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## **North Wales Connection Project**

### **Volume 5**

# **Document 5.18.2.1 Appendix 18.1 Soil Profiles, ALC Calculations and Land Holding Data**

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# 1 Appendix 18.1: Soil profiles, ALC calculations and landholding data

## 1.1 INTRODUCTION

- 1.1.1 This appendix contains details of the methodologies used to obtain soil profile data and calculate Agricultural Land Classification (ALC); along with the data used within those calculations.
- 1.1.2 Additionally, the appendix contains anonymised landholding data.
- 1.1.3 The areas of permanent land take (excluding pylons), comprising the Substation extension at Pentir and the Cable Sealing End Compounds (CSEC) and Tunnel Head Houses (THH) at Braint (Anglesey) and Tŷ Fodol (Gwynedd) and associated permanent access tracks were subject to detailed soil surveys on the 6 and 7 December 2016. Survey methodology followed the guidance set out in Natural England's Technical Information Note 049, Agricultural Land Classification: protecting the Best and Most Versatile agricultural land (Ref 18.1.1). The ALC for the areas of temporary land take, such as access tracks, and also for pylon locations was assessed in a desk-based study using published and other pre-existing data sources. This appendix describes the methodology used for the surveys and desk-based study, and their results.
- 1.1.4 This methodology was agreed by the Land Quality Advice Service (LQAS), Department for Environment and Rural Affairs, Welsh Government (see Appendix 18.2; **Document 5.18.2.2**).

### *Agricultural Land Classification (ALC)*

- 1.1.5 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.

- 1.1.6 The 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 it to Subgrade 3b and Grade 2, respectively, such land is classed as Subgrade 3b.

*Best and Most Versatile (BMV) agricultural land*

- 1.1.7 Best and most versatile (BMV) land is defined 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 (see section 2 Chapter 18 Agriculture (**Document 5.18**)). Moderate, poor and very poor quality land is designated Subgrade 3b or Grades 4 and 5 respectively.

*The limitations to agricultural land quality*

- 1.1.8 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 (Ref.18.1.vii), 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.
- 1.1.9 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.
- 1.1.10 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. 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).
- 1.1.11 Soil depth is important when determining available water capacity. Shallowness can affect cropping in several ways, such as restricting the

range of cultivation methods available, restricting nutrient uptake and root growth.

- 1.1.12 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).
- 1.1.13 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.
- 1.1.14 For ALC purposes soil wetness assessment takes account of duration of the period 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.
- 1.1.15 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.
- 1.1.16 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. Knox *et al.*, (2015) 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 (Ref. 18.1.i).

## **1.2 METHODOLOGY: SOIL SURVEY AND ALC CALCULATIONS**

### *Soil Survey (permanent land take areas except pylon footprint)*

- 1.2.1 Soil surveys were undertaken for the THH/CSECs at Braint and Tŷ Fodol and the substation extension at Pentir and their permanent access tracks. The survey methodology followed Natural England's Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land' (Ref. 18.1.ii). The survey data were used determine the ALC for those areas according to the guidelines (Ref 18.1.iii). The descriptions of the soil profiles obtained during the survey are presented in



section 1.3. The droughtiness calculations are presented in section 1.4 and the resulting ALC presented in section 1.5.

*Desk-based assessment (temporary land take and pylon footprint)*

- 1.2.2 It is important to note that the desk-based methodology was utilised for areas of temporary land take and at pylon locations. Areas of permanent land take (excluding pylons) were subject to detailed soil survey as described above.
- 1.2.3 The most current and detailed published ALC data covering the study area is the Provisional 1:250,000 ALC map of Wales (Ref. 18.1.iv). The study area for the assessment of agricultural impacts, is considered to be the Order Limits. The Order Limits are the extent of the 'Order Land' for the Development Consent Order (DCO); the Order Limits and Order Land that are applied for are the full extent of area required to locate and construct the Proposed Development. The Order Limits are illustrated on Figure 3.1 (**Document 5.3.1.1**).
- 1.2.4 The ALC map of Wales is titled 'provisional' as its use should be limited to strategic purposes, and not to describe ALC at an individual field or farm level. This is because it does not generally show areas of different land quality of less than about 80 ha, and does not distinguish between ALC Subgrade 3a and 3b. Therefore, when used in isolation, the Provisional ALC data cannot be used to identify the presence or absence of Best and Most Versatile (BMV) land. To overcome this limitation the 1:250,000 scale ALC mapping has been used in conjunction with the LandIS NATMAP Vector digital map (Ref: 18.1.v) and descriptions of the mapped soils (properties of which are summarised in Table 18.1.1) from the Soil Survey of England and Wales publication: 'Soils and their use in Wales' (Ref: 18.1.vi), together with the agroclimatic dataset (Ref: 18.1.vii).
- 1.2.5 Whilst it is possible that the ALC grade or soil association derived from this data does not reflect the grade in a particular location within a field (pylon location), it does reflect the dominant land quality or soil characteristics and therefore provides an average for a larger area, such as the Order Limits. Therefore, the ALC grade or soil association has been characterised at appropriate scale for the assessments which are provided on a Project-wide basis, rather than a pylon by pylon basis.
- 1.2.6 The 1:250,000 scale National Soil Map dataset (Ref: 18.1.v) covering the study area was purchased from the National Soil Resources Institute (NSRI), Cranfield University. The dataset contains NATMAP Vector data, which provides spatial distribution of soil associations; and associated datasets containing properties of soil associations, such as percentage of the dominant

and main component soil series. The percentage disregards any ancillary soil series which only make up a small proportion of the soils within some of the associations. 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 was then derived.

- 1.2.7 Soil series descriptions provided by Soil Survey of England and Wales (Ref: 18.1.vi), were used to identify the typical limitations to ALC grading displayed by each of the soils. Limitations include typical soil depth, soil texture, soil stone content and soil wetness. These limitations were then 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. The results of this assessment are provided in Table 18.1.1.
- 1.2.8 The soil texture information was 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.
- 1.2.9 The overall climatic limitation is assessed using the average annual rainfall and accumulated temperature. These data for the study area were obtained from the Meteorological Office agroclimatic data for England and Wales published on a five-kilometre grid basis (Ref 18.1.vii). The climatic limitation for the study area does not limit the ALC grade more than 3a.
- 1.2.10 From the climatic data, the number of field capacity days (FCD) can be determined. The number of FCD impacts the wetness limitation of the soils depending on their location within the study area. The study area is characterised by FCD in two categories, 176–225 and above 225. For the same soil present in the higher FCD category, the wetness limitation is usually higher due to longer period of waterlogging, which restricts the range of farming operations and crops that can be grown. To ensure that the assessment remains robust, it was assumed that the entire study area falls into the lower FCD category of 176–225 days, which is more likely to result in overestimation of the area of BMV land affected rather than underestimation of it.

- 1.2.11 The assessment has been carried out on mapped Grade 3 land (Provisional 1:250,000 mapping). 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 as follows to sit within ALC Grade 3. 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.
- 1.2.12 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 study area.
- 1.2.13 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 study area can only be presented in a tabular form and not represented in a mapped format (Table 18.1.1 and 18.1.2). The lack of spatial information does not affect the reporting or impact assessment.

