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Edenstone Homes Limited

Agricultural Land Classification and Soil Resources

at

Usk Road, Penperlleni, Monmouthshire

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1 Introduction

- 1.1 Reading Agricultural Consultants Ltd (RAC) is instructed by Edenstone Homes Limited to investigate the Agricultural Land Classification (ALC) and soil resources of land at Usk Road, Penperlleni, Monmouthshire by means of a detailed survey of soil and site characteristics.
- 1.2 Guidance for assessing the quality of agricultural land in England and Wales is set out in the Ministry of Agriculture, Fisheries and Food (MAFF) revised guidelines and criteria for grading the quality of agricultural land (1988)¹.
- 1.3 Agricultural land in England and Wales is graded between 1 and 5, depending on the extent to which physical or chemical characteristics impose long-term limitations on agricultural use. The principal physical factors influencing grading are climate, site and soil which, together with interactions between them, form the basis for classifying land into one of the five grades.
- 1.4 Grade 1 land is excellent quality agricultural land with very minor or no limitations to agricultural use. Grade 2 is very good quality agricultural land, with minor limitations which affect crop yield, cultivations or harvesting. Grade 3 land has moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield, and is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land). Grade 4 land is poor quality agricultural land with severe limitations which significantly restrict the range of crops and/or level of yields. Grade 5 is very poor quality land, with very severe limitations which restrict use to permanent pasture or rough grazing.
- 1.5 Land which is classified as Grades 1, 2 and 3a is defined in paragraph 3.58 of Planning Policy Wales² as the best and most versatile (BMV) agricultural land.
- 1.6 Natural Resources Wales has published a Predictive ALC Map for Wales³. The map is designed on a 50m grid. Criteria including climate, slope, soil wetness, droughtiness and stone contents have been considered and used to determine the most likely limitation to agricultural land quality

¹ **MAFF (1988).** *Agricultural Land Classification of England and Wales. Revised guidelines and criteria for grading the quality of agricultural land.* MAFF Publications.

² **Welsh Government (2021).** Planning Policy Wales, Edition 11, February 2021
https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

³ **Natural Resources Wales (2019).** *Predictive Agricultural Land Classification (ALC) Map for Wales.*
<http://lle.gov.wales/map/alc2>

within each grid square. The map predicts a majority of this site to be of Grade 2 quality with a band of Subgrade 3b quality land running from the north to south-east.

- 1.7 However, as explained by the Welsh Government's Frequently Asked Questions on ALC⁴, the only way to accurately determine the agricultural grade of land is by a detailed field survey in accordance with the current ALC guidelines. This survey follows the established methodology and guidelines for carrying out ALC surveys.

2 Site and climatic conditions

General features, land form and drainage

- 2.1 The site extends to approximately 3.4ha, mainly of rough grassland. The site is bounded to the north and west by Usk Road, to the east by a new residential development at Penperlleni, and to the south by other agricultural grassland. Non-agricultural land at the site comprises established tree belts and wooded areas
- 2.2 The topography is gently sloping from around 100m above Ordnance Datum (AOD) along the western site boundary to around 95m AOD in the east. The slope drains the land into a peripheral field ditch.
- 2.3 Natural Resources Wales's Development Advice Map⁵ shows the south-west of the site as an area known to have flooded in the past.

Agro-climatic conditions

- 2.4 Agro-climatic data for the site have been interpolated from the Meteorological Office's standard 5km grid point data set at a representative altitude of 100m AOD and are given in Table 1. The site is moderately warm and very wet with moderately small to moderate moisture deficits. The number of Field Capacity Days (FCD) is very large and is very unfavourable for providing opportunities for agricultural field work. There is an overriding climatic limitation to Grade 2.

