UK Onshore Scheme

Environmental Statement

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Appendix 9

Agriculture & Soils (Proposed DC Underground Cable)

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Contents

Appendix 9.1 Methodology for the Desk Based Determination of BMV Land

1.1 Introduction

1.1.1 It is important to note that this desk-based methodology has been utilised for areas of temporary landtake only, e.g. Underground Cables. Areas of permanent landtake, e.g. the proposed Converter Station and permanent access track, have been subject to detailed soil survey following the standard procedures as set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land' (Ref: 9-1-1).

1.2 Agricultural Land Classification (ALC) grading

1.2.1 The ALC is a standardised method for classifying agricultural land according to its versatility, productivity and workability, based upon inter-related parameters including climate, relief, soil characteristics and drainage. These factors form the basis for classifying agricultural land into one of five grades (with Grade 3 land divided into Subgrades 3a and 3b), ranked; excellent (Grade 1), very good (Grade 2), good (Subgrade 3a), moderate (Subgrade 3b), poor (Grade 4), and very poor (Grade 5) quality agricultural land. ALC is determined using Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land (Ref: 9-1-2).

1.2.2 The ALC Grade or Subgrade is determined by the most limiting factor (limitation) present. For example, if wetness and droughtiness are the only factors limiting the quality of the land, and they limit to Subgrade 3b and Grade 2, respectively, such land is classed as Subgrade 3b.

1.3 Best and most versatile (BMV) agricultural land

1.3.1 The National Planning Policy Framework defines best and most versatile (BMV) land as land of excellent (ALC Grade 1), very good (Grade 2) and good (Grade 3a) agricultural quality (Ref: 9-1-3). BMV land is afforded a degree of protection against irreversible (permanent) development within planning policy. Moderate, poor and very poor quality land is designated Subgrade 3b or Grades 4 and 5 respectively.

1.4 Methodology

1.4.1 The most current and detailed published ALC data covering the Zone of Influence (ZoI) is the Provisional 1:250,000 scale ALC mapping for the Eastern Region (Ref: 9-1-4). This mapping does not define ALC grade at a field scale; nor does it make a distinction between Subgrades 3a and 3b. Therefore, when used in isolation, the Provisional ALC data cannot be used to identify the presence or absence of BMV land or the distribution of ALC grading at the field level.

However, it may be used in conjunction with published soils data, LandIS NATMAP data (Ref: 9-1-5) and "Soils and their use in Eastern England" (Ref: 9-1-6), to determine the likely proportion of BMV land through the identification of areas of potential Subgrade 3a or 3b land.

1.4.2 The 1:250,000 scale National Soil Map dataset covering the proposed route corridor identified at scoping, plus a 100m buffer was purchased from the National Soil Resources Institute, Cranfield University. The dataset contains NATMAPvector data, which provides spatial distribution of soil associations; and associated datasets containing properties of soil associations, such as percentage of component soil series. These data are collectively referred to as the LandIS NATMAP dataset (Ref: 9-1-5) and are displayed in Figure 9.2 for the proposed DC cable route. These data have been used to inform ALC as described below.

1.4.3 The LandIS NATMAP dataset provides the area covered by each soil association and its component soil series. The LandIS data also gives the percentage distribution of the dominant or key component soil series within each association; discounting any ancillary soil series which only make up a small proportion of the soils within the association. The percentage distribution of the dominant soil series is therefore adjusted so that their total equals 100%; this is because inclusion of the lesser ancillary series would unnecessarily complicate the assessment without increasing its accuracy. The area covered by each key soil series, within areas identified as ALC Grade 3 land on the Provisional ALC mapping, can then be derived.

1.4.4 Published data from "Soils and their use in Eastern England" (Ref: 9-1-6), has then been used to identify the typical limitations to ALC grading displayed by each of the identified soil series. Limitations include typical soil depth, soil texture, soil stone content and soil wetness. These limitations have then been used to determine the subdivision of ALC Grade 3 into Subgrade 3a and 3b; using the methodology set out below and described in the ALC guidelines.

1.4.5 The soil texture information has been obtained from the published soil profile descriptions. Where a soil texture is identified as heavy or medium (i.e. silty clay loam and clay loam), it is assumed the distribution is a fifty-fifty split. Additionally, if more than one soil texture is listed in the description of soils series, their proportions have been assumed to be equal. Furthermore, if more than one soil wetness is listed in the description of soils series, the proportions have been assumed to be equal. Where soil wetness can be improved via appropriate land management, it has been assumed that appropriate management practices are in place.

1.4.6 The ALC grade is also influenced by the prevailing climatic conditions. The overall climatic limitation is assessed using the average annual rainfall and accumulated temperature. These data are obtained from the Meteorological Office published agroclimatic data for England and Wales on a five kilometre grid basis (Ref: 9-1-7).

1.4.7 From the climatic data, the number of field capacity days (FCD) can be determined (Ref: 9-1-7). FCD impacts the Wetness Grade of the soil associations depending on their location within the ZoI. The following assessment assumed the FCD were between 126 and 150.

1.4.8 Where the calculation of the ALC grade from the published data resulted in a Grade other than Subgrade 3a or 3b, the Grade was corrected. For example, a calculated Grade 1 or 2 remained

BMV land, but was re-assigned to Subgrade 3a; whilst a calculated Grade 4 or 5 remained non-BMV, but was re-assigned to Subgrade 3b. Where it was not possible to determine one single grade for a soil series, equal proportions were assumed.

1.4.9 The combination of the soil series areas within agricultural land mapped as ALC Grade 3 on the Provisional mapping; the proportion of Subgrade 3a and 3b of each series; and the Provisionally mapped ALC Grades 1 and 2 land, therefore provided the total potential area of BMV within the LoD.

1.4.10 It is noted that, the spatial arrangement of the ALC Grading cannot be obtained from the NATMAP data, as only the proportion of each soil series within an association is provided, not their geographical location. Therefore, the relative proportions of Subgrade 3a and 3b within the LoD can only be presented in a tabular form and not represented in a mapped format.

