

# AGRICULTURAL LAND CLASSIFICATION AND STATEMENT OF SOIL PHYSICAL CHARACTERISTICS

## LAND AT BEXWELL ROAD, DOWNHAM MARKET, NORFOLK

### 1.0 BACKGROUND

- 1.1 A detailed survey was carried out over 142.1 ha lying north and east of Bexwell, itself situated 2.0 km east of Downham Market, Norfolk. The land is the subject of a planning application for a proposed golf course, country club, hotel, business park and industrial development.
- 1.2 The site is bounded on the west by the A10 trunk road, in the south-west by the edge of Bexwell village, the A1122 road and Mast Farm buildings and elsewhere on the south, east and north by agricultural land interspersed with small blocks of broadleaved woodland, notably Oak Wood and Old Covert. Within the site occurs another small woodland area known as Rough Covert.
- 1.3 On the published 1:63 360 scale Agricultural Land Classification (ALC) map (MAFF, 1972) the whole area is mapped as Grade 3. More recently (MAFF, 1977), the south and west of the site was classified as Subgrade 3b. However, both maps were of a reconnaissance nature and subsequently the ALC system has been revised (MAFF, 1988) such that the previous survey data are insufficient to apply the present classification criteria. The current survey was undertaken, therefore, to provide site-specific land quality and soil information.
- 1.4 A total of 137 auger borings was made using a dutch auger to a depth of 1.2 m unless stopped by impenetrable stony layers. In addition, 6 soil pits representative of the main soil types were dug to assess subsoil conditions in more detail. The fieldwork was carried out during November 1995.
- 1.5 At the time of the survey all the land, apart from the woodland areas, was in arable production, mainly winter cereals.
- 1.6 It is understood that until approximately 25 years ago most of the site was used for an airfield. Although there is no evidence of the airfield today its removal and the subsequent reinstatement to farmland has resulted locally in the presence of some disturbed soils. In particular, small areas of imported topsoil, no topsoil and scattered

lumps of concrete can be found. Generally, though, the site's previous use appears to have little affected the soil physical characteristics.

## 2.0 PHYSICAL FACTORS AFFECTING LAND QUALITY

### Climate

- 2.1 Climatic criteria are considered when classifying land as these may have an overriding limitation in terms of the agricultural use of the land. The main parameters used in the assessment of the overall climatic limitation are average annual rainfall, as a measure of overall wetness, and accumulated temperature (day °C Jan-June) as a measure of the relative warmth of an area.
- 2.2 A detailed assessment of the prevailing climate for the site has been made by interpolation from the 5 km grid dataset produced by the Meteorological Office (Met. Office, 1989). The details are given in Table 1 and these show that there is no overall climatic limitation affecting the site. Climatic factors do, however, interact with soil properties to influence soil wetness and droughtiness.

**Table 1: Climatic Interpolation**

Grid reference	TF 634 044
Altitude (m)	35
Accumulated Temperature (day °C, Jan-June)	1404
Average Annual Rainfall (mm)	594
Moisture Deficit, Wheat (mm)	114
Moisture Deficit, Potatoes (mm)	108
Field Capacity (days)	110
Overall Climatic Grade	1

### Altitude and Relief

- 2.3 The whole site is part of a broad and very gently undulating plateau / terrace at 32 -37 m AOD. The land is almost flat, with very few slopes exceeding 1°. Neither altitude nor relief impose any limitation on the agricultural quality of the site.

## Geology and Soils

- 2.4 There is no detailed geological information. The published 1:250 000 scale geological map (Brit. Geol. Survey, 1985) shows the site to be underlain by Lower Cretaceous beds, namely Gault Clay, Red Chalk and Carstone (oolitic sandstone). Soils information (see below) indicates that in this area the solid geology is overlain by Pleistocene chalky till and glaciofluvial drift.
- 2.5 There is no published detailed soil map of the site. The reconnaissance soil survey map for the area (Soil Survey, 1983) shows all of the site to comprise soils from the Burlingham 1 association (\*), essentially loamy soils with a slowly permeable horizon and slight seasonal waterlogging.
- 2.6 The detailed survey carried out on the site shows the presence of four soil types and these are described in the following paragraphs. Briefly, there occur well-drained loamy soils, well-drained chalky clays, fine loamy over slowly permeable clay soils and slowly permeable clays. However, the drift composition and stratigraphy of the area is somewhat variable and in places this can result in significant soil profile differences over short distances, giving mapping units with some variation.

