

**SOUTHORPE QUARRY,
Nr PETERBOROUGH CAMBS.**

**Agricultural Land Classification and
Statement of Soil Physical Characteristics.
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AGRICULTURAL LAND CLASSIFICATION REPORT AND STATEMENT OF SOIL PHYSICAL CHARACTERISTICS

SOUTHORPE QUARRY, Nr PETERBOROUGH CAMBS.

INTRODUCTION

1. This report presents the findings of a detailed Mineral Site Survey of 25.6ha of land at Southorpe near Peterborough, Cambridgeshire. The survey was carried out on 7th March 1997.
2. The survey was commissioned by the Ministry of Agriculture, Fisheries and Food (MAFF) Land Use Planning Unit, Cambridge, in connection with an application to extract limestone and sand and gravel from respective areas of the site, and afterwards, to restore the area to agricultural land and an irrigation reservoir. This survey supersedes previous ALC surveys on this land.
3. The work was conducted by members of the Resource Planning Team in the Eastern Statutory Centre in ADAS. The land has been graded in accordance with the published MAFF ALC guidelines and criteria (MAFF, 1988). A description of the ALC grades and subgrades is given in Appendix I.
4. At the time of survey, the land use was divided up as follows: The field to the east of the existing quarry was sown to winter barley. Of the two fields to the immediate west of Southorpe Road, the northern one was just being sown with peas and the southern one was set aside, within which was a small wooded area. West of the disused railway was an area of low lying ground, this was predominantly rough grass, but included areas where rushes had established.

SUMMARY

5. The findings of the survey are shown on the enclosed ALC map. The map has been drawn at a scale of 1:10 000, it is accurate at this scale, but any enlargement would be misleading.
6. The area and proportions of the ALC grades and subgrades on the surveyed land are summarised in Table 1.

Table 1: Area of grades and other land

Grade/Other land	Area (hectares)	% Total site area
3a	2.6	10.2
3b	12.7	49.6
4	8.9	34.8
Other land	1.4	5.4
Total site area	25.6	100

7. The fieldwork was conducted at an average density of 1 auger boring per hectare. A total of 28 auger borings and 3 soil pits were described.

8. Much of the central and western sections of the site have been graded 3b (moderate quality agricultural land) with grade 4 (poor quality agricultural land) mapped on all the eastern and part of the western section. Small areas of subgrade 3a land (good quality agricultural land) is mapped on the western side of the central section of the site. A combination of factors limit the land to the various grades. Grade 3a land is typically limited by moderate droughtiness and topsoil stone content and on the western section of the site by wetness and workability constraints. Land graded 3b is limited in the western section by wetness and workability and in the central section by droughtiness. Land graded 4 is limited to this grade in the western section by wetness and workability and in the eastern section by high topsoil stone content and severe droughtiness.

FACTORS INFLUENCING ALC GRADE

Climate

9. Climate affects the grading of land through the assessment of an overall climatic limitation and also through interactions with soil characteristics.

10. The key climatic variables used for grading this site are given in Table 2 and were obtained from the published 5km grid datasets using the standard interpolation procedures (Met. Office, 1989).

Table 2: Climatic and altitude data

Factor	Units	Values
Grid reference	N/A	TF 085 017
Altitude	m, AOD	32
Accumulated Temperature	day°C (Jan-June)	1422
Average Annual Rainfall	mm	579
Field Capacity Days	days	110
Moisture Deficit, Wheat	mm	118
Moisture Deficit, Potatoes	mm	113

11. The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions.

12. The main parameters used in the assessment of an overall climatic limitation are average annual rainfall (AAR), as a measure of overall wetness, and accumulated temperature (ATO, January to June), as a measure of the relative warmth of a locality.

13. The combination of rainfall and temperature at this site mean there are no overriding climatic limitations to the land. It is therefore of climatic grade 1.

Site

14. The site is situated approximately 1.5km south of Southorpe village. The majority of the site lies west of the Southorpe Road and slopes gently (with typical gradients of 2-3°) westwards from approximately 30m (AOD) adjacent to the road, towards the stream in the western section of the site which lies at approximately 17m. The remainder of the site is situated east of the Southorpe Road towards the top of a hill, just east of the existing quarry workings. The altitude of this area is in the range 40-50m, and is mostly level or gently sloping, in the southern corner the slope steepens to approximately 5°.

