog; the exceptions being the steeper, dryer eastern slopes of Scalla Field and Whaa Field, the shallower substrates bordering the Burn of Weisdale, and the few acid and base rich flushes dotted through the area.

All of the blanket mire within the survey area and the surrounding landscape has been modified to some extent through historical crofting activities. The majority appears to show signs of historic peat cutting, with alternating ridges, or banks, of dryer bog vegetation interspersed with much wetter bog vegetation. It is possible that some of these areas have recovered from previous erosion. At the north of the survey area in the valley of Kergord this alternate dry/wet complex of bog may be due to differences in hydrology caused by the more variable depth of peat overlaying the bedrock.

The Upper Kergord area was subject to intensive agricultural improvement in the 1950s and 1960s. This converted a large area of blanket bog into pasture for sheep grazing. A considerable amount of drainage work appears to have been undertaken with lime and fertiliser added and, in places, surface seeding. Agricultural improvement is also evident along the Burn of Weisdale. It is also apparent that some drains have been cut into the blanket bog vegetation in places, although these do not appear to be recent.

In broad terms of the habitats present, the vast majority of the survey area is generally actively peat forming and as such should be classed as blanket bog, currently showing very little sign of erosion. By Shetland standards, this can be described as relatively intact to moderately degraded blanket bog. A series of base rich flushes at the southern end of the survey site are present; these are highly likely to be ground water dependent and in a Shetland context of moderate to high conservation interest. A series of M6 flushes were identified and are also likely to be ground water dependent but are ubiquitous in Shetland and thus of less conservation interest.

1. INTRODUCTION

RPS and the Shetland Biological Record Centre (SBRC) were commissioned by Scottish and Southern Energy Renewables (SSER) and the Viking Energy Wind Farm to undertake a ground-truthing exercise of habitats and vegetation surveys completed in 2012 and update where required, in support of a local planning application for a proposed access track to the Viking Wind Farm and associated converter station (the Kergord Access Track) The converter station does not form part of this planning application. Figures 1.1 and 3.1 of the Environmental Appraisal Report (EAR) show the location of the proposed development and detailed track layout, respectively.

In conjunction with the ground-truthing exercise, a visual assessment of the condition of blanket bog habitats present throughout the area was completed. This provides additional information as to the potential impacts of the development to these European Annex 1 Habitats. Vegetation was assessed to both standardised Phase 1 (JNCC, 2010) and National Vegetation Classification (NVC) (Rodwell, 1991, 1992, 2000, 2006) survey methodologies. An up to date baseline of vegetation is detailed within the subsequent sections of this report.

In summary the key aims of the surveys and this report are to:

- identify the broad habitat types and dominant floral communities within and immediately adjacent or in proximity to the proposed infrastructure;
- identify habitats of national and international importance such as those listed as Annex 1 Biotopes under the EC Habitats Directive and the Habitat Regulations 1994 (as amended);
- identify habitats and vegetation communities defined as groundwater dependent terrestrial ecosystems (GWDTEs) (SEPA 2014) which might be influenced by the development; and
- assess the quality of the blanket bog habitat present to supplement the standardised survey data, thus providing context for the development's impact assessment.

2. METHODOLOGIES

2.1 Desk Studies / Previous Survey

Baseline information regarding the site and surrounding area was collated from a variety of sources including SNH SiteLink website, the National Biodiversity Network Gateway (NBNG) database, and Magicmap. A previous survey covering the majority of the current habitat survey area was completed in 2012. This information was ground truthed in the field, and where necessary, updated to reflect current site conditions. Previous surveys completed in 2012 found no rare plant species present within the survey area, and a review of information present on the NBNG database returned a similar negative result for rare species.

2.2 Field Surveys

2.2.1 Phase 1 Habitat and NVC Surveys

Phase 1 Habitat surveys were completed as described in JNCC (2010) and NVC surveys as per Rodwell (1991, 1992, 2000, 2006). Surveys were completed along the length of the proposed access track and a 200m buffer (Figure 4.1). Fieldwork was undertaken by Paul Harvey (SBRC), an ecologist with experience of Phase 1 Habitat and NVC surveys within the Shetland environment. Surveys were conducted between the 5 and 7 November 2015. All habitats were mapped on to 1:10,000 Ordnance Survey (OS) base maps, with each mapped area (polygon) labelled for Phase 1 and NVC with an alphanumeric code. The resultant mapping of Phase 1 Habitats can be seen in Figure 4.2 and NVC in Figure 4.3 of the EAR.

For each survey type, the area was walked to visit all apparently different habitats and communities, and each 'stand' (apparent habitat or community) was sampled by recording the vascular plants, bryophytes and lichens present and their relative dominance noted. Consequently, qualitative rather than quantitative data was recorded on community composition; domin scale quadrat data was not recorded. Aggregate species were treated as such, e.g. *Euphrasia* agg., *Taraxacum officinale* agg. Botanical nomenclature in this report follows that of Stace (2010) for vascular plants, Atherton *et al* (2010) for bryophytes and Purvis *et al* (1992) for lichens. Scientific names for flora and fauna are given when the species is first mentioned in the text but not thereafter.

Where features of interest or importance were found, or that did not fit the relevant nomenclature, Target Notes were recorded including a GPS reference of the location, a detailed description of the features, a photograph including a reference scale, and if any follow-up actions within regards to the feature were required. The Target Note record is presented in Table 1A (Appendix 1) of this report. Target Note locations can be seen in the context of the site and survey in Figures 4.2 and 4.3 of the EAR.

Due to the complex nature of vegetation communities there were numerous polygons in which several different communities or habitats were present forming a mosaic, each too small to be mapped individually. In these areas, the compositions of the habitats or communities were noted, including percentage cover values, and the dominant community identified. Due to the nature of standardised vegetation survey techniques, some locations within the survey area did not fit into the standard nomenclature. Where this occurred, the closest match of the standardised nomenclature was used, with Target Notes included on atypical species assemblages. These are described and listed within this report.

Indicative peat probing was undertaken in peat soil habitats to aid in Phase 1 Habitat classification. Peat depth was characterised as greater than or less than 0.5m. This distinction is used to distinguish between some habitat classes. For example, heathland, flushes and springs are generally considered to be associated with peat depths of <0.5m, whereas mire, modified bog and fen habitats are considered to be associated with depths of >0.5m (JNCC, 2010). Samples were only taken in areas where approximate peat depth was required as a diagnostic feature for habitat classification.

Notes were made during the course of the surveys on the likelihood of habitats and communities to be reliant on ground water influences, thereby classified as groundwater dependent terrestrial ecosystems (GWDTEs) (SEPA, 2014).

2.3 Limitations of Survey

This survey was undertaken in November which is outside the recognised optimal survey period for some habitats – most notably grasslands. The main conservation importance of the acid grasslands covered in this survey, however, is likely to be their potential breeding wader fauna, which will have been covered in previous survey work.

Securing a best fit for NVC categories in Shetland, situated as it is at the periphery of the UK, can be problematic and this difficulty is exacerbated in areas where management, both historic in terms of peat cutting and more recent in terms of agriculture, has fundamentally changed the nature of the habitats found there. For this reason NVC sub-communities details were not recorded during the course of the surveys as this was deemed not to accurately reflect the vegetation present.

3. RESULTS

3.1 Survey Area Overview and Historical Background

Much of the survey area (as seen in Figure 4.1 within the EAR) has been subjected to historical and present anthropogenic impacts which have impacted on the habitats and communities present. The Upper Kergord area was subject to intensive agricultural improvement in the 1950s and 1960s which converted large areas of blanket bog present in the valley and on the gently sloping ground either side of the valley into pasture for sheep grazing. A considerable amount of drainage work appears to have been undertaken throughout the wider area with lime and fertiliser added and, in places, surface seeding. Signs of this improvement are obvious in the valley bottom where grass leys now exist, while the surrounding area now comprises damp acid grassland on deep peat. There are signs that some of the peripheral rough grazing is reverting slowly back to blanket bog although the central ley areas are still actively managed.

The steeper slopes in the west of the area show dryer heathland vegetation although this is probably situated on peat at a depth of approximately 0.5m. Grazing appears to have been heavy in these areas and in places has eliminated dwarf shrubs, turning the vegetation into a mosaic of dry heath and acid grassland, or acid grassland. There is quite extensive flushing (acid flushes) along the slopes, while in the improved valley bottom there are several areas of extensive wet flushes/mires dominated by soft rush (*Juncus effusus*). Some of these flushes are likely to be groundwater dependent but these flushes are ubiquitous in Shetland and of relatively low conservation interest.

The remaining blanket bog north of Upper Kergord and further south has been modified but is relatively intact, completely vegetated and as such, largely active i.e. peat forming. In many places higher, dryer areas of blanket bog are interspersed with much wetter hollows. This is generally likely to be a product of recovery after previous (historic) peat cutting but in the most northerly section may well mirror the bed rock, or glacial remains, and thus be a more natural variation.

Grazing levels are heavy throughout the survey area, particularly in areas of blanket bog in the north and west of the surveys area, and in “wetter” good quality areas trampling is causing loss of vegetation and erosion; this is likely to lead to increased peat loss in the long term.

There are a series of base-rich flushes in the south of the site in the vicinity of HU402547, which are highly likely to be groundwater dependent and relatively scarce in a Shetland context.

3.2 Field Survey Results

The following section describes the habitats and communities present across the survey area, their condition, and where appropriate comments on relevant legislation.

3.2.1 Phase 1 Habitats

Table 1 summarises the Phase 1 Habitat types present within the survey area for the Kergord Access Track. Figure 4.2 of the EAR shows the extent of each of the Phase 1 Habitat types across the survey area along with the proximity of these to the proposed development.

TABLE 1 – PHASE 1 HABITAT TYPES PRESENT IN THE KERGORD ACCESS TRACK SURVEY AREA			
Phase 1 Habitat Type	**Phase 1 Alphanumeric Code**	**Area (ha)**	**Percentage Coverage of Survey Area**
Blanket Bog	E1.6.1	58.2	35.0%
Semi – Improved Acid Grassland	B1.2	46.2	27.8%
Wet Modified Bog	E1.7	23.9	14.4%
Improved Grassland	B4	15.8	9.5%
Dry Dwarf Shrub Heath	D1.1	9.9	5.9%
Unimproved Acid Grassland	B1.1	4.6	2.8%
Built-Up Areas	J3	3.1	1.9%
Acidic Flush	E2.1	1.2	0.7%
Marshy Grassland	B5	1.1	0.6%
Running Water	G2	0.8	0.5%
Wet Dwarf Shrub Heath	D2	0.6	0.4%
Wet Heat h / Acid Grassland Mosaic	D6	0.6	0.3%
Basic Flush	E2.2	0.4	0.2%
Notes: Total survey area is approximately 166.2ha			

Bog Habitats - Context

Unmodified bog is defined as "bog-moss *Sphagnum* rich vegetation, lying on peat more than 0.5m deep, with the water table at or just below the surface and no input of water from the surrounding land" (JNCC, 2010). Modified bog occurs where blanket bog has been degraded to the point where it contains little or no bog-moss cover (JNCC, 2010). Within the context of the survey area there are habitats where little or no *Sphagnum* cover exists, however the vegetation assemblage still contains species capable of active peat formation including cotton and deer grasses. The water table in these areas was noted as at or close to the surface of the peat, providing suitable anaerobic conditions for peat formation.

Phase 1 classification defines unmodified blanket bog as bog that is not 'significantly damaged'; it does not indicate no modification. All the bog across the study area has experienced heavy grazing pressure and drainage to varying degrees. Consequently, where peat is deemed to be actively forming, these areas have been categorised as blanket bog (E1.6.1) rather than a wet modified bog (E1.7) as this is most appropriate in the context of the Shetland landscape.

Blanket Bog (E1.6.1)

Blanket bog was generally the wettest bog habitat present, in some areas containing bog pools too small to be mapped individually, and occupied approximately 58ha of the survey areas. Papillose bog-moss (*Sphagnum papillosum*) was present at its highest cover in these areas and similarly had the highest cover of red bog-moss (*S. capillifolium*) forming a patchy carpet. However, it should be noted that the majority of this habitat has been modified to some extent through grazing and drainage, but is still actively peat forming, being less degraded than the areas of modified bog in the study area. Blanket bog areas were dominated by ling heather (*Calluna vulgaris*), with hare's-tail cottongrass (*Eriophorum vaginatum*) also abundant. Bog asphodel (*Narthecium ossifragum*) and cross-leaved heath (*Erica tetralix*) were frequently found throughout the habitat, coupled with stands of crowberry (*Empetrum nigrum*). An array of herbs was also present including round-leaved sundew (*Drosera rotundifloia*), butterwort (*Pinguicula vulgaris*) and lousewort (*Pedicularis sylvatica*).

Semi-improved Acid Grassland (B1.2)

Semi-improved acid grassland was most commonly recorded at the northern end of the study area and alongside the small watercourses, occupying approximately 46ha of the

survey area. No species was truly dominant in this habitat, though areas of local dominance could be seen. Yorkshire fog (*Holcus lanatus*), crested dog's-tail (*Cynosurus cristatus*), wavy hair-grass (*Deschampsia flexuosa*), mat grass (*Nardus stricta*) and both common and velvet bent-grass (*Agrostis capillaris* / A*grostis canina*) were frequent or abundant in this habitat. Herbs, including white clover (*Trifolium repens*) and daisy (*Bellis perennis*) occurred regularly alongside occasional spear thistle (*Cirsium vulgare*) and creeping thistle (*C. arvense*). Patches of local dominance of soft rush were also a feature of this habitat.

Both semi-improved and unimproved acid grasslands were frequently found in mosaics with heath and bog habitats, indicating the level of historical impact on the dominant peatland habitats within the survey area (see Target Notes 1 and 2 for main locations of this habitat mosaic). Many of the polygons where acid grassland habitats were found covered deep peat (>0.5m), where usually such habitats would not exist, but the impact of grazing, drainage, seeding and fertilisation has enabled alteration of the peatland habitats to improve grazing for livestock. If grazing were to be reduced in these areas, over time it is envisaged that these would revert back to peatland habitats.

Wet Modified Bog (E1.7)

Wet modified bog covered 24ha of the study area, and was often dominated by one or both of ling heather and hare's-tail cottongrass. However, common cottongrass (*Eriophorum angustifolium*) and woolly fringe moss (*Racomitrium lanuginosum*) were both also abundant at times. Typical bog plants such as round-leaved sundew and cross-leaved heath were rarely recorded at percentage covers greater than 5% and were not constant in the vegetation. Glittering wood-moss (*Hylocomium splendens*) was often abundant in the wet modified bog often ≥20%. Bog asphodel was frequent, though generally in relatively low amounts. However, in some areas this was the dominant herb, covering up to 60% of the ground.

Improved Grassland (B4)

Area of improved grassland occupied approximately 16ha of the survey area and was dominated by perennial rye grass (*Lolium perenne*), with few other grass species present. White clover, creeping buttercup (*Ranunculus repens*) and common nettle (*Urtica dioica*) were the most common forb species.

Dry Dwarf-shrub Heath (D1.1)

Heath habitat is defined as containing vegetation with a greater than 25% cover of dwarf-shrubs such as ling heather and crowberry, occurring on mineral soil or shallower peat up to 0.5m deep. Such habitat occupied approximately 10ha of the survey area.

Dry dwarf-shrub heath was generally found in the steeper and higher areas at the north-west of the survey area (Figure 4.2 of the EAR). The vegetation in this area was dominated by ling heather, typically over a moss layer including more than 20% cover of species like glittering wood-moss. Other frequent species include wavy hair-grass and tormentil (*Potentilla erecta*).

Unimproved Acid Grassland (B1.1)

Unimproved acid grassland, made up primarily of acid-tolerant species, occupied a relatively small proportion of the grassland within the survey area (c.5ha). It was most common in the north (Figure 4.2 of the EAR), with much of the grassland mapped as unimproved dominated by heath rush (*Juncus squarrosus*), although species such as wavy hair-grass, common bent-grass, tormentil and mat grass were also well represented.

Built-Up Areas (J3)

This category includes the roads and buildings within the survey area such as the unnamed single track road leading to Upper Kergord, the B9075, and the buildings present at Upper Kergord (Figure 4.2 of the EAR). These built-up areas occupy approximately 3ha of the total survey area.