1.4.11 The lack of spatial information does not affect the reporting or impact assessment.

Table 9.1.1: Soil Associations within the Study Area, limitations to agricultural land quality, Subgrade 3a and 3b estimates where mapped as Grade 3

Soil association	Component soil series		Soil depth		Tex. L.	Stoniness		Org.-min.	Wet. Class	Possible textures				Wetness Class x texture combinations				3a/3b estimate for			
																		Series		Assoc.	
	Name	%	V.	L.		V.	L.			1	2	3	4	1	2	3	4	% 3a	% 3b	% 3a	% 3b
Andover 1 (343h)	Andover	55	40	3a	1	slightly	3a		I	MZCL	HZCL			1	2			100		55	
	Panholes	15	65	1	1	moderately	3b		I	MZCL	HZCL			1	2				100		15
	Coombe	10	90	1	1	slightly	3a		I	MZCL	HZCL			1	2			100		10	
	Upton	10	40	3a	1	moderately	3b		I	MZCL	HZCL			1	2				100		10
	Charity	10	100	1	1	moderately	3b		I	MZCL	HZCL			1	2				100		10
																				65	**35**
Beccles 1 (711r)	Beccles	65	100	1	1	slightly	3a		III	SCL	MCL	HCL		3a	3a	3b		75	25	48.8	16.3
	Ragdale	35	100	1	1	moderately	3b		III	C	MCL	HCL		3a	3a	3b			100		35
																				48.8	**51.3**
Blackwood (821b)	Blackwood	52	100	1	2	slightly	3a		II	LS				2				100		57.8	
	Quordon	29	100	1	1	slightly	3a		II	SL				1				100		32.2	
	Formby	10	120	1	2	stoneless	1		II	LS				2							
	Ollerton	9	90	1	1/2	slightly	3a		II	SL	LS			1	2			100		10	
																				100	**0**
Cuckney 2 (551c)	Cuckney	62	100	1	2	very slightly	2		I	LS				2							
	Curdridge	19	100	1	1	stoneless	1		II	SL	SZL			1	1						
	Spilsby	19	100	1	1	slightly	3a		I	SCL				1				100		100	
																				100	0
Fladbury 2 (813c)	Fladbury	47	100	1	1	stoneless	1		IV	C				3b					100		47
	Stixwould	29	100	1	1	stoneless	1		IV	C				3b					100		29
	Trent	24	100	1	1	stoneless	1		III	HCL	MCL			3a	3b			50	50	12	12
																				12	**88**
Holderness (711u)	Holderness	67	120	1	1	stoneless	1		III	HCL	MCL			3a	3b			50	50	33.5	33.5
	Burlingham	33	120	1	1	very slightly	2		III	HCL	MCL	SCL		3a	3b	3a		75	25	24.75	8.25
																				58.25	**41.75**
Salop (711m)	Salop	44	120	1	1	slightly	3a		III	HCL	MCL			3a	3b			50	50	22	22
	Clifton	25	100	1	1	slightly	3a		III	HCL	MCL	SCL		3a	3b	3a		75	25	18.75	6.25
	Flint	19	100	1	1	slightly	3a		III	HCL	MCL			3a	3b			50	50	9.5	9.5
	Crewe	12	100	1	1	stoneless	1		III	HCL	MCL	C		3a	3b	3b		25	75	3	9
																				53.25	46.75
Swaffham Prior (511e)	Swaffham Prior	35	100	1	1	slightly	3a		I	SL				1				100		35	
	Soham	29	55	2	1	slightly	3a		I	SCL				1				100		29	

Table 9.1.1: Soil Associations within the Study Area, limitations to agricultural land quality, Subgrade 3a and 3b estimates where mapped as Grade 3

Soil association	Component soil series		Soil depth		Tex. L.	Stoniness		Org.-min.	Wet. Class	Possible textures				Wetness Class x texture combinations				3a/3b estimate for			
																		Series		Assoc.	
	Name	%	V.	L.		V.	L.			1	2	3	4	1	2	3	4	% 3a	% 3b	% 3a	% 3b
	Moulton	12	100	1	1	slightly	3a		I	SL				1				100		12	
	Newmarket	6	50	2	1	slightly	3a		I	SL				1				100		6	
	Rudham	18	30	3a	1	moderately	3b		I	SCL	MCL	HCL		1	1	2			100		18
																				82	**18**
Tathwell (571n)	Tathwell	79	80	1	1	stoneless	1		I	SCL				1							
	Andover	11	40	3a	1	slightly	3a		I	MZCL	HZCL			1	2			100		81.5	
	Burlingham	10	120	1	1	very slightly	2		II	MCL	HCL	SCL		2	3a	2		100		18.5	
																				100	**0**
Wallasea 2 (813g)	Wallasea	58	100	1	1	stoneless	1		II	ZC				3b					100		78.38
	Newchurch	16	100	1	1	stoneless	1		II	ZC				3b					100		21.62
	Blacktoft	13	120	1	1	stoneless	1		I	MZCL	HZCL			1	2						
	Wisbech	13	100	1	1	stoneless	1		I	ZL				1							
																				0	**100**
Wickham 2 (711f)	Wickham	55	100	1	1	slightly	3a		III	MZCL	HZCL	MCL	HCL	3a	3b	3a	3b	50	50	27.5	27.5
	Denchworth	17	100	1	1	slightly	3a		III	MCL	HCL	C		3a	3b	3b		25	75	4.25	12.75
	Oxpasture	17	100	1	1	slightly	3a		III	MCL	HCL	MZCL	HZCL	3a	3b	3a	3b	50	50	8.5	8.5
	Evesham	11	120	1	1	stoneless	1		III	C				3b					100		11
																				40.25	59.75

Note: for the wetness limitation, the FCD range used was 126-150, no lower FCD areas (which would be less limited by wetness) are present within the Study Area; it was assumed that no soils are limited by droughtiness, gradient, or flooding.