#### *Summarised Soil Association Data*

- 1.2.14 Soil Survey of England and Wales (1984), Soils and their Use in Wales (Ref 18.2) identified eleven soil associations within the study area. A summary of published soil association data is provided in Table 18.9 (**Document 5.18**), together with a calculation of the area each association occupies within the study area. Estimates of the proportion of Subgrade 3a and 3b within the land mapped as Grade 3 on the Provisional ALC map, are presented in Table 18.1.1 and summarised in Table 18.1.2.

**Table 18.1.1 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																							
	Name	%	V.	L.		V.	L.			A	B	1	2	3	4	1	2	3	4	1	2	3	4	Series		Assoc.																			
																						% 3a	% 3b	% 3a	% 3b																				
541c Eardiston 1	Eardiston	67	60	1	no	slightly	1	no	1		SZL				1							100		67																					
	Bromyard	18	100	1	no	stoneless	1	no	2		MZCL	HZCL			3a	3a						100		18																					
	Bromsgrove	15	90	1	no	stoneless	1	no	1		SL				1							100		15																					
																						Total	100																						
541j Denbigh	Denbigh	54	100	1	no	slightly	1	no	1		MCL	HCL			2	3a						100		54																					
	Powys	13	25	3b	no	slightly	1	no	1		MCL	HCL	MZCL	HZCL	2	3a	2	3a				100		13																					
	Sannan	7	100	1	no	slightly	1	no	2	3	MCL	HCL			3a	3a			3a	3b		75	25	5.25	1.75																				
	Barton	13	70	1	no	slightly	1	no	1		MZCL	HZCL			2	3a						100		13																					
	Manod	13	60	1	no	slightly	1	no	1		MZCL	HZCL			2	3a						100		13																					
																						Total	98.3	1.75																					
541r Wick	Wick	56	120	1	no	slightly	1	no	1		SL	SZL			1	1						100		56																					
	Arrow	25	100	1	no	slightly	1	no	1		SL				1							100		25																					
	Newport	19	120	1	2/no	slightly	1	no	1		SL	LS			1	1						100		19																					
																						Total	100																						
541x East Keswick 1	East Keswick	53	100	1	no	slightly	1	no	1		MCL	HCL			2	3a						100		53																					
	Nercwys	35	100	1	no	slightly	1	no	2		MCL	HCL			3a	3a						100		35																					
	Arrow	12	100	1	no	slightly	1	no	2		SL				2							100		12																					
																						Total	100																						
541z East Keswick 3	East Keswick	63	100	1	no	slightly	1	no	1		MCL	HCL			2	3a						100		63																					
	Wilderhope	25	70	1	no	slightly	1	no	1		MCL	HCL	SZL		2	3a	1					100		25																					
	Crwbin	12	25	3b	no	slightly	1	no	1		MCL	HCL			2	3a						100		12																					

**Table 18.1.1 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					
	Name	%	V.	L.		V.	L.		A	B	1	2	3	4	A	A	A	A	B	B	B	B	Series		Assoc.			
									A	B	1	2	3	4	1	2	3	4	1	2	3	4	% 3a	% 3b	% 3a	% 3b		
																							Total	100				
713c Fforest	Fforest	79	100	1	no	slightly	1	no	4	5	MZCL	HZCL			3b	4			4	4					100		79	
	Wenallt	11	100	1	no	stoneless	1	no	4	5	PTY				3a				4						50	50	5.5	5.5
	Llangendeirne	10	90	1	no	slightly	1	no	4	5	MCL	HCL			3b	4			4	4							100	
																							Total	5.5	94.5			
713d Cegin	Cegin	47	100	1	no	slightly	1	no	4		MZCL	HZCL			3b	4									100		47	
	Greyland	18	100	1	no	slightly	1	no	4		MCL	HCL			3b	4									100		18	
	Brickfield	12	100	1	no	slightly	1	no	4		MCL	HCL			3b	4									100		12	
	Sannan	12	100	1	no	slightly	1	no	3		MCL	HCL			3a	3b									50	50	6	6
	Denbigh	11	100	1	no	slightly	1	no	1		MCL	HCL			2	3a										100		11
																							Total	17	83			
713f Brickfield 2	Brickfield	53	100	1	no	slightly	1	no	3	4	MCL	HCL			3a	3b			3b	4					25	75	13.3	39.8
	Nercwys	27	100	1	no	slightly	1	no	3	4	MCL	HCL			3a	3b			3b	4					25	75	6.75	20.3
	East Keswick	20	100	1	no	slightly	1	no	1		MCL	HCL			2	3a										100		20
																							Total	40	60			
721c Wilcocks 1	Wilcocks	72	100	1	no	stoneless	1	yes	5	6	PTY	MCL	HCL		4	4	4		5	5	5				100		72	
	Kielder	17	100	1	no	stoneless	1	yes	5	6	PTY	MCL	HCL		4	4	4		5	5	5				100		17	
	Fordham	11	100	1	no	slightly	1	yes	5	6	PTY	SL			4	4			5	5						100		11
																							Total		100			
811b Conway	Conway	59	120	1	no	stoneless	1	no	4	5	MZCL	HZCL			3b	4			4	4					100		59	
	Clwyd	24	100	1	no	stoneless	1	no	2	3	MZCL	HZCL			3a	3a			3a	3b					75	25	18	6
	Fladbury	17	100	1	no	stoneless	1	no	4	5	C				4				5							100		17
																							Total	18	82			

Note: Adventurers' soils (1024a) have been omitted as they do not occur on Grade 4 and Grade 5 land only; for the wetness limitation, the FCD range used was 175–225, 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.

**Table 18.1.1 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							
	Name	%	V.	L.		V.	L.		A	B	1	2	3	4	A	A	A	A	B	B	B	B	Series		Assoc.	
			1	2	3	4	1	2	3	4	% 3a	% 3b	% 3a	% 3b												
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.																										

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*Calculated BMV proportions for Soil Associations*

**Table 18.1.2: BMV proportions for Soil Associations in the study area where present within areas mapped as Grade 3**

<b>Soil Association</b>	<b>% 3a</b>	<b>% 3b</b>
Eardiston (541c)	100	0
Denbigh 1 (541j)	98	2
Wick 1 (541r)	100	0
East Keswick 1 (541x)	100	0
East Keswick 3 (541z)	100	0
Fforest (713c)	5	95
Cegin (713d)	17	83
Brickfield 2 (713f)	40	60
Wilcocks 1 (721c)	0	100
Conway (811b)	18	82
Rounded to nearest percent; Adventurers' 1 (1024a) soils are only present within Grade 4 or 5 areas		

### **1.3 DESCRIPTION OF SOIL PROFILES FROM THE DETAILED SOIL SURVEYS**

- 1.3.1 Table 18.1.3 provides a description for the non-self-explanatory terms used in the description of the soil profile.
- 1.3.2 The Braint THH/CSEC study area is located on Anglesey and the results from the soil survey are presented in Table 18.1.4.
- 1.3.3 The Tŷ Fodol THH/CSEC study area is located in Gwynedd and the results from the soil survey are presented in Table 18.1.5.
- 1.3.4 The Pentir Substation extension is located in Gwynedd and the results from the soil survey are presented in Table 18.1.6.