Geology and soils

15. At a scale of 1:50 000, the Geological Survey of Great Britain (England and Wales) sheet 157, Stamford, shows the eastern part of the site to be mostly developed from Blisworth Limestone, with a narrow band of Upper Estaurine Series running between this and the edge of the quarry. The area to the immediate west of the Southorpe Road is predominantly Upper Lincolnshire Limestone, with a small area of Lower Lincolnshire Limestone shown in the north. The area west of the disused railway is mapped as alluvium.

16. The Soil Survey of England and Wales have mapped this area on two occasions. At a scale of 1:250 000 (sheet 4, Soils of Eastern England, 1983) shows the eastern section of the site as the Sherbourne Association and the western section as the Elmton 1 Association. The former association is briefly described as shallow, well drained brashy calcareous clayey soils over limestone, associated with slowly permeable calcareous clayey soils. Elmton 1 are described as shallow well drained brashy calcareous fine loamy soils over limestone. Some similar deeper soils and some non-calcareous and calcareous clayey soils.

17. At a scale of 1:25 000 sheet TF00E/10W (Barnack), Soils of Cambridgeshire II, identifies two main soils, with other minor ones being present. The Sherborne Series corresponding to the majority of the site east of the disused railway, and the Wittering, Adventurers and Colthorpe Complex, corresponding to most of the land west of the disused railway. Sherborne Series is described as a fine loamy or clayey topsoil over weathered limestone, containing variable amounts of limestone pieces. In the area to the east of the dismantled railway this series is mapped in conjunction with the Denchworth series. These are described as stagnogley clay soils. The Wittering, Adventurers and Colthorpe Complex soils are described as having very calcareous silty clay loam or peaty topsoils, over subsoils which may include alternating layers of humified peat and calcareous clay, or be of pure humified peat or calcareous marl. Small areas of Grange Series (in the valley in the central part of the site) and Thornhaugh Series (in the northern corner of the western part of the site) are also mapped. Soils of the Grange Series are described as fine loamy soils formed from limestone drift and containing variable amounts of limestone fragments. The depth to limestone or very dense clay is variable. The Thornhaugh Series is described as being mainly a silty clay loam throughout, variants have clayey topsoils and fine sandy clay loam horizons below. The profiles are usually stoneless, but may contain a few lime stone fragments.

18. During the current more detailed survey, the site was found to comprise 3 broad soil types but within these there is considerable variation.

Soil type 1.

19. This corresponds to the area east of the quarry, and is comprised of a moderately to very stony (25-50% slabs of limestone) heavy clay loam or medium clay loam topsoil, over a very stony (35-70%) heavy clay loam or clay upper subsoil, over solid limestone at 65cm depth. Profiles are calcareous throughout and are free draining. Roots could penetrate through the upper subsoil but have a very limited soil resource to exploit. The roots were unable to penetrate the hard limestone slabs. Typically many of the auger borings in this area were impenetrable at a shallow depth.

Soil type 2.

20. This corresponds to the area to the immediate west of the Southorpe Road, and is comprised of variably stony (5-20% limestone) heavy clay loam or medium clay loam topsoil. The upper subsoil is also variably stony (10-60% limestone) with predominantly heavy clay loam or sandy clay loam textures. Many auger borings were impenetrable at a shallow depth but where they could be penetrated clay or coarse loamy sands were encountered. Generally however it was assumed to pass into limestone rock. Profiles are very calcareous throughout and free draining except where clay subsoils are present. In these cases mottling was recorded.

Soil type 3.

21. This soil is found west of the disused railway on the lowest lying part of the site. It is comprised of stoneless calcareous silty clay or heavy silty clay loam topsoils overlying peat which typically extends to at least the maximum depth of augering (110cm). In a small area the topsoil comprises loamy peat. Where peat occurs the soils are saturated and have a low bearing capacity with rutting noted on the surface.

Agricultural Land Classification

22. The details of the classification of the site are shown on the attached ALC map and the area statistics of each grade are given in Table 1, page 1.

