Viking Energy Partnership

Viking Energy Windfarm, Shetland
Abnormal Indivisible Load Transportation Assessment
May 2008

Halcrow Group Limited

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01	00	Initial draft	12.10.08	CJA
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Contents

1 Introduction

1.1 Introduction

Viking Energy Partnership is applying for permission to construct and develop a windfarm development on the mainland of Shetland, located north of Lerwick and south of Sullom Voe. Halcrow Group Ltd has been appointed to undertake an assessment of ports and road facilities and conditions with regard to the movement of turbine equipment to the site.

This report will consider the most appropriate port of arrival for the turbine equipment, and will consider which route(s) are appropriate for the onward transportation of these items to the windfarm access locations.

1.2 Study Area

The proposed windfarm development is located north of Lerwick, the main population and administration centre of the Shetland Islands. The areas under consideration form four quadrants, split by the A970/A968 on a North to South axis, and the natural narrowing between Voe and Laxo on an East West axis.

The development comprises a total of 150 wind turbines distributed across the four quadrants as shown in Table 1-1. Figures 4.1.1 and 4.1.2 at the end of this chapter show the site layouts.

Table 1-1: Numbers of Turbines

Quadrant	Number of Turbines
North East	8
South East	62
South West	47
North West	33
Total	150

1.3 Proposed Turbine Equipment

The development proposal is for 150 turbines to be constructed. It is expected that the equipment to be installed will be the Siemens 3.6MW capacity turbine facility. For each turbine, the following components are required;

- Tower Sections – 3 per turbine installation, each up to 35m height
- Blades – 3 per installation, each at 52m length
- Nacelle – 1 per installation – when loaded on trailer, 250 tonnes Gross Vehicle Weight

Appendix A contains the General Requirements for the transportation of such equipment, as provided by Siemens Wind Power A/S.

1.4 Summary

This report will consider and identify the most appropriate port facility to unload and tranship turbine equipment. It will then identify the preferred road transportation routes for the onward road transportation to the site access point(s).

This report does not contain any structural assessments of structures on the roads network, but will identify locations where such assessments may be required.

2 Government Policy Requirements

2.1 Introduction

This chapter sets out the legislative requirements for the movement of Abnormal Indivisible Loads.

2.2 Definition of an Abnormal Indivisible Load (AIL)

The Scottish Government is the authority to whom applications for Special Order category AIL movements are made, acting in turn on behalf of the Department for Transport (DfT)/Highways Agency Abnormal Loads team.

The DfT state that the strict definition of an AIL refers to a load which cannot, without undue expense or risk of damage, be divided into two or more loads for the purpose of carriage on roads and which, owing to its dimensions or weight, cannot be carried on a vehicle which complies in all respect with the 'standard vehicle regulations. ' These regulations are:

- The Road Vehicles (Construction and Use) Regulations 1986 (as amended);
- The Road Vehicles (Authorised Weight) Regulations 1998 (as amended) and;
- The Road Vehicles Lighting Regulations 1989 (as amended)

All equipment should be stripped of their ancillaries before they are transported. Further dismantling is only likely to be acceptable to the DfT and Scottish Government where it cannot be economically achieved to the requirement to construct to extremely high tolerances within specific factory environments.

2.3 Legislation

Conventional heavy goods vehicles have an operating weight limit of 44 tonnes. The category known as abnormal indivisible loads covers those vehicles where the gross weight exceeds 44 tonnes. An Abnormal Load is defined as that which cannot be carried under Construction and Use (C&U) Regulations. Items which, when loaded on the carrying vehicle exceed the weights encompassed by the C&U Regulations, but do not exceed Special Order Permission Limits are governed by Special Types General Order (STGO) categories 1 to 3 depending on size.

Where dimensions exceed 6100mm in width, 30000mm in rigid length or 150 tonnes gross weight, Special Order from the Scottish Government (on behalf of the Highways Agency) is required.

DfT have stated that heavy loads have the potential to damage roads and bridges and the low speed and physical dimensions pose problems of traffic congestion to other road users. To ensure the safety of structures each highway authority and bridge owner must be notified prior to the load being moved. Consultation with other stakeholders such as Police Authorities on the suitability of the proposed route, and whether loads need to be escorted is also an important consideration when designing the mitigation to minimise traffic disruption and ensure the safety of other road users.

The bridge structures on the road network are usually capable of carrying general haulage lorries of up to 44 tonnes gross vehicle weight, which is the maximum weight permitted in the Roads Vehicles (Authorised Weight) Regulations 1998. Vehicles in excess of this gross weight are permitted onto the highway subject to special authorisation procedures.

For legal purposes, the transportation of abnormal loads can be divided into three broad categories. Regulations controlling the dimensions of vehicles and their loads are set out in the Road Vehicles (Construction and Use) Regulations 1986

Notification to the Police is required when the load exceeds 3.0metres in width or 18.65 metres in length. Provided the authorised weight limits are adhered to then loads of up to 30.0 metres in length and up to 4.3 metres wide are permitted subject to notification to the police authorities throughout the whole route to be traversed. The fitting of specified marker boards to advise other road users of the nature of the transport arrangements is also a stipulated requirement.

