May 2022

Wates Developments Ltd

Agricultural Land Classification and Soil Resources

at

Land South of Chesterton, Oxfordshire

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1 Introduction

1.1 Reading Agricultural Consultants Ltd (RAC) is instructed by Boyer Planning on behalf of Wates Developments Ltd to investigate the Agricultural Land Classification (ALC) and soil resources of land south of Chesterton, Oxfordshire 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], and summarised in Natural England's Technical Information Note 049[2].

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 conditions 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 in the ALC system is defined as best and most versatile (BMV) agricultural land.

1.6 As explained in Natural England's TIN049, the whole of England and Wales was mapped from reconnaissance field surveys in the late 1960s and early 1970s, to provide general strategic guidance on agricultural land quality for planners. This Provisional Series of maps was published

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

[2] **Natural England (2012).** *Technical Information Note 049 - Agricultural Land Classification: protecting the best and most versatile agricultural land*, Second Edition.

on an Ordnance Survey base at a scale of One Inch to One Mile (1:63,360). The Provisional ALC map shows the site as undifferentiated Grade 3. However, TIN049 explains that:

> *"These maps are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five grades: their preparation preceded the subdivision of Grade 3 and the refinement of criteria, which occurred after 1976. They have not been updated and are out of print. A 1:250 000 scale map series based on the same information is available. These are more appropriate for the strategic use originally intended …"*

1.7 TIN049 goes on to explain that a definitive ALC grading should be obtained by undertaking a detailed survey according to the published guidelines, at an observation density of one boring per hectare. This survey follows the detailed methodology set out in the ALC guidelines.

2 Site and climatic conditions

General features, land form and drainage

2.1 The site extends to 14.8ha across two agricultural field parcels. The larger western field is in arable use and the smaller eastern field was under grass at the time of survey. The site is located on the south side of Chesterton, bounded by Green Lane, residential properties off Vespasian Way and a cricket ground to the north, by an unnamed single-track road to the west, and other agricultural land to the south and east.

2.2 The land is level at around 75m above Ordnance Datum (AOD). Drainage of the land is primarily through the soil profile.

Agro-climatic conditions

2.3 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 75m AOD, and are given in Table 1. The climate at the site is mild. Moisture deficits are moderate to moderately large. The number of Field Capacity Days is slightly smaller than average for lowland England (150) and is favourable for providing opportunities for agricultural field work. There is no overriding climatic limitation to agricultural land quality.

Table 1: Local agro-climatic conditions

Parameter	Value
Grid Reference	SP 55799 20992
Average Annual Rainfall	651mm
Accumulated Temperatures >0°C	1,421 day°
Field Capacity Days	141 days
Average Moisture Deficit, wheat	106mm
Average Moisture Deficit, potatoes	97mm

Soil parent material and soil type

2.4 The underlying geology mapped by the British Geological Survey[3] in the west of the site is the Cornbrash Formation, consisting of blue-grey limestone, wackestone and packstone (carbonate rocks) that weathers to olive or yellowish brown. The Kellaways Sand Member of the Kellaways Formation is mapped in the east of the site and includes sandstone and siltstone with interbeds of sandy and silty mudstone.

2.5 Superficial river terrace deposits of sand and gravel overlie the bedrock along the eastern edge of the smaller field parcel.

2.6 The Soil Survey of England and Wales soil association mapping[4] (1:250,000 scale) shows the Aberford association across the site, bordering on Wickham 2 to the south. Aberford soils are characterised by fine loamy textures over limestone at 40 to 50cm depth. Profiles are well drained in Wetness Class (WC) I.

2.7 The contrasting Wickham 2 association includes fine loamy over clayey textures. The subsoils are slowly permeable and profiles are in WC III or IV[5].