### Soil Type 1 (Refer to Soil Types Map and Appendix 1)

- 2.7 Characteristically, Soil Type 1 is a deep, non-calcareous, slightly stony, brown and yellowish brown loamy soil. The topsoil and upper subsoil are sandy clay loam or medium sandy loam. Usually the lower subsoil, too, below 45-65 cm, has similar textures down to at least 80 cm. However, a very few profiles have a loamy sand and sand lower subsoil. Below 80 cm the soils can continue sandy (clay) loam, become sandy and / or overlie slowly permeable clay. Subsoil horizons (to at least 80 cm) are friable, have few pores and have weakly developed coarse blocky structures. The profiles are well-drained, with no mottles or a few ochreous mottles in the subsoil, and the soil is classified as Wetness Class I.

- 
- (\*) Burlingham 1 association: Deep coarse and fine loamy soils with slowly permeable subsoils and slight seasonal waterlogging. Some deep and well-drained coarse loamy and sandy soils occur. The soils are developed from chalky till and glaciofluvial drift.

- 2.8 Soil Type 1 is of limited extent. It is mapped in four small areas in the north-west, south-west, centre and east of the site.

Soil Type 2 (Refer to Soil Types Map and Appendix 1)

- 2.9 Soil Type 2 is not extensive, being mapped only in the west of the site. The soil is characterised as a very calcareous, well-drained chalky clay.
- 2.10 Typically, a brown sandy clay loam or medium clay loam topsoil containing a few flints overlies a light yellowish brown heavy clay loam or clay upper subsoil at 30-35 cm. This horizon contains a few flints and has few or common chalk fragments. It is firm, porous and has moderately developed coarse subangular blocky structures. Between 50 and 70 cm the upper subsoil passes into a very pale brown chalky clay with few flints. This clay is porous, very firm and weakly structured. The soil is unmottled and well-drained and is classified as Wetness Class I.

Soil Type 3 (Refer to Soil Types Map and Appendix 1)

- 2.11 Soil Type 3 occurs across the centre and in the south-west of the site. It is defined as having a fine loamy topsoil and upper subsoil and a slowly permeable clay horizon within 80 cm. The upper subsoil may be mottled but the profile is not gleyed within 40 cm of the surface. Calcium carbonate content is variable across the mapping unit but most (>70% of samples) topsoils and upper subsoils are non-calcareous. The soil is slightly or very slightly stony.
- 2.12 Typically, a brown or dark greyish brown sandy clay loam or medium clay loam topsoil overlies a sandy clay loam upper subsoil at 30-35 cm. The upper subsoil is yellowish brown or light olive brown and usually contains few to many ochreous mottles and few brown mottles. The horizon may contain few fine manganiferrous concretions. The upper subsoil is friable, has few pores and has weakly developed coarse and medium subangular blocky structures. It overlies a clay or sandy clay lower subsoil most usually beginning at 45-60 cm, although in about 15% of profiles sampled the clay is not encountered until 65-70 cm. The lower subsoil is gleyed, having greyish brown or grey colours and common or many distinct grey and ochreous mottles and few fine manganiferrous concretions. It may contain few to many chalky fragments. The lower subsoil clay or sandy clay is very firm, has few pores, has weakly developed coarse prismatic structures and is slowly permeable. Fissures and ped faces are frequently

lined with fine sand and several profiles show sandy and loamy lenses within the clay. Soil Type 3 is classified as Wetness Class II.

