AGRICULTURAL LAND CLASSIFICATION AND STATEMENT OF SOIL PHYSICAL CHARACTERISTICS, KENNETT HALL FARM, KENNETT, CAMBRIDGESHIRE

1.0 BACKGROUND

1.1 The site covers an area of 83.7 hectares and is the subject of an application for a proposed landfill site. Much of the centre of the site consists of current and past mineral workings. Parts of the past workings have been restored to agricultural use. Reinstatement has occurred above fill materials at ground level, and at lower levels.

1.2 ADAS Statutory Resource Planning Team undertook a detailed Agricultural Land Classification (ALC) and soil physical characteristics survey of both the undisturbed and restored land during March 1996. Just over 11 ha of restored land in the centre of the site was surveyed in detail in 1993 (ADAS, 1993) and the results from this and the present survey have been combined and presented in this report.

1.3 A total of 66 auger borings was made, spaced at 100 m intervals to a depth of 120 cm, or shallower if an impenetrable layer was encountered. Subsoil conditions were assessed from seven inspection pits and topsoil stoniness was established from sieving at 14 representative sites.

1.4 On the published provisional 1:63 360 scale ALC map, Sheet 126 (MAFF 1971), the centre of the site is shown to be Non-agricultural and the remainder is shown as Grade 4. However, this map is of a reconnaissance nature and the current detailed survey was undertaken to provide site specific details. The previously surveyed restored land in the centre of the site was classified as Subgrade 3a.

1.5 At the time of the survey the agricultural use of the land included small areas of restored soils under rough grassland. Most of the undisturbed land and the remainder of the restored land were in arable use, either stubble from the previous harvest or ploughed and cultivated prior to spring planting. Parts of the arable land in the east of the site have been ridged and stone-picked by machine and the flints left in the wheelings. Non-agricultural land comprises the current and unrestored mineral workings, soil storage bunds, access tracks and small areas of woodland and scrub.

1.6 Land quality has been assessed on the basis of its agricultural potential in an irrigated state, since irrigation from an adequate and assured water supply is currently practised.

2.0 PHYSICAL FACTORS AFFECTING LAND QUALITY

Climate

2.1 Climate 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 climate 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 data set produced by the Meteorological Office (Met. Office 1989). The details are given in Table 1 and show that there is no overall climatic limitation affecting this site.

Table 1 : Climatic Interpolation

Grid Reference	TL 692 686
Altitude (m, AOD)	25
Accumulated Temperature Day °C, Jan-June	1430
Average Annual Rainfall (mm)	583
Moisture Deficit, Wheat (mm)	117
Moisture Deficit, Potatoes (mm)	112
Field Capacity Days	105
Overall Climatic Grade	1

Altitude and Relief

2.3 The undisturbed northern, eastern and southern parts of the site are almost flat, at 18 - 30 m AOD. Generally, slopes of up to 2° are towards the north and north-east. The lowest land is adjacent to the River Kennett in the north-east corner of the site. The restored land in the centre of the site is also almost flat, but occurs at different levels. Current workings and unrestored land in the west and centre of the site form uneven, deep, excavations. Nowhere on the agricultural areas are slopes limiting in ALC terms.

Geology and Soils

2.4 The 1:50 000 scale geology map (Geological Survey, 1982) shows most of the site to be underlain by Recent and Pleistocene 3rd Terrace Deposits, comprising sandy, flinty, and chalky gravels. A small area of 4th Terrace Deposits occurs in the south-east corner and in the north-east a small area of Pleistocene Glacial Sands and Gravels overlying Cretaceous Middle Chalk is mapped.

2.5 The reconnaissance soil survey map for the area (Soil Survey, 1983) shows the site to comprise soils of the Newport 4 association, being deep, well-drained sandy soils with some very acid profiles with bleached subsurface horizons, all derived from glaciofluvial drift. An earlier but more detailed survey (Hodge &

Seale, 1966) shows all the site to consist of Redlodge series, namely sandy loam / loamy sand over loamy sand / sand soils, with signs of podzolization.