Abbreviations: V. – value, L. – limitation, Tex. – topsoil texture (particle size distribution of the fine fraction), Org.-min. – organo-mineral or peaty soil, PTY – peaty, CL – clay loam, ZCL – silty clay loam, M – medium (less than 27% clay, H – heavy (more than 27% clay), SL – sandy loam, C – clay.

1.5 Calculated BMV proportions for Soil Associations

1.5.1 A summary of the desk-based determination of BMV land as described in Section 1.4, is shown in Table 9.1.2. The assessment included all soil associations identified within the Study Area. Please note, that soils associations; Wisbech and Arrow, are not listed in Table 9.1.2, as the desk-based determination revealed these soils to be Grade 1 or 2.

Table 9.1.2. BMV proportions for Soil Associations in the Study Area where present within areas mapped as Grade 3

Soil Association	% 3a	% 3b
Andover 1 (343h)	65.0	35.0
Arrow (543)	100.0	0.0
Banbury (544)	91.5	8.5
Beccles 1 (711r)	48.8	51.3
Beccles 2 (711s)	80.1	19.9
Blackwood (821b)	100.0	0.0
Cannamore (513)	96.25	3.75
Cuckney 2 (551c)	100.0	0.0
Downholland 1 (851a)	100.0	0.0
Downholland 2 (851b)	100.0	0.0
Fladbury 2 (813c)	12.0	88.0
Holderness (711u)	58.25	41.75
Salop (711m)	53.25	46.75
Swaffham Prior (511e)	82.0	18.0
Tathwell (571n)	100	0.0
Wallasea 2 (813g)	0.0	100.0
Wick 1 (541r)	100.0	0.0
Wickham 2 (711f)	40.3	59.8

1.6 Verification with the Natural England (NE) Predictive ALC mapping

1.6.1 The NE strategic 1:250,000 scale Predictive 'Likelihood of best and most versatile land' mapping provides an estimate of the likelihood (CAT 1 to CAT 3) of land being BMV, hence is commonly referred to as 'Predictive' ALC mapping. Within the mapping CAT 1 is indicative of land of high likelihood of BMV, and CAT 3 is indicative of land of low likelihood of BMV (Ref: 9-1-8).

1.6.2 The Provisional ALC mapping (Ref: 9-1-4) indicates that the majority of the agricultural land within the Study Area is ALC Grade 1, with smaller areas of ALC Grade 2 and discrete areas of Grade 3; which is typical for Lincolnshire; although it should be noted that there is variation

between the four local administrative areas, with East Lindsey and North Kesteven District Councils (ELDC and NKDC) having a lower proportion of Grade 1 land (Table 9.8; ES-2-B.05).

1.6.3 It is assumed that in order for NE's strategic 1:250,000 scale Predictive 'Likelihood of best and most versatile land' mapping and the desk top approach to be considered to agree, the mapped CAT 1 soils should be identified with a dominance of Subgrade 3a (i.e. BMV). A CAT 2 soil association should be identified with an approximate fifty-fifty split between Subgrade 3a and 3b, and a CAT 3 soils should be identified as predominantly subgrade 3b (i.e. non-BMV).

1.6.4 Table 9.1.3 displays the estimated distribution of Grade 3 (Subgrade 3a and 3b) for all soils identified within the LoD as calculated by WA, and is compared to the category provided by the NE BMV likelihood map.

Table 9.1.3: Soil Associations located on Grade 3 ALC land within the LoD

Soil Association	NE strategic Best and Most Versatile Likelihood dataset (Ref: 9-1-8)	WA desk-based determination of BMV land		Agree (Y/NE downgrade/WA downgrade)
	Category	3a	3b	
Andover 1 (343h)	CAT 2	65	35	NE downgrade
Blackwood (821b)	CAT 2/3	100	0	NE downgrade
Cuckney 2 (551c)	CAT 2	100	0	NE downgrade
Fladbury 2 (813c)	CAT 3	12	88	Agree
Holderness (711u)	CAT 1	58.25	41.75	Agree
Salop (711m)	CAT 2	53.25	46.75	Agree
Swaffham Prior (511e)	CAT 1	82	18	Agree
Tathwell (571n)	CAT 1	100	0	Agree
Wallasea 2 (813g)	CAT 1	0	100	WA downgrade
Wickham 2 (711f)	CAT 2/3	40.3	59.7	Agree
Note: Wisbech and Arrow soil associations are only present within Grade 1 areas within the LoD (Ref: 9-1-3)				

1.6.5 It was found that for a majority of LoD, the estimates provided in Table 9.1.3 agreed with that on the BMV likelihood map.

1.6.6 Three soil associations (Andover, Cuckney 2 and Blackwood) were given more conservative BMV estimates in the desk based study in comparison to the NE BMV likelihood map (i.e. the desk based assessment estimated a higher percentage Subgrade 3a, BMV). Therefore, the possible presence of BMV within areas of Grade 3 land for these soil associations is given a better degree of protection in the desk based assessment summarised in Table 9.1.2.

1.6.7 Where the Wallasea 2 soil association occurs in areas of Grade 3, it was mapped as Category 1 (> 60 % likelihood BMV) by NE, however the desk based assessment showed that no BMV land would be present (i.e. all land recorded as Subgrade 3b). Therefore, throughout the impact assessment, the grade of Wallasea 2 soils where they occur in areas mapped as Grade 3 on the Provisional mapping, has been re-classified as Subgrade 3a. This will present a worst case.

1.7 References

Ref: 9-1-1: Natural England, 2012. Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'. Available at http://publications.naturalengland.org.uk/file/4424325 [Accessed 24/02/2017].

Ref: 9-1-2: MAFF (1988) 'Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.

Ref: 9-1-3: Department for Communities and Local Development, 2012. National Planning Policy Framework. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 [Accessed 26/01/ 2017].

Ref: 9-1-4: MAFF, 1993. 1:250,000 Provisional Agricultural Land Classification, Eastern Region.