#### Soil Type 4 (Refer to Soil Types Map and Appendix 1)

- 2.13 Soil Type 4 is the most extensive unit and is mapped in three areas in the north-west, north-east and south of the site. The soil is defined by having a slowly permeable and gleyed clay directly beneath the topsoil. Calcium carbonate content is variable across the mapping unit; slightly more than half of topsoils and more than 70% of those upper subsoils sampled are non-calcareous. The soil is slightly or very slightly stony.
- 2.14 Typically, a brown or dark greyish brown sandy clay loam or medium clay loam (very occasionally heavy clay loam) topsoil overlies a sandy clay loam upper subsoil at 30-35 cm. This overlies a clay or sandy clay upper subsoil that is gleyed, having greyish brown or light olive brown colours and common or many distinct grey and ochreous mottles and few fine manganiferrous concretions. This horizon has few pores, is firm or very firm, has weakly developed very coarse blocky or moderately developed very coarse prismatic structures and is slowly permeable. The lower subsoil, from 50-65 cm, is normally a continuation of the clay (or occasionally sandy clay) but becomes greyer and frequently contains chalk fragments, especially below 70 cm. Fissures and ped faces are commonly lined with fine sand and almost 20% of profiles sampled show the clay to pass into sandy and loamy strata / lenses within 80 cm. Soil Type 3 is classified as Wetness Class III.

### 3.0 **AGRICULTURAL LAND CLASSIFICATION**

- 3.1 The land has been classified using the guidelines contained in the Agricultural Land Classification of England and Wales (MAFF, 1988). A breakdown of the grades found on the site is given in Table 2 and a description of each grade is given in Appendix 2. At this site the factors which primarily determine grading are the soil Wetness Class (itself a function of climate and soil permeability) and topsoil texture, and soil droughtiness.

#### Grade 2

- 3.2 The land mapped as Grade 2 includes Soil Types 1, 2 and 3. In all cases moisture balance calculations indicate that in this relatively dry area the soils' textures and stone contents give available water capacities that are somewhat inadequate for crop

**Table 2: Distribution of Grades and Subgrades**

Grade	Area (ha)	%
2	73.1	52
3a	56.0	39
Other land	13.0	9
<hr/>		
Total	142.1	100

requirements. Apart from this overall slight droughtiness limitation Soil Type 3 also suffers from a minor wetness and workability restriction. The soil is Wetness Class II which with medium clay loam or sandy clay loam topsoil textures and under the prevailing climatic conditions is limited to Grade 2. Some care will be needed with *cultivations and harvesting to avoid structural damage*.

- 3.3 Locally, some moderately droughty Subgrade 3a and 3b profiles may occur but these cannot be mapped separately. These poorer areas occur patchily, mainly within Soil Type 1, in the very few places where loamy sand or sand strata occur within 50-80cm.

Subgrade 3a

- 3.4 The land having Soil Type 4 is mapped as Subgrade 3a. As elsewhere, the land has a slight droughtiness problem but the factor primarily determining the 3a classification is the soil wetness class. The soil is Wetness Class III which with medium clay loam or sandy clay loam topsoil textures and under the prevailing climatic conditions is limited to Subgrade 3a on account of a moderate wetness limitation. The land will have a moderate workability limitation so that any cultivations and harvesting will need to be carefully controlled to avoid structural damage to the soils during the wetter periods of the year.
- 3.5 Locally, very small areas of more poorly drained Subgrade 3b land occur where topsoil texture is heavy clay loam, but these areas are not at all widespread and cannot be mapped separately.

Other land

- 3.6 Land other than agricultural comprises metalled tracks, in-field hard-standing, farm buildings and woodland.

December 1995

Resource Planning Team  
ADAS Cambridge

## REFERENCES

BRITISH GEOLOGICAL SURVEY, 1985. Sheet 52°N-00°. Solid Edition, Scale 1:250 000.

MAFF, 1972. Agricultural Land Classification Map. Provisional. Scale 1:63 360, Sheet 124.

MAFF, 1977. Reconnaissance Grade 3 Subdivision, Downham Market. RPT Cambridge File Nk.w.3.

MAFF, 1988. Agricultural Land Classification of England and Wales (Revised Guidelines and Criteria for grading the quality of agricultural land). Alnwick.

METEOROLOGICAL OFFICE, 1989. Climatological Data for Agricultural Land Classification.

SOIL SURVEY OF ENGLAND AND WALES, 1983. Sheet 4, "Soils of Eastern England". Scale 1:250 000 .