3 Agricultural land quality

Soil survey methods

3.1 In total, 15 soil profiles were examined using an Edelman (Dutch) auger at an observation density of approximately one per hectare in accordance with the established recommendations for ALC surveys[2]. One soil pit was also excavated to examine subsoil structures and stone

[3] **British Geological Survey (2022).** *Geology of Britain viewer*, http://mapapps.bgs.ac.uk/geologyofbritain/home.html

[4] **Soil Survey of England and Wales (1984).** *Soils of Midland and Western England (1:250,000),* Sheet 3

[5] **Ragg et al (1984).** *Soils and Their Use in Midland and Western England*. Soil Survey of England and Wales Bulletin 12, Harpenden.

content. The locations of observations are indicated on Figure RAC/9523/1. 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 Two topsoil samples were 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 Field Capacity Days 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 agricultural land quality has been carried out according to the revised ALC guidelines[1]. Soil profiles have been described according to Hodgson[6] which is the recognised source for describing soil profiles and characteristics according to the revised ALC guidelines.

3.6 The agricultural land quality within the site is limited by droughtiness to Subgrade 3a, other than at one central point which is limited by wetness to Subgrade 3b.

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

3.7 In the western field parcel, the topsoil is dark greyish brown (10YR4/2 in the Munsell soil colour charts[7]), heavy clay loam or sandy clay loam and in the eastern field parcel is dark greyish brown or brown (10YR4/2, 10YR4/3 or 10YR5/3), heavy clay loam. The average topsoil depth is 26cm. The topsoil stone content is typically around 10-12% by volume, although there is more localised stoniness in the north-west, where the volume is estimated at almost 20%. The topsoil becomes more calcareous with distance south-west.

3.8 Most of the topsoil is friable and has a fine subangular blocky structure. In the east of the site fine and coarse roots were found to be growing through the topsoil. Several worms were also observed. The boundary to upper subsoil is well defined.

3.9 The upper subsoil within the site is heavy clay loam or clay which is brown or (dark) yellowish brown (10YR4/3, 10YR4/4, 10YR5/3 or 10YR5/4). Similar to the topsoil, the upper subsoil also becomes more calcareous with distance south-west. The stone content is lowest along the north-eastern site boundary at around 2-5% by volume and elsewhere is up to around 20%, including flint and limestone. There continue to be common roots and some worm activity in the upper subsoil which has a medium crumb structure which is permeable, with no evidence of wetness.

3.10 The average depth of auger observation was only 41cm as the soil became impenetrable to auger due to increasing stone content through the subsoil. From the excavated pit the stony layer is estimated at around 60% hard stone including limestone. In accordance with the mapped soil type (Aberford), it is assumed that limestone bedrock is present from depths of around 60cm. Combined with the moderate to moderately large moisture deficits, the restricted capacity for water storage within the soil profiles results in a droughtiness limitation to Subgrade 3a.

3.11 Two profiles at the southern site boundary are affected by wetness; one to Subgrade 3a which is equal to the droughtiness limitation and the other (at Observation 10) to Subgrade 3b. At the location of Observation 10, which is close to a field ditch, the topsoil is very slightly stony, brown (10YR5/3), sandy clay which overlies a dark yellowish brown (10YR5/4), clay upper subsoil. The clay is firm and poorly structured and contains mottles and manganiferous nodules which are both indicative of wetness. There is a lower subsoil of dark yellowish brown (10YR5/4), sandy clay loam which is permeable. This, in addition to the upper subsoil not being considered gleyed

[7] **Munsell Color (2009).** *Munsell Soil Color Book*. Grand Rapids, MI, USA

due to the matrix colour, results in the profile being assessed as WC III rather than IV. With non-calcareous sandy clay topsoil, there is a wetness and workability limitation to Subgrade 3b.

3.12 The ALC distribution within the site is shown in Figure RAC/9523/2 and the areas of each grade are given in Table 2. Photographs taken at the site are given in Appendix 3.

Table 2: ALC areas

Grade	Description	Area (ha)	%
Subgrade 3a	Good quality	14.5	98
Subgrade 3b	Moderate quality	0.3	2
Total		14.8	100