Acid Flush (E2.1)

A number of acid flush areas identified throughout the survey area, were on moderate to steeply sloping groundwater passage through an area draining out of the surrounding blanket bog has provided suitable conditions for this habitat to colonise. These areas occupied approximately 1ha of the total survey area. Species assemblages are generally dominated by graminoids and sedges such as common sedge (*Carex nigra*) and flea sedge (*C. pulicaris*), with articulated rush (*Juncus articulates*) and common cottongrass frequently present. A variety of herbs, including bog asphodel were noted, along with some large *Sphagnum* cushions in a variety of location. Bog pondweed (*Potamogeton polygonifolius*) was seen to be dominant in runnels funnelling water throughout a number of these areas.

Marshy Grassland (B5)

Several areas of marshy grassland were found in the wettest parts of the survey area and occupied approximately 1ha of the survey area. This included areas of purple moor grass (*Molinia caerulea*) pasture and soft rush dominated wet grassland/mire. Herbs included lesser spearwort (*Ranunculus flammula*), marsh violet (*Viola palustris*) and marsh thistle (*Cirsium palustre*).

Running Water (G2)

A number of watercourses were present within the survey area, the largest of these the Burn of Weisdale which flows north to south (Figure 4.2 of the EAR). This burn for the most part is approximately 5m wide, running across a substrate of both cobbles and silt within various sections. Limited vegetation cover is present within the watercourse, and only occasional shrubs overhang the banks. Banks are on average no greater than 1m in height. Other smaller unnamed watercourses drain the survey area and catchment into the Burn of Weisdale. These are generally no greater than 50cm wide, running between steeply incised banks. The total approximate area occupied by running water is 0.8ha.

Wet Dwarf-shrub Heath (D2)

Wet dwarf-shrub heath was identified in areas in the south east of the study area and occupied approximately 0.6ha of the survey area. The wet dwarf-shrub heath vegetation in the study area was dominated by ling heather, common cottongrass and, to a lesser extent, deergrass (*Trichophorum germanicum*) over a moss layer dominated by red bog-moss and glittering wood-moss. It also contained more cross-leaved heath than any other habitat within the study area.

Wet Dwarf-shrub Heath / Acid Grassland Mosaic (D6)

A small quantity of habitat (c.0.6ha) was mapped as a mosaic of wet dwarf shrub heath and acid grassland where the changes between the habitat types were too frequent to be mapped as single polygons. The species present within these area are those as described for the separate habitat types above.

Basic Flush (E2.2)

Base rich flushes were noted in a number of separate locations where the underlying limestone intrusion was sufficiently close to the vegetation surface, that it was able to

influence the species assemblage present through raising of the natural pH of the water feeding these areas. These flushes are stony and have extensive coverages of both hooked Scorpion-moss (*Scorpidium scorpioides*) and black bog-rush (*Schoenus nigricans*) indicating their base rich nature. The majority of these are located in the south of the survey area, south of the B9075. Bases rich flushes occupy an aggregate area of 0.4ha within the survey area.

3.2.2 National Vegetation Communities (NVC)

Table 2 summaries the NVC communities present within the survey area for the Kergord Access Track. Figure 4.3 within the EAR illustrates the locations of the communities within the survey area and the context of the proposed development.

TABLE 2 – NVC COMMUNITIES PRESENT IN THE KERGORD ACCESS TRACK SURVEY AREA

NVC Community	NVC Alphanumeric Code	Area (ha)	Percentage Coverage of Survey Area
M17 *Trichophorum cespitosum – Eriophorum vaginatum* blanket mire	M17	55.7	33.5%
U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland community	U4	47.5	28.6%
M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire	M19	22.4	13.4%
H10 *Calluna vulgaris – Erica cinerea* heath	H10	9.3	5.6%
U6 *Juncus squarrosus – Festuca ovina* grassland	U6	8.5	5.1%
MG7 *Lolium perenne – Trifolium repens* leys	MG7	7.6	4.6%
U5 *Nardus stricta – Galium saxatile* grassland	U5	3.6	2.1%
N/A	Roads	3.1	1.9%
M15 *Trichophorum cespitosum – Erica tetralix* wet heath community	M15	2.5	1.5%
M6 *Carex echinata – Sphagnum recurvum/auriculatum* mire	M6	2.3	1.4%
M23 *Juncus effusus / acutiflorus – Galium palustre* rush-pasture	M23	1.5	0.9%
N/A	Water	0.8	0.5%
H9 *Calluna vulgaris – Deschampsia Flexuosa* heath	H9	0.7	0.4%
U2 *Deschampsia Flexuosa* grassland	U2	0.5	0.3%
M10 *Carex dioica – Pinguicula vulgaris* mire	M10	0.4	0.2%
M25 *Molinia caerulea – Potentilla erecta* mire	M25	<0.1	<0.1%

Within the survey area and as detailed in Table 2, 14 separate NVC communities were recorded. Given the atypical nature of the majority of the communities present within the survey area when compared against the relevant literature (Rodwell, 1991, 1992, 2000), it is not logical to assign sub-communities to the NVC communities found (the NVC nomenclature was predominately designed using data collected in England), and any attempt to do so would be misleading. The following section described the communities identified across the survey area, and the species recorded within these along with their relative abundance.

M17 Trichophorum cespitosum – Eriophorum vaginatum Blanket Mire

The M17 community was the most ubiquitous of the communities recorded within the survey area (Figure 4.3 of the EAR), occupying approximately 56ha. The community was dominated by hare's-tail cottongrass and ling heather. Where waterlogging of ground was present, a more complete carpet of bog-mosses occurred. Round-leaved sundew was also more frequently found in wetter areas of the community, with Papillose bog-moss abundant and bog asphodel frequently recorded.

In areas where extensive hagging has occurred, more drought tolerant species have colonised, these include reindeer lichen (*Cladonia arbuscular*), woolly fringe moss (*Racomitrium lanuginosum*), wavy hair-grass and a mixture of red bog-moss and glittering wood-moss.

U4 Festuca ovina – Agrostis capillaris – Galium saxatile Grassland Community

The U4 community occupies approximately 48ha of the survey area and was found predominately within areas of improved grassland habitat where a degree of drainage and modification has taken place to improve the ground for livestock (Figure 4.3 of the EAR). The community was dominated by Yorkshire fog, crested dog's-tail and common daisy. Mat grass was common and locally dominant. Soft rush was also locally dominant in small patches. Other herbs included white clover, creeping buttercup, spear thistle and creeping thistle. Both common and velvet bent-grass were also occasionally present.

M19 Calluna vulgaris – Eriophorum vaginatum Blanket Mire

The M19 community occupied approximately 22ha of the survey area and generally contained fewer species than the M17 mire community, tending to be damp underfoot with a taller and thicker growth of ling heather.

Ling heather was dominant with hare's-tail cottongrass over glittering wood-moss though bog-moss species were also present in wetter areas of this community. There was also abundant common cottongrass with occasional crowberry. Though the majority of this community was present on peat greater than 0.5m in depth and therefore on blanket bog habitat (E1.6.1), some of the higher areas of this community were not, and were therefore classed as wet dwarf-shrub heath (D2) in the Phase 1 Habitat Survey. This discrepancy was due to the nature of the Phase 1 distinction between blanket bog and wet dwarf-shrub heath.

H10 Calluna vulgaris – Erica cinerea Heath

The H10 community was found on the steeper sections of the survey area (Figure 4.3 of the EAR) and occupied approximately 9ha of the ground. Ling heather was the dominant feature, however the constant presence of wavy hair-grass was not recorded and grasses including sweet vernal grass and sheep's fescue were more abundant.

U6 Juncus squarrosus – Festuca ovina Grassland

A number of patches of the U6 grassland community were interspersed across the survey area, occupying approximately 9ha in total. It was usually found on some of the drier raised areas within the study area (Figure 4.3 of the EAR). The community was generally very short cropped and dry underfoot (possibly due to the heavy grazing within the area), with a relatively open sward which was predominately species poor. This community was dominated by heath rush, with areas of sweet vernal-grass abundant. Heath bedstraw (*Galium saxatile*) was also constant, with tormentil, common bent-grass and papillose bog-moss being present at low frequencies. The heath rush was occasionally quite localised, giving some patches an appearance superficially similar to U4 grassland. Similarly, some areas of U4 grassland had frequent heath rush. In these areas professional judgement was used to distinguish between the two communities.

MG7 Lolium perenne – Trifolium repens Leys

The MG7 improved grassland community was present mainly in fenced or walled fields, occupying approximately 8ha of the survey area, and appeared to be very heavily grazed. The MG7 was generally dry underfoot and was bright green in colour due to thes closed and uniform sward of Perennial rye grass (*Lolium perenne*). Few other grass species were present such as Yorkshire fog and crested dog's-tail being no more than occasional to frequent. White clover, creeping buttercup and common nettle were also present. Lesser stitchwort (*Stellaria graminea*) was frequently found at the edge of the fields and seemed to be very local to these areas.

U5 Nardus stricta – Galium saxatile Grassland

This community occupied approximately 4ha of the survey area, in the north west of the survey area on free draining slopes (Figure 4.3 EAR). The community is dominated by

mat grass, with occasion ericoid species such as ling heather and crowberry, and a ground flora of heath bedstraw dominant beneath the grass sward. Patches of heath rush were present throughout these areas, but not in quantities found within the U6 *Juncus squarrosus – Festuca ovina* grassland community.

M15 Trichophorum cespitosum – Erica tetralix Wet Heath Community

Limited coverage of the M15 community was recorded within the study area (c.2.5ha) with polygons often recorded as part of a matrix with U4 grassland. The majority of this community was at the south-eastern side of the study area (Figure 4.3) and was present on relatively gentle slopes. The community was distinguished by the relatively high abundance of cross-leaved heath heather which was generally absent from the majority of the rest of the survey area. This was combined with an abundance of ling heather over the dominant red bog-moss. Other common species were tormentil, common cottongrass, hare's-tail cottongrass and wavy hair-grass.

M6 Carex echinata – Sphagnum recurvum/auriculatum Mire

This community is represented by small patches of ground that were the wettest within the study area; usually very flat areas. The ground was very soft and the water table was usually at or above ground level. Locations of this community are shown in Figure 4.3 with an additional area too small to map highlighted by Target Note 3. The community occupies approximately 2ha of the total survey area.

The dominant species in this community was soft rush, found over a lush carpet of magellanic bog-moss (*Sphagnum magellanicum*), papillose bog-moss and other bog-moss species. Common haircap (*Polytrichum commune*) and tormentil were also found, though in smaller amounts along with heath bedstraw and marsh violet.

M23 Juncus effusus/acutiflorus – Galium palustre Rush-pasture

The M23 community was found in an area of flushing and high watertable in the north of the survey area (illustrated in Figure 4.3 of the EAR) where conditions were amenable to a dominant rush sward colonising. Soft rush was predominately the species accounting for the bulk of the vegetation coverage, with other species including marsh bedstraw (*Galium palustre*), lesser spearwort, tormentil and marsh thistle scattered across the areas. The community occupies approximately 1.5ha of the total survey area.

H9 Calluna vulgaris – Deschampsia Flexuosa Heath

The H9 community was generally in found in limited abundance on the steeper sections of the survey area (Figure 4.3) and occupied approximately 0.7ha. The community within the survey area has a relatively low vegetation height, rarely above ankle height due to the grazing pressures currently present. The ground itself was dry and firm underfoot with some evidence of man-made ridges, which appeared to be historical lazy beds (a crofting practice whereby straight parallel ridges were created by the fertilisation of lines of crops, which over many years created ridges and troughs), in areas where this community is present. There was little evidence of old growth of dwarf-shrubs and the majority of the ericoid species present seem to have recently (within the last 10 years) recolonised these areas.

There was a high dominance of ling heather in this community, usually over glittering wood-moss. There were also large amounts of common bent-grass and tormentil, with wavy hair-grass a constant presence. Hare's-tail cottongrass, heath rush and sweet vernal-grass were present in smaller amounts, with mat grass and common sedge only occurring sparsely. In some damp patches there was a small amount of marsh violet present.

U2 Deschampsia Flexuosa Grassland

This community occupies approximately 0.5ha in the south of the survey area (Figure 4.3) and is characterised by the dominance of wavy-hair grass with occasional ling heather present throughout the sward, above a carpet of bryophytes such as glittering wood-moss. The community separated two areas of mire on a steep ground directly south of the B9075.

M10 Carex dioica – Pinguicula vulgaris Mire

A series of base-rich flushes are located in the south of the survey area, the best of these located at the grid references HU 4022 5476, HU 4032 5468, HU 4107 5514 and HU 4031 5472 (Target Note 4-6). These are enclosed by areas of M15 *Trichophorum cespitosum – Erica tetralix* wet heath where the substrate is relatively shallow.

The flushes are stony and have extensive hooked Scorpion-moss and black-bog rush present throughout indicating their base rich nature. A band of crystalline limestone runs through here and is presumably responsible for the base richness of the flushed water.

M25 Molinia caerulea – Potentilla erecta Mire

A single small patch of this community was identified within the study area (<0.1ha) and had a dominance of purple moor grass. The area is on flat and very wet ground, with a water table at ground level. The vegetation was up to knee height and had areas of both thick growth, and areas of more sparse, open growth. Tormentil was also very common, with little in the way of a mossy carpet. Other species such as common and hare's-tail cottongrass were also constant. A type of horsetail (*Equisetum spp.*) was also constant though the time of year at which the survey was conducted meant that this was dying back and identification to species level was not possible. Devil's bit scabious (*Succisa pratensis*) was frequent though not constant.

4. EVALUATION OF BOTANICAL INTERESTS

Table 3 below lists the NVC communities present within the survey area and therefore with the potential to be affected by the wind farm development, along with their relevant European or UK legislation, and if they have the potential to be classified as a GWDTE under SEPA (2012) guidelines.

TABLE 3 – NVC COMMUNITIES PRESENT WITHIN THE SURVEY BOUNDARY AND THEIR RELEVANT CONSERVATION DESIGNATIONS

NVC Code	NVC Community	Annex 1 Biotope Code	Annex 1 Biotope Name	Scottish Biodiversity List Code	GWDTEs Potential (High/Moderate/ None)
M17	*M17 Eriophorum vaginatum – Trichophorum germanicum mire*	7130	Blanket bogs	H1, H3	None
U4	*U4 Festuca ovina – Agrostis capillaris – Galium saxatile grassland community*	-	-	H3	None
M19	*M19 Calluna vulgaris – Eriophorum vaginatum blanket mire*	7130	Blanket bogs	H1, H3	None
H10	*Calluna vulgaris - Erica cinerea heath*	4030	European dry heaths	H1, H3	None
U6	*U6 Juncus squarrosus – Festuca ovina grassland*	-	-	H3	Moderate
M19	*M19 Calluna vulgaris – Eriophorum vaginatum mire*	7130	Blanket bogs	H1, H3	None
U5	*Nardus stricta – Galium saxatile grassland*	-	-	H3	None
M15	*Trichophorum germanicum – Erica tetralix wet heath*	4010 / 7130	Northern Atlantic wet heaths with *Erica tetralix* / Blanket bogs	H1, H3	Moderate
M23	*M23 Juncus effusus / acutiflorus – Galium palustre rush-pasture*	-	-	H1, H3	High
M6	*Carex echinata-Sphagnum fallax/denticulatum mire*	-	-	H1, H3	High
Water	-	-	-	H1, H3	None
H9	*Calluna vulgaris – Deschampsia flexuosa dry heath*	4030	European dry heaths	H1, H3	None
U2	*Deschampsia flexuosa grassland*	-	-	H3	None
M10	*M10 Carex dioica – Pinguicula vulgaris mire*	H7230	Calcium-rich spring water fed fens	H1, H3	High
M25	*M25 Molinia caerulea – Potentilla erecta mire*	7120 / 7130	Degraded raised bog, Blanket bog	H1, H3	Medium

As can be seen from Table 3, a number of the communities present within the proposed access track area are listed within both UK and European legislation. As such, these communities have been considered during the design process of the development to ensure they are sympathetically treated with the minimum impact created. Any loss or disruption to the habitats and communities present within the development boundary will be adequately mitigated for via the development's overarching Viking Wind Farm Detailed Habitat Management Plan.

Table 3 also details that a number of the communities present within proximity to the wind farm and its associated infrastructure have the potential to be dependent on groundwater influences, and as such are listed within SEPA's relevant Land-Use Planning Guidance Note 4 (2014). Consideration has been given to the location of these communities in

proximity to all proposed infrastructure (Figure 4.4 of the EAR) ensuring the layout of the development causes the minimal disruption to ground water flow in these areas, thus ensuring communities continue to exist in their present state.