**Table 18.1.3: Legend for non-self-explanatory terms used in soil profile descriptions**

<b>Terminology</b>	<b>Description</b>
Horizons	number of different horizons identified within the profile
Depth	depth to the bottom of the horizon in cm
Soil Type	mineral (M) or organic-mineral (OM)/peaty (P) texture
Texture	C - clay, ZC - silty clay, SC - sandy clay, CL - clay loam, SCL – sandy clay loam, ZCL - silty clay loam, SL - sandy loam, LS - loamy sand, S - sand). OS – organic sands, OL – organic loams, OC – organic clays, PS – peaty sands, PL – peaty loams, SP – sandy peats, LP – loamy peats, HP – humified peats, FP – fibrous peats, SFP – semi-fibrous peats*
*Abbreviations M and H medium and heavy texture (M <27 %, H > 27 % Clay) Abbreviations F, M and C refer to fine, medium and coarse sandy textures.	
Colour	Hue - Munsell colour hue Value - Munsell colour value Chroma - Munsell colour chroma
Von Post	The degree of humification is graded on a scale from 1 to 10 and designated H1 to H10
Water Content	Water content is estimated on a scale from 1 (dry) to 5 (very high), designated B1 to B5
Fine Fibre Content	Fine fibres are defined as fibres or stems smaller than 1mm in diameter or width. The content of fine fibres is graded on a scale from 0 to 3 as follows: F0 (Nil); F1 (Low content); F2 (Moderate content) and F3 (High content)
Coarse Fibre Content	Coarse fibres are defined as fibres, stems and rootlets greater than 1 mm in diameter or width. The content of coarse fibres is graded on a scale from 0 to 3 as follows: R0 (Nil); R1 (Low content); R2 (Moderate content); and R3 (High content)

**Table 18.1.3: Legend for non-self-explanatory terms used in soil profile descriptions**

<b>Terminology</b>	<b>Description</b>
Wood remains	Wood and shrub content is graded on a scale from 0 to 3 as follows: W0 (Nil); W1 (Low content); W2 (Moderate content); and W3 (High content), replacing with N for shrub remains
Mottling abundance	presence of >2 % mottling, followed by Munsell colour (value and chroma) of the mottles
Ped face different colour	colour of ped faces different from the main horizon colour
Biopores	'yes' if >0.5 % biopores greater than 0.5 mm diameter present
Stones	Stones > 2 cm - Percentage of 2 – 6 cm diameter stones. Stones > 6 cm - Percentage of > 6 cm diameter stones
Structure	Structure type; SG - single grain; GR – granular; SAB - subangular blocky; AB - angular blocky; PR – prismatic; PL – platy; MAS – massive
Development	How well the structure is developed; W – weak; M – moderate; S – strong
Strength	Soil consistence; L – loose; VFR - very friable; FR – friable; FIR – firm; VFIR - very firm; EXFIR - extremely firm; EXHD - extremely hard
SPL	Slowly permeable layer
FCD	Field capacity days
Overall ALC	This part of the table combines results of the classification for every limitation

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Table 18.1.4: Soil Profile Description: Braint THH/CSEC																			
Sample	Gradient	Horizon	Depth	Texture	Hue	Value	Chroma	Mottling (abundance)	Mottling Hue	Mottling Value	Mottling Chroma	Ped face different colour	Biopores	Stones > 2 cm	Stones > 6 cm	Structure	Development	Ped size	Strength
1	0	1	40	MZCL	2.5YR	3	3	0				NO	YES	5	0	AB	M	M	FR
		2	80	SCL	5YR	5	4	20	10YR	7	8	NO	NO	5	0	AB	M	M	FR
2	0	1	30	SZL	5YR	4	3	0				NO	NO	5	0	AB	M	M	FIR
		2	75	SCL	5YR	4	6	20	10YR	6	8	NO	NO	5	0	AB	M	M	FR
3	0	1	30	SCL	5YR	4	3	0				NO	NO	5	0	AB	M	M	FIR
		2	70	MCL	5YR	4	3	20	7.5YR	5	6	NO	NO	5	0	AB	M	M	FR
4	0	1	30	MZCL	7.5YR	4	3	0				NO	NO	5	0	AB	M	M	FIR
		2	60	ZCL	10YR	6	3	40	10YR	7	8	NO	NO	5	0	AB	M	M	FR
5	0	1	40	MZCL	10YR	4	1	20	10YR	6	6	NO	NO	5	0	AB	M	M	FR
		2	75	HZCL	Gley 1	6	5G/1	20	2.5YR	7	8	NO	NO	5	0	AB	M	M	FR
6	0	1	35	SCL	10YR	3	6	0				NO	NO	5	0	AB	M	M	FIR
		2	55	SCL	10YR	4	4	2	2.5YR	5	2	NO	NO	5	0	AB	M	M	FR
		3	75	SC	Gley 1	6	5G/1	20	2.5YR	6	4	NO	NO	5	0	AB	M	M	FIR
7	0	1	60	ZL	10YR	3	4	0				NO	NO	5	0	AB	M	M	FR
		2	90	SZL	7.5YR	5	3	20	10YR	7	8	NO	NO	5	0	AB	M	M	FIR
8	0	1	40	MZCL	10YR	4	4	0				NO	NO	5	0	AB	M	M	FIR
		2	60	MZCL	10YR	4	4	2	10YR	7	8	NO	NO	5	0	AB	M	M	FIR
9	0	1	35	MZCL	10YR	3	2	0				NO	NO	5	0	AB	M	M	FR
		2	65	SCL	10YR			0				NO	NO	5	0	AB	M	M	FIR
		3	88	SCL	10YR	7	3	0				NO	NO	5	0	PL	M	M	FIR
10	0	1	30	MZCL	10YR	3	4	0				NO	NO	5	0	AB	M	M	L
		2	60	SCL	10YR	3	3	2	Gley 1	6			NO	NO	5	0	AB	M	M
11	0	1	60	ZL	10YR	3	4	0				NO	NO	5	0	AB	M	M	L
		2	90	SZL	7.5YR	5	3	20	10YR	7	8	NO	NO	5	0	AB	M	M	FR

Table 18.1.5: Soil Profile Description: Tŷ Fodol THH/CSEC																			
Sample	Gradient	Horizon	Depth	Texture	Hue	Value	Chroma	Mottling (abundance)	Mottling Hue	Mottling Value	Mottling Chroma	Ped face different colour	Biopores	Stones > 2 cm	Stones > 6 cm	Structure	Development	Ped size	Strength
1		1	30	CSZL	7.5YR	4	3	0				NO	YES	10	0	SAB	M	C	FR
2		1	30	CSZL	5YR	4	3	0				NO	YES	10	0	SAB	M	C	FR
3		1	30	CSZL	5YR	3	3	0				NO	YES	10	0	SAB	M	C	FR
4		1	22	MSZL	10YR	4	3	0				NO	YES	10	0	SAB	M	M	FR
		2	35	CSZL	10YR	6	6	0				NO	YES	10	5	SAB	M	C	VFR
			70	CS	10YR	5	6	0				NO	NO	5	10	GR	M	C	VFR
5		1	38	MSZL	10YR	2	2	0				NO	YES	10	0	SAB	M	M	FR
		2	50	CSZL	10YR	5	4	20	10YR	7	8	YES	NO	10	5	SAB	M	C	FR
6		1	35	MSZL	7.5YR	4	2	0				NO	YES	10	0	SAB	M	M	FR
		2	45	CSZL	10YR	5	4	20	10YR	7	8	YES	NO	10	5	SAB	M	C	FR

