Appendix B: Grandcourt Extension – Charity Field Supporting Information

GRANDCOURT QUARRY, EAST WINCH CHARITIES LAND, NORFOLK

Agricultural Land Classification and Soil Resource Survey

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GRANDCOURT QUARRY, EAST WINCH CHARITIES LAND, NORFOLK: Agricultural Land Classification and Soil Resource Survey

1. INTRODUCTION

This report provides detailed information on the agricultural land quality and soil resources within the East Winch Charities Land as part of a proposed extension to the existing Grandcourt Quarry, Norfolk. The survey area comprises a single arable field adjacent to the A47(T) Kings Lynn to Norwich Trunk Road. The land is bounded to the north, east and west by further agricultural land and to the south by the A47.

The survey area is approximately 1.6 ha in extent and is centred on OS Grid Reference TF 676 160.

2. SITE DESCRIPTION

2.1 Altitude & Relief

The survey area is generally level and lies at an altitude of approximately 36 mAOD. No slopes in the agricultural areas are greater than 1° and hence gradient does not constitute a limitation to the agricultural usage of the site.

2.2 Climate

Climate affects the grading of land through the assessment of an overall climatic limitation and also through interactions with soil characteristics. The key climatic variables used for grading this site are given in Table 1 and were obtained from the published 5 km grid dataset using the standard interpolation procedures (Meteorological Office, 1989).

Table 1: **Climatic & Altitude Data**	
Grid reference	TF 676 160
Altitude (mAOD)	36
Accumulated temperature (day °C Jan - June)	1397
Average annual rainfall (mm)	670
Field capacity days (days)	130
Moisture deficit, wheat (mm)	109
Moisture deficit, potatoes (mm)	102
Overall climatic grade	1

The climatic criteria are considered first when classifying land as climate can be overriding irrespective of favourable site or soil conditions. The main parameters used in the assessment of an overall climatic limitation are average annual rainfall and accumulated temperature. The combination of rainfall and temperature at this site do not result in any limitation to the agricultural quality of the land.

2.3 Published Soils Information

The 1:250 000 scale reconnaissance soil map of the area (Soil Survey, 1983) shows the whole of the survey area to be mapped as soils of the Newport 2 Association. Newport 2 Association soils are briefly described by the Soil Survey (1983) as ‘Deep well drained sandy often ferruginous soils.'

The whole of the survey area is mapped as Grade 3 quality land on the Provisional Agricultural Land Classification maps issued by the Ministry of Agriculture, Fisheries and Food (MAFF, 1972). However, these provisional maps were produced prior to the issuing of revised guidelines for the grading of agricultural land in 1988 and before the subdivision of Grade 3 land. These maps were not intended for site specific grading and should only be treated as indicative of the agricultural land quality of large areas.

2.4 Geology

The 1:50 000 BGS information records the whole of the survey area as Carstone Formation, a Cretaceous Period sandstone. No superficial deposits are recorded within the survey area.

2.5 Land Use

At the time of the survey the whole area was awaiting cultivation and comprised of wild oats and weed species.

3. SURVEY METHODS

The survey was undertaken in September 2021. Soil profiles were examined using a hand auger and/or spade to a depth of 120 cm where possible. The fieldwork was conducted at a very detailed density of one auger boring per 0.16 ha (Figure 1 & Appendix I) to satisfy the criteria for surveys of small greenfield sites contained in the Department for Environment, Food and Rural Affairs Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009). Soil pits were dug in representative soil types (Appendix II) to assess subsoil structure and allow the preparation of a statement of soil physical characteristics (Appendix III).

4. SOIL PHYSICAL CHARACTERISTICS

This survey showed the site to comprise two distinct soil types (Figure 2). The statement of soil physical characteristics is given at Appendix III.

Soil Type 1

4.1 Soil Type 1 comprises a very slightly calcareous, slightly stony, medium loamy sand topsoil, which overlies a similarly textured subsoil. The subsoil is slightly stony and usually extends to below sample depth. However, very occasionally gravel material was encountered which prevented sampling to full depth. Profiles of this soil type are well drained and assessed as Wetness Class I.