⁴ **Welsh Government (2020).** *Agricultural Land Classification, Frequently Asked Questions.*
<https://gov.wales/sites/default/files/publications/2020-06/agricultural-land-classification-frequently-asked-questions.pdf>

⁵ **Natural Resources Wales (2021).** *Development Advice Map,*
https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=2 accessed 19/08/2021

Table 1: Local agro-climatic conditions

Parameter	Measurement
Grid Ref	SO 31989 04270
Altitude	100m AOD
Average Annual Rainfall	1,150mm
Accumulated Temperatures >0°C	1,427 day°
Field Capacity Days	232 days
Average Moisture Deficit, wheat	76mm
Average Moisture Deficit, potatoes	61mm

Soil parent material and soil type

- 2.5 The principal underlying geology mapped by the British Geological Survey⁶ is the Raglan Mudstone Formation, comprising red mudstones and silty mudstones with calcretes and sandstones. Superficial deposits of glacial till overlie most of the site and include a mixture of clay and boulders. Deposits of alluvium are mapped in the south-west of the site and normally comprise compressible silty clay but may include layers of silt, sand, peat and gravel.
- 2.6 The Soil Survey of England and Wales soil association mapping⁷ (1:250,000 scale) shows two associations at the site. In the north is the Fforest association, within which the main soils include silty clay loam throughout the profile. Fforest soils are mostly under permanent grassland which may be rush-infested. The soils are slowly permeable and commonly of Wetness Class (WC) IV or V.
- 2.7 In the south of the site is the contrasting Wick 1 association. In south Wales, the Wick and Hall series are most common and include sandy loam upper horizons, passing to loamy sand or sand at depth. Wick series subsoils are moderately stony and Hall series subsoils are very stony. Profiles are well drained (WC I)⁸.

⁶ **British Geological Survey (2021).** *Geology of Britain viewer*, <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁷ **Soil Survey of England and Wales (1984).** *Soils of Wales* (1:250,000), Sheet 2

⁸ **Rudeforth et al (1984).** *Soils and Their Use in Wales*. Soil Survey of England and Wales Bulletin 11, Harpenden.

3 Agricultural land quality

Soil survey methods

- 3.1 Four soil profiles were examined using an Edelman (Dutch) auger at an observation density of one per hectare in accordance with the established recommendations for ALC surveys. One observation pit was also excavated to examine subsoil structures. The locations of observations are shown on Figure RAC9311-1. At each observation point the following characteristics were assessed for each soil horizon up to a maximum of 120cm or any impenetrable layer:
- soil texture;
 - significant stoniness;
 - colour (including localised mottling);
 - consistency;
 - structural condition;
 - free carbonate; and
 - depth.
- 3.2 One topsoil sample was submitted for laboratory determination of particle size distribution, pH, organic matter content and nutrient contents (P, K, Mg). Results are presented in Appendix 1.
- 3.3 Soil Wetness Class (WC) was determined from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling, and slowly permeable subsoil layers at least 15cm thick, in relation to the number of FCD at the location.
- 3.4 Soil droughtiness was investigated by the calculation of moisture balance equations (given in Appendix 2). Crop-adjusted Available Profile Water (AP) is estimated from texture, stoniness and depth, and then compared to a calculated moisture deficit (MD) for the standard crops, wheat and potatoes. The MD is a function of potential evapotranspiration and rainfall. Grading of the land can be affected if the AP is insufficient to balance the MD and droughtiness occurs.

Agricultural land classification and site limitations

- 3.5 Assessment of land quality has been carried out according to the revised ALC guidelines (1988)¹. Soil profiles have been described according to Hodgson (1997)⁹ which is the recognised source for describing soil profiles and characteristics according to the revised ALC guidelines.
- 3.6 The main limitation to agricultural land quality is wetness and workability, which is heavily influenced by the climatic conditions of the site. The site is limited to Subgrade 3a in the north and Subgrade 3b in the south.
- 3.7 Two soil types have been identified at the site. The main soil type includes medium clay loam or sandy clay loam topsoil of 32cm average depth. The topsoil is dark brown, dark greyish brown or brown (10YR3/3, 10YR4/2 or 10YR4/3 in the Munsell soil colour charts¹⁰), slightly stony and non-calcareous. The structure is well developed with fine subangular blocky peds. Many fine roots are present in the top 10cm of soil, becoming less abundant with depth.
- 3.8 Subsoil horizons are dark greyish brown or brown (10Yr4/2 or 10YR4/3) medium clay loam or sandy clay loam. The stone content increases with depth from around 15-28% by volume in the upper subsoil to 30-35% by volume in the lower subsoil. The subsoil is friable and has a fine subangular blocky to crumb structure which is well drained. Roots and worms were observed to 50cm depth, from which point further observation was hindered by stones.
- 3.9 Two profiles are WC I and are limited by wetness to Subgrade 3a. One profile includes common ochreous mottles in the upper subsoil which reduces the profile to WC III due to the large number of FCD. This profile is limited by wetness to Subgrade 3b.
- 3.10 The second, minor soil type is in the south-west of the site. The topsoil is dark greyish brown (10YR4/2) sandy clay loam of 34cm depth. The stone content is moderate. The upper subsoil is sandy loam which is also dark greyish brown. Distinct ochreous mottles are present in the upper subsoil. Observation was impeded at a depth of 40cm due to an increasing volume of stones, estimated at 30%. It is assumed that these characteristics continue to moderate depth then pass to loamy sand, in accordance with the mapped Wick 1 soil association. The subsoil is permeable but gleyed and the profile is of WC II. However, the area is characterised by reeds and