Blanket mire habitats are abundant across the proposed development area, and although the majority of these exhibit a degree of modification from historical land-use, the bulk of these habitats are still actively forming peat thus fall within the definition of the Annex 1 Biotope 7130. Consequently, these habitats are within the protection as afforded by the relevant European legislation associated with the Habitats Directive (1994, as amended.)

The M10 flush communities found in the south of the survey area are those of the highest conservation value given their rarity on the Shetland Mainland. Consequently, consideration should be given to maintaining the flow of groundwater which these are reliant on, and if construction is considered necessary within the area, protection of these flush communities should be a priority.

Dry and wet heath communities are found across the site, predominately in areas of shallow peat (<0.5m). Such habitats are listed within both European and UK legislation and are afforded the relevant protection associated with this status. Current heavy grazing within the area is impacting on the sward composition both in terms of structure and species diversity. However, relaxation of this is likely to allow the rapid recovery of habitats. Disruption to such habitats should be minimised wherever possible during both the design and construction processes.

5. REFERENCES

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FIGURES

List of Figures Referenced in this Report:

APPENDIX 1 – TARGET NOTE RECORD

TABLE A1 – TARGET NOTE RECORD FOR PHASE 1 HABITAT AND NVC SURVEYS				
Target Note Number	**Survey Type**	**Easting**	**Northing**	**Comment**
1	Phase 1	439997	1155034	Modified blanket bog interspersed with acid grassland
2		440277	1155038	Modified wet bog interspersed with semi-improved acid grassland
3	NVC	439960	1156675	M6 flush
4		440220	1154760	Base-rich M10 flush
5		440320	1154680	Base-rich M10 flush
6		440310	1154720	Base-rich M10 flush

Appendix C. Otter Survey Report 2015

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Appendix C
Kergord Access Track
Environmental Appraisal Report

Otter Survey Report 2015

01 July 2016

Project Number: SEC8088

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Issue Date:	**01 July 2016**	Revision Number:	**-**	
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REPORT TEMPLATE

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CONTENTS

EXECUTIVE SUMMARY

RPS was commissioned by Scottish and Southern Energy Renewables and the Viking Energy Wind Farm to undertake an otter survey for the proposed Kergord Access Track associated within the Viking Wind Farm, mainland Shetland, (central Ordnance Survey (OS) grid reference HU 39810 56190).

Otters are a European protected species and Shetland has long been recognised as an important area for otters, with animals found throughout the islands. Surveys of otters across Shetland in the late 1980s and early 1990s showed that these animals were common throughout much of the archipelago, numbers being lowest in the southern mainland and highest in the north. Shetland still has probably one of the most dense otter populations in Europe, and the population continues to be regarded as being of national and international significance.

The otter survey was undertaken on 01 and 02 November 2015. No shelters were found within the survey area, however spraint sites were observed. Seven different spraint sites were found along the main watercourse, the Burn of Weisdale, with no evidence of the presence of otters on any of the minor watercourses that run into the Burn of Weisdale. Fresh sprainting was found next to the road bridge spanning the B9075 showing that otters are using the Burn of Weisdale at the time of the survey.

No shelters were found within proximity to the proposed development during the course of the surveys. As such, there are currently no requirements for a disturbance licence with regards to the species to allow the development to proceed. However, once construction dates and plans are finalised, surveys of the proposed construction areas and their direct surroundings should be completed prior to works commencing. This will provide updated evidence of otter activity within the construction area to ensure any changes between the time of this survey and the start of construction are identified and taken into consideration to ensure appropriate protection is provided for the species and all relevant legislation adhered to.

1. INTRODUCTION

1.1 Background

RPS was commissioned by Scottish and Southern Energy Renewables (SSER) and the Viking Energy Wind Farm to undertake an otter survey in conjunction with the construction of the proposed Kergord Access Track associated with the Viking Wind Farm, Mainland Shetland (central Ordnance Survey (OS) grid reference HU 39810 56190). The location of the site is shown in Figure 1.1 of the overall Environmental Appraisal (EAR) for the proposed development with a detailed route given in Figure 3.1 of the EAR.

Otters are a European Protected Species and Shetland has long been recognised as an important area for otters, with animals being found throughout the islands. Surveys of otters throughout Shetland in the late 1980s and early 1990s showed that these animals were common throughout much of the archipelago, numbers being lowest in the southern mainland and highest in the north (Conroy & Kruuk, 1995).

Shetland still has probably one of the most dense otter populations in Europe, and the population continues to be regarded as being of national and international significance (Conroy, 1998). This importance was recognised by the Scottish Executive, who designated parts of the islands as a Special Area of Conservation (SAC) for otters.

On Shetland, the otter is primarily a marine living species (Kruuk, 1995), with an estimated population of between 800 and 1050 adults in 1993 (Conroy & Kruuk, 1995). Based on the UK population estimate for the mid 1980s (Harris et al., 1995), Shetland contained about 12% of the UK otter population; a significant proportion.

Otters in Shetland predominately hold coastal ranges with most of their dens (holts) found on the rocky coasts and are associated with peatland habitats and fresh water, with otters needing to be near freshwater to drink and to wash salt from their fur prior to grooming.

There are numerous burns and lochans across the islands that the otter use to travel inland and across the islands to other coastlines. Although otters are not as numerous on the inland sites compared to the coast they use these burns and lochans on a daily basis, with some lochs and burns being an essential part of an otter's habitat.

1.2 Relevant Legislation

The following European and UK legislation was taken into consideration in planning and undertaking the otter surveys.

1.2.1 The Habitats Directive

European Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') was adopted in 1992 in response to the Bern Convention. The Habitats Directive requires Member States to maintain habitats listed on Annex I at favourable conservation status through the creation of a network of Special Areas of Conservation (SACs). In addition Annex IV of the Habitats Directive includes a list of species which require strict protection, and are termed 'European Protected Species'. Otters are included in this Annex.

1.2.2 The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

The Habitats Directive is transposed into law in Scotland through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).

Regulation 39 of the Habitats Regulations make it an offence to deliberately or recklessly capture, injure, kill, harass or disturb any animal included in Schedule 2 of the regulations (European Protected Species (EPS)). It is also unlawful to deliberately or recklessly obstruct access to a breeding site or resting place of any such animal, or to damage or destroy such a place, whether or not it is in use or occupied. Any activity which is likely to affect these species requires prior consultation with the relevant statutory nature conservation organisation (i.e. Scottish Natural Heritage (SNH)) and may require a licence to be issued before they can be carried out. If there is a risk that an activity could potentially be unlawful then in some instances a licence may be granted to carry out the activity (EPS Licence). When EPS are present, licences to permit development can only be granted subject to three strict tests being met:

• Test 1: The reason for the licence must relate to one of several specified purposes listed in Regulation 44(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (as amended);

• Test 2: There must be no satisfactory alternative; and

• Test 3: The proposed action must not be detrimental to the maintenance of the species at 'favourable conservation status'.

1.2.3 The Wildlife and Countryside Act 1981 (as amended)

The Wildlife and Countryside Act 1981, as amended by the Nature Conservation (Scotland) Act 2004 and The Wildlife & Natural Environment (Scotland) Act 2011 (the 'WANE Act'), is the primary legislation which protects animals, plants, and certain habitats in Scotland.

Enhanced protection is provided for species listed on Schedule 5 making it an offence to kill, injure or take such an animal. It is also an offence to damage, destroy or obstruct access to any place used for shelter or breeding. Schedule 6 of the Act provides protection to listed animals from prohibited forms of capture. Any works which may potentially cause disturbance to these species requires prior consultation with SNH.

1.3 Terms, Conditions of Use & Limitations

The surveys were completed at the optimal time of year for otters (October / November) when the females bring young out of the natal holts and the previous year cubs are looking for ranges to live in. Two survey days were completed, one during overcast weather with watercourses in moderate flow, with the second survey day being in complete sunshine. Strong winds and heavy rainfall were recorded the day before the survey which could have washed away some of the signs that show otters presence. However, during the survey the weather was mainly dry. No further limitations were identified.

2. METHODOLOGY

Surveys for otter were completed on 01 and 02 November 2015 by two experienced ecologists. The survey area can be seen in Figure 4.1 of the EAR and includes the area of proposed development and a surrounding buffer of 250m.

The following section details the signs searched for and the guidance followed in completing the otter survey.

2.1 Otters

All water bodies, watercourses, and minor ditches within the survey area were assessed for their potential to support otter (where access permitted and where it was safe to do so).

Otter field signs are described in Bang & Dahlstrøm (2001) and include shelters and resting sites (e.g. holts and couches), spraints, prints and feeding remains. Descriptions of these and other field evidence terms are summarised below:

- **Shelters/Holts**: these are underground features where otters live. They can be tunnels within banksides, underneath root-plates or boulder piles, and even man-made structures such as disused drains. Holts are used by otters to rest up during the day, and are the usual site of natal or breeding places. Otters may use holts permanently or temporarily.
- **Couches**: these are above ground resting sites. They may be partially sheltered, or fully exposed. Couches may be regularly used, especially in reedbeds and on in-stream islands. They have been known to be used as natal and breeding sites. Couches can be very difficult to identify, sometimes consisting of no more than an area of flattened grass or earth, and are best identified by the presence of other field signs (e.g. spraints). Where rocks or rock armour are used as couches, these can be almost impossible to identify without observing the otter in-situ.
- **Prints**: otters have characteristic footprints that can be found in soft ground and muddy areas.
- **Spraints**: otter faeces can be used to mark territories, often on in-stream boulders. They can be present within or outside the entrances of holts and couches. Spraints have a characteristic smell and often contain fish remains.
- **Feeding signs**: the remains of prey items may be found at preferred feeding stations. Remains of fish, crabs or skinned amphibians can indicate the presence of otters.
- **Paths**: these are terrestrial routes that otters take when moving between resting-up sites and watercourses, or at high flow conditions when they will travel along bank sides in preference to swimming.
- **Slides and play areas**: slides are typically worn areas on steep slopes where otters slide on their bellies, often found between holts/couches and watercourses. Play areas are used by juvenile otters in play, and are often evident by trampled vegetation and the presence of slides. These are often positioned in sheltered areas adjacent to the natal holt.

Any of these field signs are diagnostic of the presence of otters although spraints are the most reliably identifiable evidence. Where resting sites are discovered, then an indication of their importance is recorded. This is done by evaluating spraint freshness, prints and paths or niche availability and quality of the feature.

3. RESULTS

3.1 Desk Study

A desk study of designated sites was conducted of the area surrounding the proposed development using the SNH SiteLink website[1]. Local, Regional and National designated sites were searched for within a 2km radius of the development, whilst relevant International designated sites were considered within a 15km radius.

A single Site of Special Scientific Interest (SSSI), the Sand Water, is present approximately 1km to the south east of the development. The area is designated for its mesotrophic loch freshwater habitats and the open water transition fen, both designating features were classified in 2004 as in favourable condition.

The nearest relevant designated Special Area of Conservation (SAC) with regards to otter is the Yell Sound Coast SAC, located approximately 15km to the north of the proposed development. The SAC is designated in part for its otter population which was last assessed as of an Unfavourable condition. Otters utilising the area of the proposed development could feasibly be associated with this SAC and move along the Burn of Weisdale to commute between coastal areas to the north and south of the proposed development.

Shetland Biological Records Centre were consulted on 11 November 2015 for records of otter presence between 2000 and 2015 within a 12km2 surrounding the proposed development area (box area from HU3954-4154 to HU3957-4157). The results of this are presented in the Confidential Annex.

3.2 Field Survey

The results of the field survey are presented in the Confidential Annex.

[1] http://gateway.snh.gov.uk/sitelink/

4. CONCLUSIONS

The conclusions of the Otter Surveys are presented in the Confidential Annex.

5. REFERENCES

- Bang, P & DahlstrØm, P (2001). Animal Tracks and Signs. Oxford University Press, Oxford.
- Conroy, J. W. H., & Kruuk, H. (1995). Changes in otter numbers in Shetland between 1988 and 1993. *Oryx*, 29(3):197–204.
- Harris, S., Morris, P.A., Wray, S. & Yalden, D. 1995. A Review of British Mammals: Population Estimates and Conservation Status of British Mammals other than Cetaceans. JNCC, Peterborough.
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FIGURES

List of Figures Referenced in this Report:

APPENDIX 1 – PHOTOGRAPHIC RECORD OF OTTER EVIDENCE

Appendix 1 is provided within the Confidential Annex.

Appendix D. Fish Habitat and Population Assessment

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Kergord Access Track
Environmental Appraisal
Appendix D
Burn of Weisdale, Kergord:
Fish habitat and population assessment

Report to RPS Ltd.

November 2015

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1 Introduction

1.1 Background

This survey was commissioned to provide data on fish habitats and populations in the Burn of Weisdale and its tributaries to inform a local planning application and the associated Environmental Appraisal Report (EAR) for the proposed Kergord Access Track, Mainland Shetland, central Ordnance Survey grid reference HU 39810 56190.

Fish populations in the Burn of Weisdale were previously surveyed by Waterside Ecology (2008) as part of the baseline assessments for the Viking Wind Farm. That survey found that the stream supported populations of trout *Salmo trutta* and European eels *Anguilla anguilla*. The same species were identified during sampling by Wallace *et al*. (2009). No other fish species were identified in either survey. The Burn of Weisdale was included in the Scottish Natural Heritage (SNH) funded national survey of lamprey species in Scotland (Watt & Ravenscroft 2005) but, as in other streams that were surveyed in the Shetland Isles, no lampreys were found.

1.2 Fish habitat requirements

1.2.1 Salmon and trout

The physical habitat requirements of juvenile salmonids have been subject to a considerable amount of detailed study (for reviews see e.g. Crisp 1993; Hendry & Cragg-Hine 2003; Klemetsen *et al*. 2003; Summers *et al*. 1996; Youngson & Hay 1996). Trout and salmon spawn in late autumn and early winter, depositing their eggs in redds which they excavate in gravel and pebble substrates. Eggs are often deposited in areas of accelerating flow, such as the tails of pools and glides, upstream from riffles. However, in upland streams eggs may be deposited in any areas of gravel that can be physically moved. A good supply of oxygen is essential for eggs to develop and this is facilitated by a flow of water through the gravel. Clogging with fine sediment such as silt and fine sand reduces water flow resulting in egg mortality due to lack of oxygen. Egg survival is also affected by redd 'washouts' during winter spates – the direct, physical, scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all determine the extent of siltation and washouts.

After hatching the young fry remain in the gravel, absorbing nutrients from the remaining yolk sac. On emergence, usually between March and early May, the young fry disperse and set up territories which they defend aggressively. Salmon fry prefer fast flows (>30cm/s) and favour areas with surface turbulence (riffle habitat). They require a rough bed of pebble, cobble and gravel. Trout fry prefer areas of relatively low velocity water near the streambed. Cover from stones, plants or debris is required and good cover is essential for maintaining high fry densities.

Salmon that have survived their first winter (parr) prefer deeper water than fry (typically 15-40cm) and a coarser substrate of pebbles, cobbles and boulders. Trout parr generally favour areas of relatively low current speed where cover is available. Juvenile trout are often to be found in cover alongside the banks, in undercuts, among tree roots or in marginal vegetation. Cover remains important for adult trout and salmon particularly in smaller streams. In larger rivers and lochs this may be less important, as deep water provides refuge.

1.2.2 Eels

Eel habitat requirements have received less attention than those of salmonid fish. Tesch (1977) suggests that so long as temperature and oxygen requirements are met, there are few stretches of water that are not suitable for eels. The main requirement for eels is cover, as they are averse to light and require suitable refuges during daylight hours. Eels of different size show different substrate preferences. Larger eels require large hollows, crevices or weed beds whereas small eels are sometimes abundant in cobble substrates, where they can burrow between the stones. Tree stumps,

roots and other large structures provide ideal cover for eels. Eel diet is diverse, but the majority of diet consists of benthic species (Moriarty 1978; Kottelat & Freyhof 2007).

2 Objectives and survey reaches

- Describe fish habitats, particularly salmonid habitats, in the reaches potentially affected by the proposed crossing works (habitat surveys extended approx. 0.5km downstream of crossing location and 0.2km upstream).
- Describe the distribution and abundance of fish at three sites in Burn of Weisdale that were previously surveyed in 2008.
- Provide guidance on potential sensitivities relating to fish habitats or populations that may result from the proposed development.

