

**CAMBORNE SEWAGE WORKS
SITES 15, 27, 18 AND 21**

AGRICULTURAL LAND CLASSIFICATION SURVEY

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**CAMBORNE SEWAGE WORKS
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AGRICULTURAL LAND CLASSIFICATION SURVEY

INTRODUCTION

1. This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 34.0 ha of land in three sites at Treswithian Downs, Camborne. Field survey was based on 35 auger borings and 3 soil profile pits, and was completed in May 1999. During the survey 4 samples were analysed for particle size distribution (PSD).
2. The survey was conducted by the Resource Planning Team of FRCA Western Region on behalf of MAFF in its statutory role in connection with an application to the Planning Authority under the Town and Country Planning Act, 1990 for a new sewage treatment works for Camborne.
3. Information on climate, geology and soils, and from previous ALC surveys was considered and is presented in the relevant section. The published regional ALC map (MAFF 1977), shows the sites at a reconnaissance scale as Grade 3 for Sites 15 and 27 and Grade 2 for Sites 18 and 21. The sites had not been surveyed previously and as the current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF, 1988), it supersedes the previously published information which was based on guidelines for classification prior to 1988. Grade descriptions are summarised in Appendix I.
4. Two previous detailed ALC surveys carried out to the Revised Guidelines on land nearby (ADAS 1991 and FRCA 1998) show mainly Grade 2 with medium clay loam topsoil at Wetness Class I. This is consistent with the findings of the current survey of those areas which are nearest to the previous surveys, particularly Site 15. However, observations on other parts of the current survey found distinct evidence of wetness in the form of gleying just below the topsoil, leading to assessment as Wetness Class III, wetness Grade 3a with medium clay loam topsoil.
5. At the time of survey land cover was mainly early potatoes under polythene with some silage grass at Site 15, mainly grass for grazing at Site 27 and mainly cereals with some grass at Sites 18 and 21. The only area of non agricultural land which was not surveyed was a small area of mine spoil at the south end of Site 27.

SUMMARY

6. The distribution of ALC grades is shown on the accompanying 1: 10 000 scale ALC map. The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas. Areas are summarised in the Tables 1, 2 and 3.

Table 1: Distribution of ALC grades: Site 15

Grade	Area (ha)	% Surveyed Area (10.7 ha)
2	5.4	50
3a	5.3	50
Total site area	10.7	

Table 2: Distribution of ALC grades: Site 27

Grade	Area (ha)	% Surveyed Area (8.6 ha)
3a	8.6	100
Other Land	0.3	
Total site area	8.9	

Table 3: Distribution of ALC grades: Site 18 and 21

Grade	Area (ha)	% Surveyed Area (14.4 ha)
3a	13.5	94
3b	0.9	6
Total site area	14.4	

7. This shows that 97% of the area surveyed in three sites was found to be best and most versatile, mainly Subgrade 3a limited by wetness, although there was some variability as described in the full report. 50% of Site 15 was found to be Grade 2 limited by restricted workability.

CLIMATE

8. Estimates of climatic variables for this site were derived from the published agricultural climate dataset “Climatological Data for Agricultural Land Classification” (Meteorological Office, 1989) using standard interpolation procedures. Data for key points around the site are given in Table 4 below.

9. Since the ALC grade of land is determined by the most limiting factor present, overall climate is considered first because it can have an overriding influence by restricting land to a lower grade despite more favourable site and soil conditions. Parameters used for assessing overall climate are accumulated temperature, a measure of relative warmth and average annual rainfall, a measure of overall wetness. The results shown in Table 2 indicate that there is no overall climatic limitation.

AGRICULTURAL LAND CLASSIFICATION

15. The distribution of ALC grades found by the current survey is shown on the accompanying 1: 10 000 scale map and areas are summarised in Tables 1, 2 and 3. The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas.

Site 15

16. This shows a large area of Grade 2 with medium clay loam topsoil at Wetness Class I (see Appendix II), limited only by restricted workability. Such conditions were illustrated by Pit 1 of the 1998 survey at Race Farm nearby (Camborne Sewage Works, ADAS 1998).

17. However, a significant and apparently consistent area to the south of the meteorological station is shown as Subgrade 3a limited by wetness with medium clay loam topsoil at Wetness Class III. This was assessed on the evidence of gleying in Horizon 2, although Horizon 3 was generally found to be not gleyed. These conditions are illustrated by Pit 1.

Site 27

18. This is shown as Subgrade 3a although the area surveyed also includes two Grade 2 borings and two Subgrade 3b borings. The Subgrade 3a was found to be limited mainly by wetness with medium clay loam topsoil at Wetness Class III and is illustrated by Pit 2. This shows a gleyed second horizon similar to that found at Pit 1 on site 15, but only around 5 cm thick. This was typical of several of the borings on this site which shows that the distinction between Wetness Class I with no evidence of gleying and Wetness Class III with a narrow band of gleying above the parent material is somewhat tenuous but assumes greater significance because of the climatic data for this site which shows around 208 Field Capacity Days.