Soil Type 2

4.2 Soil Type 2 has similar topsoil and upper subsoil horizons to Soil Type 1, however, these horizons overlie a clay textured lower subsoil. This lower subsoil is gleyed and mottled with a weakly developed coarse angular blocky structure and hence

constitutes a slowly permeable layer. Very occasionally the upper subsoil is absent and the topsoil directly overlies the clay material.

Profiles of this soil type are therefore imperfectly drained and are assessed as Wetness Class II or III depending on the depth to the slowly permeable clay horizon.

5. AGRICULTURAL LAND CLASSIFICATION

The quality of the agricultural land within the proposed site was assessed using the revised guidelines and criteria for grading the quality of agricultural land issued by the Ministry of Agriculture, Fisheries and Food (MAFF, 1988). Agricultural Land Classification provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. Land is graded on a scale of 1 to 5 with Grade 3 being sub-divided into Subgrades 3a and 3b. The descriptions of the different grades of land used by MAFF are:

Grade1 - excellent quality agricultural land

Grade 2 - very good quality agricultural land

Subgrade 3a - good quality agricultural land

Subgrade 3b - moderate quality agricultural land

Grade 4 - poor quality agricultural land

Grade 5 - very poor quality agricultural land

Land of Grades1, 2 and Subgrade 3a are described as 'Best and Most Versatile' land.

Auger boring information for each sample point (Figure 1) is shown at Appendix I and soil pit profile descriptions are given at Appendix II. The agricultural land classification and extent of each grade or subgrade is shown at Figure 3.

Although soil profiles of Soil Type 2 are imperfectly drained the limiting factor for the quality of the agricultural land within the whole survey area for Soil Types 1 and 2 is droughtiness.

5.1 Subgrade 3a (good quality agricultural land)

Land of Subgrade 3a quality is associated with profiles of Soil Type 2 which have the clay lower subsoil at a relatively shallow depth and hence this clay horizon provides a better soil moisture reserve than the coarse textured loamy sand material. However, such soil profiles still have a moderate droughtiness limitation which restricts quality to Subgrade 3a.

5.2 Subgrade 3b (moderate quality agricultural land)

Land of Subgrade 3b quality is associated with Soil Type 1 and those areas of Soil Type 2 which have the clay lower subsoil deep in the soil profile. The coarse textured topsoil and subsoil have limited moisture reserves and hence have a significant droughtiness limitation which restricts these profiles to Subgrade 3b.

6. SOIL RESOURCES

The soil resources within the proposed site have been estimated from the median thicknesses of each horizon and the area of that horizon within the proposed site (Table 2).

6.1 Topsoil

TS1

The loamy medium sand topsoil of both Soil Types 1 and 2 is similar and hence should be stripped and stored as a single unit at a median thickness of 37 cm over the whole survey area.

6.2 Subsoil

SS1

The loamy medium sand subsoil of Soil Types 1 and the upper subsoil of Soil Type 2 is also similar and therefore this subsoil may be stripped and stored as a single

unit at a median thickness of 53 and 16 cm from areas of Soil Type 1 and Soil Type 2 respectively.

SS2

The clay lower subsoil materials from areas of Soil Type 2 may be stripped and stored as a single unit at a median thickness of 67 cm.

Table 2: Soil Resources

Material Type	Source	Predominant Texture	Thickness (m)	Area (ha)	Volume (m^3)
Topsoil **TS1**	Whole site	Loamy medium sand	0.37	1.6	5,920
Subsoil **SS1**	Whole site	Loamy medium sand	Soil Type 1 = 0.53 Soil Type 2 = 0.16	Soil Type 1 = 0.6 Soil Type 2 = 1.0	Soil Type 1 = 3,180 Soil Type 2 = 1,600
Subsoil **SS2**	Soil Type 2	Clay	0.67	1.0	6,700

All areas and volumes are approximate.

7. REFERENCES

Department for Environment, Food and Rural Affairs (2009)
Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. Defra: London.

Meteorological Office (1989)
Climatological Data for Agricultural Land Classification. Meteorological Office: Bracknell.

Ministry of Agriculture, Fisheries and Food (1972)
Agricultural Land Classification Map (Provisional). Sheet 124. 1 : 63 360 Scale. MAFF: London.

Ministry of Agriculture, Fisheries and Food (1988)
Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land. MAFF: London.