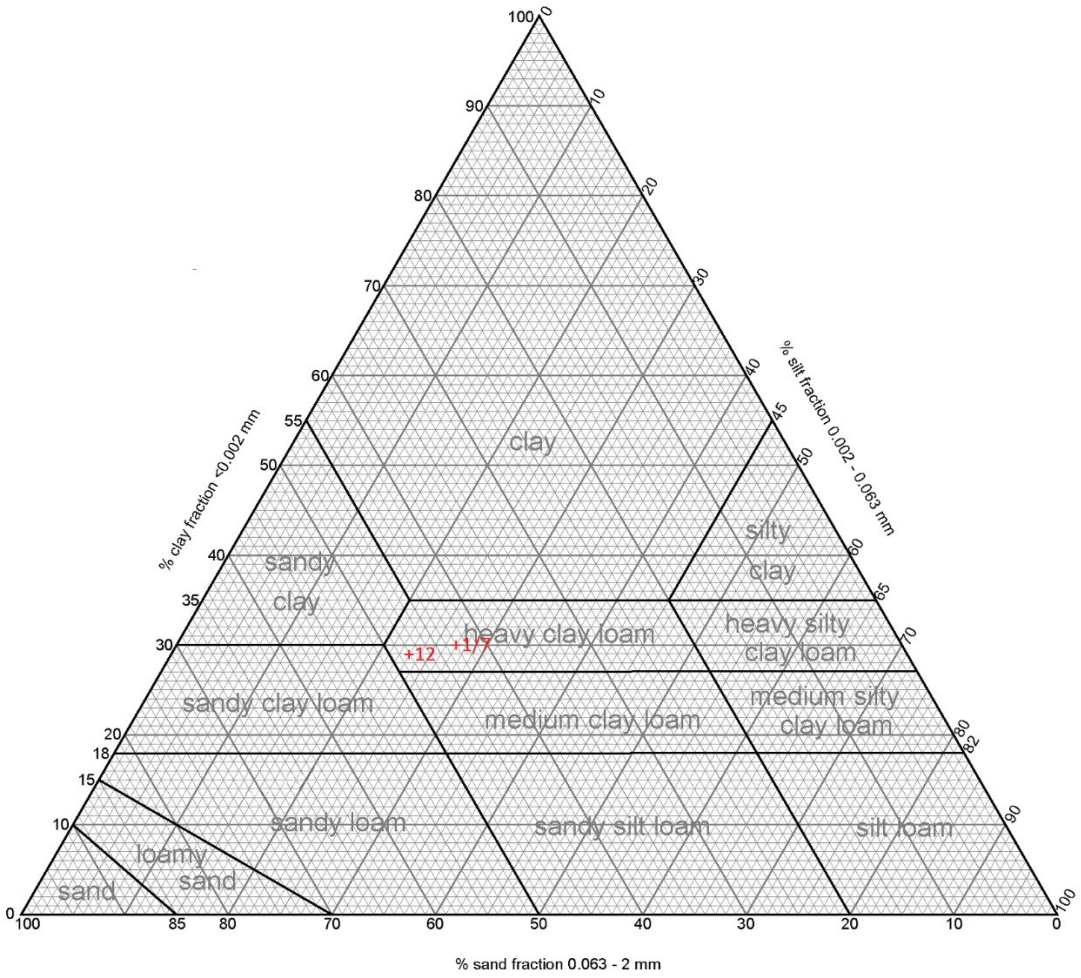
Appendix 1: Laboratory Data

Determinand	Site 1/7	Site 12	Units
Sand 2.00-0.063 mm	43	48	% w/w
Silt 0.063-0.002 mm	27	23	% w/w
Clay <0.002 mm	30	29	% w/w
Organic Matter	5.1	5.4	% w/w
Texture	Heavy Clay Loam	Heavy Clay Loam	