Those with a requirement to transport indivisible loads at weights in excess of 44 tonnes and up to a maximum of 150 tonnes are required to provide either two or five days notification, dependent on various weight categories, in writing to each and every highway authority and bridge owner on the proposed route. Loads in excess of 4.3 metres and up to 5.0 metres width are authorised subject to meeting certain conditions, and for those between 5.0 and 6.1 metres an additional notification process (VR1 application) to the Scottish Government is required. This is a similar authorisation process to the requirement for Special Order movements, but without the detailed route clearance procedures necessary there.

These rules are set out in the Road Vehicles (Authorisation of Special Types) (General) Order 2003. These regulations, commonly referred to as STGO regulations, were revised in August 2003.

AIL vehicles up to 150 tonnes gross weight are subject only to the appropriate highways authority(s) and police notification. Thee vehicles are classified as:

- Category 1: up to 46 tonnes gross weight;
- Category 2: up to 80 tonnes gross weight
- Category 3: up to 150 tonnes gross weight.

For loads longer than 30.0 metres, exceeding 6.1 metres in width or above 150 tonne gross weight then a separate Special Order process is carried out and is administered now by the HA, although applications in Scotland are still made to the Scottish Government's Bridges Section. The Scottish Government co-ordinates approaches to the structural authorities throughout the route and sanction to move is only granted once clearance is provided by the owners of structures en-route. This process requires eight weeks prior notification and is often protracted due to the need for specific bridge or other structural assessment.

In summary, vehicles loaded to more than 150 tonnes, 30.0 metres length or 6.1 metres width are subject to specific route planning and authorisation by the HA, whereas vehicles loaded to between 44 and 150 tonnes are subject to HA and Police notification only.

2.4 DfT / Scottish Government Policy on the Movement of Special Order Category Loads

The DfT has adopted a 'water-preferred' policy for the transport of AILs. This means that, where an application is sought for the movement of a Special Order or VR1 category load (more than 5.0m width) by road, the Department, via its executive agency (the Highways Agency) turn down the application where it is feasible for a coastal or inland waterway route to be used instead of road.

The HA advise that this decision is based on a number of factors including whether the load is divisible, the availability of a suitable route, the amount of traffic congestion that is likely to be caused and the justification for the load to be moved.

The HA Traffic Division is the department responsible for the authorisation of Special Order AILs and government policy is that the closest available port of access should be used for the delivery of such oversize items. As previously stated, within Scotland this process is facilitated by the Scottish Government.

2.5 Summary

It is considered that turbine blades and tower sections will require to be moved under a Special Order, as they will be in excess of 30m in length. The nacelle/transformer unit for each turbine will be the heaviest items to be moved, and these are expected to form a 220 tonne gross vehicle weight load, with axle loadings of approximately 14 tonne. These will also require a Special Order.

The Scottish Government has not been approached regarding their requirements for any Special Order deliveries for the proposed Viking windfarm development. It is the intention of this report to demonstrate that such loads can be shipped to a suitable port facility on Shetland, and can be successfully moved from the port to the site accesses by road in keeping with Scottish Government policy and the regulations surrounding the movement of AILs.

It should be noted that Shetland Islands Council are the only roads authority for the road network to be utilised, and that there are no other bridges or structures under the ownership of other statutory agencies (such as Network Rail or British Waterways Board). It would be considered beneficial for all AIL loads to arrive at one port facility to avoid duplication in the provision of craneage and hard standing areas, and to allow a single, suitable AIL route from the port facility to the site access points to be approved.

3 Port Of Arrival

3.1 *Introduction*

This chapter will consider the characteristics of several port facilities on Shetland, with regard to the berthing and offloading of turbine equipment.

Several potential port facilities were identified, these being:

- The construction jetty at Sullom Voe Oil Terminal;
- Sella Ness (opposite the Sullom Voe Oil Terminal);
- Greenhead Base, Lerwick; and
- Dales Voe Base, Lerwick

Scalloway was considered, but rejected because it was much more environmentally sensitive and created significantly greater community severance than the alternatives.

Other quays and jetties were rejected without detailed examination because they were only accessible using local access roads, and they are regularly used by lifeline local ferry services. A further potential port on the island of Unst was rejected because of the need for further ferry crossings to reach the Shetland Mainland.

Consultation was undertaken with the respective port operators to examine the capabilities of these facilities to handle the turbine equipment identified in Chapter 1.

Among the criteria examined were:

- Draft for berthing
- Craneage facilities, or potential for locating craneage;
- Laydown or hard standing areas and security
- Suitability for handling nacelles, tower sections and blades
- Hours of operation / conflict with other operations.

3.2 *Sullom Voe Construction Jetty (Shetland Islands Council – Ports & Harbours Operations)*

This facility is located immediately adjacent to, but outwith, Sullom Voe Oil Terminal in the east of Sullom Voe. This facility is operated by Shetland Islands Council, Ports and Harbours. The jetty was constructed to permit the development of the neighbouring Sullom Voe Oil Terminal, and is currently used for projects associated with the oil terminal.

(a) This facility has a datum of 9.0m depth for berthing vessels. The jetty is constructed for heavy-lift operations with a designated hard-pad for crane operations. There is no dedicated heavy lift crane at this jetty, but cranes can be sourced from local handling companies. Approximately 85m of quayside is available on the outer side of the jetty.

(b) Lay-down areas are available, and there is a possibility of longer term storage being available immediately adjacent to the east of the quay on reclaimed land (subject to SIC Ports and Harbours confirming weight/strength).