Ref: 9-1-5: National Soil Resources Institute, Cranfield University 1:250,000 scale National Soil Map, digital dataset (Landis NATMAP dataset).

Ref: 9-1-6: Soil Survey of England and Wales, 1984. Soils and their use in Eastern England

Ref: 9-1-7: Met Office, 1989. Climatological Data for Agricultural Land Classification: Gridpoint datasets of climatic variables at 5km intervals for England and Wales

Ref: 9-1-8: Natural England strategic 1:250,000 scale Predictive 'Likelihood of best and most versatile land' mapping.

Appendix 9.2 Soil Survey Consultation

Letter: Soil Methodologies (July 2016)

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your earth our world

Our ref: CR/ER/NT12231/0014

Date: 16 May 2017

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By email

Dear

NGVL – Soil methodologies

Wardell Armstrong has written a Technical Note, which sets out the details and methodology for the Soils and Agriculture discipline for the Environmental Statement, for the UK onshore scheme of the Viking Link Interconnector, as requested by Natural England at a meeting on 9th June 2016.

The attached Technical Note presents two scenarios to determine the Agricultural Land Classification (ALC) Grade and the soil resources present along areas of temporary development (e.g. the cable route and the landfall site). Scenario 1, a desk-based study using data from the Soil Survey of England and Wales and purchased LandIS data, would provide the relative proportions of ALC Subgrade 3a and 3b and hence the quantity of best and most versatile (BMV) land along the route; and Scenario 2, a combined approach using soil survey to verify the desk based data and provide the spatial arrangement of ALC grading (BMV land) along the route.

Wardell Armstrong recommend the use of Scenario 1 to provide the baseline agriculture and soils data for areas of temporary development within the NGVL UK Onshore Scheme. The EIA impact assessment criteria which have agreed for the NGVL UK Onshore Scheme; and have been accepted as best practice on a number of similar projects, only require a knowledge of the overall quantity of BMV and non-BMV land across the route, not their spatial arrangement. Therefore, the desk based approach of Scenario 1 will provide sufficient data to allow a robust impact assessment to be undertaken. However, it is acknowledged that for certain areas of the route corridor, it may be pertinent to undertake limited soil survey, subject to the available desk top data and landowner discussion, to verify the ALC grading and BMV agricultural land status at particular points. This desk based methodology is in line with that agreed with Natural England for the temporary development areas of other similar projects within the Region.

The only area of permanent development for the NGVL UK Onshore Scheme is the Converter Station. The methodology for this area will follow standard sampling procedures as set out in

Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'.

It would be greatly appreciated if Natural England could provide comment pertaining to the methodologies contained within this Technical Note.

Yours sincerely
for Wardell Armstrong LLP

Environmental Scientist

Technical Note: Survey Methodology

Subject: **Soils & Agriculture: Methodology**	
Prepared by:	Date: 14/06/2016
Checked by:	Date: 07/07/2016
Approved by:	Date: 20/07/2016

Overview

This Technical Note sets out the details and methodology for the Soils and Agriculture discipline for the Environmental Statement, for the UK onshore scheme of the Viking Link Interconnector, as requested by Natural England at a meeting on 9th June 2016.

It sets out two scenarios to determine the Agricultural Land Classification (ALC) Grade and the soil resources present along areas of temporary development (e.g. the cable route and the landfall site): the first, a desk-based study using purchased LandIS data; and the second, a combined approach using a soil survey to verify the desk based data and provide the spatial arrangement of ALC grading along the route.

It is important to note that regardless of the methodology utilised for areas of temporary development, the methodology employed at the Converter Station (i.e. area permanent land take), will follow standard procedures as set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'[1] (See Section 2.3).

1 Introduction

Scenario 1 (desk based) can provide the relative proportion of Subgrade 3a (Best and Most Versatile (BMV)) and Subgrade 3b (non-BMV) land within each soil association. However, the spatial arrangement of the Agricultural Land Classification (ALC) cannot be determined. Therefore, the relative proportions of Subgrade 3a and 3b within the route can only be presented in a tabular form and not represented in a mapped format.

Scenario 2 (desk & field based) can accurately verify the relative proportion of Subgrade 3a and 3b land within each soil association as well as providing the spatial distribution of BMV agricultural land across the route.

The only area of permanent landtake would be the Converter Station. In accordance with the recommendations set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'[1], this area will therefore undergo soil survey and ALC grade verification.

[1] Natural England (2012) Agricultural Land Classification; protecting the best and most versatile agricultural land. Available at http://publications.naturalengland.org.uk/file/4424325 [Accessed 26 January 2016].

1.1 Agricultural Land Classification (ALC) grading

The ALC is a standardised method for classifying agricultural land according to its versatility, productivity and workability, based upon inter-related parameters including climate, relief, soil characteristics and drainage. These factors form the basis for classifying agricultural land into one of five grades (with Grade 3 land divided into Subgrades 3a and 3b), ranked; excellent (Grade 1), very good (Grade 2), good (Subgrade 3a), moderate (Subgrade 3b), poor (Grade 4), and very poor (Grade 5) quality agricultural land. ALC is determined using Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land[2].

The ALC Grade or Subgrade is determined by the most limiting factor (limitation) present. For example, if wetness and droughtiness are the only factors limiting the quality of the land, and they limit to Subgrade 3b and Grade 2, respectively, such land is classed as Subgrade 3b.

1.2 Best and most versatile (BMV) agricultural land

The National Planning Policy Framework[3] defines best and most versatile (BMV) land as land of excellent (ALC Grade 1), very good (Grade 2) and good (Grade 3a) agricultural quality. BMV land is afforded a degree of protection against irreversible (permanent) development within planning policy. Moderate, poor and very poor quality land is designated Subgrade 3b or Grades 4 and 5 respectively, and is restricted to a narrower range of agricultural uses.

1.3 The limitations to ALC grading

The agroclimatic data of a site influences the ALC in respect of growing conditions and the soil reaction in terms of wetness and droughtiness. The Meteorological Office published agroclimatic data for England and Wales on a five kilometre grid basis[4], from which site specific data can be estimated. The overall climatic limitation is assessed using the average annual rainfall and accumulated temperature at crop establishment (January to June). It reflects the direct effects of water supply and energy available for photosynthesis on plant growth.