3 Methods

3.1 Habitat survey

The survey method was based on walkover protocols described by Hendry and Cragg-Hine (1997), SEPA (2010a) and Summers *et al*. (1996). These characterise in-stream habitats according to depth, substrate, flow and thus suitability for different age classes of salmon. The habitat categories used during the survey and in this report are set out in Table 1. Surveys were based on contiguous sections river channel. Areas of each habitat category were marked on 1:5,000 maps of the river in the field, using colour codes.

Obstacles to migration were recorded and photographed. Their likely passability for adult salmonids was assessed. Where possible, the height (lip to water surface at base/plunge pool) and length (upstream to downstream) of obstacles was measured using a tape and bob weight. The likelihood of obstacles being passable was based on data provided by SEPA (2010a), SNIFFER (2010) and the surveyor's own wide experience of fish population survey.

Table 1 Habitat categories used for walkover survey

Habitat category	Description
Fry habitat	Shallow habitats (mainly <15cm) with some cover for smaller fish in cobble and pebble. Cover not large enough to hold parr or adults that would displace fry.
Mixed juvenile habitat	Habitats with mixed depth and coarse substrates including cobble, boulder and pebble that provide cover for salmonid fry and parr. Usually between 10 and 45cm depth.
Glide	Low or moderate gradient channel with small substrates. Lacking cover for fish. Productive only if instream macrophytes or bankside cover are present.
Deep pool	Over 60cm deep. Slow or eddying current. Suitable for adult salmonids if cover is present. If >1m deep cover may be less important, as depth can provide refuge.
Spawning	Ideally well oxygenated, stable & not compacted. Typically comprising gravel and pebble. Fines (sand & fine gravel <2mm) less than 20%. Not silted.
Bedrock	Sheet bedrock or compacted earth covering majority of streambed. No cover. Unproductive habitat.

Areas of suitable spawning substrate were recorded. Other variables recorded in each survey section were: (i) up and downstream grid reference, (ii) wet width, (iii), stability of substrate, (iv) compaction of substrate and (v) availability of cover for fish alongside banks. The surveyor also made a subjective assessment of typical habitat quality for juvenile salmon and trout in each section, based on published habitat preferences.

3.2 Fish population survey

3.2.1 Survey

Fish populations were surveyed by electric fishing on 8th and 9th October 2015. The three sites had previously been surveyed in 2008. The 2008 data and site photographs were used to ensure accurate replication during the current survey. Site locations are given in Table 2 while event details are presented in Appendices 4.1 to 4.3. Sites WEI1 and WEI2 are upstream of the existing B9075 crossing while WEI3 is downstream.

Table 2 Electric fishing survey sites

Code	NGR	Location	Survey type	Area (m^2)
WEI1	HU4053 5779	Start at tail of glide by tributary (right bank). Fish up to clear constriction.	Semi-quantitative	103.2
WEI2	HU4051 5672	Downstream end marked by large red rock at right of channel (6m down from right bend).	Semi-quantitative	134.9
WEI3	HU4013 5421	Downstream end is 11m up from post and rail fence (approx. 13m up from footbridge).	Fully quantitative	127.1

Surveys were conducted using fully and semi-quantitative methods as described by Scottish Fisheries Co-ordination Centre (SFCC 2007). Three electric fishing runs were carried out through the fully quantitative site. This permits total fish density to be established based on the depletion in fish numbers during consecutive runs (SFCC 2007). A single electric fishing run was conducted at semi-quantitative survey sites. Stop nets were established at the fully quantitative site immediately prior to survey. All survey sites covered the full stream width and incorporated a representative range of habitat types. Fish were captured in hand-held dip nets then placed in bins of clean water where they were held until ready for processing.

Fish were anaesthetised for processing. Salmonid fork length was measured to the nearest millimetre and eel total length to the nearest 0.5cm. Scales were collected from salmonids to assist with age determination. All fish were allowed to recover fully in clean water before being released back into the survey reach. Habitat descriptions at electric fishing survey sites were collected according to the SFCC protocol (SFCC 2007).

3.2.2 Analysis

Minimum density was calculated as number of fish caught divided by area and is expressed throughout at number of fish per 100 square metres of wetted habitat. Site areas were based on the 2008 survey site dimensions. Since wetted area varies with water level this was necessary to permit comparisons across years. Fish density at the fully quantitative site was calculated using the programme Removal Sampling, (version 2.2.2.22) from Pisces Conservation. The estimator used was “constant P”, more usually known as the Zippin estimate.

4 Results

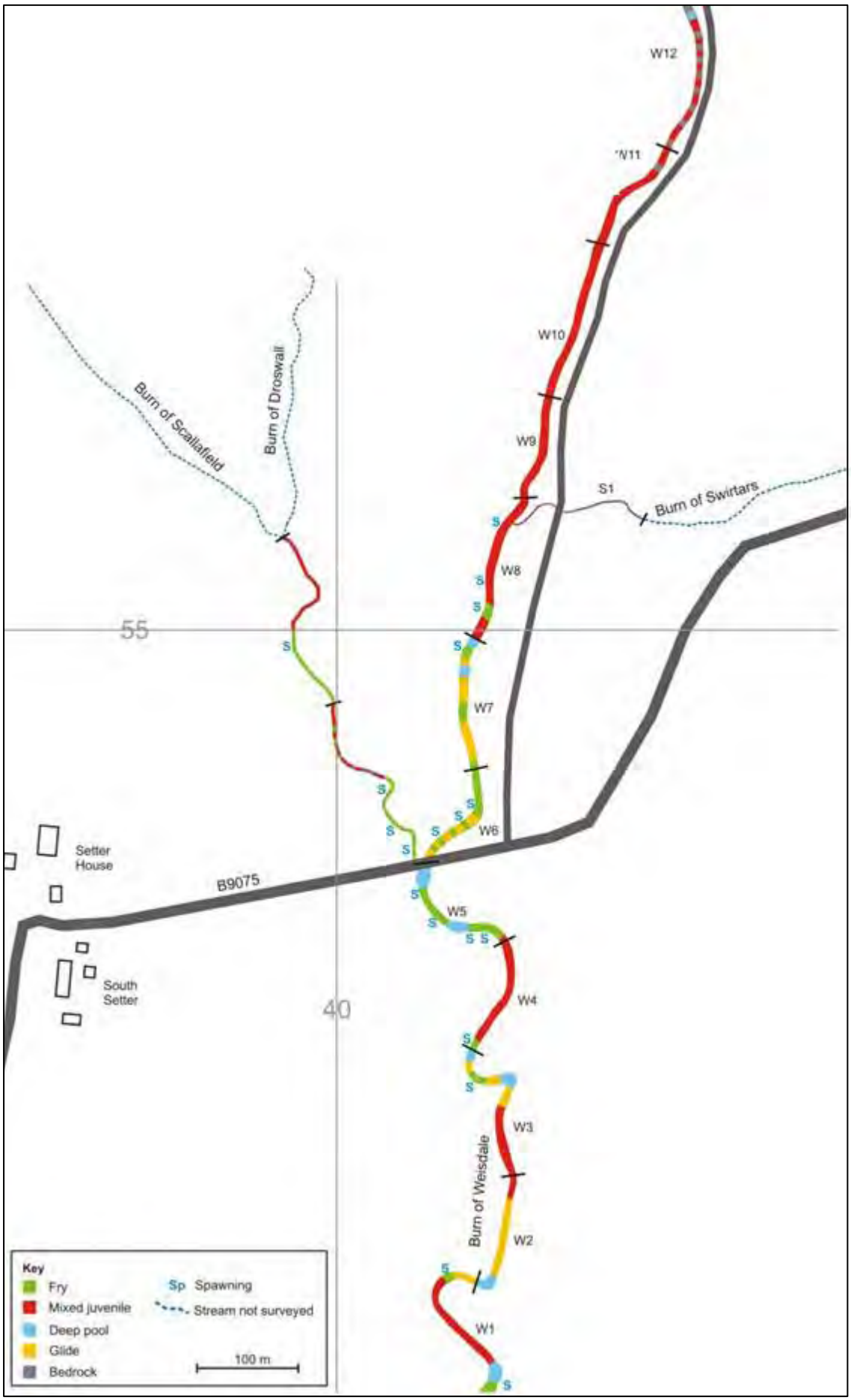
4.1 Salmonid habitats

4.1.1 Burn of Weisdale

Survey sections W1 to W4 have a moderate to low gradient and a typical wet width of between three and four metres (Table 3 and Appendix 2). Flow types comprise runs, glides and pools. There are three pools that are deep and large enough to provide resting areas for adult salmon or trout. Substrates are mainly of very stable, mossy cobble and boulder set round with coarse sand providing a moderate amount of cover for juvenile salmonids across the full channel width. Macrophytes, including *Potamogeton* sp. provide further cover. Depths are variable but typically range from 15 to 40cm in the glides and runs with pools to 2m. Spawning habitats totalling $20m^2$ were identified across

the four survey sections, located mainly at the run-outs of pools or glides. Spawning habitat locations are given in Appendix 3 and indicated on Figure 1. Sections W1 to W4 flow through improved pasture and the stream banks are grassy. The bank material is earth and peat and this is undercut in many places providing good overhead cover for fish. This is of particular value to trout. The banks are mainly stable although some erosion and slumping is evident on the outsides of bends in sections W2 and W3 (see Appendix 5 for photographs).

Figure 1. Habitat survey sections and distribution of salmonid habitats



Overall, habitat quality for juvenile salmonids through sections W1 to W4 was generally classified as being of moderate quality (Appendix 2), although section W3 was assessed as poor. The stable streambed would not be expected to be subject to rapid change and the channel itself, despite some erosion on bends, is clearly stable over time.

Table 3 Estimated areas of stream habitats in Burn of Weisdale survey sections

Survey section	**Wet width** (m)	**Estimated area of habitat type** (m^2)				
		Fry	Mixed juvenile	Glide	Deep pool	Spawning
W1	3	45	360	68	125	11
W2	4	0	80	300	150	0
W3	4	160	300	120	200	2
W4	3	60	300	0	100	7
W5	7	1400	0	0	400	17
W6	4	480	0	240	0	46
W7	3.2	352	32	192	100	9
W8	4	200	400	0	0	21
W9	3.5	0	368	0	0	0
W10	3.2	0	352	0	0	0
W11	3.2	0	416	0	0	0
W12	3.0	0	288	0	50	0

Sections W5 and W6 are down and upstream of the existing B9075 bridge respectively. Streambed substrates in these sections show less long term stability than those further downstream and macrophytes are scarce. Substrates typically comprise pebble, cobble and gravel. Flow types are run, riffle and glide sequences with two deep pools downstream of the bridge. Spawning opportunities are widespread in both sections and spawning habitats are of good quality with little evidence of siltation. It is clear from the presence of side and point bars, as well as some braiding of the channel in W5, that the reach is more dynamic than those downstream. Nevertheless neither section was classified as being particularly unstable and redd washout was judged to be unlikely at most potential spawning locations. Due to the relatively small size of streambed substrates these two sections are probably best suited to fry, cover for parr being scarce.

Section W7 has much in common with W5 and W6, with depositional features including side and point bars on bends. Much of W7 is a long glide with poor instream cover but abundant cover beneath undercuts and draped vegetation. Due to the presence of overhead cover, this section provides better habitat for trout parr than the preceding sections.

Sections W8 and W9 are both characterised by moderate stability. Depositional side and point bars are present and eroding banks – particularly in W9 – provide important sources of cobble and pebble substrates to the channel. Due to the presence of a higher proportion of large cobble and some boulder instream cover for salmonid fish is more plentiful than in the sections immediately downstream. Current speed is moderate to fast and flow types include a high proportion of run and riffle. Both sections were judged to provide good quality habitat for juvenile salmon. Depth in both sections is typically in the 15 to 30cm range, slightly deeper in W9 than in W8. Overhead cover alongside the stream banks is scarce in both sections. Potential spawning habitat, suited mainly to salmon, was recorded at three locations in W8 but not in W9. Approximately 50% of this appeared unstable and may be prone to loss of ova through redd washout during spate events.

Section W10 is more stable than W8 or W9 and lacks large depositional bars or substantial areas of bank erosion. Flow types are mainly run and riffle. Substrate comprises stable boulder, cobble and pebble and water depth manly ranges from 15 to 30cm. The section provides good juvenile salmon

habitat, suited both to trout and salmon. There is a moderate amount of overhead cover available alongside the streambanks from undercuts.

The stream becomes increasingly entrenched between bedrock banks through sections W11 and W12. At its downstream end substrate in W11 is mainly cobble with a few boulders. The proportion of bedrock increases through this section and through W12, and stream gradient is high. Smaller substrates are unstable and bed transport appears substantial. There are no large depositional features, in contrast to the sections further downstream, and spawning habitat is lacking. Habitat quality for juvenile trout and salmon is good at the downstream end of W11 but becomes increasingly poor through the bedrock reaches. The banks are very stable but provide little overhead cover.

4.1.2 Burn of Droswall/Burn of Scallafield

This stream joins Burn of Weisdale at the existing B9075 road bridge (Figure 1). The survey extended approximately 0.4km upstream from the confluence. The stream is small with a typical wet width of 1.0 to 1.2m. The gradient is moderate and flow types are mainly run with some glide and riffle. Depth is typically between 10 and 20cm and substrates are dominated by cobble and pebble. The lower reaches provide some good quality spawning habitat, including a patch of $9m^2$ stabilised behind the existing B9075 road bridge (see Appendix 5 for photograph). Three further patches of apparently suitable spawning substrate totalling $15m^2$ were identified in section D1, all in the first 100m of upstream of the bridge. A single patch of $5m^2$ was identified further upstream in D2.

Due to its shallow depth and lack of boulder cover instream habitats are probably best suited to fry rather than parr. However, overhead cover alongside the banks is plentiful and trout parr would be expected to be present where stream depth permits.

Table 4 Estimated areas of stream habitats in Burn of Droswall/Burn of Scallafield survey sections

Survey section	**Wet width** (m)	**Estimated area of habitat type** (m^2)				
		Fry	Mixed juvenile	Glide	Deep pool	Spawning
D1	1.1	220	132	0	0	24
D2	1.1	176	88	0	0	5

4.1.3 Burn of Swirtars

This very small stream joins Burn of Weisdale in section W8 at HU 4018 5509. Wet width is typically 0.2 to 0.3m with a depth of 2 to 10cm. The simple incised channel runs between stony earth banks. There is little bed transport and substrates form a hard immobile matrix. There are some sections of bedrock. No potential spawning habitat was identified and habitat quality for juvenile salmonids was judged to be very poor. The stream may well be fishless and it was not quantitatively surveyed.

4.2 Habitat for other fish species

Suitable cover for eels is present mainly in the more stable survey section, particularly sections WEI1 to WEI4 where boulders and macrophytes provide potential refuges.

Larval lamprey habitats are present in the survey reaches in the form of patches of stable fine sand and silt in eddies. These habitats were not quantified, as past surveys have found that lamprey were absent.

4.3 Fish populations

4.3.1 Trout

The fish population assessment of Burn of Weisdale found trout fry and parr to be present at all three survey sites (Table 5). Average single run fry and parr densities were 12.5 fish.$100m^{-2}$ and 8.1 fish.$100m^{-2}$ respectively. Densities varied substantially across the sites with highest fry density at WEI3, the most downstream site, and highest parr density at WEI1 the most upstream.