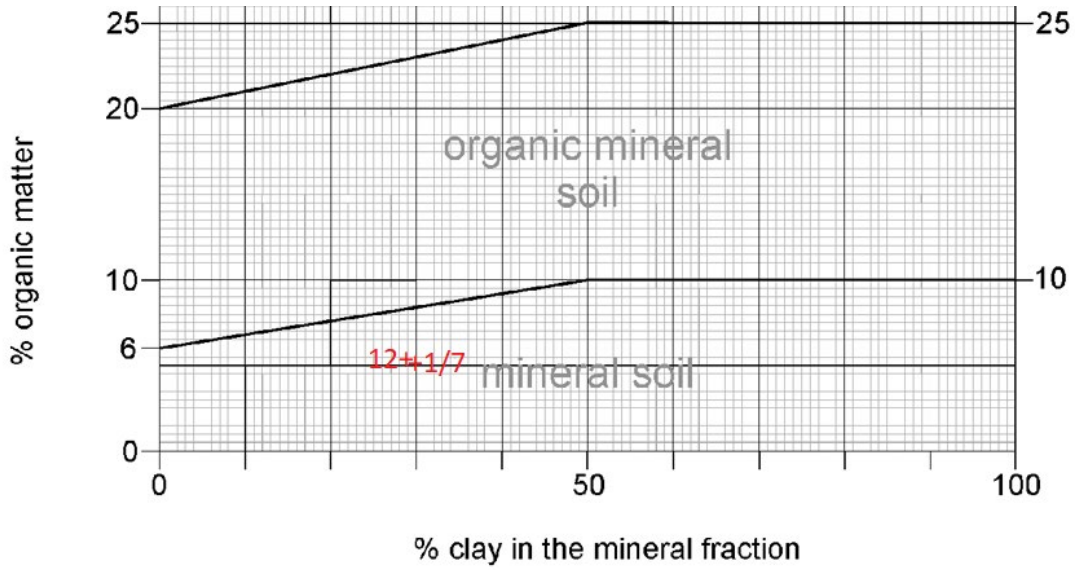
Determinand	Site 1/7	Site 12	Units
Soil pH	7.9	7.7	
Phosphorus (P)	30.2	8.0	mg/l (av)
Potassium (K)	268	58.4	mg/l (av)
Magnesium (Mg)	46.5	37.8	mg/l (av)

Determinand	Site 1/7	Site 12	Units
Phosphorus (P)	3	0	ADAS Index
Potassium (K)	3	0	ADAS Index
Magnesium (Mg)	1	1	ADAS Index

Soil Texture by Particle Size Analysis



Organic Matter Class



Appendix 2: Soil Profile Summaries and Droughtiness Calculations

Wetness / workability limitations are determined 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		
%	TAv	EAv
hard	1	0.5
Lstone	4	3

Climate Data	
MDwheat	106
MDpotato	97
FCD	141
AAR	651

Wetness Class Guidelines	*II*	*III*	*IV*	*V*
SPL within 80cm, gleying within 40cm	>66cm	38-66cm	<38cm	
SPL within 80cm, gleying at 40-70cm	>48cm	<48cm		
No SPL but gleying within 40cm	coarse subsoil	*I*	other cases	*II*

Climate
1421 D°
Limitation
Grade 1

hard flint & pebble

Maximum depth of auger penetration is underlined

Site No.		Depth cm		Texture	$CaCO_3$	Colour	Mottle colour	abund-ance	stone% hard	stone% Lstone	Struct-ure	APwheat mm	AP potato mm	Gley	SPL	WC	Wetness grade WE	Final Grade	Limiting Factor(s)
1	T	0	22	SCL	slight	10YR4/2			18	0		31	31	n	n	*I*	1	**3a**	DR ST
		22	40	hCL	mod	10YR4/3			15	0		25	25	n	n				
		40	60	hCL	mod	10YR4/3			15	5		21	26	n	n				
		60	120	Lstone								18	4	n	n				
											Total	**95**	**86**						
											MB	-11	-11						
									Droughtiness grade (DR)			3a	3a						
2	T	0	20	SCL	slight	10YR4/2			10	0	-	31	31	n	n	*I*	1	**3a**	DR
		20	35	hCL	very	10YR4/3			15	5		20	20	n	n				
		35	60	hCL	very	10YR4/3			10	15		27	44	n	n				
		60	120	Lstone								18	0	n	n				
											Total	**96**	**95**						
											MB	-10	-2						
									Droughtiness grade(DR)			3a	2						
3	T	0	22	hCL	very	10YR4/2			10	0	-	36	36	n	n	*I*	2	**3a**	DR
		22	32	C	very	10YR5/4			15	5		13	13	n	n				
		32	60	C	very	10YR5/4			10	15		29	36	n	n				
		60	120	Lstone								18	4	n	n				
											Total	**96**	**89**						