(c) The construction jetty can be made available for operations on a 24 hour basis. The operator discussed potential future commitments at this jetty in relation to projects on behalf of BP, the operators of Sullom Voe Oil Terminal, but did not expect any conflict to arise, due to the timescales being discussed.

(d) It was considered that the Construction Jetty would be suitable for handling nacelles, towers and blades.

(e) A lockable gate on the access road provides security to the site, although increased security could be provided. There are no buildings on the area occupied by the Construction Jetty.

(f) Immediately adjacent to the construction jetty on the inner side is a concrete ramp which can be used for ro-ro operation should this type of operation be required.

(g) Vehicles departing the jetty negotiate a sweeping right hand bend on an upward incline, and travel along an unclassified access road without undue horizontal or vertical alignment issues, which also serves Sullom Voe Oil Terminal. The road joins the B9076 approximately 1.75km to the east of the jetty at a wide priority junction.

3.3 Sella Ness Tug Jetty, Jetty (Shetland Islands Council – Ports & Harbours Operations)

This facility lies in the east of Sullom Voe, on a headland between Garths Voe and Voe of Skatska., and is also owned and operated by Shetland Islands Council, Ports and Harbours. There are several piers available at this long established port facility. Only one jetty was considered suitable for use in association with this windfarm proposal, known as the Tug Jetty.

(a) The Tug Jetty has a depth of water varying from 4.5m to 13.0m available, and approximately 80m of quayside available. The jetty does not have a designated hard-pad area for heavy-lift operations, and is not structurally secure enough to permit such operation.

(b) No cranes are available on-site, but cranes can be sourced from local handling companies. Short-term lay-down areas are available on the

quayside, and longer-term storage can be available close to the jetty, either on land currently in the ownership of the operator, or the adjacent industrial estate area operated by Highland and Islands Enterprise. A minor constraint to storage on the H&IE land is the proximity of Skatska Airport.

(c) The Tug Jetty can be made available 24 hours a day, and no long term commitments or constraints to use were identified.

(d) Given the lack of a hard-pad, this jetty is considered suitable for the unloading and handling of tower sections and blades but not turbine nacelles.

(e) The Tug Jetty can be secured, but other port activity prevents dedicated security; the long-term storage area can be fully secured. A currently unoccupied office building could be made available within boundaries of the operator's control, if required.

(f) There is no facility for ro-ro operations at this site.

(g) Vehicles departing Sella Ness use the port access road, which is flat, but features a left hand bend where lighting columns will require to be relocated to accommodate the turning requirements of blade carrying trailers. A cattle grid is crossed on the port boundary, which can be covered by steel plate. The access road joins the B9076 at a wide priority junction with good visibility, although the geometry would require to be altered slightly to allow Abnormal Indivisible Loads to turn left or right onto the B9076

3.4 Greenhead Base, Lerwick (Lerwick Port Authority)

This facility occupies the northern part of Lerwick waterfront, and is owned and operated by the Lerwick Port Authority. The site has a history of heavy-lift operations in support of the oil industry, with previous lifts of 350 tonne having been undertaken.

(a) Approximately 600m of quayside is available at this site, with 7.5m+ depth for deep water vessels, and heavy-lift facilities are available.

(b) No dedicated cranes are available on-site, but cranes can be sourced from local handling companies. Lay-down sites are available within the port facility, although space is constrained by other port and oil related activity undertaken by existing tenants of the site. Currently, an area immediately to the north of the base is being reclaimed, which will provide approximately 40 acres additional lay-down or long-term storage.

(c) Operations at Greenhead Base can take place 24 hours a day if required.

(d) It was considered that the Greenhead Base would be suitable for handling nacelles, towers and blades.

(e) Specific areas of the base can be made secure if required.

(f) There is no facility for ro-ro operations at this site.

(g) Vehicles departing Greenhead Base use port access roads to join the public highway, climbing up from the port. There is a T-junction layout with traffic to/from the Base having priority. This road then passes through the Gremista industrial estate, which features side arms and accesses to industrial and commercial deport, progressing onwards to join the A970 at the northern outskirts of Lerwick.

3.5 Dales Voe Base, Lerwick (Lerwick Port Authority)

This facility lies on Dales Voe, around the Kebister Ness headland from the approaches to Lerwick Harbour, and is owned and operated by the Lerwick Port Authority. The facility was constructed in the early/mid 1980s, although fluctuating oil markets means that the site has had limited operation over the years.

(a) 56m of quayside are available, although much longer vessels can tie-up alongside, and there is a 12.5m deep water depth available, with no tidal extremes. The facility is capable of heavy-lift operations.

(b) There is currently approximately 15,000m2 of set-down and storage available, and this area is currently being expanded.

(c) Operations at Dales Voe can take place 24 hours a day if required.

(d) It was considered that the Dales Voe would be suitable for handling nacelles, towers and blades.

(e) The base is currently secured, and there are no conflicting operations projected.

(f) There is no facility for ro-ro operations at this site.

(g) Vehicles departing Dales Voe Base use a 7.5m A-class specification road which climbs gently from the base. There is one short stretch of carriageway which features a tighter bend and a sharp summit. The road then continues south to join the access road to the Greenhead Base. At this junction traffic to and from the Greenhead Base have priority, although the geometry of the junction suggests that the Greenhead access is the 'side arm' of the junction. The road then passes through the Gremista industrial estate, which features side arms and accesses to industrial and commercial deport, progressing onwards to join the A970 at the northern outskirts of Lerwick.