23. The location of the auger borings and pits is shown on the attached sample location map and the details of the soils data are presented in Appendix III.

Subgrade 3a

24. This grade corresponds to the less stony variants of soil type 2 described in paragraph 20 above. The grade is assigned mainly to the dry valley which runs east to west across the middle of the central part of the site, and to the slightly raised area of mineral soil found to the north west of the western part of the site. The land in the central part of the site is restricted to this grade due to a moderate droughtiness limitation. The combination of profile stone and textures result in the land having reduced available water reserves for crop growth, thus excluding the land from a higher grade. Locally, land is also limited to this subgrade by top soil stone and in the very small area in the north west of the site, by a slight wetness and workability limitation.

Subgrade 3b

25. This grade corresponds to the majority of soil type 2 described in paragraph 20 and to the land with mineral topsoils associated with soil type 3 (paragraph 21) in the western part of the site. In the former area, the main limiting factor is droughtiness, the limitation being caused by the interaction between the low available water capacity of the soil (due mainly to the high stone content) and the relatively high expected soil moisture deficits of the area. The latter area was limited due to a wetness and workability constraint. The high water table and clayey topsoil texture will severely restrict mechanised field operations during autumn and spring.

Grade 4

26. This grade corresponds to two areas. Firstly this land is associated with soil type 1 described in paragraph 19. The shallow moderately to very stony soil suffers severe droughtiness and topsoil stoniness limitations. The topsoil stone limitation arises because such volumes of medium and large stones adversely affect drilling and harvesting operations and may also seriously damage cultivation machinery. The combination of shallow soils and high profile stone content also severely limit the amount of soil resource that roots can exploit to obtain moisture for crop growth, thus imposing a severe droughtiness limitation on this land.

27. Secondly the wetter area within soil type 3 (paragraph 21), where the high water table and low bearing strength of the peaty profile prevents cultivations being carried out at any time of the year, thus restricting the area to poor grassland. This excludes this land from a higher grade.

Other land

28. Other land comprises a small area of woodland and the old railway.

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SOURCES OF REFERENCE

Geological Survey of Great Britain (England and Wales), 1971, *Sheet No.12*, BGS: 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.

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

Hodgson, J M [Ed] (1976) *Soil Survey Field Handbook*. Soil Survey Technical Monograph No. 5. Harpenden.

Soil Survey of England and Wales (1983) *Sheet 4, Soils of Eastern England*. SSEW: Harpenden.

Soil Survey of England and Wales (1984) *Soils and their Use in Eastern England* SSEW: Harpenden

APPENDIX I

DESCRIPTION OF THE GRADES AND SUBGRADES

Grade 1: Excellent Quality Agricultural Land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2: Very Good Quality Agricultural Land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural or horticultural crops can usually be grown but on some land of this grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1 land.

Grade 3: Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When more demanding crops are grown, yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a: Good Quality Agricultural Land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b: Moderate Quality Agricultural Land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass, or lower yields of a wider range of crops or high yields of grass that can be grazed or harvested over most of the year.

Grade 4: Poor Quality Agricultural Land

Land with severe limitations which significantly restrict the range of crops and/or the level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5: Very Poor Quality Agricultural Land

Land with severe limitations that restricts use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

APPENDIX II

SOIL WETNESS CLASSIFICATION

Definitions of Soil Wetness Classes

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile. Six soil wetness classes are identified and are defined in the table below.

Wetness Class	Duration of waterlogging ¹
I	The soil profile is not wet within 70 cm depth for more than 30 days in most years. ²
II	The soil profile is wet within 70 cm depth for 31-90 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but only wet within 40 cm depth for 30 days in most years.
III	The soil profile is wet within 70 cm depth for 91-180 days in most years or, if there is no slowly permeable layer present within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31-90 days in most years.
IV	The soil profile is wet within 70 cm depth for more than 180 days but not wet within 40 cm depth for more than 210 days in most years or, if there is no slowly permeable layer present within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.
V	The soil profile is wet within 40 cm depth for 211-335 days in most years.
VI	The soil profile is wet within 40 cm depth for more than 335 days in most years.

Assessment of Wetness Class

Soils have been allocated to wetness classes by the interpretation of soil profile characteristics and climatic factors using the methodology described in *Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land* (MAFF, 1988).