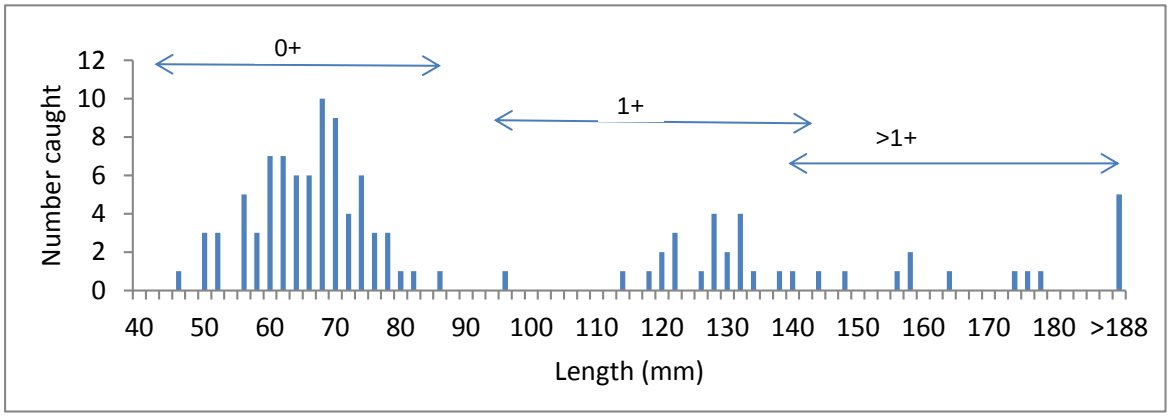
Table 5 Electric fishing results, trout

Site	Number caught		Single run minimum density (fish.100 m^{-2})		Zippin density and 95% confidence limits (fish.100 m^{-2})	
	Fry (0+)	*Parr (1++)*	*Fry (0+)*	*Parr (1++)*	*Fry (0+)*	*Parr (1++)*
WEI1	7	14	6.8	13.6	NA	NA
WEI2	18	8	13.3	5.9	NA	NA
WEI3	22	6	17.3	4.7	30.7 (28.3 – 34.9)	7.9 (7.1 – 11.6)

Juvenile trout were mainly fry (aged 0+) and 1+ parr with small numbers of 2+ parr. Larger fish were scarce (Figure 2). There was no overlap in length between the 0+ and 1+ age groups but slight overlap was evident between 1+ and 2+ parr.

An adult sea trout was caught at WEI1, the most upstream site, demonstrating that all three survey sites are accessible to migratory salmonids. The sea trout had signs of quite severe sea louse *Lepeophtheirus salmonis* damage to its dorsal fin.

Figure 2. Length distribution of trout (all sites)



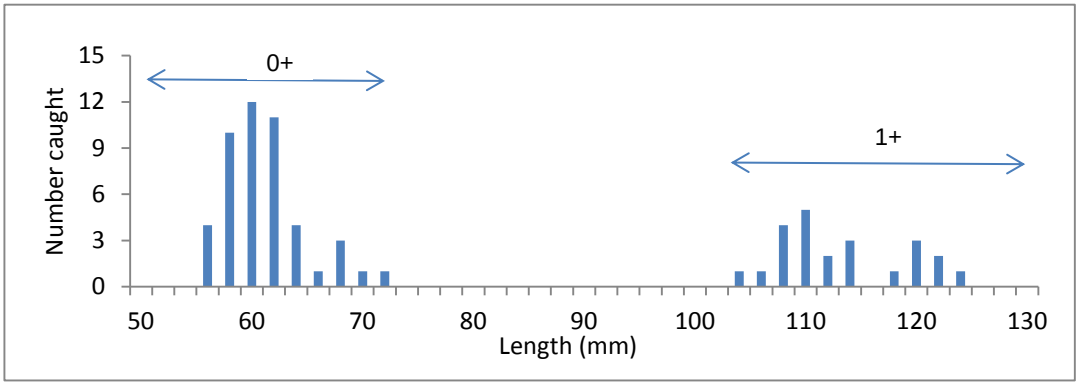
4.3.2 Salmon

Salmon were present only at WEI3, the most downstream survey site (Table 6). Two year classes present: fry (0+) and 1+ parr, which would have hatched 2015 and 2014 respectively. There was no overlap of size between the 0+ and 1+ year classes (Figure 3) and rapid growth of the 1+ group during 2015 was evident from scale annuli.

Table 6 Electric fishing results, salmon

Site	Number caught (first run only)		Single run minimum density (fish.100 m^{-2})		Zippin density and 95% confidence limits (fish.100 m^{-2})	
	Fry (0+)	*Parr (1++)*	*Fry (0+)*	*Parr (1++)*	*Fry (0+)*	*Parr (1++)*
WEI1	0	0	0.0	0.0	NA	NA
WEI2	0	0	0.0	0.0	NA	NA
WEI3	16	9	12.6	7.1	31.5 (25.2 – 40.9)	14.2 (13.4 – 16.2)

Figure 3. Length distribution of salmon



4.3.3 Other fish species

Eels were captured at all three survey sites (Table 7). Eels ranged in length from 95mm to 330mm. Eels cannot accurately be aged on scale annuli so scales were not taken. The smallest eels are likely to have entered the stream during 2014 or 2015 while the largest may have been many years old. Eels were much more abundant at WEI3, the most downstream site, than at either of the other two sites. This probably reflects the greater amount of stable cover at this site.

Spot checks for larval lampreys in apparently suitable habitats found no larvae, confirming earlier results.

Table 7 Eel numbers and lengths

Site	Number	Length of captured eels (mm)
WEI1	1	190
WEI2	2	130, 260
WEI3	24	95, 95, 95, 95, 95, 100, 130, 135, 135, 145, 145, 160, 160, 170, 175, 195, 200, 205, 220, 260, 285, 290, 310, 330

5 Interpretation and implications

5.1 Fish habitats and populations

Fish habitat surveys were restricted to the reaches immediately up and downstream of the B9075 stream crossing. The surveys found that these stream reaches provides a variety of habitats that are well suited to all age classes of trout and salmon; with deep pools for adults, widespread juvenile habitats and some good quality spawning habitats. The electric fishing survey sites were placed outside of the habitat survey reach at locations previously surveyed during 2008. Site WEI3 is a short distance (<200m) downstream of the habitat survey area and supported similar habitat to that found in habitat survey sections W1 to W4. It is probable that the fish community at WEI1 is representative of that in the habitat survey area. As in previous surveys (Waterside Ecology 2008; Wallace *et al*. 2009) trout and eels were found to be widespread in the Burn of Weisdale. However, in contrast with the previous surveys salmon were also present. The upstream limit of salmon distribution is unknown, but seems likely to be somewhere between WEI3 and WEI2 since salmon were absent from the latter. The presence of an adult sea trout at WEI1 indicates that migratory salmonids have access to reaches well upstream of Upper Kergord.

As all three electric fishing survey sites were previously surveyed during 2008 it is possible to directly compare fish numbers between the two surveys (Table 8). The most striking between-year difference, as noted above, is the presence of juvenile salmon during the current survey. All survey sites are upstream of the weir at Weisdale Mill (HU 396 531). This has been altered substantially since the 2008 survey and water is no longer diverted into the old Mill lade. In addition, pipework has

been removed from the weir face. These changes may well have improved conditions for upstream fish passage between the two surveys. There has been no stocking of salmon in Burn of Weisdale (Alex Miller, Shetland Anglers Association, pers. comm.) so the juvenile salmon at WEI3 were wild-spawned. Their genetic provenance – wild, progeny fish farm escapees or crosses – is unknown.

Trout densities at individual sites showed a substantial degree on variation between years. In particular, fry density at WEI1 was much lower during 2015 than it had been in 2008, while the opposite trend was apparent at WEI3. In contrast, parr density at WEI3 was much lower in 2015 than it had been in 2008. There was little change in fry or parr densities at WEI2. The lack of any consistent pattern of increase or decline suggests that the observed changes probably result from normal variation in egg deposition, hatching success and inter-stage survival between years.

Table 8 Salmon and trout minimum densities 2008 and 2015

Site	Salmon fry		Salmon parr		Trout fry		Trout parr	
	2008	*2015*	*2008*	*2015*	*2008*	*2015*	*2008*	*2015*
WEI1	0.0	0.0	0.0	0.0	26.2	6.8	14.5	13.6
WEI2	0.0	0.0	0.0	0.0	14.8	13.3	5.9	5.9
WEI3	0.0	12.6	0.0	7.1	1.6	17.3	23.6	4.7
Average	*0.0*	*4.2*	*0.0*	*2.3*	*14.2*	*12.5*	*14.7*	*8.1*

All of the electric fishing sites are accessible to sea trout and marine survival of post-smolts and adults is likely to play a role in inter-annual variation in egg deposition in the stream. Post-smolt marine survival may well be influenced by sea louse abundance as well as by other marine variables. Survival and distribution of young trout in the stream may be influenced by many factors operating in freshwaters, including flood events. In particular, it is possible that there may have been some downstream displacement of trout fry during a substantial flood event in the days preceding the current survey. Such displacement is considered most likely at WEI1 where the gravel and pebble substrate provides little shelter.

The Burn of Droswall/Burn of Scallafield sub-catchment appears to provide high quality habitat for juvenile salmonids and is likely to support good densities of juvenile trout, although no electric fishing data are available to confirm this. Given its small size it is improbable that salmon would penetrate far up this stream. However, the spawning habitats in the lower reaches might be utilised by salmon as well as by trout.

5.2 Implications

Formal impact assessment is outside the scope of this report and at present the proposed scale and nature of any instream works are unknown. Key sensitivities in relation to fish are likely to relate to three issues: (i) physical impacts on stream habitat – especially spawning habitats; (ii) water quality impacts and (iii) ensuring fish access during construction and past any new or modified structures such as bridges or culverts.

The existing B9075 crossing consists of a pipe bridge with five circular culverts (see Appendix 5 for photographs). As the structure is within the channel rather than spanning it, its presence has modified the stream environment both up and downstream. Were this bridge to be removed or substantially modified some realignment and regrading of the channel near this location would be expected. As there are several areas of high quality spawning habitat in these reaches appropriate mitigation would need to be developed, encompassing both the nature and timing of works. Any crossing design must ensure that fish passage is maintained (see Scottish Government 2011). If substantial instream work is required or there is likely to be significant disturbance to the riverbed SEPA may require that works avoid periods when eggs are in the gravel or fry are emerging, in case

of downstream impacts on nearby spawning habitats or ova. Such restrictions would typically cover the period between October and May (SEPA 2010b).

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Appendix 1.1 Stream survey sections and habitat descriptions, Burn of Weisdale.

Section code	NGR		Instream habitat notes	Banks
	Downstream	Upstream		
W1	HU 40145 54255	HU 40131 54345	Stable, mossy cobble and boulder surrounded by sand and gravel. Some spawning habitat present. Flow type is mainly glide but habitat is suited to juvenile salmonids due to coarse substrates. Approx. 5% macrophytes (vascular) plus bryophytes on boulders. Depth typically 15 to 50cm.	Improved pasture. Some erosion and slumping on outside of bends but mainly stable and grassy. Overhead cover provided by undercuts.
W2	HU 40131 54345	HU 40169 54458	Mainly glide flow type but with boulder, gravel and sand substrate. Good cover in macrophytes and plenty overhead cover alongside banks. Depth typically 40 to 50cm with a deep pool (>1m) at the downstream end of the section.	Improved pasture. Some slumping on bend but mainly stable and grassy. Good overhead cover from undercuts.
W3	HU 40169 54458	HU 40124 54572	Low to moderate gradient. Meandering channel. Substrates mainly small providing little cover. Some stable, mossy boulders. Vascular plants (mainly *Potamogeton* spp.) 20%. Depth varied and includes deep pool habitat.	Eroding earth and peat. Some gravel and pebble inputs to channel.
W4	HU 40124 54572	HU 40165 54675	Gravel and sand around stable, mossy cobbles with a few scattered boulders. Low to moderate current speed with typical depth of 20 to 40cm. Some spawning habitat present.	Mainly low, grassy, grazed banks. Improved pasture. Some overhead cover from undercuts.
W5	HU 40165 54675	HU 40080 54758	Braided and a little unstable. Substrates are mainly cobble, pebble and gravel with some good spawning habitat. Small substrate probably suits habitat best to salmon fry. Some shallow margins suited to trout fry. There is a broad, deep pool by the bridge that would shelter adult trout or salmon prior to spawning.	Cropped grass on banks. Undercutting and slumping on bends. Some braiding of channel and exposed side and point bars.
W6	HU 40080 54758	HU 40128 54862	Riffle and glide sequences with substrates of pebble and gravel. Little cover for parr but good salmon fry habitat. Depth typically 5 to 15cm.	Grass and rushes. Low banks are mainly stable. A few undercuts but overhead cover is scarce.
W7	HU 40128 54862	HU 40140 54999	Substrate is mainly small cobble and pebble surrounded by sand and gravel. Poor instream cover. Rather homogeneous with glide flow type.	Good overhead cover from undercuts and draped vegetation.
W8	HU 40140 54999	HU 40177 55114	Rather unstable with substrates of cobble, pebble and a few boulders. Macrophytes lacking. Depth is 10 to 25cm with run and riffle flow types. Good juvenile salmon habitat.	Some bank modification at upstream end. Exposed margins and little overhead cover.
W9	HU 40177 55114	HU 40199 55214	Moderate to fast current speed with substrates of cobble, pebble and boulder. Good juvenile salmon habitat. Depth typically 15 to 30cm.	Bank erosion provides inputs of gravel, pebble and cobble to channel. Little overhead cover.
W10	HU 40199 55214	HU 40231 55304	Stable reach with mossy boulders and cobbles. Flow types mainly run and riffle. Good juvenile salmon habitat. Eddies around boulders suited to trout parr and some good edge habitat. Depth 15 to 30cm.	Banks are mainly stable and provide overhead cover beneath undercuts.
W11	HU 40231 55304	HU 40318 55464	The stream becomes increasingly steep. At its downstream end substrate is mainly cobble with a few boulders. Some bedrock in upper parts of reach. Varied depth. Flow type mainly runs.	Stable banks become steeper and higher towards upstream end of section with some bedrock.
W12	HU 40318 55464	HU 40334 55591	Fast flowing stream with substrates of boulder, cobble and bedrock. Smaller substrates are unstable. Higher gradient and lack of depositional features.	Channel is entrenched between bedrock banks through most of section. Little overhead cover.

Appendix 1.2 Stream survey sections and habitat descriptions, Burn of Droswater/Scallafield.

Section code	NGR		Instream habitat notes	Banks
	Downstream	Upstream		
D1	HU 40080 54758	HU 3991 54921	Downstream end of section is 1.2m wide with substrates of pebble and gravel. Some good spawning habitat present. Depth typically 5 to 15cm and up to 30cm in a few areas.	Stable turf banks are low to water but do provide lots of overhead cover from undercuts.
D2	HU 3991 54921	HU 39946 55071	Substrates of cobble, pebble and gravel with some boulder at upstream end of section. Depth typically 10 to 20cm with run, riffle and glide flow types.	Stable turf banks are low to water but do provide lots of overhead cover from undercuts.
S1	HU 40180 55120	HU 40331 55094	Tiny stream with depths of 2 to 10cm at moderate discharge. Substrate of embedded cobble, pebble and bedrock. Very simple, incised channel. Poor fish habitat. Steep.	Stable grassy banks are low to water and provide a little overhead cover. No sediment input to channel.

Appendix 2. Stream survey data.

Section code	Length (m)	Visible streambed (% of area)	Width (m)		Substrate		Instream cover	Bankside cover (% of bank length)		Quality for salmon		Quality for trout	
			Wet	Bank	Stability	Compaction		left	right	Fry	Parr	Fry	Parr
W1	170	70	3	3.5	Stable	Partly	Moderate	10 - 25	>25	Moderate	Moderate	Moderate	Moderate
W2	110	30	4	4	Stable	Partly	Moderate	>25	>25	Moderate	Moderate	Moderate	Good
W3	145	70	4	4	Stable	Compacted	Poor	10 - 25	10 - 25	Poor	Poor	Moderate	Moderate
W4	120	75	3	3	Stable	Partly	Moderate	10 - 25	10 - 25	Moderate	Moderate	Moderate	Moderate
W5	140	80	7	6	Moderate	Uncompacted	Poor	<10	<10	Good	Moderate	Good	Poor
W6	120	95	4	4	Moderate	Uncompacted	Poor	<10	<10	Good	Poor	Moderate	Poor
W7	135	95	3.2	3.2	Stable	Uncompacted	Poor	>25	>25	Good	Moderate	Moderate	Moderate
W8	125	100	4	5	Moderate	Uncompacted	Moderate	<10	<10	Good	Good	Moderate	Poor
W9	105	100	3.5	4.5	Moderate	Uncompacted	Moderate	<10	<10	Good	Good	Moderate	Moderate
W10	110	100	3.2	3.2	Stable	Uncompacted	Moderate	10 - 25	10 - 25	Good	Good	Good	Moderate
D1	220	100	1.1	1.1	Stable	Uncompacted	Poor	>25	>25	Moderate	Poor	Good	Poor
D2	160	100	1.1	1.1	Stable	Uncompacted	Moderate	>25	>25	Moderate	Moderate	Good	Moderate
S1	180	75	0.3	0.4	Stable	Partly	Poor	10 - 25	10 - 25	Poor	Unsuitable	Poor	Unsuitable

NA – not applicable as these reaches inaccessible to salmon.