3.6 Roll-on Roll-off Operations

There are two potential sites available for ro-ro operations, should components (particularly nacelles) be shipped on a suitable trailer/bogie arrangement.

The first site is immediately adjacent to the Sullom Voe Construction Jetty, where there is a concrete ramp available. Although a structural assessment has not been undertaken, it is understood from Shetland Islands Council – Ports & Harbours Operations that this facility has been used for large, heavy items in the past, and should be capable of accepting loads as proposed in this study.

The second ro-ro option is to use the facility at the Holmsgarth ferry terminal within Lerwick, as proposed by Lerwick Port Authority. This link-span facility has been used in the past for abnormal indivisible loads, but the weight tolerances have not been established. This facility is also in daily use by the commercial ro-ro ferry services to and from the mainland of Scotland

Of the two ro-ro options, the Sullom Voe Construction Jetty offers the better alternative, as it would not be in competition for operational use, and it allows loads to progress directly onto the spine road network, rather than having to travel through northern Lerwick.

3.7 Craneage Facilities

Heavy-lift cranes with the capacity to undertake the lifts associated with turbine equipment are commercially available from handling companies in Shetland. At present, there is unlikely to be the capacity to provide a dedicated heavy-lift crane at any port facility for the duration of the turbine construction period.

Local companies may be prepared to invest in a dedicated crane to service this project, alternatively the construction company may prefer to make their own arrangements, bearing in mind that such a crane is also required on-site to undertake the lifting and erection of the turbines.

3.8 Summary

The sections above provide a summary of the facilities available at the ports considered.

A gravity model was developed to consider the route kilometerage involved in servicing the various Site Access points with turbine equipment. A proxy distance from the arrival on public highway was taken for the northern and southern access ports, and the number of turbines delivered to each access point was calculated. Then the distance was multiplied by the number of loads required to show a total kilometerage for Abnormal Indivisible Loads from Sella Ness/Sullom Voe and from Greenbank/Dales Voe.

This gravity model is shown as Table 3-1. This demonstrates that Sella Ness/Sullom Voe is the closest port in terms of the number of vehicle loads required to construct the 150 turbines across the four quadrants, using five Site Access locations.

Table 3-1: Gravity Model for Vehicle Kilometerage

	Access 1	**Access 2**	**Access 3**	**Access 4**	**Access 5**	**Access 6**	**Access 7**	**Access 8**	**Totals**
Number Of Turbines Accessed (Sella Ness and Sullom Voe)	33	*0*	8	32	*0*	36	*0*	41	**150**
Number Of Loads Per Turbine	4		4	4		4		4	
Total Number Of Loads	132		32	128		144		164	
Average Route Length From Port	2.025		14.85	20.45		32.65		31.25	
	267		475	2618		4702		5125	**13187**

	Access 1	**Access 2**	**Access 3**	**Access 4**	**Access 5**	**Access 6**	**Access 7**	**Access 8**	**Totals**
Number Of Turbines Accessed (Greenhead Or Dales)	*0*	33	8	21	11	18	18	41	**150**
Number Of Loads Per Turbine		4	4	4	4	4	4	4	
Total Number Of Loads		132	32	84	44	72	72	164	
Average Route Length From Port		44.05	32.05	26.25	21.25	22.35	22.95	19.65	
		5815	1026	2205	935	1609	1652	3223	**16465**

3.9 ***Recommendation of Port Facility***

It is recommended that the combination offered by Shetland Islands Council – Ports & Harbours Operations of Sella Ness for blades and tower sections with Sullom Voe Construction Jetty for nacelles be considered as the port of arrival for turbine equipment. This is in keeping with Scottish Government advice that items to be moved by road under Special Order must use the nearest available port (see Chapter 2).