¹ The number of days is not necessarily a continuous period.

² 'In most years' is defined as more than 10 out of 20 years.

APPENDIX III

Statement of Soil physical characteristics.

Soil type 1.

Topsoil	Texture	heavy clay loam
	Colour	10YR4/4 and 10YR4/3
	Depth	25/30cm
	Stoniness	typically 25 - 35% total, 20%>2cm, 10%>6cm limestone slabs.
	Roots	many fine and very fine
	Calcium carbonate	very calcareous
	Boundary form	smooth, abrupt
Upper subsoil	Texture	heavy clay loam
	Colour	7.5YR5/6, 10YR5/6
	Depth	50cm
	Stoniness	70% hard limestone, 2-5cm thick plates
	Structure	too rocky to assess
	Consistence	too rocky to assess
	Porosity	too rocky to assess
	Roots	few fine roots around rocks
	Calcium carbonate	very calcareous
	Concretions	none
	Boundary form	abrupt wavy
Lower subsoil	Texture	clay
	Colour	2.5Y7/4
	Depth	65cm
	Stoniness	30% hard limestone pieces
	Structure	(possibly) moderately developed coarse angular blocky, difficult to assess
	Consistence	firm
	Porosity	<0.5% pores >0.5mm
	Roots	few very fine roots
	Calcium carbonate	extremely calcareous
	Concretions	none
	Boundary form	-
Comments:	below 65cm was solid limestone. roots unable to penetrate solid limestone Many of the auger borings stopped at a shallow depth, therefore depths to solid limestone difficult to assess.	

Soil type 2.

Topsoil	Texture	heavy or medium clay loam	
	Colour	10YR4/4, 4/3	
	Depth	typically 25cm, (range 20 - 30 cm)	
	Stoniness	Variable, typically 10 -20% total, (range 5 - 25%) limestone.	
	Roots	common fine and very fine	
	Calcium carbonate	very calcareous	
	Boundary form	smooth, abrupt	
	Upper subsoil	Texture	heavy clay loam or sandy clay loam
		Colour	Variable 7.5YR5/6, 6/6, 4/6, 5YR5/6 & 7.5YR7/3.
		Depth	35/70cm
Stoniness		variable, typically 15-30% small, medium and large hard limestone pieces. (range 5-60%)	
Structure		too rocky to assess	
Consistence		too rocky to assess	
Porosity		too rocky to assess	
Roots		common very fine roots	
Calcium carbonate		very calcareous	
Concretions		none	
Boundary form	irregular, abrupt		
*Lower subsoil	Texture	silty clay	
	Colour	2.5Y6/3 and 7/3	
	Depth	80cm	
	Stoniness	15% medium and large hard limestone and ironstone pieces	
	Structure	moderately developed coarse sub angular blocky, tending towards angular blocky	
	Consistence	very firm	
	Porosity	<0.5% pores >0.5mm	
	Roots	few very fine roots	
	Calcium carbonate	extremely calcareous	
	Concretions	none	
Boundary form	-		
Comments:	*lower subsoil generally impenetrable to auger limestone in upper subsoil is very fragmented, therefore allowing good exploration by roots. typically assessed as wetness class I, occasionally wetness class III where dense clay occurs		

Soil type 3.

Topsoil	Texture	silty clay, heavy silty clay loam (occasionally loamy peat)
	Colour	10YR4/3
	Depth	30/35cm
	Stoniness	<1% small limestone pieces
	Roots	abundant fine and very fine
	Calcium carbonate	very calcareous
	Boundary form	smooth, abrupt

Subsoil	Texture	peat, largely humified, but with some fibrous remains
	Colour	10YR2/1
	Depth	90cm+
	Stoniness	stoneless
	Structure	moderately developed coarse sub angular blocky, (waterlogged, therefore difficult to assess)
	Consistence	too wet to assess
	Porosity	>0.5% pores >0.5mm
	Roots	common fine and very fine
	Calcium carbonate	non calcareous
	Concretions	none
	Boundary form	-

Comments: Occasionally there is a transitional zone between the topsoil and peat
Assessed as wetness class IV
Occasionally clay found at depth (80cm)