Appendix 3. Potential spawning habitats identified during survey

Section	Code	NGR	Area (m^2)	Washout risk	Suitability		Comment
					Salmon	Trout	
W1	W1.1	HU 40154 54253	5	No	Suitable	Suitable	Pool tail
W1	W1.2	HU 40111 54358	6	No	Suitable	Suitable	Tail of glide
W3	W3.1	HU 40124 54547	2	No	Poor	Suitable	Tail of glide. Further gravel and pebble areas are present but as thin layer on clay/earth.
W4	W4.1	HU 40129 54579	7	No	Suitable	Suitable	
W5	W5.1	HU 40143 54703	2	No	Suitable	Suitable	
W5	W5.2	HU 40121 54699	4	No	Suitable	Suitable	
W5	W5.3	HU 40096 54708	3	No	Suitable	Suitable	Run in to pool
W5	W5.4	HU 40082 54734	8	No	Suitable	Poor	Tail of pool below bridge and at upstream end of riffle
W6	W6.1	HU 40097 54783	2	No	Good	Good	Clean gravel and pebble
W6	W6.2	HU 40139 54795	14	No	Good	Good	5 patches in approximately 35m of stream
W6	W6.3	HU 40151 54800	30	Possible	Good	Good	Moderately stable. Good
W7	W7.1	HU 40127 54974	9	No	Suitable	Suitable	At run out of pool
W8	W8.1	HU 40138 56007	8	No	Suitable	Suitable	
W8	W8.2	HU 40141 55031	9	Possible	Suitable	Poor	Too coarse for most trout
W8	W8.3	HU 40162 55087	4	Yes	Suitable	Poor	Unstable. Risk of washout
D1	D1.1	HU 40070 54768	9	No	Good	Good	At upstream edge of bridge
D1	D1.2	HU 40076 54790	6	No	Suitable	Suitable	
D1	D1.3	HU 40043 54820	4	No	Suitable	Suitable	Further small patches might allow trout to spawn
D2	D2.1	HU 39987 54927	5	No	Suitable	Suitable	

Appendix 4.1 Electric fishing site and event details

Code	NGR	Location	Survey runs (n)	Length (m)	Width (m)	Voltage	Amps	Conductivity ($\mu S.cm^{-1}$)	Temp (°C)	Level	Colour
WEI1	HU 40526 57788	Start at tail of glide by tributary (right bank). Fish up to clear constriction.	1	86	1.2	190	0.5	89	11.2	Medium-high	Coloured
WEI2	HU 50510 56718	Downstream end marked by large red rock at right of channel (6m down from right bend).	1	43.5	3.1	160	0.5	110	10.0	Medium	Slight colour
WEI3	HU 40123 54207	Downstream end is 11 m up from post and rail fence (approx. 13 m up from footbridge).	3	38.5	3.3	160	0.6	163	11.0	Medium	Slight colour

Appendix 4.2. Instream habitats at quantitative electric fishing sites

Site	Depth in cm (% of wetted area)						Substrate (% of wetted area)									Flow types (% of wetted area)							
	<10	*11-20*	*21-30*	*31-40*	*41-50*	*>50*	*HO*	*SI*	*SA*	*GR*	*PE*	*CO*	*BO*	*BE*	*OB*	*SM*	*DP*	*SP*	*DG*	*SG*	*RU*	*RI*	*TO*
WEI1	0	5	10	15	50	20	10	0	5	10	50	20	5	0	0	0	20	0	10	0	70	0	0
WEI2	10	35	35	20	0	0	4	0	10	20	35	40	1	0	0	0	0	10	10	10	50	20	0
WEI3	5	15	20	35	20	5	0	0	5	10	30	40	15	0	0	0	15	5	0	0	60	20	0

Substrates: HO = high organic (peat); SI = silt; SA = sand; GR = gravel; PE = pebble; CO = cobble; BO = boulder; BE = bedrock; OB = obscured.
Flow types: SM = shallow marginal; DP = deep pool; SP = shallow pool; DG = deep glide; SG = shallow glide; RU = run; RI = riffle; TO = torrent.

Site	Cover left bank (% of bank length)				Cover right bank (% of bank length)				Cover in wider channel
	UC	DR	BA	MA	UC	DR	BA	MA	
WEI1	25	0	75	0	15	0	85	5	Poor
WEI2	20	0	80	0	5	0	95	0	Poor
WEI3	30	0	70	0	40	0	60	0	Moderate

Bankside fish cover: UC = undercut bank; DR = draped vegetation; BA = bare (no cover); MA = marginal vegetation (incl. tree roots).

Appendix 4.3. Depletions attained at fully quantitative survey site

Site	Number salmon fry			Number salmon parr			Number trout fry			Number trout parr		
	run 1	*run 2*	*run 3*	*run 1*	*run 2*	*run 3*	*run 1*	*run 2*	*run 3*	*run 1*	*run 2*	*run 3*
WEI3	16	8	8	9	6	2	22	8	6	6	2	1

Appendix 5. Habitat survey photographs

	Section W1 HU 4015 5426
	Section W1 Spawning substrates at HU 4011 5436
	Section W2 HU4017 5446

Appendix 5 contd.

	Section W2 HU 4015 5435
	Section 3 HU 4016 5448
	Section W3 HU 4017 5455

Appendix 5 contd.

	Section W4 HU 404015 5461
	Section W5 HU 4015 5470
	Section W5 HU 4100 5471

Appendix 5 contd.

	Burn of Weisdale Section W5 HU 4009 5472
	Burn of Weisdale Section W6 HU 4009 5477
	Burn of Weisdale Section W6 HU 4015 5483

Appendix 5 contd.

	Burn of Weisdale Section W6 Clean spawning gravels at HU 4015 5483
	Burn of Weisdale Section W7 HU 4012 5488
	Burn of Weisdale Section W7 HU 4012 5496

Appendix 5 contd.

	Burn of Weisdale Section W8 HU 4014 5503
	Burn of Weisdale Section W8 HU 4014 5507
	Burn of Weisdale Section W8 HU 4018 5511

Appendix 5 contd.

	Burn of Weisdale Section W9 HU 4019 5513
	Burn of Weisdale Section W9 HU 404020 5520
	Burn of Weisdale Section W10 HU 4022 5525

Appendix 5 contd.

	Burn of Weisdale Section W11 HU 4026 5538
	Burn of Weisdale Section W12 HU 4030 5543
	Burn of Weisdale Section W11 HU 4033 5558

Appendix 5 contd.

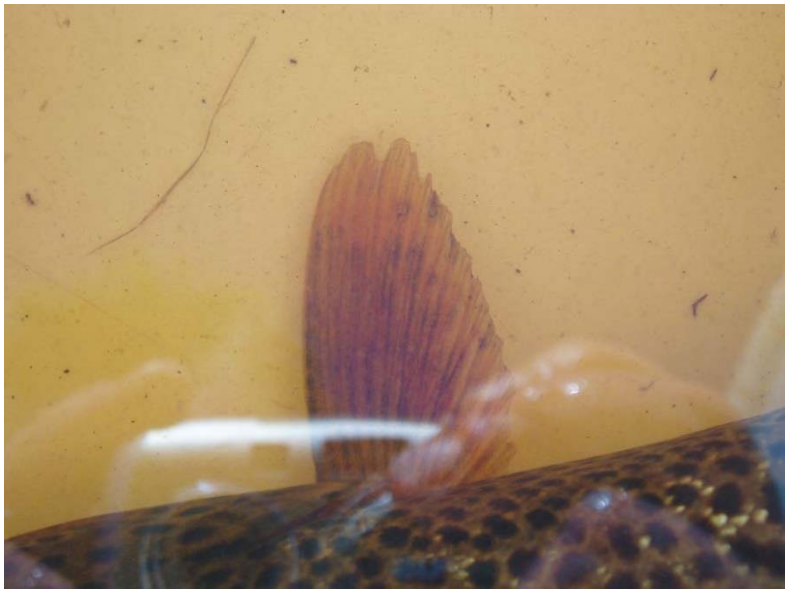
	Burn of Droswall Section D1 Spawning habitat at upstream edge of B9075 bridge (HU 4007 5477)
	Burn of Droswall Section D1 HU 4003 5485
	Burn of Droswall Section D1 Typical substrates of pebble, gravel and cobble HU 4003 5485

Appendix 5 contd.

	Burn of Droswall Section D2 HU 3995 5498

	Burn of Swirtars Section S1 HU 4027 5510

Appendix 6. Electric fishing site photographs

	WEI1 HU 40526 57788 From downstream
	WEI1 Adult sea trout with severe dorsal fin erosion due to sea louse grazing.
	WEI1 Adult sea trout pectoral fin (same individual as above). The round dark marks are symptomatic of infestation with sea lice.

Appendix 6. Electric fishing site photographs

	WEI2 HU 50510 56718 From downstream
	WEI2 Riffle at upstream end of site
	WEI3 HU 40123 54207 From downstream

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Appendix E. Freshwater Invertebrate Survey 2015

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APPENDIX E
KERGORD ACCESS TRACK ENVIRONMENTAL APPRAISAL REPORT

BURN OF WEISDALE FRESHWATER INVERTEBRATE SURVEY 2015

Report to: RPS Group

October 2015

Aquaterra Ecology




Aquaterra Ecology, Crombie Cottage, Aberchirder, Huntly, Aberdeenshire AB54 7QU

Kergord Access Track (Weisdale): Freshwater Invertebrate Surveys, October 2015.

1 Summary

1.1 Background

This survey was commissioned to assess the water quality and invertebrate communities of the Burn of Weisdale and tributary burns, as part of the environmental surveys required for a local planning application for the proposed Kergord Access Track associated with the Viking Wind Farm, Mainland Shetland, central Ordnance Survey (OS) grid reference HU 39810 56190. The survey is a repeat of part of the survey for the Viking Wind Farm (Aquaterra Ecology 2008). The key objectives of this survey were to provide:

- characterisation of the invertebrate community of the watercourses to species level highlighting any rarities or notable species present; and
- complete an assessment of the water quality of the watercourses using a range of biotic indices.

Macro-invertebrate communities were sampled using standard kick sampling methods (SEPA 2001, UKTAG 2008) from two sites, one on the Burn of Weisdale downstream of the existing B9075 road and one on the main tributary (formed by the Burn of Droswall, Burn of Scallafield and Black Burn), upstream of the road (Appendix 1). Sampling was conducted on the 10th October 2015.

Major groups (Malacostraca, Ephemeroptera, Trichoptera, Plecoptera, Mollusca, Odonata and adult Coleoptera) were identified to species level to establish presence of any rare species and to provide data for production of biological indices: Biological Monitoring Working Party (BMWP), Average Score Per Taxon (ASPT), Water Framework Directive (WFD) class, Water Chemistry Status and Index of Acidity.

Physical environmental variables including bed width, depth, flow and substrate profile were recorded at each site. GPS generated grid references and photographs were taken (Appendix 2) to enable future site identification.

1.2 Main Findings

- Invertebrate communities of the Burn of Weisdale and tributary largely consisted of common and widespread species typical of Scottish upland or rural watercourses and no rarities were identified.
- The invertebrate community, dominated by Ephemeroptera, Plecoptera and Trichoptera indicates that the water quality is good.
- Abundance, and diversity of macro-invertebrates as measured by taxon richness, was generally moderate. Macro-invertebrate communities may be depauperate as a result of Shetlands geographic isolation.
- The ASPT index indicated fair to good water quality with no significant organic pollution. This index may be affected by the low diversity of Shetland freshwater macroinvertebrates.
- The Water Chemistry Status was Class 1 indicating circum-neutral water chemistry and the Index of Acidity was Class II indicating slightly acidic conditions. Buffering is moderate and the watercourses are not significantly acidified.
- The Burn of Weisdale and tributary reach the WFD required standard of good for both the ASPT and Number of Taxa (NTAXA) parameters of the WFD ecological status class.
- Overall the invertebrates, environmental variables and indices were similar in 2015 to the previous survey of 2008, indicating that the invertebrate communities are stable, and the water quality, invertebrate communities and productivity of the Burn of Weisdale and tributary should support sustainable salmonid populations if other environmental factors are suitable.

2 Introduction

2.1 Bio-monitoring

Macroinvertebrates are a diverse group with a wide range of environmental tolerances and preferences and consequently communities exhibit both qualitative and quantitative responses to a spectrum of environmental changes (Sykes ***et al***. 1999). Aquatic invertebrate species can therefore be used as biological indicators to both broadly assess the general quality of freshwater burns and rivers, and to assess more specific chemical status, for example acidity. The production of biotic indices to assess water quality is an established method using the BMWP) and ASPT system. These scores were primarily developed for identifying organic pollution, but they are widely used as indicators of general stream health.

Acidification is a potential problem across large areas of upland Scotland, but evidence of ecological damage is mainly confined to fresh waters in Galloway, smaller areas of the Cairngorms and the western and central Highlands (SEPA 2006). Biotic indices can be used to overcome the difficulties associated with direct monitoring of pH, which tends to fluctuate markedly in acidic streams. Macroinvertebrates integrate recent (weeks to months) pH conditions at a site (Davy-Bowker ***et al***. 2005) and are therefore well suited for bio-monitoring where the sampling frequency is constrained. In general the relationship between the tolerance of most acid-sensitive invertebrates and that of salmonid fish is fairly close, although trout can survive slightly more acid conditions than some of the invertebrate indicators (Patterson and Morrison 1993).

Bio-monitoring is an important component of the classification of water bodies' ecological status for the WFD. River Invertebrate Prediction and Classification System (RIVPACS 4) has been used in the development of the River Invertebrate Classification Tool (RICT) available for online data input. RICT can be used to generate WFD classes of ecological status using a standard set of site specific environmental variables and observed values of TAXA and ASPT.

Assessment of macro-invertebrates can therefore both augment the interpretation of chemical analysis of water quality and monitor the biological consequences of changes in water chemistry. The recommended sampling periods are April-May and September-October. Greater resolution of indices is achieved through combined spring and autumn samples, although single sampling periods are also used.

Semi-quantitative abundance assessments of macro-invertebrates will also provide accurate characterisations of the community, and a measure of invertebrate diversity and productivity of the watercourse.

2.2 Objectives

The overall aim is to characterise the invertebrate communities and use the resulting data set to assess water quality using a range of biotic indices. The freshwater invertebrate survey of the watercourses provides:

i) a description of the macro-invertebrate community including species level identification in most major groups (Malacostraca, Ephemeroptera, Trichoptera, Plecoptera, Mollusca [excepting Sphaeriidae], Odonata and adult Coleoptera);

ii) BMWP and ASPT scores as an assessment of water quality (SEPA 2001);

iii) indices of acidity: Water Chemistry Status (Patterson & Morrison 1993) and Index of Acidity (Clyde River Purification Board 1995);

iv) WFD ecological status class for ASPT and NTAXA parameters;

v) semi-quantitative assessments of invertebrate abundance;

vi) a description of the environmental variables at each monitoring site including depth, width, flow, substrate profile, estimates of in-stream vegetation and canopy cover.

vii) recordings of temperature, pH, conductivity and alkalinity.

3 Methods

3.1 Field sampling

Sampling was based on standard kick sampling methodologies employed by Scottish Environment Protection Agency (SEPA 2001, UKTAG 2008). A 25cm wide kick sample net with a 1mm mesh was used at all sites. Sampling at sites was conducted in riffle-type habitat when available. Riffles are one of the most productive habitats in rivers and streams and are the standard habitat for water quality bio-monitoring (SEPA 2001).

The sampling procedure involved a total of three minutes of kick sampling at each site. Sampling covered the range of micro–habitats within the riffle area, for example moss covered stones and patches of fine sediment at stream edges. The net was held vertically, downstream from the sampler's feet and resting on the riverbed. The sampler disturbed the river bed vigorously with the heels, by kicking or rotating, to dislodge the substrate to a depth of about 10cm. Dislodged invertebrates were washed into the sampling net.

A further one minute period of hand sampling was carried out at all sites, searching on and under stones and rocks for attached invertebrates such as molluscs and cased caddis.

Samples from kicking and hand collecting were preserved together in 70% Industrial Methylated Spirits (IMS) in sealed plastic containers.

Kick samples are produced by timed effort sampling and are therefore semi-quantitative. Variations in the area kicked result from different individual approaches to sampling and from physical factors at each site such as substrate composition, depth and flow rate. The area kicked in the surveys will be estimated by the approximate distance travelled during kicking in metres multiplied by the width of the net. Although this is an approximation, it does facilitate comparison between sites within a watercourse and between watercourses if undertaken in a consistent manner.