2.6 The detailed survey of the site shows the presence of seven soil types. Three of these types occur on the undisturbed land while four soil types characterise the 17.0 ha of restored or disturbed land.

Undisturbed soils

2.7 Soil type 1 is widespread in the north, south and east of the site and typically comprises a brown loamy medium sand topsoil to about 40 cm overlying a brown or dark yellowish brown loamy medium sand upper subsoil. At variable depths, usually below 55 cm, the subsoil becomes a brown or yellowish brown medium sand. Many profiles contain discontinuous lenses of sandy clay loam in the lower subsoil and in certain places the soils rest on weathering chalky strata below 80 cm. Apart from this chalky material the soils are predominantly non-calcareous and very slightly or slightly stony throughout. The soils are free draining and are assessed as Wetness Class I.

2.8 The main variability within the Soil type 1 mapping unit is that in the south-west of the site topsoils are moderately stony and in places in the east and south the lower subsoils are moderately stony. Some profiles, especially in the east, have a medium sandy loam topsoil and upper subsoil.

2.9 Soil type 2 occurs in the north-east of the site. It typically comprises a brown, moderately flinty, medium sandy loam or clay loam topsoil to 30 / 35 cm overlying a thin horizon of strong brown, moderately flinty, medium sandy loam. Below 40 / 50 cm occurs a mixture of light grey sandy clay loam or medium clay loam, many flints and many weathering chalk fragments. The soil is very calcareous throughout. It is well drained and is assessed as Wetness Class I.

2.10 Soil type 3 occurs as a narrow strip alongside the River Kennett. A dark brownish grey clay topsoil to 40 cm overlies a greyish brown silty clay with common pale and ochreous mottles. Typically, at 60 cm the subsoil becomes a grey, mottled, sandy clay and this passes below 100 cm into a light brownish grey medium sandy loam which is affected by groundwater in winter. The soil contains a few flints and small chalky fragments throughout and it is very calcareous. Drainage is imperfect but the soil is porous and is assessed as Wetness Class II.

Restored soils

2.11 Soil type 4 occurs on the restored land in the centre of the site. The soils typically comprise very slightly or slightly stony medium sandy loam topsoils over subsoils of moderately stony chalky material. The subsoil textures are typically silty clay loam or sandy silt loams and profiles are rootable to a depth of at least 80 cm. All profiles are freely draining and have been assessed as Wetness Class 1.

2.12 Soil type 5 is associated with land to the west of Halfmoon Plantation restored above fill materials. The land is slightly domed but has a very uneven surface. The soils comprise 50 cm of very slightly stony, calcareous, brown over yellowish brown medium sandy loam. This overlies the hard, black, impenetrable fill material. At the base of the profile the soil is discoloured and malodorous. The soil profile is permeable but water lies in the lower subsoil above the underlying fill. Because the profile is wet within 40 / 50 cm for significant periods each year the soil is assessed as Wetness Class III.

2.13 Soil type 6 occurs in three small areas where land has been restored with deep sandy material. However, topsoil has frequently been buried by subsoil material so that profiles are often brown on top and dark brown beneath. Typically, the soil to 40 cm comprises a slightly stony medium sandy loam. This overlies a very slightly stony medium sand or loamy medium sand to 60 /

80 cm, with a yellowish brown, very stony medium sand below this. The soil drains freely and is assessed as Wetness Class I.

2.14 Soil type 7 is associated with a small area of disturbed ground. There is no profile horizonation; soils are deep, brownish yellow, medium sand containing about 30% flints throughout . The soil drains freely and is assessed as Wetness Class I.

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 soil droughtiness (a function of soil depth, texture, structure and stoniness relative to the crop adjusted moisture deficits in the area), availability of irrigation, topsoil stoniness and soil wetness (a function of climate and soil permeability).

Table 2. Agricultural Land Classification

Grade	ha	%
2	4.5	6
3a	47.8	56
3b	4.6	6
4	3.3	4
Other land	23.5	28
TOTAL	83.7	100.0

Grade 2

3.2 Land assessed as Grade 2 occurs in two separate locations. The land is associated with soil type 3 (paragraph 2.10). The soil profiles are clayey,

imperfectly drained and periodically affected by groundwater at the base of the profile. However, the soils are calcareous and porous and accordingly suffer from a slight wetness and workability limitation, demanding care with soil management to avoid structural damage.