Table 18.1.6: Soil Profile Description: Pentir Substation Extension																		
Sample	Horizon	Depth	Texture	Hue	Value	Chroma	Mottling (abundance)	Mottling Hue	Mottling Value	Mottling Chroma	Ped face different colour	Biopores	Stones > 2 cm	Stones > 6 cm	Structure	Development	Ped size	Strength
1	1	25	MZCL	10YR	3	2	2	10YR	6	4	NO	YES	0	0	GR	M	M	FR
	2	70	SCL	10YR	5	3	20	10YR	5	6	YES	NO	0	0	AB	M	M	FIR
2	1	25	MZCL	10YR	4	3	0				NO	YES	0	0	GR	M	M	FR
	2	70	MZCL	10YR	6	2	20	7.5YR	6	8	YES	NO	0	0	AB	M	M	FIR
3	1	15	MZCL	10YR	3	2	0				NO	YES	0	0	GR	M	M	L
	2	24	SCL	10YR	5	8	40	2.5YR	6	2	NO	NO	0	0	AB	M	M	FIR
	3	65	ZCL	2.5YR	6	2	20	5YR	2.5	1	YES	NO	0	0				
4	1	31	SCL	10YR	3	2	0				NO	YES	15	10	GR	M	M	FR

Table 18.1.6: Soil Profile Description: Pentir Substation Extension																		
Sample	Horizon	Depth	Texture	Hue	Value	Chroma	Mottling (abundance)	Mottling Hue	Mottling Value	Mottling Chroma	Ped face different colour	Biopores	Stones > 2 cm	Stones > 6 cm	Structure	Development	Ped size	Strength
	2	55	SCL	10YR	4	3	20	10YR	5	6	YES	NO	15	10	AB	M	M	FR
	3	87	MZCL	10YR	5	4	40	7.5YR	5	6	NO	NO	15	10	AB	M	M	FIR
5	1	30	MZCL	10YR	3	4	0				NO	YES	15	10	GR	M	M	L
	2	60	MZCL	2.5YR	6	4	20	10YR	6	8	NO	NO	15	10	AB	M	M	FR
6	1	28	MZCL	10YR	4	2	0				NO	YES	15	10	GR	M	M	FR
	2	45	MZCL	10YR	4	2	40	10YR	6	6	NO	NO	15	10	AB	M	M	FR
7	1	40	SCL	10YR	6	4	0				NO	YES	15	10	GR	M	M	FR
	2	72	SCL	2.5YR	6	2	20	10YR	5	6	NO	NO	15	10	AB	M	M	FR

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## 1.4 DROUGHTINESS CALCULATIONS

- 1.4.1 Table 18.1.7 provides a description for the abbreviations used in the droughtiness calculations.
- 1.4.2 The droughtiness calculations for Braint THH/CSEC, Tŷ Fodol THH/CSEC and the Pentir Substation extension are presented in Tables 18.1.8 to 18.1.10.

<b>Table 18.1.7: Droughtiness Calculation abbreviations</b>	
<b>Abbreviations</b>	<b>Description</b>
TA <sub>v</sub>	Total amount of soil water available to plants, considered to be the volumetric soil water content between 0.05 and 15 bar suction or, in case of sands and loamy sands, 0.10 and 15 bar suction. These suctions approximate to the conditions of field capacity and wilting point (when the plants can extract no more moisture from the soil)*
EA <sub>v</sub>	Easily available water, held in the soil between 0.05 and 2.0 bar suction, used for calculating cereal available water below 50 cm depth where root systems are less well developed, and the plant's ability to extract water is diminished*
*Values of TA <sub>v</sub> and EA <sub>v</sub> are estimated for each horizon based on soil texture and structural condition according to the ALC guidelines (MAFF, 1988).	
AP	Crop adjusted available water capacity, a measure of the quantity of water held in the soil profile which can be taken up by a specific crop
MD	The moisture deficit term used in the ALC droughtiness assessment is a crop-related meteorological variable which represents the balance between rainfall and potential evapotranspiration calculated over a critical portion of the growing season



**Table 18.1.7: Droughtiness Calculation abbreviations**

<b>Abbreviations</b>	<b>Description</b>
MB	Moisture balance: $MB=AP-MD$ , MB for wheat and potatoes determines limitation by droughtiness

**Table 18.1.8: Droughtiness Calculations: Braint THH/CSEC**

Sample	Horizon	Horizon thickness	Texture	% stones	Structural condition	TAv %	EAv%	Start depth	End depth	Horizon thickness	TAv / EAv	% non stone	TAv / EAv stones	% stones	AP wheat	AP(wheat) - MD(wheat)	AP potatoes	AP(potato) - MD(potato)	ALC limit
1	1	40	MZCL	5	good	19		0	40	40	19	95	0	5	114.95	36	114.95	51	1
	2	40	SCL	5	moderate	15	10	40	80	10	15	95	0	5					
2	1	35	SZL	5	good	19		0	35	35	19	95	0	5	108.3	30	113.05	49	2
	2	40	SCL	5	moderate	15	10	35	75	15	15	95	0	5					
3	1	30	SCL	5	good	17		0	30	30	17	95	0	5	97.85	19	109.25	46	2
	2	40	MCL	5	moderate	16	10	30	70	20	16	95	0	5					
4	1	30	MZCL	5	good	19		0	30	30	19	95	0	5	95.95	17	102.6	39	2
	2	30	ZCL	5	moderate	17	10	30	60	20	17	95	0	5					
5	1	40	MZCL	5	good	19		0	40	40	19	95	0	5	112.1	34	120.65	57	1
	2	35	HZCL	5	moderate	17	10	40	75	10	17	95	0	5					
6	1	35	SCL	5	good	17		0	35	35	17	95	0	5	97.85	19	103.55	40	2
	2	20	SCL	5	moderate	15	10	35	55	15	15	95	0	5					
	3	20	SC	5	poor	13	8	55	75	0	13	95	0	5					
7	1	60	ZL	5	good	23		0	60	50	23	95	0	5	137.75	59	147.25	84	1
	2	30	SZL	5	moderate	17	10	60	90	0	17	95	0	5					
8	1	40	MZCL	5	good	19		0	40	40	19	95	0	5	97.85	19	104.5	41	2
	2	20	MZCL	5	moderate	17	10	40	60	10	17	95	0	5					
9	1	35	MZCL	5	good	19		0	35	35	19	95	0	5	120.65	42	113.05	49	1
	2	30	SCL	5	moderate	15	10	35	65	15	15	95	0	5					
	3	23	SCL	5	moderate	15	10	65	88	0	15	95	0	5					
10	1	30	MZCL	5	good	19		0	30	30	19	95	0	5	92.15	14	96.9	33	2
	2	30	SCL	5	moderate	15	10	30	60	20	15	95	0	5					
11	1	60	ZL	5	good	23		0	60	50	23	95	0	5	137.75	59	147.25	84	1
	2	30	SZL	5	moderate	17	10	60	90	0	17	95	0	5					