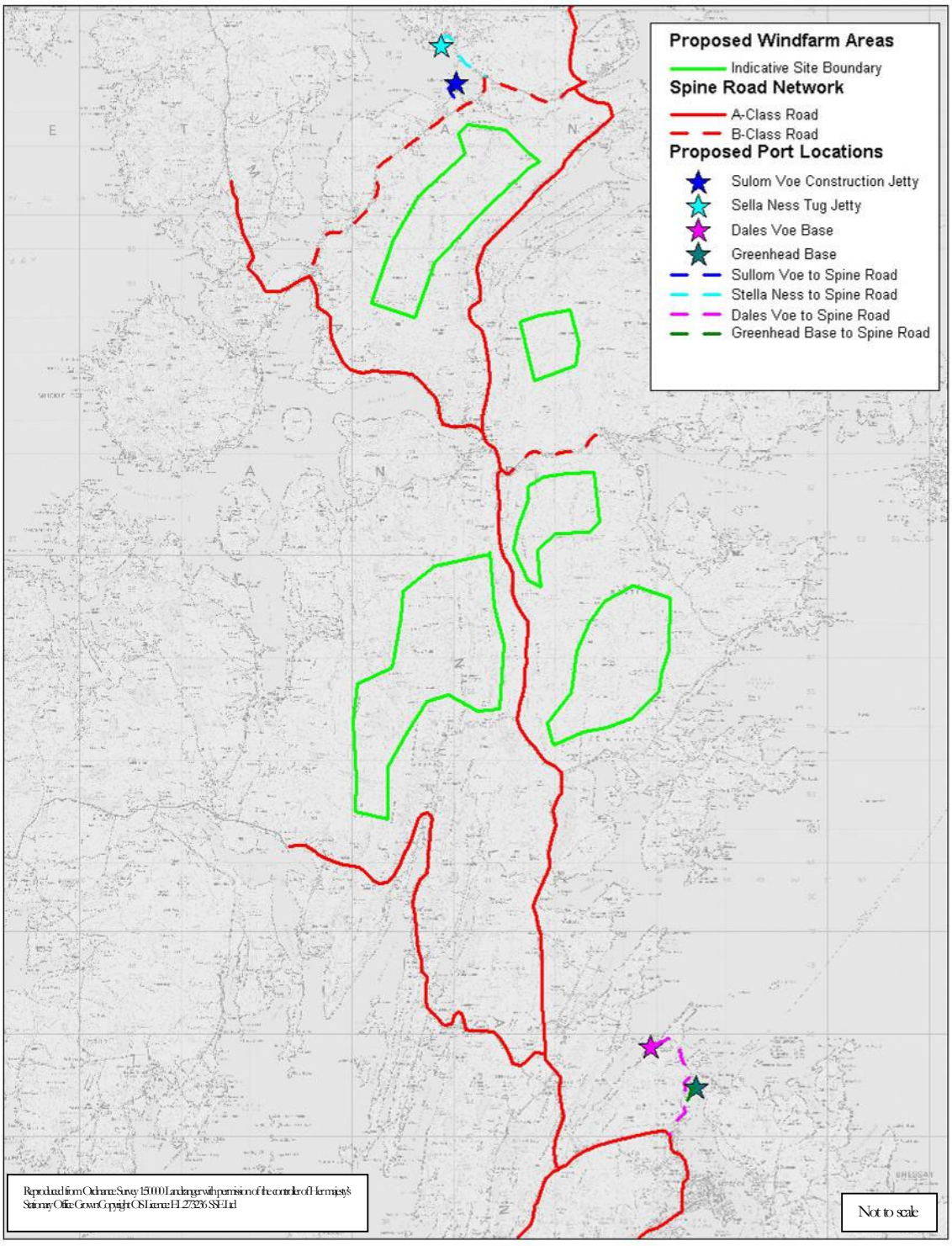

Figure 3-1: Potential Ports and Access to Public Highway

4 Road Transportation

4.1 *Introduction*

This chapter will consider the road transportation of the turbine components from port of arrival to the windfarm access points on the public highway.

4.2 *Shetland's Spine Road Network*

Shetland Island Council has developed a spine-road network, comprising roads of the highest strategic level to local needs, including links to ferry facilities. The Shetland Local Transport Strategy identifies the following roads as the spine road network

- The A970 Lerwick to Sumburgh road;
- The A970 Lerwick-Brae-Hillswick Junction
- The A970 and B9073 Lerwick-Scalloway
- The A968 extending from Voe to the ferry at Toft
- The A971 from Lerwick to the West Mainland
- B9071 Voe to Laxo
- B9076 Brae-Firth via Graven

These routes are shown in Figure 4-1. Consultations with officers from Shetland Islands Council, Infrastructure Services Department – Roads confirmed that the A-class spine roads are all suitable for the passage of Abnormal Indivisible Loads, subject to adherence to axle loading criteria. They also identified the section of B-class road through Weisdale as being extremely environmentally sensitive, and that no authority would be given to using this section of road. Information was also provided regarding areas where the existing road construction is on a peat-based bad, where care will be required if new roads construction is proposed.

SIC officers also stated that Site Access 4, which provides access to the South East and South West quadrants, must be a staggered junction layout, as opposed to a crossroad layout.

The A-class spine roads are twin carriageway, generally 7.3m to 7.5m in width with hard edges. They feature moderate vertical and horizontal alignment, there are no severe gradient issues (10% or greater) and there are no localised weight

restrictions in effect. Existing junctions are generally to modern design standards, with good visibility.

This assessment is based on a drive through of the roads network, with walkover surveys taking place where required. A full instrument survey has not been undertaken.

4.3 Proposed Routes for Turbine Equipment Delivery

This section will describe the route which will require to be approved for the delivery of turbine equipment from the port of arrival at Sella Ness/Sullom Voe to the various Site Access Points.

Using the northern port option, it is possible to use just five of the designated Site Access Points for turbine equipment (Site Access 1, 3, 4, 6 and 8). This concentrates traffic to the spine road and minimises unnecessary mileage.

To Access Point 1

Blades and tower sections exit Sella Ness port by a priority junction, turning right to the B9076. They travel approximately 1km south west to the new Site Access Point 1, a priority junction to the left.

Nacelles progress from Sullom Voe Construction Jetty to the B9076 making a right turn and travelling approximately 2.5km south west to the new access junction.

To Access Point 3

Blades and tower sections exit Sella Ness port turning left to the B9076 and move northwards. They are joined at the Sullom Voe access road by nacelle loads. The route continues east on the B9076 to the junction with the A968 at Mossbank, joining the A-class road at a right hand priority junction. The route climbs around the Hill of Swinster, turning south. The route remains on the A968 until the side arm junction leading to Collafirth. Loads turn left here and progress along an unclassified road for approximately 400m before reaching the proposed Site Access Point 3 with a right hand turn.