										MB	-10	-8							
									Droughtiness grade(DR)		3a	2							
4	T	0	22	hCL	slight	10YR4/2	10	0	-		36	36	n	n	*III*	3a	**3a**	DR WE	
		22	44	C	slight	10YR5/4	10	0	poor		26	26	n	y					
		44	60	C	slight	10YR5/4	10	10	poor		12	17	n	y					
		60	120	Lstone							18	4	n	n					
										Total	**92**	**83**							
										MB	-14	-14							
									Droughtiness grade(DR)		3a	3a							
5	T	0	23	SCL	v.sli	10YR4/2	10	0	-		35	35	n	n	*I*	1	**3a**	DR	
		23	30	hCL	v.sli	10YR4/3	10	10			9	9	n	n					
		30	60	hCL	v.sli	10YR4/3	10	15			33	38	n	n					
		60	120	Lstone							18	4	n	n					
										Total	**96**	**87**							
										MB	-10	-10							
									Droughtiness grade(DR)		3a	3a							
6	T	0	25	SC	v.sli	10YR4/2	12	0	-		38	38	n	n	*I*	3a	**3a**	DR WE	
		25	28	C	v.sli	10YR4/3	10	10			4	4	n	n					
		28	60	C	v.sli	10YR4/3	10	15			34	41	n	n					
		60	120	Lstone							18	4	n	n					
										Total	**94**	**86**							
										MB	-12	-11							
									Droughtiness grade(DR)		3a	3a							
7	T	0	25	hCL		10YR4/2	12	0	-		38	38	n	n	*I*	2	**3a**	DR	
		25	34	C	v.sli	10YR4/4	5	0			4	4	n	n					
		34	60	C	very	10YR4/4	10	15			36	43	n	n					
		60	120	Lstone							18	4	n	n					
										Total	**96**	**88**			Chalk stones at 34cm				
										MB	-10	-9							
									Droughtiness grade(DR)		3a	2							
8	T	0	24	hCL	v.sli	10YR4/2	12	0	-		38	38	n	n	*I*	2	**3a**	DR	
		24	30	C	slight	10YR4/4	5	0			9	9	n	n					

		30	60	C	very	10YR4/4			10	15		32	38	n	n					
		60	120	Lstone								18	4	n	n					
											Total	**97**	**90**			Chalk stones at 30cm				
											MB	-9	-7							
											Droughtiness grade(DR)	3a	2							
9	T	0	25	hCL	v.sli	10YR4/2			2	0	-	44	44	n	n	*I*	2	**3a**	DR	
		25	43	C	slight	10YR4/4			10	0		26	26	n	n					
		43	60	C	very	10YR4/4			10	10		16	23	n	n					
		60	120	Lstone								18	4	n	n					
											Total	**104**	**97**							
											MB	-2	0							
											Droughtiness grade(DR)	3a	2							
10	T	0	32	SC		10YR5/3			2	0	-	53	53	n	n	*III*	3b	**3b**	WE	
		32	65	C		10YR5/4	FeMn	com	1	0	poor	34	43	n	y					
		65	70	SCL		10YR5/4	FeMn	com	2	0		5	7	n	n					
		70	120	SCL		10YR5/4	FeMn	com	2	0		49	0	n	n					
											Total	**141**	**103**							
											MB	35	6							
											Droughtiness grade(DR)	1	2							
11	T	0	30	CL		10YR4/3			2	0	-	53	53	n	n	*I*	1	**3a**	DR	
		30	44	hCL	v.sli	10YR4/3	Fe	com	5	0		21	21	n	n					
		44	60	hCL	slight	10YR4/3	Fe	com	20	5		15	20	n	n					
		60	120	Lstone								18	4	n	n					
											Total	**108**	**98**							
											MB	2	1							
											Droughtiness grade(DR)	3a	2							
12	T	0	32	hCL	v.sli	10YR4/2			12	0	-	51	51	n	n	*I*	2	**3a**	DR	
Pit 1		32	38	hCL	mod	10YR5/4			20	0		8	8	n	n					
		38	45	SCL	very	10YR5/4	Fe	com	40	20		5	5	n	n					
		45	60	SCL	very	10YR5/4	Fe	com	40	20		8	11	n	n					
		60	120	Lstone								18	4	n	n					