**Table 18.1.9: Droughtiness Calculations: Tŷ Fodol THH/CSEC**

Sample	Horizon	Horizon thickness	Texture	% stones	Structural condition	TAv %	EAv%	Start depth	End depth	Horizon thickness	TAv / EAv	% non stone	TAv / EAv stones	% stones	AP wheat	AP(wheat) - MD(wheat)	AP potatoes	AP(potato) - MD(potato)	ALC limit
1	1	30	CSZL	10	good	19		0	30	30	19	90	0	10	51.3	-21	51.3	-5	3b
2	1	30	CSZL	10	good	19		0	30	30	19	90	0	10	51.3	-21	51.3	-5	3b
3	1	30	CSZL	10	good	19		0	30	30	19	90	0	10	51.3	-21	51.3	-5	3b
4	1	22	MSZL	10	good	19		0	22	22	19	90	0	10	76.21	3	77.91	22	3a
	2	13	CSZL	15	good	23	17	22	35	13	23	85	0	15					
	3	35	CS	15	good	5	4	35	70	15	5	85	0	15					
5	1	38	MSZL	10	good	19		0	38	38	19	90	0	10	76.2	3	76.2	20	3a
	2	12	CSZL	15	moderate	11	6	38	50	12	11	85	0	15					
6	1	35	MSZL	10	good	19		0	35	35	19	90	0	10	76	3	76	20	3a
	2	10	CSZL	15	moderate	19	11	35	45	10	19	85	0	15					

**Table 18.1.10: Droughtiness Calculations: Pentir Substation Extension**

Sample	Horizon	Horizon thickness	Texture	% stones	Structural condition	TAv %	EAv%	Start depth	End depth	Horizon thickness	TAv / EAv	% non stone	TAv / EAv stones	% stones	AP wheat	AP(wheat) - MD(wheat)	AP potatoes	AP(potato) - MD(potato)	ALC limit
1	1	25	MZCL		GOOD	19		0	25	25	19	100	0	0	105	36	115	64	1
	2	45	SCL		MODERATE	15	10	25	70	25	15	100	0	0					
2	1	25	MZCL		GOOD	19		0	25	25	19	100	0	0	110	41	124	73	1
	2	45	MZCL		MODERATE	17	10	25	70	25	17	100	0	0					
3	1	15	MZCL		GOOD	19		0	15	15	19	100	0	0	82.2	13	91.2	40	2
	2	9	SCL		MODERATE	15	10	15	24	9	15	100	0	0					
	3	41	ZCL		MODERATE	12	6	24	65	26	12	100	0	0					
4	1	31	SCL	25	GOOD	17		0	31	31	17	75	0	25	88.65	20	85.65	35	2
	2	24	SCL	25	MODERATE	15	10	31	55	19	15	75	0	25					
	3	32	MZCL	25	MODERATE	17	10	55	87	0	17	75	0	25					

Table 18.1.10: Droughtiness Calculations: Pentir Substation Extension																			
Sample	Horizon	Horizon thickness	Texture	% stones	Structural condition	TA <sub>v</sub> %	EA <sub>v</sub> %	Start depth	End depth	Horizon thickness	TA <sub>v</sub> / EA <sub>v</sub>	% non stone	TA <sub>v</sub> / EA <sub>v</sub> stones	% stones	AP wheat	AP(wheat) - MD(wheat)	AP potatoes	AP(potato) - MD(potato)	ALC limit
5	1	30	MZCL	25	GOOD	19		0	30	30	19	75	0	25	75.75	7	81	30	2
	2	30	MZCL	25	MODERATE	17	10	30	60	20	17	75	0	25					
6	1	28	MZCL	25	GOOD	19		0	28	28	19	75	0	25	61.57 5	-7	61.575	11	3a
	2	17	MZCL	25	MODERATE	17	10	28	45	17	17	75	0	25					
7	1	40	SCL	25	GOOD	17		0	40	40	17	75	0	25	78.75	10	84.75	34	2
	2	32	SCL	25	MODERATE	15	10	40	72	10	15	75	0	25					

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## **1.5 OVERALL ALC CALCULATIONS**

- 1.5.1 The overall ALC calculation are presented for Braint THH/CSEC; Tŷ Fodol THH/CSEC and the Pentir substation extension are presented in Tables 18.1.11 to 18.1.13.

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Table 18.1.11: Soil Profile ALC: Braint THH/CSEC													
Sample	Climatic ALC	Gradient	Flood Risk	Soil Depth	Topsoil stoniness	Wetness Class	Wetness limitation	Drought-iness	Topsoil texture	ALC Grade	Limited by	SPL criteria	Criteria for the limitation(s)
1	2	1	1	1	1	IV	3b	1	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
2	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60cm, SZL topsoil
3	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, SCL topsoil
4	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
5	2	1	1	1	1	IV	3b	1	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
6	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, SCL topsoil
7	2	1	1	1	1	IV	3b	1	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, ZL topsoil
8	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
9	2	1	1	1	1	IV	3b	1	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
10	2	1	1	1	1	IV	3b	2	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, MZCL topsoil
11	3a	1	1	1	1	IV	3b	1	1	3b	Wetness	Red soils with SPL within 60cm and FCD of 233	SPL within 60 cm, ZL topsoil

Table 18.1.2: Soil Profile ALC: Tŷ Fodol THH/CSEC													
Sample	Climatic ALC	Gradient	Flood Risk	Soil Depth	Topsoil stoniness	Wetness Class	Wetness limitation	Drought-iness	Topsoil texture	ALC Grade	Limited by	SPL criteria	Criteria for the limitation(s)
1	3a	1	1	3a	2	I	2	3b	1	3b	Droughtiness		



Table 18.1.2: Soil Profile ALC: Tŷ Fodol THH/CSEC													
Sample	Climatic ALC	Gradient	Flood Risk	Soil Depth	Topsoil stoniness	Wetness Class	Wetness limitation	Droughtiness	Topsoil texture	ALC Grade	Limited by	SPL criteria	Criteria for the limitation(s)
2	3a	1	1	3a	2	I	2	3b	1	3b	Droughtiness		
3	3a	1	1	3a	2	I	2	3b	1	3b	Droughtiness		
4	3a	1	1	1	2	I	2	3a	1	3a	Climate & Droughtiness		
5	3a	1	1	2	2	I	2	3a	1	3a	Climate & Droughtiness		
6	3a	1	1	2	2	I	2	3a	1	3a	Climate & Droughtiness		

Table 18.1.13: Soil Profile ALC: Pentir Substation extension													
Sample	Climatic ALC	Gradient	Flood Risk	Soil Depth	Topsoil stoniness	Wetness Class	Wetness limitation	Droughtiness	Topsoil texture	ALC Grade	Limited by	SPL criteria	Criteria for the limitation(s)
1	3a	1	1	1	1	V	4	1	1	4	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, MZCL topsoil
2	3a	1	1	1	1	V	4	1	1	4	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, MZCL topsoil
3	3a	1	1	1	1	V	4	2	1	4	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, MZCL topsoil
4	3a	1	1	1	3a	IV	3b	2	1	3b	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, SCL topsoil