In small burns with limited size of suitable riffles multiple riffles may be used to produce a composite sample. Where substrate and/or depth prevented kick sampling, timed sweep netting was employed.

3.2 Sites

Sites were accurately recorded using photographs (Appendix 2) and ten figure GPS generated grid references. Physical environmental factors including stream width, depth, flow and substrate profiles based on the Wentworth scale (Wentworth 1922) were recorded for the kick habitat. Width and depth were measured; substrate proportions and macrophyte cover were estimated by eye.

Temperature, pH and conductivity were recorded with a portable calibrated meter. Water samples were taken and total alkalinity was measured using a Hanna Alkalinity Test Kit H3811, smallest increment 3mg/L CaCO3. Data were recorded on standard fieldsheets.

3.3 Invertebrate identification

Invertebrates were examined using a Wild binocular microscope at 6-50X magnification and a Brunel compound microscope at 100X. Identification employed standard keys (Brooks & Lewington 1999; Dobson *et al* 2012; Edington & Hildrew 1995; Elliot 2009; Elliot & Humpesch 2010; Elliot, & Mann 1979; Foster & Friday 2011; Friday 1988; Gledhill *et el.* 1993; Hynes 1977; Killeen *et al.* 2004; Macan 1959; Macan 1977; Nilsson 1996, 1997; Reynoldson & Young 2000; Savage 1989; Savage 1999; Scourfield & Harding 1994; Smallshire & Swash 2010; Timm & Veldhuijzen van Zanten 2002 and Wallace *et al.* 1990).

Specimens from kick samples were identified to species level to provide data for a range of biotic indices.

Species were checked for rarities using the JNCC Taxon Designations spreadsheet (JNCC 2011). This includes all major conservation designations, for example 'Habitats Directive', 'Red Lists', UKBAP and the Scottish Biodiversity List.

3.4 BMWP and ASPT Indices

These scores were primarily developed for identifying organic pollution, but they are widely used as indicators of general stream health.

The scoring system is based on the pollution sensitivity of each invertebrate family. The scale is 1-10 and a score of 1 is allocated to the most pollution tolerant families and 10 to the most pollution sensitive (Appendix 3). The BMWP index is the sum of the group scores for the sample. The ASPT (Average Score Per Taxon) index is the average score for the groups present in the sample.

Low scores for the BMWP or ASPT indices indicate possible pollution; high scores indicate good water quality.

The physical nature of the watercourse and the sampling effort of different individual samplers can influence the BMWP score. ASPT is viewed as a more stable and reliable index of pollution.

The number of scoring taxa is also an indicator of water status. A fall in the number of taxa is a general index of ecological damage, including overall pollution encompassing organic, toxic and physical pollution such as siltation, and damage to the habitats or the river channel, (General Quality Assessment of Rivers, Environment Agency website). The indices are used to provide a classification of the watercourses, see Table i below.

Table i Simplified Scottish River Classification Scheme as used by SEPA.

Class	Description	BMWP	ASPT	Comments
A1	Excellent	≥85	≥6.0	Sustainable* salmonid population
A2	Good	70-84	5.0-5.9	Sustainable* salmonid population
B	Fair	50-69	4.2-4.9	Salmonids may be present
C	Poor	15-49	3.0-4.1	Fish may be present
D	Seriously Polluted	<15	<3.0	Fish absent or seriously restricted

* If other environmental variables are suitable

3.5 Water Chemistry Status

Patterson and Morrison (1993) developed a Definition of Classes for water chemistry status based on the presence of invertebrate indicator groups. Two indicator groups are used: Group 1 taxa normally with a tolerance of a minimum pH of 6.0 and Group 2 with a tolerance of a minimum pH of 5.5 (Appendix 4). Three classes were defined (Table ii).

Table ii. Water Chemistry Classes

Class	Description	Comment
Class 1	Circumneutral	Group 1 taxa present. The water chemistry is suitable for the great majority of plants and animals. Alkalinity should be sufficient to buffer against most acid spate waters and the mean pH is ≥6.0 and unlikely to drop below 5.6. Salmonid fish are not stressed by the water chemistry.
Class 2	Not significantly acidified	Group 1 absent, group 2 present. The water chemistry is suitable for all except the most sensitive taxa. The mean pH is likely to be 5.6 or above. Where heavy metal and aluminium levels are low and/or organic content is high mean pH could be as low as 5.3. The water chemistry is likely to be suitable for salmonid fish but such streams may be vulnerable to future acidification.
Class 3	May be acidified	Groups 1 and 2 absent. Water chemistry may be acid to the point where wildlife is significantly affected including reduction of invertebrate diversity and reduction of salmonid fish populations, especially salmon. Further survey and chemical analysis is recommended to improve the diagnosis.

3.6 Index of Acidity

An Index of Acidity Classes was developed by the Clyde River Purification Board as an indication of the probability and likely magnitude of acidification of freshwaters (Clyde River Purification Board

1995). Although developed for streams in Ayrshire and Argyll, the system has been applied by SEPA for more northern rivers and has shown good correspondence with juvenile salmon densities (Ian Milne, SEPA Dingwall, pers. comm.). As with the index of Water Chemistry Status, this index is based on the presence or absence of taxa with varying degrees of acid sensitivity from two lists, A and B (Appendix 4). For samples collected between May and October the definitions used are in Table iii:

Table iii. Index of Acidity Classes

Class	Description	Comment
Class I	Non-acid or slightly acid	At least three taxa from both Lists A and B present. Salmonid populations probably undamaged.
Class II	Intermediate	One or two List A taxa present or if List A taxa absent more than two List B taxa are present. Salmonid populations may show some signs of acid damage, for example reduced densities and missing or weak age classes.
Class III	Acid	List A absent and two or fewer List B taxa present. Trout populations reduced or absent and probably unable to sustain juvenile salmon.

3.7 Ecological Quality Index (EQI) and Water Framework Directive (WFD) Class

The WFD requires the assessment of the ecological status of water bodies, including a biological element. Parts of the assessment of the benthic invertebrate quality element are the parameters ASPT and NTAXA, sensitive to organic enrichment and also to toxic pollution. Assessment of the ASPT and NTAXA parameters is achieved using a set of reference sites largely unaffected by anthropogenic activity, established for RIVPACS. The RIVPACS methods were originally developed to use benthic macro-invertebrates to assess the biological quality of rivers by predicting macro-invertebrate fauna expected in the absence of major environmental stress (Wright *et al*. 2000). Using a standard set of environmental variables for sampling sites the observed invertebrates and resultant indices can be compared to predicted (expected) indices produced by RIVPACS. The resulting EQI values are the ratio of the observed to expected values (O/E) and this standardises biotic indices so that a particular value of EQI ratio implies the same ecological quality for that index, no matter what type of river or stream. The EQI values are used to produce the Ecological Quality Ratio (Eqr) and WFD class of the water body.

For the ASPT and NTAXA parameters the following classes are assigned from EQR values (Environment Agency 2011):

Table iv. ASPT and NTAXA status classification

Classification	ASPT	NTAXA
High	≥0.97	≥0.85
Good	0.86-0.96	0.71-0.84
Moderate	0.75-0.85	0.57-0.70
Poor	0.63-0.74	0.47-0.56
Bad	<0.63	<0.47

4 Results and Discussion

4.1 Sites

The grid references for sites are given in Table 1. Physical and chemical environmental variables are found in Table 2.

Land use in the study area is mainly sheep grazing and the intensification of this with the associated use of fertilisers and the possible erosion from high stocking densities have been identified as two areas of concern for water quality (Hardy 2004). The watercourses do not flow through any significantly populated areas and it is likely that anthropogenic pressures are limited.

The area largely has a solid geology of metamorphic Dalradian rocks with bands of limestone running in an approximately north to south direction; the erosion of one of these limestone bands has produced the Valley of Kergord through which the Burn of Weisdale flows. The rocks are overlaid with glacial till. These solid and drift geologies are important in determining the characteristics of the stream chemistries.

Both the Burn of Weisdale and the tributary burn are small with a wet width of <3m and a depth of <15cm on the sample day. The Burn of Weisdale catchment is small and the burn flows directly to the sea. The substrates of the run/riffles sampled were dominated by hard elements, with 80% cobbles and boulders at BW1 and 70% at BW2. The sites were open with no canopy cover and instream vegetation cover was low at 5% at BW1 and 11% at BW2. The macrophytes consisted of a mixture of bryophytes and algae.

4.2 Invertebrate Communities

The proportional abundances of invertebrate groups are shown in Figure 1 (expressed as percentages of the total population). The numbers of each species found in the samples are recorded in Appendix 5.

The categories in Figure 1 represent the groups Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddis flies), Diptera (two-winged flies) and 'Other'. The first three groups are generally intolerant of organic pollution. Diptera contains the chironomids, a group very tolerant of organic pollution or enrichment. The 'Other' Category contains a wide mixture of groups including Coleoptera (beetles), Mollusca, Crustacea, Oligochaeta (worms) and Hirudinea (leeches). They are mainly moderately tolerant of organic pollution.

Macro-invertebrate communities of flowing water typical of large areas of upland Britain are dominated by the aquatic stages of the insect orders Ephemeroptera, Plecoptera and Trichoptera (Ormerod *et al*. 1993).

Stoneflies are generally found in fast flowing, clean, cold well oxygenated streams and an abundance of mayflies is generally a sign of reasonably healthy and productive water (FIN Abundance and Indicator Taxa, Environmental Change Network website).

The families Heptageniidae and Baetidae and species from these families are consistently used as acid sensitive indicators and are known to be vulnerable to both chronic and episodic acidification (Merret *et al*. 1991, Ormerod *et al.* 1993, Patterson & Morrison 1993 and Rutt *et al*. 1990).

As the majority of species of Ephemeroptera, Plecoptera and Trichoptera (EPT) are pollution sensitive, a combined proportion of these taxa as a percentage of invertebrates present, is an indication of water quality. If EPT is >50% then water quality is likely to be good, 25-50% indicating moderate quality.

The mean proportion of EPT at BW1 was 60% and at BW2 was 67% indicating good water quality. It is not likely that the watercourses are organically polluted. In 2008 the respective proportions of EPT were 44% and 48%. The main change in 2015 was a greater proportion of Ephemeroptera represented by the common *Baetis rhodani*.

One important characteristic of the sites was the absence of some common and widespread families likely to be present in similar burns on the Scottish mainland. The main reason for this in lotic waters is probably the isolation of Shetland (Hardy 2004). Many islands have depauperate fauna in comparison to the nearest mainland. Low diversity was present in most groups, only one species of Ephemeroptera was present, two families of Plecoptera and four species of Trichoptera. 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, and the Ephemeroptera family Heptageniidae. 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.

Most species present were common and widespread such as the mayfly *Baetis rhodani*, the stonefly *Leuctra inermis* and the predatory caddis flies *Polycentropus flavomaculatus* and *Rhyacophila dorsalis*.

No rarities were identified and invertebrate communities largely consisted of common and widespread species typical of upland and/or rural Scottish watercourses. The water quality is likely to be good if the probable depauperate island character of the macro-invertebrate communities is considered.

4.3 Invertebrate Abundance and Diversity

Invertebrate abundance is shown numerically in Table 1 (total invertebrates per kick).

Invertebrate densities were 92 per m² kicked at BW1 and 284 per m² kicked in BW2.

It is difficult to assess diversity as a variety of taxonomic levels of identification have been used in scientific works and comparisons with other surveys are often invalid. Taxon richness (numbers of taxa present) was 19 at BW1 and 17 at BW2. Taxon richness is at the low end of moderate (15-25).

Comparison with 2008 is not possible as diversity and abundance were calculated from Surber or Hess samples.

4.4 BMWP and ASPT scores

BMWP and ASPT scores are summarised in Table 1. The scoring taxa recorded at each site are shown in Appendix 6.

The BMWP scores were 59 (Fair B) at BW1 and 72 (Good A2) at BW2. In 2008 the respective scores were 57 (Fair B) at both sites.

Generally ASPT scores are regarded as more reliable and these were 4.92 (Fair B) at BW1 and 5.14 (Good A2) at BW2. In 2008 the scores were 5.2 (Good A2) at both sites.

The water quality as measured by these indices remains consistent and the burns are not likely to have any significant organic pollution and are generally healthy.

4.5 Water Chemistry Status

The classifications are shown in Table 1 and the indicator groups recorded as present are listed in Appendix 7.

The Water Chemistry Status Class was 1 at both sites indicating likely circum-neutral water chemistry. This classification is the same as 2008.

4.6 Index of Acidity

The classifications are shown in Table 1 and the indicator species recorded as present are listed in Appendix 8.

Index of Acidity classifications were Class II at both sites indicating intermediate burns. Index of Acidity indices are generated by the presence/absence of a wide range of species. If diversity is reduced by factors other than acidification (possibly geographic isolation) then this scoring system may be unreliable. The classification is the same as 2008.

Morris (1987) found there was little evidence of significant acidification of Shetland streams and the water chemistry results and pH records of this survey support this.

4.7 Ecological Status Class for ASPT and NTAXA

The EQI and WFD ecological status scores are given in Table 3.

At site BW1 the ASPT parameter was classed as good (G) and at BW2 it was classed as high (H). The NTAXA parameter was classed high (H) at both sites. Both sites were classed high (H) in 2008 for both parameters.

SEPA classifies the Burn of Weisdale as moderate for ASPT and high for the NTAXA parameter (SEPA 2010). Ecological status classification conducted by SEPA is based on spring and autumn samples combined; this survey is based on single season autumn sampling.

The results of this survey indicates that the Burn of Weisdale and tributary should reach the WFD required standard of good for both the ASPT and NTAXA parameters. The overall indication is that these watercourses are not organically enriched and that the invertebrate element of stream biota was healthy in both 2008 and 2015.

4.8 pH, Conductivity and Alkalinity

pH, conductivity and alkalinity recordings are shown in Table 2.

The pH of small burns flowing through areas of peat may be considerably variable with increased acidity in times of high flows, these samples were taken as waters were returning to normal levels after a spate. The pH on survey days was 6.6 at BW1 and 6.4 at BW2 indicating these watercourses may be circum-neutral.

The typical range of conductivity for streams is 50 – 1500µS/cm with the optimum range for invertebrate diversity of 150 – 500µS/cm (Behar 1997). Conductivity was 138µS/cm at BW1 and 178µS/cm at BW2. Conductivity is related linearly to total dissolved solids (TDS), usually mineral salts. The low conductivity therefore suggests a low loading of TDS and the watercourses are unlikely to be polluted by substances containing mineral salts.

Akalinity is a measure of the degree to which a waterbody can resist change to pH, known as the buffering capacity. In the summary of river typography used in river macrophyte classification the United Kingdom Technical Advisory Group (UKTAG) classifies alkalinity as low (<10mg/L $CaCO_3$), moderate (10-50), high (50-200) and very high (>200). The US Environmental Protection Agency classes watercourses with alkalinity levels of <20mg/L $CaCO_3$ as sensitive to acid rain.

Alkalinity was moderate, 25mg/L $CaCO_3$ at BW1 and 60mg/L $CaCO_3$ at BW2. The buffering capacity of the Burn of Weisdale and tributary is moderate and they are unlikely to be vulnerable to episodic acidification.

5 Assessment

5.1 Invertebrate Community

Invertebrate species found were mostly common and widespread and the communities generally had moderate abundance and taxon richness. Taxon richness is generally low in Shetland watercourses and this may be the result of the isolation of Shetland (Hardy 2004). Islands may have depauperate fauna when compared to the nearest mainland.

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. SEPA have found the monitoring results of RIVPACS unreliable in Shetland because of low diversity (David Okill, pers comm. 2008).

With this caveat the overall invertebrate communities and indices indicated there was no significant organic pollution or acidification and that the Burn of Weisdale and the tributary burn are healthy and well-oxygenated with low anthropogenic impacts. The water quality, invertebrate communities and productivity should support sustainable salmonid populations, if other environmental factors are suitable.