⁹ **Hodgson, J. M. (Ed.) (1997).** *Soil survey field handbook*. Soil Survey Technical Monograph No. 5, Silsoe.

¹⁰ **Munsell Color (2009).** *Munsell Soil Color Book*. Grand Rapids, MI, USA

corresponds with the mapped flood area. The land is not considered to be of a quality higher than Subgrade 3b.

- 3.11 The areas of each ALC grade at the site are given in Table 2 and their distribution is shown in Figure RAC9311-2. Photographs taken at the site are given in Appendix 3.

Table 2: Agricultural land classification

Grade	Description	Hectares	%
Subgrade 3a	Good quality	1.5	44
Subgrade 3b	Moderate quality	1.3	38
Non-agricultural		0.6	18
Total		3.4	100

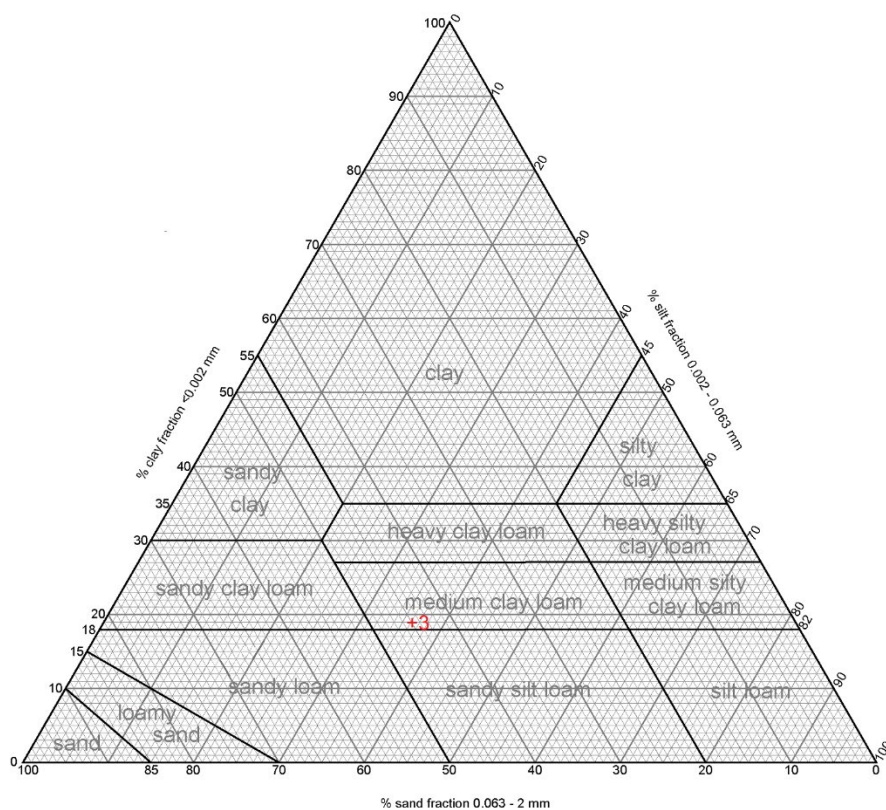
Appendix 1: Laboratory Data

Determinand	Site 3	Units
Sand 2.00-0.063 mm	45	% w/w
Silt 0.063-0.002 mm	36	% w/w
Clay <0.002 mm	19	% w/w
Organic Matter	5.0	% w/w
Texture	Medium Clay Loam	