19. The two borings shown as Grade 2 found medium clay loam topsoil at Wetness Class I and the two borings shown as Subgrade 3b found heavy clay loam topsoil at Wetness Class III.

Sites 18 and 21

20. This is shown as mainly Subgrade 3a with a small area in the north of the site shown as Subgrade 3b limited by gradient, with slopes of up to 11 degrees.

21. The area shown as Subgrade 3a is somewhat variable with several borings around and including Pit 3 having heavy clay loam topsoil at Wetness Class I and therefore limited primarily by restricted workability. However, several of these borings were considered to be more stony than the pit and would be limited to Subgrade 3a also because of droughtiness.

22. In the south of the site several borings were found to be similar to Pits 1 and 2 on Sites 15 and 27, with medium clay loam topsoil at Wetness Class III, limited by wetness.

23. On the lower slopes on the north east side of the site several borings were found to be deeper with medium clay loam topsoil at Wetness Class I and were therefore assessed as Grade 2 limited only by restricted workability. However, there was insufficient topographical evidence to delineate a consistent area of Grade 2 with any reliability so these borings have been included within the area shown as Subgrade 3a.

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28 May 1999

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APPENDIX I

DESCRIPTION OF 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 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 root 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 level of yields. It is mainly suited to grass with occasional arable crops (eg cereals and forage crops) the yields 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.*

Source: MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land, MAFF Publications, Alnwick.

APPENDIX II

DEFINITION OF SOIL WETNESS CLASSES

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile.

Wetness Class I

The soil profile is not wet within 70 cm depth for more than 30 days in most years.

Wetness Class 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 *not wet within 40 cm depth for more than 30 days in most years.*

Wetness Class 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 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 and 90 days in most years.

Wetness Class IV

The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.

Wetness Class V

The soil profile is wet within 40 cm depth for 211-335 days in most years.

Wetness Class VI

The soil profile is wet within 40 cm depth for more than 335 days in most years.

Notes: The number of days specified is not necessarily a continuous period.

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

Source: Hodgson, J M (Ed) (1997) Soil Survey Field Handbook. Soil Survey Technical Monograph No 5, Silsoe.

APPENDIX III

ABBREVIATIONS AND TERMS USED IN SURVEY DATA

Soil pit and auger boring information collected during ALC survey is held on a computer database and is reproduced in this report. Terms used and abbreviations are set out below. These conform to definitions contained in the Soil Survey Field Handbook (Hodgson, 1997).

1. Terms used on computer database, in order of occurrence.

GRID REF: National 100 km grid square and 8 figure grid reference.

LAND USE: At the time of survey

WHT: Wheat	SBT: Sugar Beet	HTH: Heathland
BAR: Barley	BRA: Brassicas	BOG: Bog or Marsh
OAT: Oats	FCD: Fodder Crops	DCW: Deciduous Wood
CER: Cereals	FRT: Soft and Top Fruit	CFW: Coniferous Woodland
MZE: Maize	HRT: Horticultural Crops	PLO: Ploughed
OSR: Oilseed Rape	LEY: Ley Grass	FLW: Fallow (inc. Set aside)
POT: Potatoes	PGR: Permanent Pasture	SAS: Set Aside (where known)
LIN: Linseed	RGR: Rough Grazing	OTH: Other
BEN: Field Beans	SCR: Scrub	

GRDNT: Gradient as estimated or measured by hand-held optical clinometer.

GLEY, SPL: Depth in centimetres to gleying or slowly permeable layer.

AP (WHEAT/POTS): Crop-adjusted available water capacity.

MB (WHEAT/POTS): Moisture Balance. (Crop adjusted AP - crop potential MD)

DRT: Best grade according to soil droughtiness.

If any of the following factors are considered significant, 'Y' will be entered in the relevant column.

MREL: Microrelief limitation	FLOOD: Flood risk	EROSN: Soil erosion risk
EXP: Exposure limitation	FROST: Frost prone	DIST: Disturbed land
CHEM: Chemical limitation		

LIMIT: The main limitation to land quality: The following abbreviations are used.

OC: Overall Climate	AE: Aspect	EX: Exposure
FR: Frost Risk	GR: Gradient	MR: Microrelief

FL: Flood Risk	TX: Topsoil Texture	DP: Soil Depth
CH: Chemical	WE: Wetness	WK: Workability
DR: Drought	ER: Erosion Risk	WD: Soil Wetness/Droughtiness
ST: Topsoil Stoniness		

TEXTURE: Soil texture classes are denoted by the following abbreviations:-

S: Sand	LS: Loamy Sand	SL: Sandy Loam
SZL: Sandy Silt Loam	CL: Clay Loam	ZCL: Silty Clay Loam
ZL: Silt Loam	SCL: Sandy Clay Loam	C: Clay
SC: Sandy clay	ZC: Silty clay	OL: Organic Loam
P: Peat	SP: Sandy Peat	LP: Loamy Peat
PL: Peaty Loam	PS: Peaty Sand	MZ: Marine Light Silts

For the sand, loamy sand, sandy loam and sandy silt loam classes, the predominant size of sand fraction will be indicated by the use of the following prefixes:-

F: Fine (more than 66% of the sand less than 0.2mm)
M: Medium (less than 66% fine sand and less than 33% coarse sand)
C: Coarse (more than 33% of the sand larger than 0.6mm)

The clay loam and silty clay loam classes will be sub-divided according to the clay content: **M:** Medium (< 27% clay) **H:** heavy (27 - 35% clay)

MOTTLE COL: Mottle colour using Munsell notation.