Gradient has a significant effect on mechanised farm operations since most conventional agricultural machinery performs best on level ground. The safe and efficient use of machinery on sloping land depends very much on the type and design of the machine and on the nature of the slope being farmed. Microrelief involves complex changes in slope angle and direction over short distances, or the presence of boulders or rock outcrops; all of which can impact upon the use agricultural machinery.

Flooding can affect choice of crops to be grown, because it may have negative influence on the yield of some crops and restricts soil cultivation. The main factor determining the risk of flooding is topography. Local conditions can be assessed based on local knowledge and information from the water authorities (including: Witham Fourth IDB; Lindsey Marsh IDB; Black Sluice IDB; and Lincolnshire County Council). Floods which occur in summer are generally more damaging than winter floods because the growing roots of the crops are more sensitive to waterlogging. The flood limitation is therefore assessed separately for a ‘winter’ and a longer ‘summer’ periods (the latter including spring sowing and autumn cultivation).

Soil depth is important when determining available water capacity. Shallowness can affect cropping in a number of ways, such as restricting the range of cultivation methods available, restricting nutrient uptake and root growth.

[2]MAFF, 1988. Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.

[3] Department for Communities and Local Development, 2012. National Planning Policy Framework, available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 (accessed: 25/04/2016).

[4] Met Office, 1989. Climatological Data for Agricultural Land Classification: Gridpoint datasets of climatic variables at 5km intervals for England and Wales.

Stones act as an impediment to cultivation, harvesting and crop growth. A high stone content reduces the potential for certain agricultural crop management, can cause wear and tear to agricultural implements and tyres, and can reduce the quality of crops (i.e. bruising potatoes during harvesting).

Physical limitations resulting from interactions between climate, site and soil characteristics are soil wetness and droughtiness. Soil wetness adversely affects plant growth and agricultural management (e.g. restricts grazing and operation of farm machinery). Droughtiness is most likely to be a significant limitation to crop growth in areas with low rainfall and high evapotranspiration, or where the soil profile holds only small reserves of moisture, for example if the soil is sandy.

For ALC purposes, soil wetness assessment takes account of duration of the period of time when soil moisture is at field capacity, and soil susceptibility to waterlogging, based on the following soil profile characteristics: depth to slowly permeable layer, depth to gleying, and topsoil texture.

Droughtiness is assessed based on the average drought risk of two reference crops: winter wheat and potatoes. The method uses rooting depth and foliar characteristics of the reference crops to estimate soil moisture balance at a given location.

A secondary factor, accompanying other more critical limitations such as slope or droughtiness, is erosion related to wind or water action. Soils can be at risk of a loss of topsoil, seeds, seedlings and fertiliser, plants can also be damaged by abrasion. Cranfield University published a comprehensive list of soil associations at risk of wind and water erosion, ranging from a very small risk to a very high risk for England and Wales[5].

1.4 Published data

Available data:

i. Provisional 1:250,000 scale ALC mapping for the Eastern Region[6]
ii. Post-1988 surveys (typically 1:10,000)[7]

The provisional 1:250,000 scale ALC mapping for the Eastern Region**Error! Bookmark not defined.** cannot be used to identify the ALC grade of the land at the field level, nor does it provide a division of Grade 3 into Subgrades 3a (BMV) and 3b (non-BMV) and therefore does not allow the identification of BMV land.

Between 1989 and 1999, some areas of England and Wales were surveyed at the field level by MAFF (now Defra), allowing a detailed assessment of the ALC for these areas to be undertaken. These are collectively known as post-1988 ALC surveys and are considered to be the most detailed and up to date dataset. The post-1988 surveys were undertaken at varying scales and level of detail, ranging from 1:5,000 to 1:50,000 (typically 1:10,000), and provide division of Grade 3 allowing the identification of BMV land. However, there are no post-1988 ALC survey reports available for the Study Area.

Therefore, all desk based assessment for the project is based upon the 1:250,000 scale provisional mapping.

1.5 Recent precedent

It is important to note that the Triton Knoll Electrical System, a below ground cable connecting offshore wind generation to Bicker Fen substation, routeing through the Viking Link study area, have proposed a desk-based study providing only the Provisional 1:250,000 scale ALC mapping, and have not differentiated between Subgrade 3a and 3b.

[5] Knox et al., 2015. Research to develop the evidence base on soil erosion and water use in agriculture. Final Technical Report, Cranfield University.
[6] MAFF, 1993. 1:250,000 Provisional Agricultural Land Classification, Eastern Region.
[7] Magic Map http://magic.defra.gov.uk/MagicMap.aspx. Post-1988 ALC reports and maps available by request from Natural England.

The Triton Knoll Electrical System methodology has been submitted to the planning inspectorate and has been reviewed by statutory consultees, including Natural England (NE). In the Triton Knoll Electrical System Relevant Representations of Natural England (Planning Inspectorate Reference: EN020019), NE confirmed they had been working closely with Triton Knoll Offshore Windfarm Limited, since May 2014, to provide advice and guidance as part of the evidence plan process. In paragraphs 4.9.1 *et alia*., NE state that they 'welcomes the assessment of impact provided within this chapter'. The representation goes on to accept the ALC gradings and areas derived from the desk based review of the Provisional ALC mapping[8].

2 ALC Methodologies

2.1 ALC Grading Methodology: Desk study (Scenario 1)

The following ALC Grading methodology is to inform the sections of the route which will undergo temporary development. A desk-based study will be carried out using published and purchased data sources to determine the general soil characteristics of the Study Area and identify the ALC grading.

The 1:250,000 scale National Soil Map dataset for the Study Area will be purchased from the National Soil Resources Institute, Cranfield University[9]. The dataset contains NATMAPvector data, which provides spatial distribution of soil associations; and associated datasets containing properties of soil associations, such as percentage of component soil series. These data are collectively referred to as the LandIS NATMAP dataset. These data can be used to inform ALC as described below.