Soil Survey of England and Wales (1983)
Sheet 4, Soils of Eastern England. 1 : 250 000 Scale. SSEW: Harpenden.

APPENDIX I

Field Data: Hand Auger Borings

Field data : Hand Auger Borings						
Boring No.	**Depth (cm)**	**Texture**	**Colour**	**Mottles**	**Stone content (%)**	**Comments**
1	0 – 37	LMS	10YR4/4	-	10	Wetness Class I Subgrade 3b Drought
	37 - 77	LMS	10YR4/6	-	10	
	77 - 90	LMS	2.5Y5/3	MPOM	15	
	90+ Impenetrable					
2	0 – 38	LMS	10YR4/4	-	8	Wetness Class II Subgrade 3b Drought
	38 - 77	LMS	10YR4/6	-	10	
	77 - 120	C	2.5Y5/3, 5/6	VMPOM	5	Common FMn
3	0 – 39	LMS	10YR4/4	-	8	Wetness Class II Subgrade 3a Drought
	39 - 55	LMS	10YR4/6	-	10	
	55 - 120	C	2.5Y5/3, 5/6	VMPOM	5	Common FMn
4	0 – 34	LMS	10YR4/4	-	8	Wetness Class I Subgrade 3b Drought
	34 - 120	LMS	10YR4/6	-	10	
5	0 – 36	LMS	10YR4/3	-	10	Wetness Class III Subgrade 3a Drought
	36 - 120	C	2.5Y5/3, 5/6	VMPOM	10	Common FMn
6	0 – 33	LMS	10YR4/4	-	7	Wetness Class I Subgrade 3b Drought
	33 - 70	LMS	10YR5/6	-	10	
	70+ Impenetrable					
7	0 – 38	LMS	10YR4/4	-	10	Wetness Class I Subgrade 3b Drought
	38 - 60	LMS	10YR4/6	-	15	
	60+ Impenetrable					
8	0 – 37	LMS	10YR4/4	-	8	Wetness Class II Subgrade 3a Drought
	37 - 45	LMS	10YR4/6	-	5	
	45 - 120	C	2.5Y5/3, 5/6	VMPOM	5	Common FMn
9	0 – 36	LMS	10YR4/4	-	5	Wetness Class I Subgrade 3b Drought
	36 - 77	LMS	10YR4/6	-	5	
	77 - 120	LMS + C	10YR5/6	-	15	
10	0 – 35	LMS	10YR4/4	-	5	Wetness Class I Subgrade 3b Drought
	35 - 120	LMS	10YR4/6	-	5	

Appendix I: Key

Textures:	LMS	Loamy medium sand
	C	Clay
Colours:	All colours are defined according to the Munsell soil colour system (Munsell Colour Company Inc. Baltimore, Maryland 21218, USA)	
Mottles:	MPOM	Many prominent ochreous mottles
	VMPOM	Very many prominent ochreous mottles
Stones:	Stones were small occasionally medium and of mixed lithology but predominantly flint.	

FMn refers to ferri-manganiferous concentrations.

APPENDIX II

Soil Pit Data

Soil pit data

Pit 1: Slope - Level
Land use – Weeds

Depth (cm)	Texture	Colour	Mottles	Stone Content	Structure	Pores	Consistence	Structural Condition	Roots	Calcium Carbonate Content	Manganese	Horizon Boundary
0 – 30	Loamy medium sand	10YR4/4 (Dark yellowish brown)	None	8% small stones of mixed lithology mainly flint	-	-	-	-	Abundant very fine and fine	Very slightly calcareous	-	Abrupt, smooth
30 - 100+	Loamy medium sand	10YR4/6 (Dark yellowish brown)	None	10% small stones of mixed lithology mainly flint	Single grain - Loose	>0.5%	-	Moderate	Common very fine and fine	Non-calcareous	-	

Wetness Class I

Available Water	wheat	82
	potato	65
Moisture Deficit	wheat	109
	potato	102
Moisture Balance	wheat	-27
	potato	-37