Table 18.1.13: Soil Profile ALC: Pentir Substation extension													
Sample	Climatic ALC	Gradient	Flood Risk	Soil Depth	Topsoil stoniness	Wetness Class	Wetness limitation	Drought-iness	Topsoil texture	ALC Grade	Limited by	SPL criteria	Criteria for the limitation(s)
5	3a	1	1	1	3a	IV	3b	2	1	3b	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, MZCL topsoil
6	3a	1	1	2	3a	IV	3b	3a	1	3b	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, MZCL topsoil
7	3a	1	1	1	3a	IV	3b	2	1	3b	Wetness	SPL within 35 cm, ped faces gleyed and FCD of 238	SPL within 35 cm, SCL topsoil

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## 1.6 LANDHOLDING ASSESSMENT METHODOLOGY AND DATA

- 1.6.1 The assessment of impact to landholding is based upon detailed data collated by National Grid. When collating the data, National Grid assigned a unique identifier to each party or individual who registered an interest in the land with them (registered party of interest). Consequently, each landholding may have more than one registered party of interest, for instance this has occurred for some family-run farms where different family members have each registered an interest with National Grid. As a result, for the 271 landholdings within the Order Limits, there are 351 registered parties of interest. The landholding numbers given in Table 18.1.13 were assigned for means of identification.
- 1.6.2 Based upon the layout of the Proposed Development as shown on the Construction Plans (**Document 4.14**), 100 of the 271 landholdings within the study area (Order Limits) experience no temporary or permanent land take due to the Proposed Development. These landholdings have no temporary or permanent infrastructure on their land, but may have land which would be beneath (over-sailed by) the OHL. It is acknowledged that these over-sailed landholdings will be required to consider the health and safety implications of working beneath the OHL, however it is considered that the designed clearance between the OHL and the land surface is sufficient so as not to impact normal farm operations. Other landholdings may simply lie within the study area in a location where the layout of the Proposed Development shows no development to occur. Landholdings which only experience over-sail or which are otherwise avoided by development are therefore excluded from the assessment, as there is no direct impact to land.
- 1.6.3 Within the assessment, impact is assessed for each landholding experiencing temporary land take, rather than for each registered party of interest. Permanent land take (loss of landholding area) is not considered within the assessment as the effects to landholdings are considered to be fully mitigated through the process of discussion and negotiation between National Grid, the landowners and any agricultural tenants (if applicable), with the environmental impacts assessed through the permanent loss of agricultural land assessment. However, details of both temporary and permanent loss of land holding area are presented within this appendix for information purposes, as is information regarding over-sailed or undisturbed land holdings (Table 18.1.15).
- 1.6.4 Impact is assessed as the amount of agricultural land take as a percentage of the overall landholding. The overall landholding as described as the all land owned and/or tenanted by a business or farming enterprise; both within and without the Order Limits. Consequently, where an individual field within the

Order Limits is tenanted it will be considered twice within the assessment, once as part of the tenanted landholding and once as part of the landowners' estate (landholding).

- 1.6.5 Table 18.1.15 lists all landholdings; along with details of the size of landholdings, and calculated temporary and permanent land take. It is noted that for landholdings 133, 159, 190, 205 and 218 the amount of permanent land take is reduced as a consequence of the removal of pylons and the assumed reversion of this land to agricultural use; permanent land 'take' for these landholdings is therefore reported as a negative number.
- 1.6.6 For necessary reasons of privacy and confidentiality, the data are anonymous; however, the location of each landholding and identity of each party is known to National Grid, such that where potential impacts to landholdings are identified appropriate mitigation would be put in place. Additionally, for necessary privacy and confidentiality, the locations of landholdings are not represented as a Figure within the ES.
- 1.6.7 It should be noted that, as described in sections 5.1 of Chapter 18: Agriculture (**Document 5.18**) and in Chapter 3 Description of the Proposed Development (**Document 5.3**), there are two Options for the OHL routeing in the vicinity of a property at Dolydd Newydd in Section D:
- Option A: the property is over-sailed.
  - Option B: the longer route (property is avoided).
- 1.6.8 Option A results in the loss of one pylon (pylon 4AP065) and the locations of pylons 4AP064 and 4AP066 would be different from the Option B design. These Options impact the amount of temporary and/or permanent land take for seven landholdings (83, 95, 97, 142, 165, 193 and 200). Table 18.1.15 considers both Options (data for these landholdings are presented at the end of the Table).
- 1.6.9 The following elements of infrastructure were considered:

*Permanent Land Take*

- pylons (measured as footprint within the leg span);
- the tunnel head houses (THH);
- the cable sealing end compounds (CSEC);
- new permanent accesses; and

- areas of mitigation where land is removed from agricultural use (such as new woodland planting on current agricultural land).

*Temporary Land Take*

- pylon working areas;
- access tracks;
- third part access tracks and working areas (non-overlapping with access tracks);
- scaffold working areas;
- bridge working areas;
- drainage mitigation areas; and
- bellmouths.

1.6.10 The magnitude of impact due to the temporary loss of landholding area is displayed in Table 18.1.14, according to the criteria in Table 18.3 of Chapter 18 Agriculture (**Document 5.18**).

<b>Table 18.1.14: Magnitude of Impact</b>				
Magnitude of impact	negligible	low	medium	high
Criteria	<1 % of total landholding	1 to 4.9 of total landholding	5 to 10 % of total landholding	>10 % of total landholding

1.6.11 It should be noted that, contrary to the matrix above, landholdings 129, 192 and 296 are shown to have a temporary land take of 5 % which is of low significance and landholding 87 is shown to have a temporary land take of 10 % which is of medium significance. This is due to rounding up within the Table; and all landholdings and percentage land takes are of less than 5 % and less than 10 % respectively when the unrounded figure is investigated.

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m2)	PERMANENT		TEMPORARY	
		Land take (m2)	% of land holding	Land take (m2)	% of land holding
1	192	0	0.0%	0	0.0%
2	195	0	0.0%	194	99.5%
3	215	0	0.0%	0	0.0%
4	349	0	0.0%	0	0.0%
5	500	0	0.0%	0	0.0%
6	588	0	0.0%	0	0.0%
7	765	0	0.0%	717	93.7%
8	812	0	0.0%	0	0.0%
9	841	0	0.0%	0	0.0%
10	864	0	0.0%	0	0.0%
11	924	0	0.0%	0	0.0%
12	1012	0	0.0%	0	0.0%
13	1052	0	0.0%	0	0.0%
14	1117	0	0.0%	0	0.0%
15	1194	0	0.0%	0	0.0%
16	1226	0	0.0%	0	0.0%
17	1230	0	0.0%	0	0.0%
18	1290	0	0.0%	0	0.0%
19	1364	0	0.0%	0	0.0%
20	1445	0	0.0%	0	0.0%
21	1531	0	0.0%	0	0.0%
22	1579	0	0.0%	0	0.0%
23	1687	0	0.0%	0	0.0%
24	1697	0	0.0%	0	0.0%
25	1864	0	0.0%	0	0.0%