To Access Point 4

As above for Access Point 3, but continues past the Collafirth junction, south to the village of Voe. Here the loads make a left turn to the A970 and progress south to Hamarigrind Scord. Loads would turn left and right at Access Point 4, depending on the final location.

To Access Point 5

As above to Access Point 4, but route continues south past Petta Dale to the junction with the B9075. Here loads turn right, onto what is currently single track road with passing places, and travels approximately 1.75km to the Site Access Point 6 at the side arm junction to Upper Kergord, making a right turn. (There is a possibility of providing a second access from this route, from the B9075 at Lamba Scord – Site Access 5, but it is noted that this line of turbines can be accessed from Point 4, reducing the kilometres travelled on public highway)

To Access Point 8

As above, but passing the side arm to the B9075 and continuing south for a further 1km. Here loads turn left at a new access junction.

4.4 Proposed Junction Improvements

In order for turbine equipment to be transported from the port(s) of arrival at Sella Ness/Sullom Voe Construction Jetty, the following specific improvements to the public highway will be required. The requirement for these improvements has been determined from a preliminary swept path analysis. The location of the Site Access Junctions and areas of highway reconstruction are shown in Figure 4-2.

Sella Ness Access Junction

This is an open T-junction to a 7.3m B-class spine road. There is good visibility to north and south. There is available width, particularly on the southern side of the existing junction, to realign the minor arm to a more central position, to allow long loads to exit. The speed limit on the B9076 is 60mph

Site Access Junction 1

A new site access junction is required approximately 1km south of the Sella Ness access road at Houb of Skatska on the B9076. The carriageway is approximately 7.3m wide, with good visibility. The new access junction will be to the east of the existing carriageway, and requires construction to permit the left turning into the site of turbine equipment.

B9076 / A968 Junction at Mossbank

Approaching from the west on the B7076 this junction requires widening on the right hand side to allow loads to negotiate this junction. A watercourse requires to be contained in a culvert. Both the main road and the side arm are approximately 7.3m in width, and there is good visibility on all approaches. All approaches are 60mph.

A968 / Unclassified Road to Collafirth (leading to Site Access 3)
The A968 spine road is approximately 7.3m in width with an additional narrow hard edge on either side. Although there are warnings for a 'hidden dip', visibility is good. The speed limit here is 60mph. The side arm is approximately 4.0m in width, with soft edges. A new access junction will be required to allow vehicles to turn left to the side arm. The side arm itself will require upgrading to allow the passage of heavy loads eastward to the final access point to site tracks, a length of approximately 300m

A968 / A970 at Voe
The side arm of this junction lies within the 30mph speed limited area of Voe village. Attention will have to be given to existing street furniture within the village. The junction itself is the junction of two links of the spine road network, but will require realignment on the southern side of the minor arm (A968) to allow vehicles to successfully turn left. The area required is currently landscaped.

The main arms of this junction are within a 50mph speed limit, and consideration should be given to extending the existing 30mph limit on the side arm onto the main road approach arms.

Site Access Junction 4
This access will be located on the A970 at Hamarigrind Scord, approximately 3.25km south of the village of Voe, where the national speed limit of 60mph applies. SIC have indicated that this must be a staggered junction layout. The requirement therefore will be for a right turn provision to access the south west quadrant, followed by a left turn to access the south east quadrant (when considered travelling from the north). This arrangement prevents unnecessary queuing of traffic on the main arms.

SIC have also indicated that the existing carriageway is constructed on a peat bed, and therefore careful consideration will be required when determining an engineering solution at this junction.

Site Access Junction 6
The junction of the A970 and the existing B9075 is a simple priority junction, with 60mph speed limits. Turbine components turn left onto the B9075 which is a single track road with passing places. The entire length of this road to be used (approximately 1.9km) requires to be upgraded to allow the passage of turbine components. A number of minor watercourses pass beneath the existing

carriageway, and these will require culverts in the new construction. A new access junction at the unclassified turn-off to Upper Kergord is required.

Site Access Junction 8

Site Access Junction 8 will be located between the B9075 (Weisdale) and B9075 (South Nestings), and will be a left turn for turbine component. The A970 here is of good layout, approximately 7.3m wide and features hard strips at either side. Visibility is good, and the speed limit is 60mph.

4.5 Structural Assessments

No structural assessments were undertaken as part of this investigation. SIC have identified three structures which require assessment. These are located as follows

- GR 435737 – on the A968 spine road near its junction with the B9076
- GR 425503 – on the A970 spine road near Girlsta
- GR 392471 – on the A971 spine road near Olligarth

The first structure is on the route from Sella Ness south to the NE, SE and SW quadrants (affecting 117 turbines) with the route from Lerwick unaffected.

The second structure is on the route from Lerwick to the NE, NW, SE and most of the SW quadrants (affecting 132 turbines) with the route from Sella Ness unaffected)

The third structure only affects 18 turbines in the SW quadrant accessed from Lerwick with the route from Sella Ness unaffected.