3.3 Also mapped as Grade 2 is a small area of soil type 1 where topsoil texture is medium sandy loam and profiles are consequently less droughty than normal with this soil type (paragraphs 2.7 and 2.8). The land has a moderate droughtiness limitation (Subgrade 3a) in that moisture balance calculations show that the available water capacity within the soil profiles is limiting for the requirements of certain crops. However, with irrigation the land is upgraded to Grade 2.

Subgrade 3a

3.4 Land of this subgrade is the most widespread, being associated with soil types 1, 2, 4 and 6 (paragraphs 2.7, 2.9, 2.11 and 2.13). As regards soil types 4, 6 and most of 1 (see paras. 3.3 above and 3.5 below), the land has a moderately severe droughtiness limitation (Subgrade 3b) where moisture balance calculations show that the available water capacity within the soil profiles is limiting for the requirements of the reference crops. However, with irrigation the land is upgraded to Subgrade 3a. Soil type 2 also has a moderate droughtiness limitation, but even with irrigation cannot be classified better than Subgrade 3a by virtue of a moderately stony topsoil containing more than 10% of stones larger than 2 cm.

3.5 A small area of soil type 1 in the south-west of the site is excluded from this upgrade because the topsoil stone content is such that the land cannot be classified higher than Subgrade 3b (see paragraph 3.6).

Subgrade 3b

3.6 Land of this subgrade is associated both with the moderately stony topsoil variant of soil type 1 (paragraph 2.8) and with soil type 7 (paragraph 2.14). In the first case the land has a moderately severe droughtiness limitation but is precluded from being upgraded by irrigation on account of having more than 15% of flints larger than 2 cm in the topsoil. Soil type 7 suffers from a severe droughtiness limitation (Grade 4) but with irrigation the land is upgraded to Subgrade 3b. The land cannot be classified higher than this because the soil also has 15% of flints larger than 2 cm in the topsoil.

Grade 4

3.7 The land restored above fill materials (soil type 5, paragraph 2.12) is classified as Grade 4. The overriding limitation demanding this classification is the presence of anaerobism due to landfill gases ocurring within 50 cm of the surface. The other limitations of a restricted rooting depth, poor soil structures and moderately severe droughtiness all combine to present severe limitations for agriculture, such that permanent grass or rough grazing is the most likely utilisation.

Other land

3.8 Non-agricultural land comprises the current and unrestored mineral workings, soil storage bunds, access tracks and small areas of woodland and scrub.

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Appendix 1

STATEMENT OF SOIL PHYSICAL CHARACTERISTICS

SOIL TYPE 1

Topsoil	Texture	:	loamy medium sand; locally medium sandy loam
	Colour	:	brown (10YR4/3; 7.5YR4/3)
	Mottles	:	none
	Concretions	:	none
	Stone	:	5-12% small to large flints
	Roots	:	common fine and very fine
	$CaCO^3$	:	non to slightly calcareous
	Depth	:	35/45 cm
	Boundary	:	abrupt smooth
Upper subsoil	Texture	:	loamy medium sand; locally medium sandy loam
	Colour	:	brown (7.5YR4/4); yellowish brown (10YR5/6); dark yellowish brown (10YR4/6)
	Mottles	:	none
	Concretions	:	none
	Stone	:	5-10% small to large flints, locally 15-30%
	Structure	:	weak medium & coarse subangular blocky
	Consistence	:	very friable
	Structural condition	:	moderate
	Pores	:	>0.5%
	Roots	:	few fine and very fine
	$CaCO^3$	:	non to slightly calcareous
	Depth	:	variable, mainly 55/65 cm
	Boundary	:	clear smooth
Lower subsoil	Texture	:	medium sand; locally sandy clay loam lenses
	Colour	:	yellowish brown (10YR5/6); brownish yellow (10YR6/6); strong brown (7.5YR4/6, 5/6)
	Mottles	:	none
	Concretions	:	none
	Stone	:	5-15% small to large flints, locally 16-30%
	Structure	:	single grain
	Consistence	:	loose
	Structural condition	:	moderate
	Pores	:	>0.5%
	Roots	:	none
	$CaCO^3$	:	non calcareous