<b>Table 18.1.15: Landholding Assessment Data</b>					
Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
26	1872	0	0.0%	0	0.0%
27	2059	0	0.0%	0	0.0%
28	2103	0	0.0%	0	0.0%
29	2182	0	0.0%	0	0.0%
30	2220	0	0.0%	0	0.0%
31	2382	0	0.0%	186	7.8%
32	2536	0	0.0%	0	0.0%
33	2629	0	0.0%	9	0.3%
34	2909	0	0.0%	0	0.0%
35	2970	0	0.0%	0	0.0%
36	3082	0	0.0%	0	0.0%
37	3529	0	0.0%	266	7.5%
38	3801	0	0.0%	0	0.0%
39	3955	0	0.0%	1000	25.3%
40	4329	0	0.0%	0	0.0%
41	4707	0	0.0%	0	0.0%
42	4717	0	0.0%	0	0.0%
43	4939	0	0.0%	725	14.7%
44	5901	0	0.0%	505	8.6%
45	6149	0	0.0%	477	7.8%
46	6569	0	0.0%	202	3.1%
47	8224	0	0.0%	0	0.0%
48	8404	0	0.0%	0	0.0%
49	8539	0	0.0%	0	0.0%
50	9171	0	0.0%	32	0.3%



**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
51	9253	0	0.0%	0	0.0%
52	9454	0	0.0%	0	0.0%
53	9922	0	0.0%	33	0.3%
54	10008	0	0.0%	207	2.1%
55	10198	0	0.0%	0	0.0%
56	10349	0	0.0%	0	0.0%
57	11850	0	0.0%	4	0.0%
58	12391	0	0.0%	0	0.0%
59	12889	0	0.0%	3555	27.6%
60	12969	0	0.0%	0	0.0%
61	14100	0	0.0%	996	7.1%
62	16435	0	0.0%	1741	10.6%
63	17128	0	0.0%	0	0.0%
64	17260	0	0.0%	0	0.0%
65	17728	0	0.0%	0	0.0%
66	18134	0	0.0%	0	0.0%
67	19451	0	0.0%	1424	7.3%
68	20122	0	0.0%	0	0.0%
69	20621	0	0.0%	3128	15.2%
70	23543	0	0.0%	0	0.0%
71	23953	0	0.0%	0	0.0%
72	25002	0	0.0%	0	0.0%
73	25168	0	0.0%	364	1.4%
74	25533	0	0.0%	80	0.3%
75	28248	0	0.0%	0	0.0%

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
76	28360	0	0.0%	940	3.3%
77	28425	0	0.0%	505	1.8%
78	29066	0	0.0%	178	0.6%
79	30127	0	0.0%	0	0.0%
80	32026	0	0.0%	0	0.0%
81	32133	0	0.0%	0	0.0%
82	39345	0	0.0%	0	0.0%
84	41990	0	0.0%	10474	24.9%
85	43583	0	0.0%	72	0.2%
86	44466	0	0.0%	1293	2.9%
87	47331	83	0.18%	4716	10.0%
88	47438	50	0.11%	11769	24.8%
89	49237	0	0.0%	1683	3.4%
90	49789	0	0.0%	0	0.0%
91	52366	83	0.16%	5922	11.3%
92	52940	0	0.0%	0	0.0%
93	54397	0	0.0%	1683	3.1%
94	55995	50	0.09%	11769	21.0%
96	57044	0	0.0%	10252	18.0%
97	57772	0	0.0%	903	1.6%
98	59405	0	0.0%	1492	2.5%
99	60110	0	0.0%	0	0.0%
100	64484	0	0.0%	0	0.0%
101	64657	83	0.13%	5844	9.0%
102	66771	0	0.0%	2302	3.4%

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
103	68670	0	0.0%	2302	3.4%
104	69581	0	0.0%	0	0.0%
105	71076	71	0.10%	5917	8.3%
106	74466	0	0.0%	160	0.2%
107	75740	0	0.0%	0	0.0%
108	76244	0	0.0%	11	0.0%
109	77912	0	0.0%	71	0.1%
110	84827	0	0.0%	0	0.0%
111	88796	0	0.0%	0	0.0%
112	89273	96	0.11%	9155	10.3%
113	89357	0	0.0%	0	0.0%
114	90378	0	0.0%	510	0.6%
115	90422	60	0.07%	13036	14.4%
116	90439	0	0.0%	0	0.0%
117	91710	0	0.0%	6557	7.1%
118	92322	71	0.08%	12367	13.4%
119	94271	32865	34.9%	3571	3.8%
120	96602	0	0.0%	0	0.0%
121	98796	0	0.0%	2237	2.3%
122	100399	83	0.08%	14030	14.0%
123	101174	50	0.05%	11369	11.2%
124	101908	0	0.0%	8984	8.8%
125	102063	0	0.0%	8984	8.8%
126	103641	40	0.04%	5168	5.0%

<b>Table 18.1.15: Landholding Assessment Data</b>					
Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
127	103875	0	0.0%	0	0.0%
128	104969	0	0.0%	4995	4.8%
129	104999	0	0.0%	5245	5.0%
130	106299	40	0.04%	5168	4.9%
131	107238	0	0.0%	5168	4.8%
132	110539	0	0.0%	0	0.0%
133	110733	-45	-0.04%	8593	7.8%
134	111330	0	0.0%	0	0.0%
135	114272	126	0.11%	22317	19.5%
136	114833	0	0.0%	4	0.0%
137	119409	60	0.05%	13036	10.9%
138	121644	49	0.04%	10468	8.6%
139	123401	0	0.0%	0	0.0%
140	123605	0	0.0%	0	0.0%
141	124912	0	0.0%	0	0.0%
143	130302	0	0.0%	366	0.3%
144	136805	96	0.07%	14134	10.3%
145	137471	69	0.05%	6087	4.4%
146	137594	60	0.04%	4518	3.3%
147	137970	0	0.0%	0	0.0%
148	147992	60	0.04%	7312	4.9%
149	155573	71	0.05%	7487	4.8%
150	156215	71	0.05%	7487	4.8%
151	171828	131	0.08%	18346	10.7%

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
152	172573	0	0.0%	956	0.6%
153	173515	131	0.08%	18346	10.6%
154	174773	19221	11.0%	26993	15.4%
155	175649	60	0.03%	17876	10.2%
156	176297	0	0.0%	205	0.1%
157	181926	0	0.0%	0	0.0%
158	185857	0	0.0%	444	0.2%
159	207371	-95	-0.05%	19217	9.3%
160	212286	0	0.0%	5291	2.5%
161	216908	0	0.0%	58	0.0%
162	222025	71	0.03%	12077	5.4%
163	234397	0	0.00%	4137	1.8%
164	235912	212	0.09%	25582	10.8%
166	242296	0	0.0%	1196	0.5%
167	244500	0	0.0%	0	0.0%
168	248965	0	0.0%	5291	2.1%
169	263269	0	0.0%	0	0.0%
170	263805	0	0.0%	0	0.0%
171	268460	50	0.02%	6776	2.5%
172	269573	71	0.03%	8522	3.2%
173	273301	0	0.0%	1620	0.6%
174	276607	0	0.0%	0	0.0%
175	287961	0	0.0%	0	0.0%