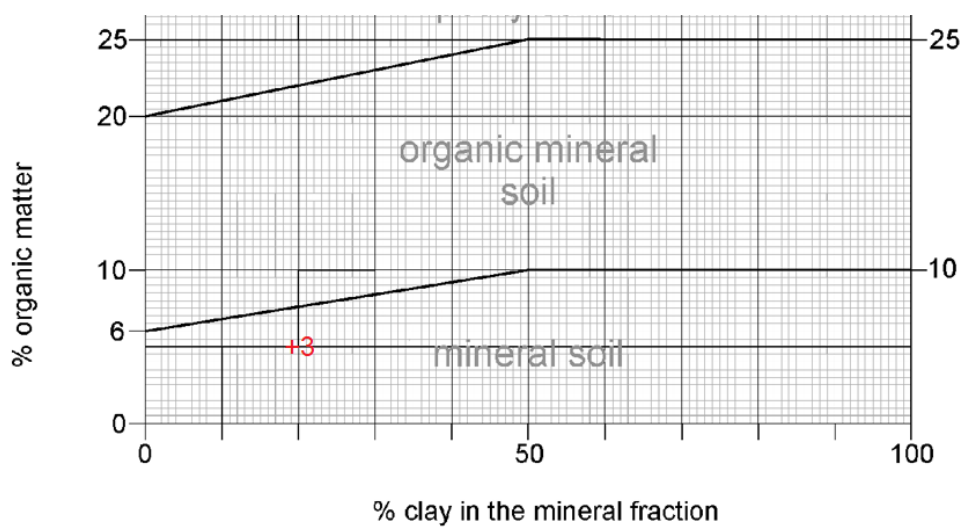
Determinand	Site 3	Units
Soil pH	6.6	
Phosphorus (P)	12.6	mg/l (av)
Potassium (K)	170	mg/l (av)
Magnesium (Mg)	91.5	mg/l (av)

Determinand	Site 3	Units
Phosphorus (P)	1	ADAS Index
Potassium (K)	2-	ADAS Index
Magnesium (Mg)	2	ADAS Index

Soil Texture by Particle Size Analysis



Organic Matter Class



¹ Less than 50% sand in the mineral fraction

² 50% sand or more in the mineral fraction

Appendix 2: Soil Profile Summaries and Droughtiness Calculations

Wetness calculations are made according to the methodology given in Appendix 3 of the ALC guidelines, MAFF 1988

Droughtiness calculations are made according to the methodology given in Appendix 4 of the ALC guidelines, MAFF 1988.

Grades are shown for drought, wetness and any other soil or site factors which are relevant. The overall Grade is set by the most limiting factor and shown on the right.

Stone types			Climate Data		Wetness Class Guidelines				
%	TA _v	EA _v	MDwheat	76					
hard	1	0.5	MDpotato	61					
.			FCD	232					

hard	flint & pebble
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Maximum depth of auger penetration is <u>underlined</u>				
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Site No.	Depth cm	Texture	CaCO ₃	Colour	Mottle colour	abundance	stone% hard	stone%	Structure	APwheat mm	AP potato mm	Gley	SPL	WC	Wetness grade WE	Final Grade	Limiting Factor(s)
1	T 0 34	SCL		10YR4/2			15		-	49	49	n	n	//	3a	3b	GW
	34 40	SL		10YR4/2	Fe	com	30			6	6	y	n				
	<u>40</u> 60	SL		10YR4/2	Fe	com	30			19	21	y	n				
	60 120	LS					30			<u>27</u>	6	y	n				
Total										101	83	Vegetation characterised by reeds - wet					
MB										25	22						
Droughtiness grade (DR)										2	1						
2	T 0 33	mCL		10YR4/2			5		-	56	56	n	n	///	3b	3b	WE
	33 43	mCL		10YR4/2	Fe	com	15			14	14	y	n				
	<u>43</u> 60	mCL		10YR4/2	Fe	com	15			18	23	y	n				
	60 120	mCL					20			<u>49</u>	13	y	n				
Total										137	106						
MB										61	45						
Droughtiness grade (DR)										1	1						
3	T 0 32	mCL		10YR3/3			15		-	49	63	n	n	/	3a	3a	WE
	32 50	mCL		10YR4/3			28			21	21	n	n				
	<u>50</u> 120	mCL		10YR4/3			35			48	21	n	n				