## Appendix 1

### **DESCRIPTION OF SOIL PHYSICAL CHARACTERISTICS**

#### SOIL TYPE 1

##### Topsoil

Depth	: 30/35 cm
Texture	: Medium sandy loam, sandy clay loam
Colour	: Brown (10YR4/3), dark greyish brown (10YR4/2)
Mottles	: None
Stones	: 2-5% small and medium, hard, angular and subangular flint
CaCO <sub>3</sub>	: Non-calcareous
Boundary	: Clear smooth

##### Upper Subsoil

Depth	: 45/65 cm
Texture	: Sandy clay loam, medium sandy loam
Colour	: Brown (10YR4/3; 7.5YR4/4), yellowish brown (10YR5/4)
Mottles	: None, or occasionally few, distinct, yellowish brown (10YR5/6)
Concretions	: None, or occasionally few, fine, manganiferous
Stones	: 2-3% small and medium, hard, angular and subangular flint
Structure	: Weakly developed coarse and medium angular blocky
Consistence	: Friable
Structural condition	: Moderate
Pores	: <0.5%
Roots	: Common fine and very fine
CaCO <sub>3</sub>	: Non-calcareous
Boundary	: Clear smooth

##### Lower Subsoil

Depth	: 120 + cm
Texture	: Medium sandy loam, sandy clay loam, occasionally loamy medium sand and medium sand, +/- clay below 80 cm
Colour	: Yellowish brown (10YR5/6), dark yellowish brown (10YR4/6), brownish yellow (10YR6/6)

Mottles : None, or occasionally few, distinct, yellowish brown (10YR5/6)  
Concretions : None, or occasionally few, fine, manganiferrous  
Stones : 2-3% small to large, hard, angular and subangular flint  
Structure : Weakly developed coarse and very coarse subangular blocky  
Consistence : Friable  
Structural condition : Good  
Pores : < 0.5%  
Roots : Few, fine  
CaCO<sup>3</sup> : Non-calcareous

Wetness Class : I

## SOIL TYPE 2

### Topsoil

Depth : 30/35 cm  
Texture : Medium clay loam, sandy clay loam  
Colour : Brown (10YR4/3), dark greyish brown (10YR4/2), olive brown (2.5Y4/3)  
Mottles : None  
Stones : 1-3% small and medium, hard, angular and subangular flint  
CaCO<sup>3</sup> : Very calcareous  
Boundary : Abrupt smooth

### Upper Subsoil

Depth : 50/70 cm  
Texture : Heavy clay loam, clay  
Colour : Light olive brown (2.5Y5/4), light yellowish brown (10YR6/4; 2.5Y6/4)  
Mottles : None  
Concretions : None  
Stones : 2-5% small to large, hard, angular and subangular flint and 2-6% chalk fragments  
Structure : Moderately developed very coarse subangular blocky, breaking to medium and coarse subangular blocky  
Consistence : Firm  
Structural condition : Moderate

Pores : >0.5%  
Roots : Few fine and very fine  
CaCO<sup>3</sup> : Very calcareous  
Boundary : Clear smooth

#### Lower Subsoil

Depth : 120 + cm  
Texture : Clay  
Colour : Light yellowish brown (10YR6/4; 2.5Y6/4), very pale brown (10YR7/5)  
Mottles : None  
Concretions : None  
Stones : 4-5% medium and large, hard, angular and subangular flint; 5-12% chalk fragments  
Structure : Massive (dry) breaking to medium subangular blocky  
Consistence : Very firm  
Structural condition : Poor / moderate  
Pores : > 0.5%  
Roots : Few, fine and very fine  
CaCO<sup>3</sup> : Very calcareous

Wetness Class : I

#### SOIL TYPE 3

##### Topsoil

Depth : 30/35 cm  
Texture : Medium clay loam, sandy clay loam  
Colour : Brown (10YR4/3), dark greyish brown (10YR4/2; 2.5Y4/2), olive brown (2.5Y4/3)  
Mottles : None  
Stones : 2-10% small and medium, hard, angular and subangular flint  
CaCO<sup>3</sup> : Non-calcareous to calcareous  
Boundary : Clear smooth