Overall the invertebrates, environmental variables and indices were similar in 2015 to the previous survey of 2008 indicating that the invertebrate communities are stable

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Table 1 *Biological Monitoring Scores and Classifications*

Watercourse	Sample/ Site Code	Grid Reference		Sampling date	Total invertebrate abundance (n)	Number of Taxa Present	BMWP score	Number of scoring taxa (n)	ASPT score	Index of Acidity	Water Class
		East	North								
Burn of Weisdale	BW1	39973	55004	10/10/2015	147	19	59	12	4.92	II	1
Burn of Weisdale tributary	BW2	40085	54728	10/10/2015	404	17	72	14	5.14	II	1

Table 2 *Environmental variables: Kick samples*

Site Code	Wet width m	Bed width m	Depth 1/4 cm	Depth 1/2 cm	Depth 3/4 cm	HO %	SI %	SA %	GR %	PE %	CO %	BO %	BE %	clarity cm	flow	speed ms^{-1}	canopy %
BW1	1.3	1.7	12	15	15	0	0	2	3	15	70	10	0	40	run/riffle	0.7	0
BW2	3.0	3.0	10	10	15	0	0	2	8	20	65	5	0	40	run/riffle	0.9	0

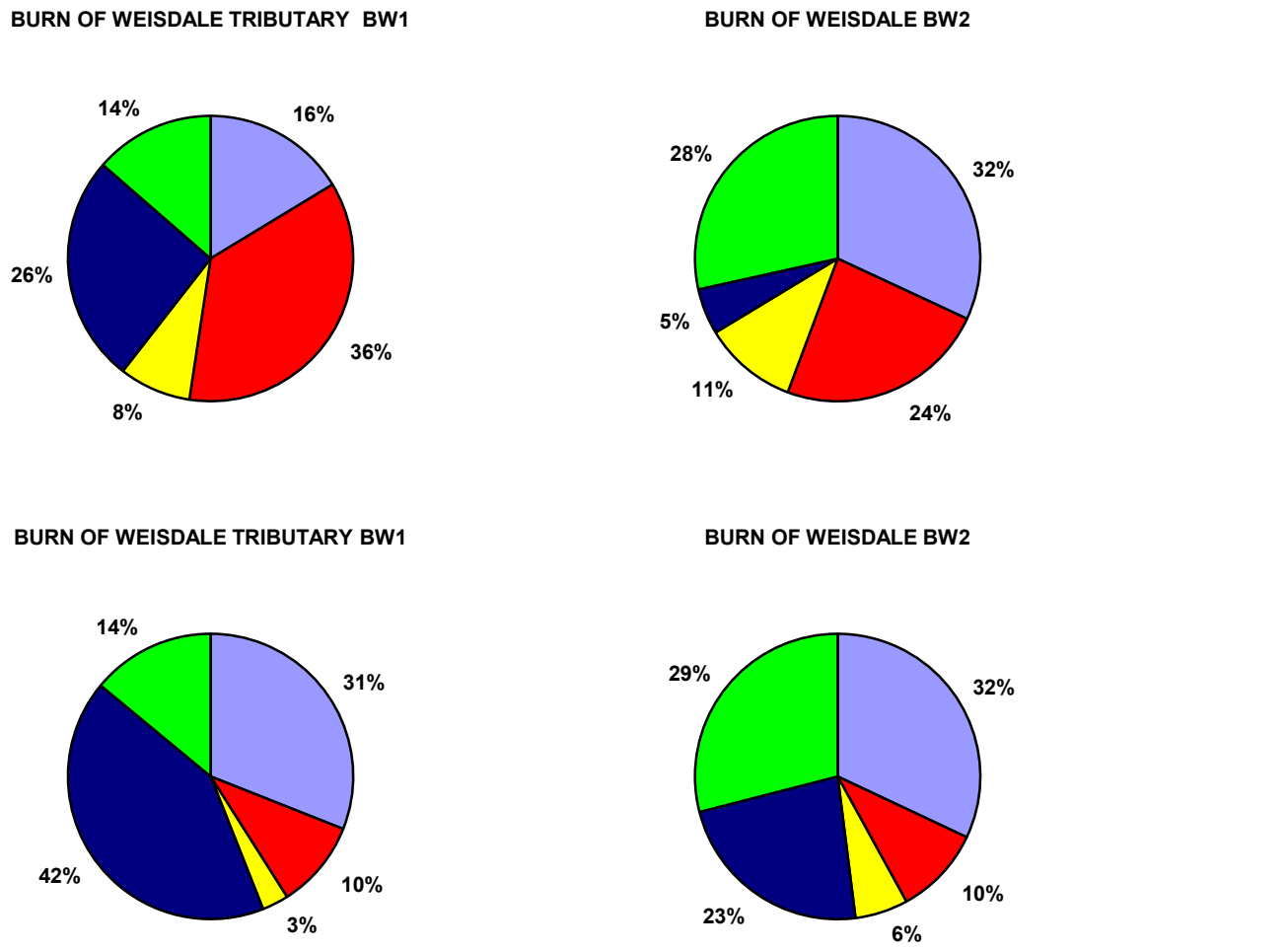
HO = High Organic SI = silt SA = sand GR = Gravel PE = Pebble CO = Cobble BO = Boulder BE = Bedrock

Site Code	Temperature °C	pH	Conductivity µS/cm	Alkalinity mg/L $CaCO_3$	Vegetation Cover %	Vegetation composition
BW1	11.8	6.60	138	25.0	5	5% Bryophytes, Algae mixed
BW2	12.2	6.40	178	60.0	11	5% Bryophytes, 5% Algae, 1% Vascular.

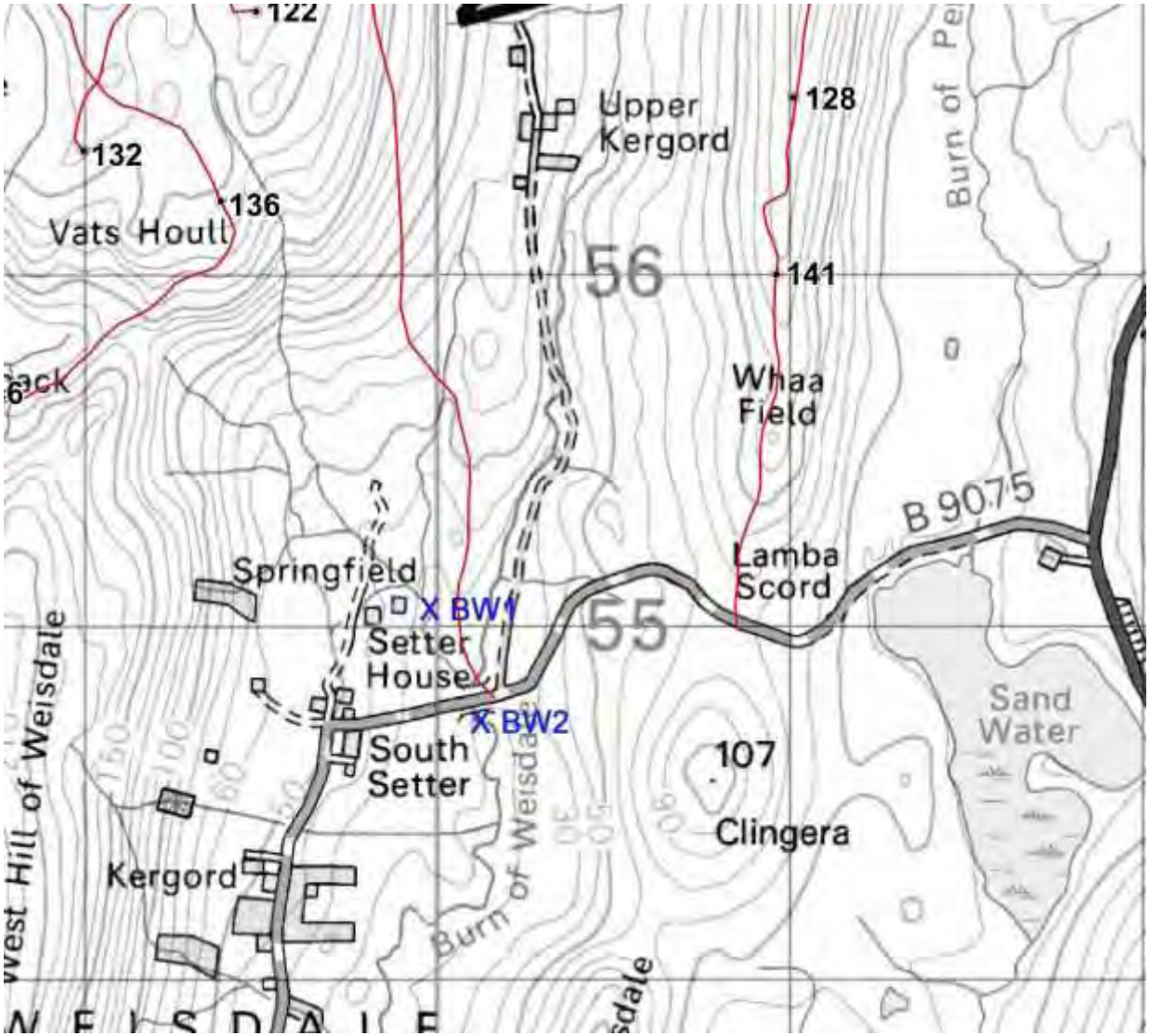
Table 3 *Ecological Quality Index and Water Framework Directive Ecological Status Class for ASPT and NTAXA*

Site	Index	Observed	Reference Adjusted Expected	Average (Bias corrected) EQI	Eqr factor	Average Face value Band Eqr	Most Probable Class	Probability of Most Probable Class (%)
2015								
BW1	ASPT	4.92	5.1	0.971	0.9643	0.937	G	53.92
	NTAXA	12	11.845	1.156	0.9573	1.106	H	90.56
BW2	ASPT	5.14	5.105	1.011	0.9643	0.975	H	53.45
	NTAXA	14	11.906	1.318	0.9573	1.261	H	98
2008								
BW1	ASPT	5.2	4.128	1.258	0.9643	1.213	H	99.56
	NTAXA	11	9.212	1.379	0.9573	1.32	H	97.62
BW2	ASPT	5.2	4.129	1.258	0.9643	1.213	H	99.55
	NTAXA	11	9.222	1.378	0.9573	1.319	H	97.6

Figure 1 *Invertebrate groups: percentages of sample by number, 2015 above, 2008 below*



Appendix 1 *Approximate Sampling Locations*



Appendix 2 *Site photographs*

Burn of Weisdale tributary BW1

Burn of Weisdale BW2

Appendix 3 *Pressure sensitivity (BMWP) Scores for Individual Taxa*

Common Name	Family	BMWP Score	Common Name	Family	BMWP Score
Flatworms	Planariidae	5	Bugs	Mesoveliidae	5
	Dendrocoelidae	5		Hydrometridae	5
Snails	Neritidae	6		Gerridae	5
	Viviparidae	6		Nepidae	5
	Valvatidae	3		Naucoridae	5
	Hydrobiidae	3		Aphelocheiridae	10
	Lymnaeidae	3		Notonectidae	5
	Physidae	3		Pleidae	5
	Planorbidae	3		Corixidae	5
Limpets and Mussels	Ancylidae	6	Beetles	Haliplidae	5
	Unionidae	6		Hygrobiidae	5
	Sphaeriidae	3		Dytiscidae	5
Worms	Oligochaeta	1		Gyrinidae	5
Leeches	Piscicolidae	4		Hydrophilidae	5
	Glossiphoniidae	3		Clambidae	5
	Hirudididae	3		Scirtidae	5
	Erpobdellidae	3		Dryopidae	5
Crustaceans	Asellidae	3		Elmidae	5
	Corophiidae	6		Chrysomelidae	5
	Gammaridae	6		Curculionidae	5
	Astacidae	8	Alderflies	Sialidae	4
Mayflies	Siphlonuridae	10	Caddisflies	Rhyacophilidae	7
	Baetidae	4		Philopotamidae	8
	Heptageniidae	10		Polycentropidae	7
	Leptophlebiidae	10		Psychomyiidae	8
	Ephemerellidae	10		Hydropsychidae	5
	Potamanthidae	10		Hydroptilidae	6
	Ephemeridae	10		Phryganeidae	10
	Caenidae	7		Limnephilidae	7
Stoneflies	Taeniopterygidae	10		Molannidae	10
	Nemouridae	7		Beraeidae	10
	Leuctridae	10		Odontoceridae	10
	Capniidae	10		Leptoceridae	10
	Perlodidae	10		Goeridae	10
	Perlidae	10		Lepidostomatidae	10
	Chloroperlidae	10		Brachycentridae	10
Damselflies	Platycnemidae	6		Sericostomatidae	10
	Coenagriidae	6	True flies	Tipulidae	5
	Lestidae	8		Chironomidae	2
	Calopterygidae	8		Simuliidae	5
Dragonflies	Gomphidae	8			
	Cordulegasteridae	8			
	Aeshnidae	8			
	Corduliidae	8			
	Libellulidae	8			

Appendix 4 *Acid intolerant indicators: Water Chemistry Status Groups and Index of Acidity Lists*

Water Chemistry Status

Species	Normal Minimum pH
Group 1	
Gammarus pulex	≥ 6.0
Glossosoma & Agapetus spp.	6.0
Ancylus fluviatilis	6.0
Radix balthica	6.0
Asellus aquaticus	6.0
Group 2	
Hydropsyche sp.	5.5 - 6.0
Baetis sp.	5.5 Occasionally 5.2
Heptageniidae	5.5 Occasionally 5.2

Index of Acidity

List A taxa (absent at pH <6.0)	List B taxa (absent at pH <5.5)
Gammarus pulex	*Baetis rhodani*
Radix balthica	*Rhithrogena semicolorata*
Ancylus fluviatilis	*Ecdyonurus spp.*
Potamopyrgus jenkinsi	*Electrogena lateralis*
Baetis scambus	*Perlodes microcephala*
Alaites muticus	*Chloroperla bipunctata*
Caenis rivulorum	*Hydraena gracilis*
Serratella ignita	*Hydropsyche pellucidula*
Perla bipunctata	
Dinocras cephalotes	
Esolus parallelipipidus	
Glossosoma spp.	
Agapetus spp.	
Hydropsyche instabilis	
Silo pallipes	
Odontocerum albicorne	
Philopotamus montanus	
Wormaldia sp.	
Sericostoma personatum	

Appendix 5 *Invertebrate numbers present in kick samples*

Sample Code	BW1	BW2
Plecoptera		
Chloroperlidae		
Chloroperla torrentium		4
Leuctridae		
Leuctra sp.	8	16
Leuctra inermis	16	109
Ephemeroptera		
Baetidae		
Baetis rhodani	53	96
Trichoptera		
Hydropsychidae		
Hydropsyche sp.	1	3
Hydropsyche siltalai	1	1
Limnephilidae		
Potamophylax latipennis	5	2
Polycentropidae		
Polycentropus flavomaculatus	2	16
Rhyacophilidae		
Rhyacophila dorsalis	3	21
Diptera		
Chironomidae	26	20
Empididae	7	
Pediciidae		
Dicranota sp.	1	
Pedicia sp.	1	
Simulidae	3	1
Coleoptera		
Hydraenidae		
Hydraena gracilis		13
Scirtidae		
Elodes sp.	1	1
Mollusca		
Hydrobiidae		
Potamopyrgus antipodarum	1	
Lymnaeidae		
Radix balthica	1	5
Sphaeriidae		
Pisidium sp.		1
Hirudinea		
Erpobdellidae		
Helobdella stagnalis		5
Oligochaeta		
Enchytraeidae	12	
Lumbricidae	4	90
Lumbriculidae	1	

Appendix 6 *BMWP, ASPT indicator groups present in kick samples with scores*

	Sample Code	BW1	BW2
Plecoptera	Chloroperlidae		10
	Leuctridae	10	10
Ephemeroptera	Baetidae	4	4
Trichoptera	Limnephilidae	7	7
	Polycentropidae	7	7
	Rhyacophilidae	7	7
Diptera	Chironomidae	2	2
	Simulidae	5	5
	Tipuloidea	5	
Coleoptera	Hydraenidae		5
	Scirtidae	5	5
Mollusca	Hydrobiidae	3	
	Lymnaeidae	3	3
	Sphaeriidae		3
Hirudinea	Erpobdellidae		3
Oligochaeta		1	1

Appendix 7 *Water Chemistry indicator groups and species present in kick samples*

Sample code	BW1	BW2
Group 1		
Radix balthica	✓	✓
Group 2		
Baetis rhodani	✓	✓
Hydropsychidae	✓	✓

Appendix 8 *Index of Acidity indicator groups and species present in kick samples*

Sample code	BW1	BW2
List A		
Radix balthica	✓	✓
Potamopyrgus antipodarum	✓	
List B		
Baetis rhodani	✓	✓
Hydraena gracilis		✓