ALC Grade: 3b

Main limiting factor: Droughtiness

Pit 2: Slope - Level
Land use – Weeds

Depth (cm)	Texture	Colour	Mottles	Stone Content	Structure	Pores	Consistence	Structural Condition	Roots	Calcium Carbonate Content	Manganese	Horizon Boundary
0 – 36	Loamy medium sand	10YR4/3 (Brown)	None	10% small stones of mixed lithology mainly flint	-	-	-	-	Abundant very fine and fine	Very slightly calcareous	-	Abrupt, smooth
36 – 100+	Clay	2.5Y5/3, 5/6 (Light olive brown)	Very many prominent ochreous mottles	10% small stones of mixed lithology mainly flint	Weakly developed coarse angular blocky	<0.5%	Firm	Poor	Few very fine and fine	Non-calcareous	Common	

Wetness Class III

Available Water	wheat	103
	potato	83
Moisture Deficit	wheat	109
	potato	102
Moisture Balance	wheat	-6
	potato	-19

ALC Grade: 3a

Main limiting factor: Droughtiness

APPENDIX III

Statement of Soil Physical Characteristics

Statement of Soil Physical Characteristics
Soil Type I

Topsoil

Texture	Loamy medium sand
Colour	10YR4/4, dark yellowish brown
Mottles	None
Stones	Typically 8% (range 5 - 10%) mixed lithology but mainly angular flint
Roots	Abundant very fine and fine
Calcium carbonate	Very slightly calcareous
Boundary	Abrupt, smooth
Depth	35 cm (Median thickness 35 cm, range 33 - 38 cm)

Subsoil

Texture	Loamy medium sand
Colour	10YR4/6, dark yellowish brown
Mottles	None
Stones	Typically 10% (range 5 - 15%) mixed lithology but mainly angular flint
Structure	Single grain - loose
Structural Condition	Moderate
Roots	Common very fine and fine
Calcium carbonate	Non-calcareous
Manganese	None
Depth	120 cm (Median thickness 53 cm, range 22 - 86 cm)

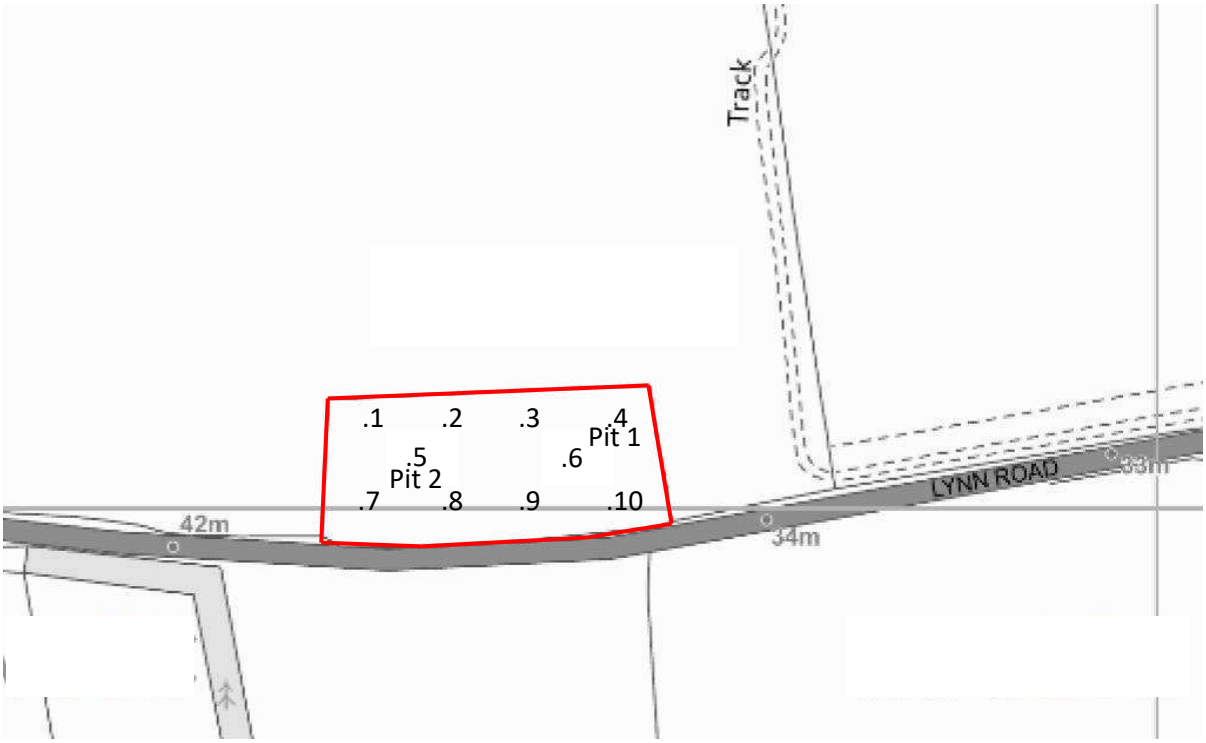
Statement of Soil Physical Characteristics
Soil Type 2