##### Upper Subsoil

Depth : 45/60 cm

Texture : Sandy clay loam  
Colour : Yellowish brown (10YR5/4), light olive brown (2.5Y5/4)  
Mottles : Few / many, faint / distinct yellowish brown (10YR5/5-5/8; few brown (10YR5/3)  
Concretions : None, or few fine manganiferrous  
Stones : 2-5% small to large, hard, angular and subangular flint  
Structure : Weakly developed coarse and medium subangular blocky  
Consistence : Friable  
Structural condition : Moderate  
Pores : <0.5%  
Roots : Few fine and very fine  
CaCO<sub>3</sub> : Non-calcareous, occasionally slightly calcareous  
Boundary : Clear smooth

#### Lower Subsoil

Depth : 120 + cm  
Texture : Clay, sandy clay, occasionally with sandy or loamy lenses / strata  
Colour : Light olive brown (2.5Y5/3), brown (10YR5/3), greyish brown (10YR5/2; 2.5Y5/2), grey (10YR5/1; 2.5Y5/1)  
Mottles : Common / many distinct yellowish brown (10YR5/4-5/8), dark yellowish brown (10YR4/6) and few/common distinct grey (10YR5/1) and greyish brown (10YR5/2)  
Concretions : None, or few fine manganiferrous  
Stones : 2-6% small to large, hard, angular and subangular flint; frequently 2-12% chalky fragments, especially > 70 cm  
Structure : Weakly developed coarse prismatic  
Consistence : Very firm  
Structural condition : Poor  
Pores : < 0.5%  
Roots : Few, fine and very fine  
CaCO<sub>3</sub> : Non-very calcareous

Wetness Class : II

## SOIL TYPE 4

### Topsoil

Depth	: 30/35 cm
Texture	: Medium clay loam, sandy clay loam
Colour	: Brown (10YR4/3), dark greyish brown (10YR4/2; 2.5Y4/2), olive brown (2.5Y4/3)
Mottles	: None
Stones	: 2-8% small and medium, hard, angular and subangular flint
CaCO <sup>3</sup>	: Non-calcareous to calcareous
Boundary	: Clear smooth

### Upper Subsoil

Depth	: 50/65 cm
Texture	: Sandy clay, clay
Colour	: Brown (10YR5/3), light olive brown (2.5Y5/3), greyish brown (10YR5/2; 2.5Y5/2)
Mottles	: Common / many, distinct, yellowish brown (10YR5/6) and greyish brown (10YR5/2)
Concretions	: None, or few fine manganiferrous
Stones	: 2-5% small to large, hard, angular and subangular flint
Structure	: Weakly developed very coarse subangular and angular blocky; moderately developed very coarse prismatic
Consistence	: Firm, very firm
Structural condition	: Poor
Pores	: <0.5%
Roots	: Common fine and very fine
CaCO <sup>3</sup>	: Non-calcareous, occasionally slightly calcareous
Boundary	: Clear smooth / wavy

### Lower Subsoil

Depth	: 120 + cm
Texture	: Clay, sandy clay, occasionally with sandy or loamy lenses / strata
Colour	: Light olive brown (2.5Y5/3), brown (10YR5/3), greyish brown (10YR5/2; 2.5Y5/2), grey (10YR5/1; 2.5Y5/1)

**Mottles** : Common / many distinct yellowish brown (10YR5/4-5/8), dark yellowish brown (10YR4/6) and few/common distinct grey (10YR5/1) and greyish brown (10YR5/2)

**Concretions** : None, or few fine manganiferrous

**Stones** : 2-6% small to large, hard, angular and subangular flint; frequently 2-12% chalky fragments, especially > 70 cm

**Structure** : Weakly developed coarse prismatic and very coarse subangular blocky

**Consistence** : Very firm

**Structural condition** : Poor

**Pores** : < 0.5%

**Roots** : Few, fine and very fine

**CaCO<sub>3</sub>** : Non-very calcareous

**Wetness Class** : III

## Appendix 2

### **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 include 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 and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable crops. The level of yield is generally high but may be lower or more variable than Grade 1.

### **Grade 3 - good to moderate quality agricultural land**

Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where 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 which 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 levels of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yield of which are variable. In most 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 very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.