4.6 Consultation with Northern Constabulary

Consultations have been undertaken with the Traffic Officer's office of Northern Constabulary in Lerwick, during which the nature of the turbine equipment movements were explained, along with the details of proposed routes. The Police had no undue concerns about vehicle routing, but advised that passing through the village of Brae would not be recommended.

Under current ACPOS guidelines, Police are not required to escort abnormal loads, unless formal road closures have been approved, but in this case, they would recommend assisting in the preliminary delivery movements, to ensure that drivers are competent and familiar with the local environment. After that, loads could be escorted by the haulage company's own pilot vehicles.

The Police also recommended careful scheduling of abnormal loads, to avoid undue delays to other vehicle traffic on the Spine Road network, which serves lifeline ferry services to the Outer Isles. Evening and night-time operations would minimise the risk of disruption to other traffic.

4.7 Summary

The routing proposed above for the transport of turbine equipment from Sella Ness / Sullom Voe has been agreed in principal with officials from SIC – Roads, and uses the highest level in the road hierarchy for as much of the route as possible (the Spine Road Network).

The delivery route to each Site Access Point has been described, and the remedial measures necessary to allow the passage of turbine equipment has been identified. No detailed design drawings for new or improved junctions have been provided, but engineering solutions are considered to be achievable at each location.

	
Towards Sella Ness from B9076	Towards Access Junction 1 (looking South)
	
Mossbank Junction – loads move from left towards camera	To access Junction 3, looking south
	
A968 joining A970 Voe, loads turn left	Looking South to Access Junction 4

	
B9075 at potential Access junction 5 – Access Junction 6 in distance at bend	B9075 at A970 – loads turn from left towards camera