															Total	118	104
															MB	42	43
															Droughtiness grade (DR)	1	1
4	T	0	32	SCL	10YR4/3			15	-	46	46	n	n	/	3a	3a	WE
			32	50	SCL	10YR4/3	Fe	com	20	22	22	n	n				
			50	85	SCL	10YR4/3	Fe	com	30	26	21	n	n				
			85	120	SCL	10YR4/3	Fe	com	30	26	0	n	n				
																Total	119
															MB	43	28
															Droughtiness grade (DR)	1	1

Appendix 3: Site Photographs



Pit 1



Pit 1 topsoil



Pit 1 subsoil



Pit 1 subsoil stone



Southern field parcel with reeds



- Survey Area
 +1 Auger Observation
 .P1 Pit Observation

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Scale 1:10,000@A4 August/2021

Figure RAC9311-1: Observations

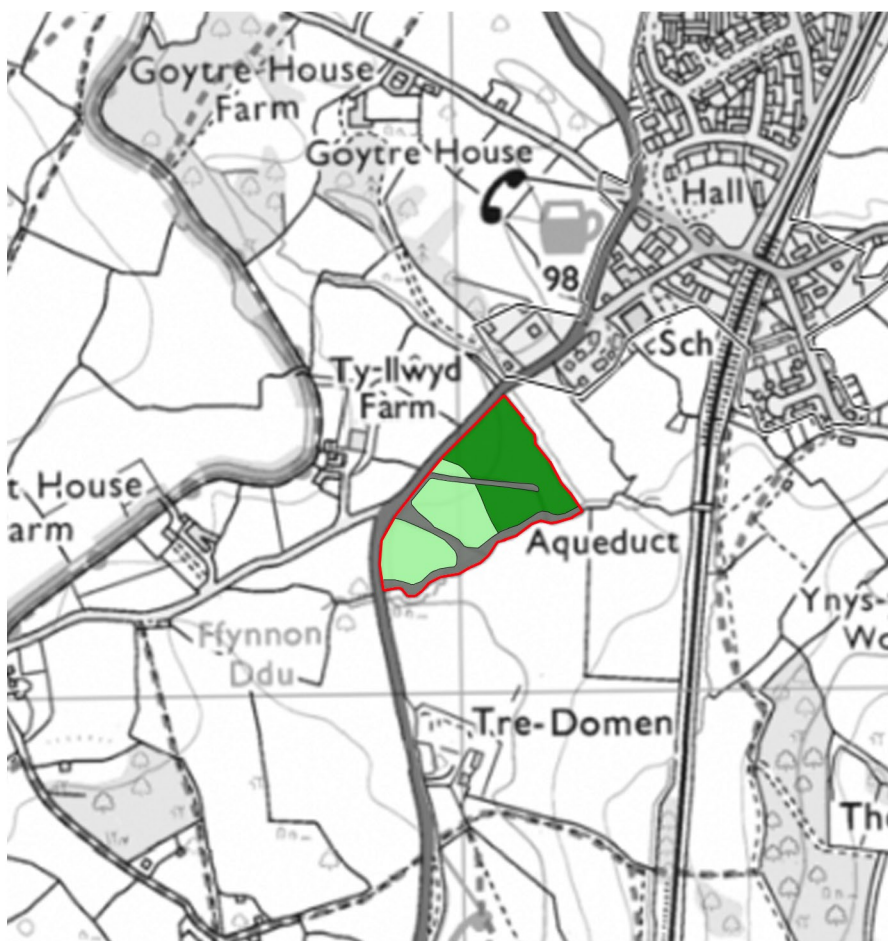
Site: Land at Usk Road, Penperlleni

Client: Edenstone Homes Limited



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Figure RAC9311-2: Agricultural Land Classification

Site: Land at Usk Road, Penperlleni

Client: Edenstone Homes Limited



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