Topsoil

Texture	Loamy medium sand
Colour	10YR4/3, brown
Mottles	None
Stones	Typically 8% (range 5 - 10%) mixed lithology but mainly angular flint
Roots	Abundant very fine and fine
Calcium carbonate	Very slightly calcareous
Boundary	Abrupt, smooth
Depth	37 cm (Median thickness 37 cm, range 36 - 39 cm)

Subsoil

Texture	Clay
Colour	2.5Y5/3, 5/6, light olive brown
Mottles	Very many prominent ochreous mottles
Stones	Typically 5% (range 5 - 15%) mixed lithology but mainly angular flint
Structure	Weakly developed coarse angular blocky
Pores	<0.5% biopores
Consistence	Firm
Structural Condition	Poor
Roots	Few very fine and fine
Calcium carbonate	Non-calcareous
Manganese	Common
Depth	120 cm (Median thickness 65 cm, range 43 - 84 cm)



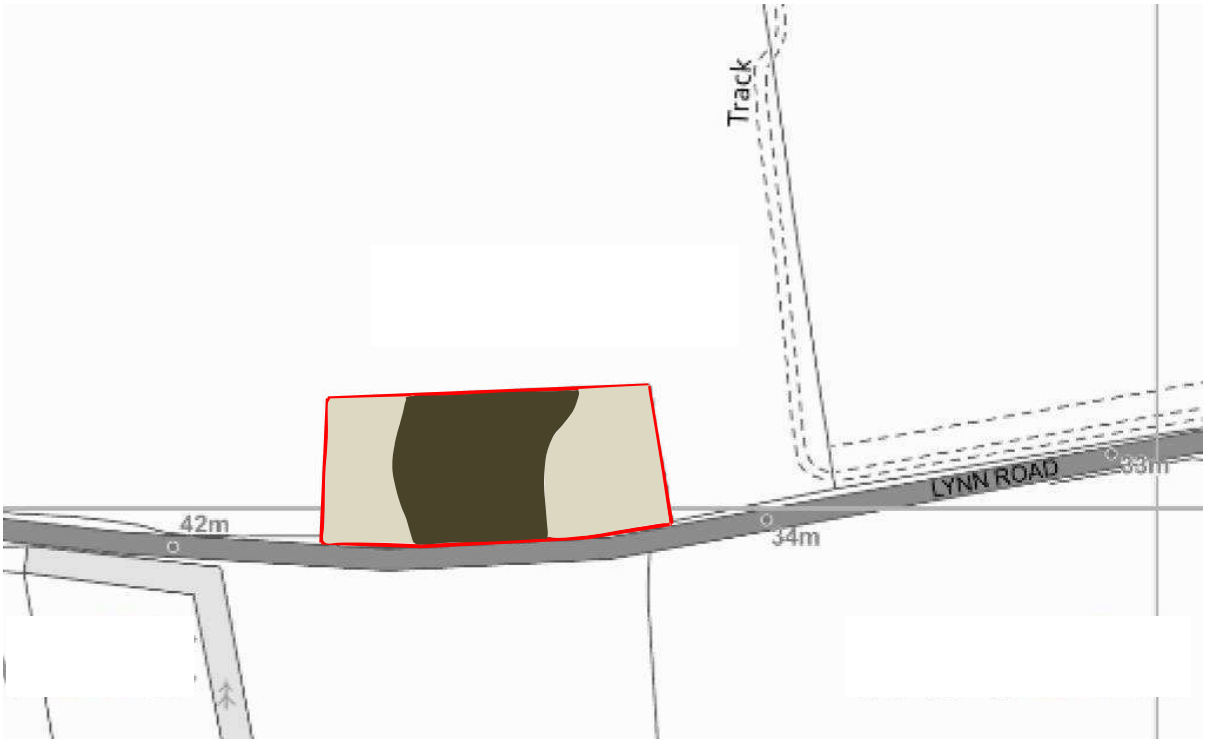
Grandcourt Quarry East Winch Charities Land