As described in Section 1.4, when used in isolation, the Provisional 1:250,000 ALC mapping cannot be used to identify the presence or absence of BMV land or the distribution of ALC grading at the field level. However, it may be used in conjunction with published soils data; LandIS NATMAP data and "Soils and their use in Eastern England"[10] to identify the likely proportion of BMV land through the identification of areas of potential Subgrade 3a or 3b land.

The LandIS NATMAP dataset provides the area covered by each soil association and its component soil series within the Study Area. The LandIS data also gives the percentage distribution of the dominant or key component soil series within each association; discounting any ancillary soil series which only make up a small proportion of the soils within the association. The percentage distribution of the dominant soil series is therefore adjusted so that their total equals 100%; this is because inclusion of the lesser ancillary series would unnecessarily complicate the assessment without increasing its accuracy. The area covered by each key soil series, within areas identified as ALC Grade 3 land on the provisional 1:250,000 ALC mapping can then be derived.

Published data from "Soils and their use in Eastern England" will be used to identify the typical limitations to agricultural land quality (ALC) displayed by each of the identified soil series. Limitations include typical soil depth, soil texture, soil stone content and soil wetness. These limitations will then be used to determine the subdivision of ALC Grade 3 into Subgrade 3a and 3b; using the methodology set out below and described in MAFF[11].

[8]Triton Knoll Electrical System: Relevant Representations of Natural England (2015) http://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/07/Natural-England-Relevant-Representation.pdf (accessed: 13/06/2016).

[9] Cranfield University, 2015. The Soils Guide, available at: www.landis.org.uk. Cranfield University, UK (accessed: 25/04/2016).

[10] Soil Survey of England and Wales, 1984. Soils and their use in Eastern England

[11] MAFF, 1988. Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.

The soil texture information is obtained from the published soil profile descriptions[10]. Where a soil texture is identified as heavy or medium (i.e. silty clay loam and clay loam), it is assumed the distribution is a fifty-fifty split. Additionally, if more than one soil texture is listed in the description of soils series, their proportions will be assumed to be equal. Furthermore, if more than one soil wetness is listed in the description of soils series, the proportions are assumed to be equal. Where soil wetness can be improved via appropriate land management, it is assumed that appropriate management practices are in place.

If the calculation of the ALC grade from the published data results in a Grade other than 3a or 3b, the Grade will be corrected. For example, a calculated Grade 1 or 2 will remain BMV land, but re-assigned to Subgrade 3a, whilst a calculated Grade 4 or 5 will remain non-BMV, but re-assigned to Subgrade 3b. Where it is not possible to determine one single grade for a soil series, equal proportions will be assumed.

The combination of the soil series areas within mapped ALC Grade 3 agricultural land; the proportion of Subgrade 3a and 3b of each series; and the mapped ALC Grades 1 and 2 land, can therefore provide the total potential area of BMV in the Study Area.

However, the spatial arrangement of the ALC Grading cannot be obtained from the NATMAP data, as only the proportion of each soil series within an association is provided, not their geographical location. Therefore, the relative proportions of Subgrade 3a and 3b within the Study Area can only be presented in a tabular form and not represented in a mapped format.

The lack of spatial information will not affect the reporting or impact assessment along the majority of the route. However, it is acknowledged that for certain areas of the route corridor it may be pertinent to undertake limited soil survey, subject to the available desk top data and landowner discussion, to verify the ALC grading and BMV status at particular points.

2.2 ALC Grading Methodology: Soil Survey and Desk Study (Scenario 2)

The following ALC Grading methodology is to inform the route which will undergo temporary development. A soil survey will be carried out to accurately determine the soil characteristics, identify the ALC grading to identify the presence or absence of BMV land, and provide the distribution of ALC grading at the field level., This methodology can also assist with the micro-siting of the cable and associated joint bays, as the spatial arrangement of the ALC Grading can be derived.

The proposed soil surveying methodology will consist of a site walkover and soil survey using manual sampling techniques. Prior to any survey work, a safety check with a Cable Avoidance Tool (CAT Scanner) is carried out at each identified sample point, so to avoid buried services. All members of the Soils Team have been trained in the use of a CAT Scanner. Should buried services be detected, the sample point would be relocated, and the relocated point scanned as above. Following the safety check, soil sampling will consist of both soil profile pits and auger cores. Soil cores are taken using a 70mm diameter Edelman auger capable of sampling down to a depth of 1.2m. After examination the soil is replaced, in sequence, into the core leaving no hole or divet. Soil profile pits are dug with a spade to approximately 80cm depth. The dimensions of the pit opening are approximately 50cm by 100cm. After examination the soil is replaced, replicating the soil profile (e.g. discrete layering of subsoil, topsoil and any additional horizons within) to ensure minimal disturbance. If present, the overlying turf is then carefully replaced in the same orientation as it was removed and tamped down. No hole, divet or excess material will be evident upon completion. Given the scale of the works and the minimal disturbance, soil survey is therefore considered to be non-intrusive, compared to large scale (mechanical) geotechnical site investigation.

In addition to the soil information obtained through auger sampling (including soil depth, horizons, colour, texture, gleying) a soil profile pit can also be used to identify the soil structure. Therefore, a robust soils assessment requires both soil pits and soil cores.

It is recommended that soil auger cores are undertaken along the route with a minimum of one per agricultural field (avoiding areas of non-agricultural land, forestry *etc.)*.

Soil profile pit locations will be informed by the results of the desktop study (as described in 1.2) and information obtained by the NG Lands Team; which will indicate the ALC Grade (land quality), land use, and provide a verification of the LandIS data. Soil profile pits will be concentrated in regions of transitioning soil associations; or in land of high sensitivity located close to proposed link box locations to assist with micro-siting. As a result, the survey methodology and the density of sampling will vary along the route, depending upon the defined corridor, the local environment, and the nature of the development at a given location.