	Depth	:	120 cm; may overlie weathering chalky material below 80 cm
Wetness Class:	I		

SOIL TYPE 2

Topsoil	Texture	:	medium sandy loam, sandy clay loam, medium clay loam
	Colour	:	brown (10YR4/3; 7.5YR4/3)
	Mottles	:	none
	Concretions	:	none
	Stone	:	5-15% small to large flints
	Roots	:	common fine and very fine
	$CaCO^3$	:	very calcareous
	Depth	:	30/35 cm
	Boundary	:	clear smooth
Upper subsoil	Texture	:	medium sandy loam
	Colour	:	brown (7.5YR4/4); strong brown (7.5YR4/4)
	Mottles	:	none
	Concretions	:	none
	Stone	:	25% small to large flints
	Structure	:	moderate coarse subangular blocky
	Consistence	:	friable
	Structural condition	:	moderate
	Pores	:	<0.5%
	Roots	:	few fine and very fine
	$CaCO^3$	:	very calcareous
	Depth	:	40/50 cm
	Boundary	:	clear irregular
Lower subsoil	Texture	:	sandy clay loam; medium clay loam
	Colour	:	light grey (10YR7/2); very pale brown (10YR7/3, 7/4); dark yellowish brown (10YR4/4)
	Mottles	:	none
	Concretions	:	none
	Stone	:	20% small to large flints; 10% hard chalk; 20% soft weathered chalk
	Structure	:	not seen (too stony)
	Consistence	:	firm
	Structural condition	:	moderate
	Pores	:	<0.5%
	Roots	:	few fine and very fine
	$CaCO^3$	:	very calcareous
	Depth	:	85+ cm

Wetness Class:	I		

SOIL TYPE 3

Topsoil	Texture	:	clay
	Colour	:	dark greyish brown (10YR4/2)
	Mottles	:	none
	Concretions	:	none
	Stone	:	2% small flints and chalky fragments
	Roots	:	common fine, few medium
	$CaCO^3$	:	very calcareous
	Depth	:	35/40 cm
	Boundary	:	abrupt smooth
Upper subsoil	Texture	:	silty clay; clay
	Colour	:	greyish brown (10YR5/2); brown (10YR5/3)
	Mottles	:	common fine distinct strong brown (7.5YR4/6, 5/6)
	Concretions	:	none
	Stone	:	2% small chalky fragments
	Structure	:	weak coarse subangular blocky
	Consistence	:	firm
	Structural condition	:	moderate
	Pores	:	>1.0%
	Roots	:	few fine
	$CaCO^3$	:	very calcareous
	Depth	:	60 cm
	Boundary	:	clear smooth
Lower subsoil	Texture	:	sandy clay
	Colour	:	grey (2.5Y5/1.5)
	Mottles	:	common fine and medium distinct strong brown (7.5YR4/6)
	Concretions	:	none
	Stone	:	2% small flints and 5% small and medium chalky fragments
	Structure	:	moderate medium subangular blocky
	Consistence	:	firm
	Structural condition	:	moderate
	Pores	:	>1.0%
	Roots	:	few fine
	$CaCO^3$	:	very calcareous
	Depth	:	100 cm, over light brownish grey medium sandy loam affected by groundwater

Wetness Class:	II		

SOIL TYPE 4 (disturbed)

Topsoil	Texture	:	medium sandy loam
	Colour	:	yellowish brown (10YR5/4); dark brown (10YR3/3)
	Stone	:	typically 4% (ranging from 2-12%) > 2 cm flints
	Roots	:	many fine and very fine
	$CaCO^3$	:	calcareous to non calcareous
	Depth	:	40 cm
	Boundary	:	abruptand wavy
Subsoil	Texture	:	silty clay loam; sandy silt loam or sandy clay loam
	Colour	:	very pale brown (10YR7/4
	Stone	:	20/35% flint and chalk
	Structure	:	too stony to assess
	Consistence	:	very firm
	Roots	:	rooting visible to at least 80 cm
	$CaCO^3$	:	calcareous
	Depth	:	120 cm
Wetness Class:	I		