Figure 1. Auger boring and Soil Pit Locations

Survey by: R Leverton BSc, PhD, CBiol, MRSB, FISoil Sci

Key

• 1	Auger boring location
Pit 1	Soil pit location
▬	Survey boundary



Grandcourt Quarry East Winch Charities Land

Figure 2. Soil Types

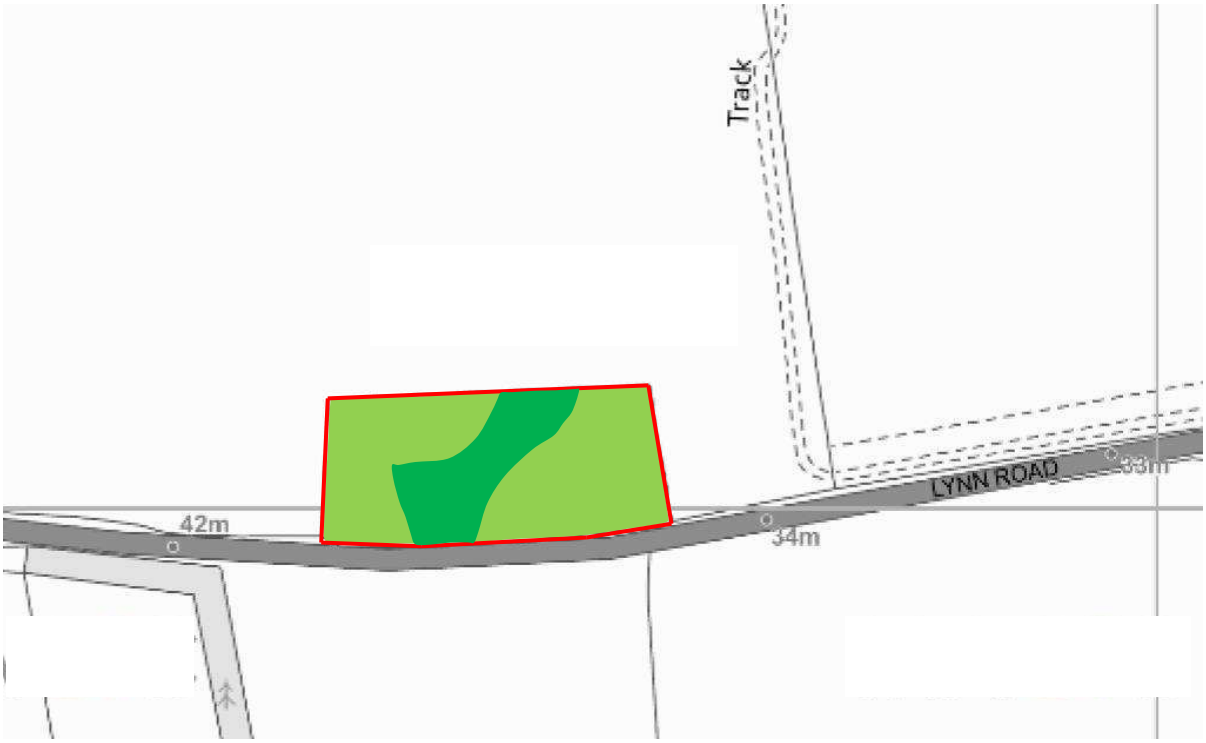
Survey by: R Leverton BSc, PhD, CBiol, MRSB, FISoil Sci

Key

Soil Type 1

Soil Type 2

Survey boundary



Grandcourt Quarry East Winch Charities Land

Figure 3. Agricultural Land Classification

Survey by: R Leverton BSc, PhD, CBiol, MRSB, FISoil Sci

Key

Subgrade 3a

Subgrade 3b

Survey boundary