2.3 ALC Grading Methodology: Soil Survey in areas undergoing permanent development

The following ALC Grading methodology is to inform the sections of the route which will undergo permanent development (i.e. the converter station). A soil survey will be carried out to accurately determine the soil characteristics and identify the ALC grading.
The proposed soil surveying methodology will consist of a site walkover and soil survey using manual sampling techniques, as described in Section 2.2. Soil sampling will consist of both soil profile pits and auger cores, to ensure a robust assessment.

A survey density of approximately one soil profile pit per 10ha or less (with at least one soil pit per site) and soil cores at a density of approximately one point per hectare, avoiding features such as hedgerows and tracks, will be used in accordance with the recommendations set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'[12].

3 Soil Restoration

The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites[13] provides detailed guidance for the assessment and management of soil during the planning, construction and restoration (landscaping and habitat creation) phases of a development. The code of practice demonstrates how the correct implementation of soil management techniques can improve the quality of a development and lower development costs.

The Good Practice Guide for Handling Soils[14] also offers guidance for the removal, storage, working and replacement of soil resources by machinery. This document aims to reduce negative impacts upon soil resources during and after working.

The development will result in a disturbance to soil resources. The activities undertaken during the construction phase include, but are not limited to:

[12] Natural England (2012) Agricultural Land Classification; protecting the best and most versatile agricultural land. Available at http://publications.naturalengland.org.uk/file/4424325 [Accessed 26 January 2016].
[13] DEFRA (2009) Construction Code of Practice for the Sustainable use of Soils on Construction Sites. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69308/pb13298-code-of-practice-090910.pdf [Accessed 26 January 2016].
[14] MAFF (2000) Good Practice Guide for Handling Soils. Available at http://www.persona.uk.com/a5dunstable/deposit-docs/DD076-DD100/DD-093.pdf [Accessed 26 January 2016].

- Stripping, stockpiling and reinstatement of topsoil and subsoil.
- Ground works including excavation, levelling and trenching.
- Haul road / access construction.
- Vehicle movements on Site.

The potential adverse effects of such operations on soil resources and soil health include, but are not limited to:

- Damage to the structure and compaction.
- Loss of nutrients (e.g. nitrogen) and soil biota (e.g. bacteria, fungi, earthworms) and reduction of its activity.
- Mixing of horizons (especially topsoil with subsoil) reducing their potential reuse.
- Loss of ecosystem services, such as the ability of the soil to support food production and habitat creation.

Soil resources will be protected against damage by the adoption of appropriate up to date guidance measures. Current Defra guidelines highlight the importance of soil management before, during and after construction, which will also maintain soil health.

Typical mitigation measures include, but are not limited to:

- The handling of soil resources only when sufficiently dry, generally limiting soil operations to the months April to September (although this period may be extended during dry periods);
- The stripping, handling and storage of topsoil separately from subsoil movements;
- Appropriate seeding of soil storage mounds required on site for a period longer than six months, to prevent loss of soil health (e.g. prevent erosion, maintain soil structure, nutrient content and biological activity); and
- Minimising the number of machine and vehicle movements across topsoil to minimise compaction and retain soil structure which are essential components of soil health.

The implementation of the mitigation measures outlined above would maintain the quality of the soil resource and ensure the maintenance of soil health.

4 Summary

Scenario 1 (desk based) can provide the relative proportion of Subgrade 3a and 3b land within each soil association. The method does not allow the spatial arrangement of the ALC grading to be determined, but this will not affect the reporting or impact assessment along the majority of the route. It is however acknowledged that limited soil survey may be required to verify ALC and BMV status at particular points along the route, depending upon landowner discussions and the available desk top data.

Scenario 2 (desk & field based) would verify the ALC grading and provide the spatial distribution of BMV agricultural land across the route.

The only area of permanent landtake would be the Converter Station. The site In accordance with the recommendations set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'[15], this area will undergo detailed soil survey and ALC grade verification.

[15] Natural England (2012) Agricultural Land Classification; protecting the best and most versatile agricultural land. Available at http://publications.naturalengland.org.uk/file/4424325 [Accessed 26 January 2016].

Soil Survey Methodology Natural England Advice (August 2016)

Date: 12 August 2016
Our ref: 191889
Your ref: Technical Soil Methodology

BY EMAIL ONLY

Re: National Grid Viking Link Soil Survey Methodologies

Thank you for consulting Natural England on 22nd July 2016 regarding the Viking Link Soils Survey Methodology. The following constitutes Natural England's Discretionary Advice.

Natural England welcomes the commitment to Natural England best practice for permanent land take, as detailed in technical information note 049 'Agricultural Land Classification; protecting the Best and Most Versatile agricultural land.'

Natural England notes that any permanent loss of land would require detailed ALC assessment, with a minimum of one auger boring per hectare, supported by pits dug in each main soil type to confirm the physical characteristics of the full depth of the soil resource (1.2metres).

Natural England advises that as part of the Survey Methodology there is a need for an inventory of soil resources to facilitate the production of a Soil Management Plan. The Soil Management Plan would include the type and volume of each soil type to be stripped, stored and restored. ALC grade would be used in the restoration stage to determine the type of soil movement etc. that takes place on the eventual development site. Natural England advocates the use of best practice on all restoration, particularly given the linear nature of the Viking Link proposal.

Natural England notes that in mapping soil and regional ALC, the map scale is not fine enough to make any field scale interpretation, so whilst the mapping can give an indication of what might be found in an area. It is suggested that given the variable nature of soils field surveys would be required for confirmation.

Natural England welcomes the information provided in Section 3 (restoration) but notes that soil type and volume are required information, since without these restoration is unlikely to be successful. Such information can only be obtained from a field survey. Natural England accepts that for the initial scoping a desk based exercise is adequate, but prior to works commencing a full field survey would be required in order to produce a Soil Management Plans. It is a requirement of EIA that Soil and Land Quality be considered and the EIA should set out how adverse impacts on soils can be minimised. Further guidance is contained in the *Defra Construction Code of Practice for the Sustainable Use of Soil on Development Sites*.