											Total	**90**	**79**						
											MB	-16	-18						
									Droughtiness grade(DR)			3a	3a						
13	T	0	27	hCL	v.sli	10YR4/2			12	0	-	43	43	n	n	/	2	**3a**	DR
		27	43	C	mod	10YR5/3			18	0		21	21	n	n				
		43	45	SCL	very	10YR5/4	Fe	com	40	20		1	1	n	n				
		45	60	SCL	very	10YR5/4	Fe	com	40	20		8	11	n	n				
		60	120	Lstone								18	4	n	n				
											Total	**92**	**81**						
											MB	-14	-16						
									Droughtiness grade(DR)			3a	3a						
14	T	0	25	hCL	v.sli	10YR4/2			12	0	-	40	40	n	n	/	2	**3a**	DR
		25	40	C	mod	10YR5/3			18	0		20	20	n	n				
		40	45	C	mod	10YR5/3			18	0		7	7	n	n				
		45	60	SCL	very	10YR5/4	Fe	com	40	20		8	11	n	n				
		60	120	Lstone								18	4	n	n				
											Total	**93**	**81**						
											MB	-13	-16						
									Droughtiness grade(DR)			3a	3a						
15	T	0	32	hCL	slight	10YR4/2			2	0	-	57	57	n	n	/	2	**3a**	DR
		32	56	SC	mod	10YR5/3-5/4	Fe	com	10	0	m/poor	28	30	n	n				
		56	65	SC	mod	10YR5/3-5/4	Fe	com	25	0	m/poor	6	15	n	n				
		65	120	Lstone								17	0	n	n				
											Total	**107**	**102**						
											MB	1	5						
									Droughtiness grade(DR)			3a	2						

Appendix 3: Photographs

Pit 1

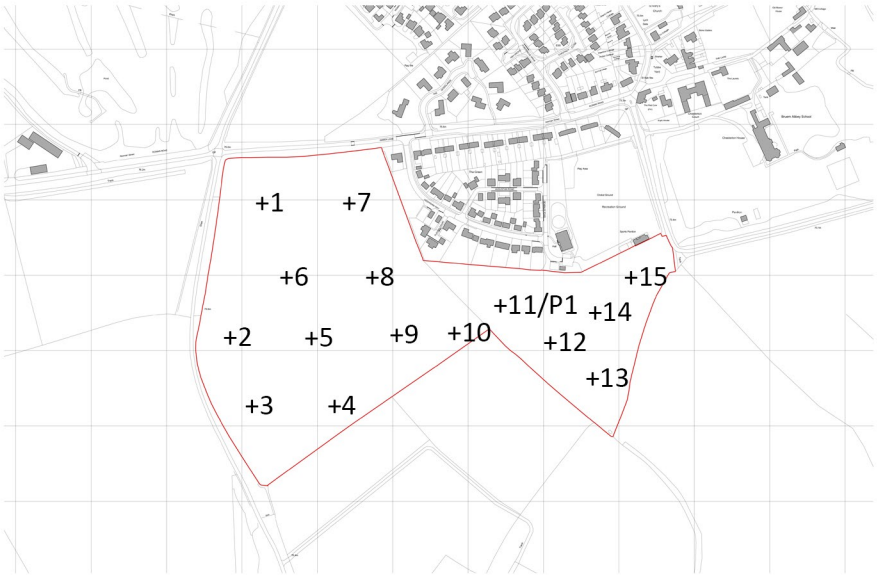
Pit 1 topsoil

Pit 1 subsoil

Stony bottom of pit

Clay at Observation 10

Localised stoniness in the north-west



Survey Area

+1 Auger Observation

.P1 Pit Observation

N

Scale 1:10,000@A4 May/2022

Figure	RAC/9523/1: Observations
Site:	Land South of Chesterton, Oxfordshire
Client:	Wates Developments Ltd

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Grade 1 - excellent quality
Grade 2 - very good quality
Subgrade 3a - good quality
} Best and most versatile land
Not Present
Subgrade 3b - moderate quality
Grade 4 - poor quality
Grade 5 - very poor quality
Non-agricultural

N

Scale 1:10,000@A4 May/2022

Figure	RAC/9523/2: Agricultural Land Classification
Site:	Land South of Chesterton, Oxfordshire
Client:	Wates Developments Ltd

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