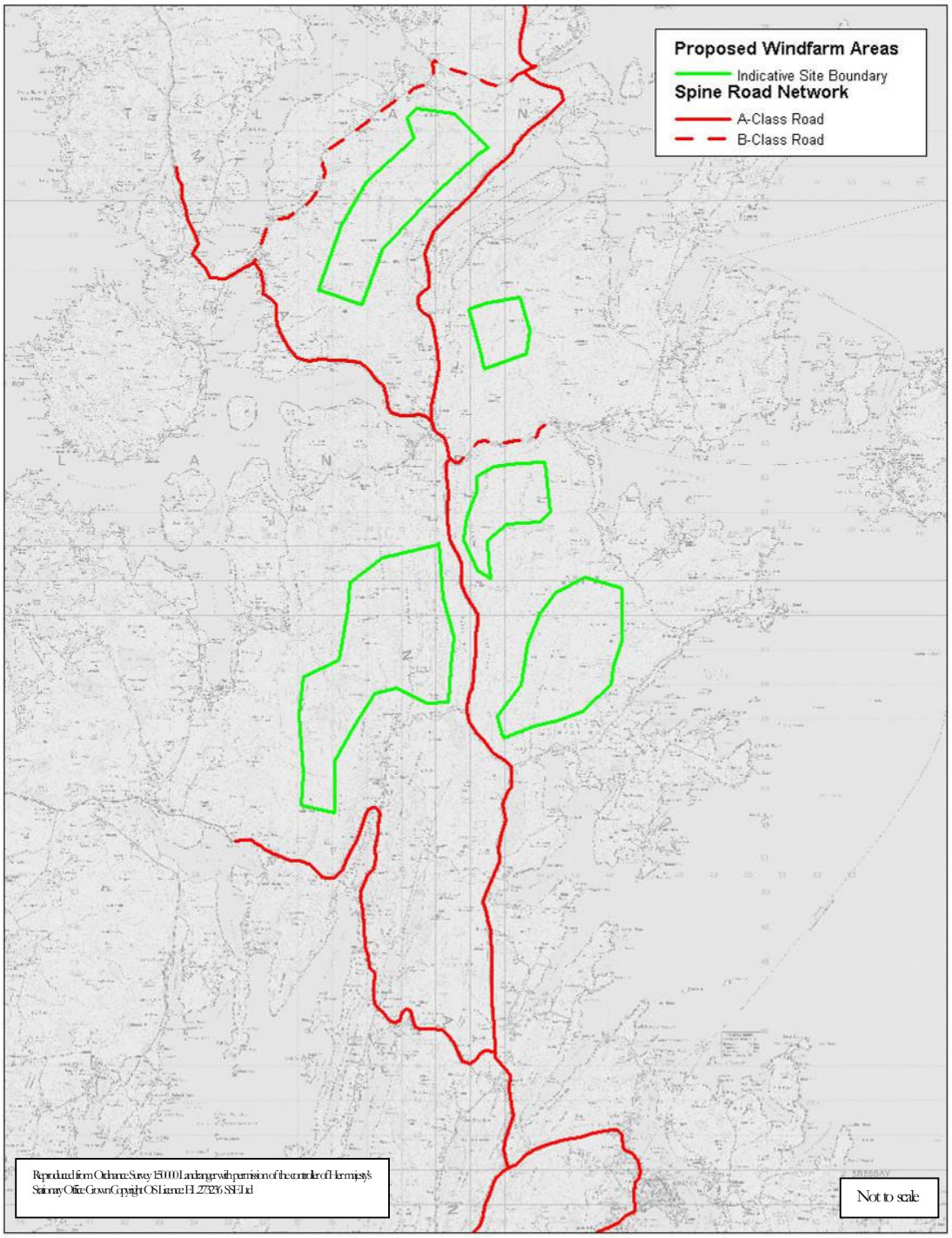

Figure 4-1: Spine Road Network and Windfarm Boundaries

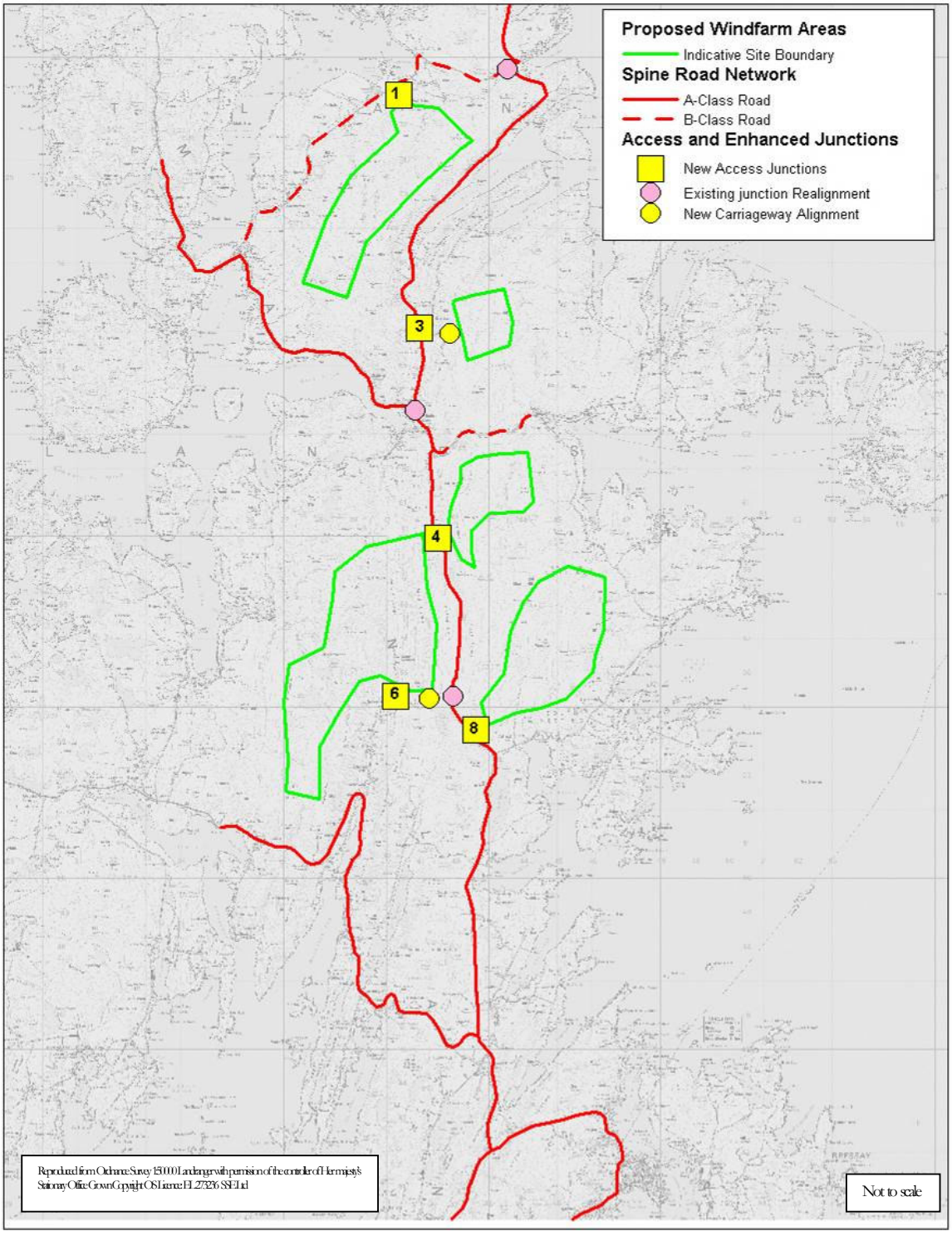

Figure 4-2: Location of Access Junctions and Remedial Measures

5 Summary and Conclusions

5.1 *Summary*

This Report has considered the constraints and opportunities to move Abnormal Indivisible Loads to the proposed Viking Windfarm on Shetland. It has considered the merits and facilities available at four port facilities. It has also considered the required routes between a preferred port facility and the access points leading from public highway to off-road site access tracks. Junction and network improvements required to allow the passage of these loads have also been identified.

5.2 *Recommendations*

It is recommended that the combination offered by Shetland Islands Council – Ports & Harbours Operations of Sella Ness for blades and tower sections with Sullom Voe Construction Jetty for nacelles be considered as the port of arrival for turbine equipment. This is in keeping with Scottish Government advice that items to be moved by road under Special Order must use the nearest available port (see Chapter 2).

Sella Ness / Sullom Voe Construction Jetty provide the nearest suitable port facility in terms of the overall requirements for turbine equipment, and can offer longer term storage facilities if required

It is recommended that the Shetland Spine Road Network be used for the onward road movement of the turbine equipment. This is in keeping with SIC's road hierarchy, and provides the most direct routes while minimising disruption to local communities or road users.

A series of junction improvements and requirements for new carriageway to be constructed has been identified, and although detailed design drawings have not been prepared, engineering solutions are believed to be achievable.