Should you wish to discuss the above comments further, Natural England would be happy to arrange a meeting under our discretionary advice service.

Please do not hesitate to contact me if you have any questions.

Marine Lead Adviser – Lincolnshire Coast, Marshes and Marine Team
Natural England, Dragonfly House,
2 Gilders Way, Norwich, NR3 1UB

Mob: 07825 218 748, Landline: 0208 0264 842

Confirmation Email

From:
Sent: 01 September 2016 09:28
To:
Cc:
Subject: RE: Soil Survey Methodologies for Viking Link

Categories: Saved

Dear ,

Thank you for your email and please accept my apologies for the delay in coming back to you, I have been out of the office.
As you outlined in your email I can confirm that our expectation would be for the detailed surveys and the development of detailed Soil Management Plans to be carried out post-consent / pre-commencement.
If you have any further questions please don't hesitate to contact me.

Best Wishes,

Marine Lead Adviser – Lincolnshire Coast, Marshes and Marine Team
Natural England, Dragonfly House, 2 Gilders Way, Norwich, NR3 1UB

Mob: 07825 218 748, Landline: 0208 0264 842

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www.gov.uk/natural-england

We are here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

In an effort to reduce Natural England's carbon footprint I will, wherever possible, avoid travelling to meetings and attend via audio, video or web conferencing.

Natural England is accredited to the Cabinet Office Customer Service Excellence Standard

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From:
Sent: 24 August 2016 14:22
To:
Cc:
Subject: Soil Survey Methodologies for Viking Link

Dear

Thank you for providing Natural England's discretionary advice on the Viking Link soil survey methodology (NE letter reference 191889 received via email 12th August), as attached.

As an update, we are undertaking a detailed survey of the permanent development area (Converter Station site) this week. The survey will follow the methodology detailed in technical information note 049 'Agricultural Land

Classification; protecting the Best and Most Versatile agricultural land', and utilise both auger cores and soil profile pits.

The discretionary advice states that the proposed desk based method is appropriate for 'initial scoping'. Could you please confirm that 'initial scoping' refers to both the Scoping Report, PEIR and ES (Planning) phases of the project; and that therefore Natural England are satisfied for detailed surveys and the development of detailed Soil Management Plans to be carried out post-consent / pre-commencement?

Many thanks

Kind regards

| Associate Director Wardell Armstrong LLP
City Quadrant, 11 Waterloo Square, Newcastle Upon Tyne, NE1 4DP
t: 0191 232 0943

Letter: Revised Soil Methodologies

Wardell Armstrong LLP
City Quadrant, 11 Waterloo Square, Newcastle upon Tyne, NE1 4DP, United Kingdom
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your earth our world

Our ref: CR/ER/NT12231/0025 *Date*: 22 March 2017
Your ref:

Marine Lead Advisor
Natural England
Norwich
NR3 1UB

By email

Dear

UK ONSHORE SCHEME OF THE VIKING LINK INTERCONNECTOR – REVISED SOIL METHODOLOGIES

Wardell Armstrong has previously provided Natural England with a written a Technical Note, (issued on 22nd July 2016) which set out the details and methodology to be followed in the production of the Environmental Impact Assessment presented in the Soils and Agriculture chapter of the Environmental Statement for the UK Onshore Scheme of the Viking Link Interconnector. The Technical Note was requested by Natural England at a meeting on 9th June 2016.

The methodology set out a primarily desk-based study using data from the Soil Survey of England and Wales together with purchased LandIS data to provide the relative proportions of ALC Subgrade 3a and 3b and hence the quantity of best and most versatile (BMV) land along the cable route. A soil survey was proposed at areas of permanent development following standard sampling procedures as set out in Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'. It was also acknowledged that for certain areas of the route corridor, it may be pertinent to undertake limited soil survey, subject to the available desk top data and landowner discussion, to verify the ALC grading and BMV agricultural land status at particular points, particularly in areas of high sensitivity soils.

Similar desk based methodologies have been agreed by Natural England and their counterparts in the Welsh Government for a number of National Grid linear infrastructure schemes; with the understanding that detailed soil survey would be undertaken, as required, post-consent.

However, owing to the sensitive nature of the agricultural land and the reliance on complex systems of agricultural land drainage along the route of the UK Onshore Scheme, it has been necessary for National Grid to bring forward detailed pre-and post-construction agricultural drainage design works to an earlier stage of the project programme. This detailed drainage design must be informed by site specific soils data; and therefore a programme of soil survey is currently being devised by National Grid's specialist agricultural drainage contractor, Land Drainage Consultancy Limited (LDC). LDC have also been appointed to produce ALC data for the route, based upon the soil survey.

At this time, the survey density is not known however through discussions with LDC we can confirm that it will be either a detailed, 1 sample per 100m (linear), survey; a semi-detailed, 1 sample per 250 to 300m (linear) survey; or a combination of both, depending upon the particular drainage requirements of the area under survey. All samples are to be taken within the currently proposed 30m easement of the cable route. We will advise you of the survey density once known.

Wardell Armstrong therefore propose to use the LDC survey data and survey derived ALC within the Soils and Agriculture assessment either in place of or in combination with the published data. Whilst this methodology differs to that set out in the Technical Note, we strongly believe that the use of site specific data will provide a more robust assessment of the soil resource and ALC along the route; and better inform the identification of sensitive soils and appropriate mitigation methodologies.

I would be grateful if you could confirm whether Natural England agree with the proposed change. Please do not hesitate to contact me should you have further questions about the proposals.

Yours Sincerely
for Wardell Armstrong LLP

Associate Director

CONTACT US

You can find out more information by:

calling our freephone number:
0800 731 0561

Sending an email to:
vikinglink@communityrelations.co.uk

Writing to our freepost address at:
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Visiting our website at:
www.viking-link.com

If you, or someone you know, would like information in Braille, audio, large print or another language, please call us on the freephone number above.