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
176	289308	121	0.04%	121869	42.1%
177	290599	0	0.0%	0	0.0%
178	292505	0	0.0%	36	0.0%
179	292671	207	0.07%	21878	7.5%
180	294248	0	0.0%	2258	0.8%
181	304223	0	0.0%	0	0.0%
182	305390	85	0.03%	17467	5.7%
183	314076	0	0.0%	0	0.0%
184	317558	142	0.04%	30760	9.7%
185	320649	0	0.0%	3248	1.0%
186	322314	0	0.0%	3248	1.0%
187	325463	0	0.0%	7531	2.3%
188	326598	154	0.05%	19044	5.8%
189	328105	177	0.05%	22609	6.9%
190	332880	-34	-0.01%	36698	11.0%
191	340592	107	0.03%	3793	1.1%
192	346967	71	0.02%	17260	5.0%
194	389235	50	0.01%	16738	4.3%
195	392074	96	0.02%	12112	3.1%
196	404868	96	0.02%	3400	0.8%
197	407702	1647	0.4%	81086	19.9%
198	411415	126	0.03%	22317	5.4%
199	412994	0	0.0%	6714	1.6%
201	420675	71	0.02%	22282	5.3%

<b>Table 18.1.15: Landholding Assessment Data</b>					
Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
202	428198	0	0.0%	6911	1.6%
203	445655	0	0.0%	205	0.0%
204	450213	0	0.0%	0	0.0%
205	450795	-3	0.0%	24391	5.4%
206	450893	0	0.0%	0	0.0%
207	462321	0	0.0%	5269	1.1%
208	467842	0	0.0%	4298	0.9%
209	470707	0	0.0%	0	0.0%
210	478414	267	0.06%	55371	11.6%
211	478993	96	0.02%	12112	2.5%
212	510752	60	0.01%	12216	2.4%
213	541964	0	0.0%	2298	0.4%
214	551432	0	0.0%	0	0.0%
215	565528	305	0.05%	34307	6.1%
216	581517	154	0.03%	40118	6.9%
217	596685	-34	-0.01%	36698	6.2%
218	598879	-22	0.0%	39142	6.5%
219	601736	0	0.0%	0	0.0%
220	624814	0	0.0%	0	0.0%
221	656238	0	0.0%	2258	0.3%
222	666313	0	0.0%	4856	0.7%
223	668431	0	0.0%	8	0.0%
224	721460	0	0.0%	173	0.0%
225	796948	1738	0.2%	28777	3.6%

**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
226	800819	0	0.0%	1209	0.2%
227	805298	1610	0.2%	19379	2.4%
228	811206	0	0.0%	0	0.0%
229	862947	27929	3.2%	4052	0.5%
230	897404	0	0.0%	1737	0.2%
231	904222	208	0.02%	15228	1.7%
232	908465	0	0.0%	1560	0.2%
233	922831	1282	0.14%	2732	0.3%
234	932817	333	0.04%	31739	3.4%
235	964706	0	0.0%	0	0.0%
236	980382	401	0.04%	43462	4.4%
237	990199	68	0.01%	17663	1.8%
238	1055601	0	0.0%	0	0.0%
239	1119094	343	0.03%	25925	2.3%
240	1128657	44106	3.9%	68430	6.1%
241	1181273	255	0.02%	19050	1.6%
242	1189831	168	0.01%	20646	1.7%
243	1207911	173	0.01%	20197	1.7%
244	1276254	255	0.02%	19050	1.5%
245	1322088	0	0.0%	177	0.0%
246	1363973	0	0.0%	0	0.0%
247	1438205	0	0.0%	0	0.0%
248	1545135	107	0.01%	3793	0.2%



**Table 18.1.15: Landholding Assessment Data**

Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
249	1572373	343	0.02%	25925	1.6%
250	1750147	107	0.01%	3793	0.2%
251	1771907	0	0.0%	1561	0.1%
252	1786839	607	0.03%	76973	4.3%
253	1833654	0	0.0%	0	0.0%
254	1848502	107	0.01%	3793	0.2%
255	1875025	85	0.0%	17467	0.9%
256	1893268	44247	2.3%	106997	5.7%
257	1970758	181	0.01%	31030	1.6%
258	2071163	0	0.0%	0	0.0%
259	2135075	206	0.01%	33511	1.6%
260	2136576	0	0.0%	1490	0.1%
261	2167699	323	0.01%	36713	1.7%
262	2199747	44247	2.0%	106997	4.9%
263	2426747	403	0.02%	64640	2.7%
264	2561058	50	0.0%	14577	0.6%
265	2634919	213	0.01%	54773	2.1%
266	2638460	213	0.01%	54773	2.1%
267	3745618	393	0.01%	69649	1.9%
268	4093610	0	0.0%	0	0.0%
269	7292847	485	0.01%	26438	0.4%
270	8520850	1015	0.01%	160827	1.9%
271	765	0	0.0%	0	0.0%

<b>Table 18.1.15: Landholding Assessment Data</b>					
Landholding number	Total landholding area (m <sup>2</sup> )	PERMANENT		TEMPORARY	
		Land take (m <sup>2</sup> )	% of land holding	Land take (m <sup>2</sup> )	% of land holding
<b>Option A</b>					
83	40409	83	0.2%	7562	18.7%
95	56245	83	0.15%	7562	13.4%
142	125083	0	0.0%	5163	4.1%
142	125083	0	0.0%	5163	4.1%
165	240398	121	0.05%	18129	7.5%
193	365365	165	0.05%	34302	9.4%
200	419760	192	0.05%	30206	7.2%
<b>Option B</b>					
83	40409	82	0.2%	8453	20.9%
95	56245	82	0.15%	8453	15.0%
142	125083	46	0.04%	6343	5.1%
165	240398	100	0.04%	19306	8.0%
193	365365	165	0.05%	33838	9.3%
200	419760	171	0.04%	31383	7.5%

1.6.12 The data for landholdings experiencing permanent or temporary land take presented in Table 18.1.15 are summarised in Table 18.1.16. There are also an additional 100 landholdings which are either over-sailed or not impacted by development as per the assessed design.

<b>Table 18.1.16: Number of Landholdings Experiencing Temporary and / or Permanent Land Take and Scale of Change (as % of total landholding area).</b>				
Scale of loss	<1 % of landholding	1 to 4.9 % of landholding	5 to 10 % of landholding	>10% of landholding
<b>Option A: Expedited Route</b>				
Temporary land take	43	64	33	31
Permanent land take	165	4	0	2
<b>Option B: Longer Route</b>				
Temporary land take	43	63	34	31
Permanent land take	165	4	0	2

## 2 References

- 2.1.1 Ref. 18.1.1: Knox et al., (2015); Research to develop the evidence base on soil erosion and water use in agriculture. Final Technical Report, Cranfield University.
- 2.1.2 Ref 18.1.2: 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 February 2017].
- 2.1.3 Ref 18.1.3: MAFF (1988); Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land, also available online: <http://archive.defra.gov.uk/foodfarm/landmanage/land-use/documents/alc-guidelines-1988.pdf>
- 2.1.4 Ref 18.1.4: ADAS (1977); 1:250,000 "Provisional Agricultural Land Classification Sheet, Wales.
- 2.1.5 Ref 18.1.5: Cranfield University, (2015); The Soils Guide, available at: [www.landis.org.uk](http://www.landis.org.uk). [Accessed 22 January 2017].
- 2.1.6 Ref 18.1.6: Soil Survey of England and Wales (1984); Soils and their Use in Wales and accompanying 1:250,000 map Sheet 2.
- 2.1.7 Ref 18.1.7: Met Office, (1989); Climatological Data for Agricultural Land Classification: Gridpoint datasets of climatic variables at 5km intervals for England and Wales
- 2.1.8
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