SOIL TYPE 5 (disturbed)

Topsoil	Texture	:	medium sandy loam
	Colour	:	brown (10YR4/3)
	Mottles	:	none
	Concretions	:	none
	Stone	:	2% small and medium flints
	Roots	:	common fine and very fine
	$CaCO^3$	:	calcareous
	Depth	:	25 cm
	Boundary	:	clear smooth
Upper subsoil	Texture	:	medium sandy loam
	Colour	:	yellowish brown (10YR5/4)
	Mottles	:	common fine distinct strong brown (7.5YR4/6) and yellowish brown (10YR5/8)
	Concretions	:	none
	Stone	:	2% small and medium flints
	Structure	:	weak coarse angular blocky

	Consistence	:	very friable
	Structural condition	:	moderate
	Pores	:	<0.5%
	Roots	:	few fine and very fine
	$CaCO^3$	:	calcareous
	Depth	:	40 cm
	Boundary	:	clear irregular
Lower subsoil	Texture	:	medium sandy loam
	Colour	:	dark greyish brown (2.5Y4/2); malodorous
	Mottles	:	none
	Concretions	:	none
	Stone	:	2% small and medium flints
	Structure	:	massive
	Consistence	:	friable
	Structural condition	:	moderate
	Pores	:	<0.5%
	Roots	:	none
	$CaCO^3$	:	calcareous
	Depth	:	50/55 cm, over impenetrable fill
Wetness Class:	III		

SOIL TYPE 6 (disturbed)

Topsoil	Texture	:	medium sandy loam
	Colour	:	brown (7.5YR4/3)
	Mottles	:	none
	Concretions	:	none
	Stone	:	7% small and medium flints
	Roots	:	*many fine and few medium*
	$CaCO^3$	:	very calcareous
	Depth	:	35/40 cm
	Boundary	:	abrupt smooth
Upper subsoil	Texture	:	loamy medium sand or medium sand
	Colour	:	dark brown (7.5YR3/2)
	Mottles	:	none
	Concretions	:	none
	Stone	:	3% small to large flints
	Structure	:	weak coarse platy and massive
	Consistence	:	friable
	Structural condition	:	moderate
	Pores	:	<0.1%
	Roots	:	few fine
	$CaCO^3$	:	non calcareous

	Depth	:	60/80 cm
	Boundary	:	sharp irregular
Lower subsoil	Texture	:	medium sand
	Colour	:	yellowish brown (10YR5/8)
	Mottles	:	none
	Concretions	:	none
	Stone	:	35% small to large flints
	Structure	:	single grain
	Consistence	:	loose
	Structural condition	:	moderate
	Pores	:	>0.5%
	Roots	:	few fine
	$CaCO^3$	:	very calcareous
	Depth	:	120 cm
Wetness Class:	I		

SOIL TYPE 7 (disturbed)

Topsoil	Texture	:	medium sand
	Colour	:	brownish yellow (10YR6/6); yellow (10YR7/8)
	Stone	:	25% medium and large flints
	Roots	:	few fine and very fine
	Depth	:	50+ cm, impenetrably stony below
Wetness Class:	I		

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.

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Note on the ALC assuming the site is not irrigated

The ALC report classifies the land on the basis that adequate irrigation is available. This report shows:

Grade	ha	%
2	4.5	6
3a	47.8	56
3b	4.6	6
4	3.3	4
Other land	23.5	28
Total :	**83.7**	**100.0**

If the land were to be classified on the basis that sufficient irrigation was **not** available then the overall quality of the site would be significantly lower, namely:

Grade	ha	%
2	2.8	4
3a	5.3	6
3b	47.1	56
4	5.0	6
Other land	23.5	28
Total :	**83.7**	**100.0**

With irrigation:

Best and most versatile land (Grades 1 - 3a) = 52.3 ha, = 62%.

Without irrigation:

Best and most versatile land (Grades 1 - 3a) = 8.1 ha, = 10%.