MOTTLE ABUN: Mottle abundance, expressed as a percentage of the matrix or surface described.

F: few <2% **C:** common 2 - 20% **M:** many 20 - 40% **VM:** very many 40%+

MOTTLE CONT: Mottle contrast

F: faint - indistinct mottles, evident only on close inspection
D: distinct - mottles are readily seen
P: Prominent - mottling is conspicuous and one of the outstanding features of the horizon.

PED. COL: Ped face colour using Munsell notation.

GLEYS: If the soil horizon is gleyed a 'Y' will appear in this column. If slightly gleyed, an 'S' will appear.

STONE LITH: Stone Lithology - One of the following is used.

HR: All hard rocks and stones	SLST: Soft oolitic or dolimitic limestone
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CH:	Chalk	FSST:	Soft, fine grained sandstone
ZR:	Soft, argillaceous, or silty rocks	GH:	Gravel with non-porous (hard) stones
MSST:	Soft, medium grained sandstone	GS:	Gravel with porous (soft) stones
SI:	Soft weathered igneous or metamorphic rock		

Stone contents are given in % by volume for sizes >2cm, >6cm and total stone >2mm.

STRUCT: The degree of development, size and shape of soil peds are described using the following notation

<u>Degree of development</u>	WA: Weakly developed Adherent	WK: Weakly developed
	MD: Moderately developed	ST: Strongly developed
<u>Ped size</u>	F: Fine	M: Medium
	C: Coarse	VC: Very coarse
<u>Ped Shape</u>	S: Single grain	M: Massive
	GR: Granular	AB: Angular blocky
	SAB: Sub-angular blocky	PR: Prismatic
	PL: Platy	

CONSIST: Soil consistence is described using the following notation:

L: Loose	VF: Very Friable	FR: Friable	FM: Firm
VM: Very firm	EM: Extremely firm	EH: Extremely Hard	

SUBS STR: Subsoil structural condition recorded for the purpose of calculating profile droughtiness: **G:** Good **M:** Moderate **P:** Poor

POR: Soil porosity. If a soil horizon has poor porosity with less than 0.5% biopores >0.5mm, a 'Y' will appear in this column.

IMP: If the profile is impenetrable to rooting a 'Y' will appear in this column at the appropriate horizon.

SPL: Slowly permeable layer. If the soil horizon is slowly permeable a 'Y' will appear in this column.

CALC: If the soil horizon is calcareous with naturally occurring calcium carbonate exceeding 1% a 'Y' will appear this column.

2. Additional terms and abbreviations used mainly in soil pit descriptions.

STONE ASSESSMENT:

VIS: Visual	S: Sieve	D: Displacement
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MOTTLE SIZE:

EF: Extremely fine <1mm	M: Medium 5-15mm
VF: Very fine 1-2mm>	C: Coarse >15mm
F: Fine 2-5mm	

MOTTLE COLOUR: May be described by Munsell notation or as ochreous (OM) or grey (GM).

ROOT CHANNELS: In topsoil the presence of 'rusty root channels' should also be noted.

MANGANESE CONCRETIONS: Assessed by volume

N: None	M: Many	20-40%
F: Few <2%	VM: Very Many	>40%
C: Common 2-20%		

POROSITY:

P: Poor - less than 0.5% biopores at least 0.5mm in diameter
G: Good - more than 0.5% biopores at least 0.5mm in diameter

ROOT ABUNDANCE:

The number of roots per 100cm ² :		Very Fine and Fine	Medium and Coarse
F: Few		1-10	1 or 2
C: Common		10.25	2 - 5
M: Many		25-200	>5
A: Abundant		>200	

ROOT SIZE

VF: Very fine <1mm	M: Medium 2 - 5mm
F: Fine 1-2mm	C: Coarse >5mm

HORIZON BOUNDARY DISTINCTNESS:

Sharp: <0.5cm	Gradual: 6 - 13cm
Abrupt: 0.5 - 2.5cm	Diffuse: >13cm
Clear: 2.5 - 6cm	

HORIZON BOUNDARY FORM: Smooth, wavy, irregular or broken.*

* See Soil Survey Field Handbook (Hodgson, 1997) for details.

SITE NAME		PROFILE NO.	SLOPE AND ASPECT	LAND USE	Av Rainfall: 1072 mm	PARENT MATERIAL
Camborne Sewage Works		Pit 1 (Nr Asp 2)	1° W	Early Potatoes (under ploythene)	ATO: 1555 day °C	
JOB NO.		DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 210	PSD SAMPLES TAKEN
33.99		11.5.99	SW 6283 4057	PB	Climatic Grade: 1 Exposure Grade:	

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	30	MCL	10YR43	25% HR (v)	0	0	-	-	-	-	CF, VF	-	Clear Smooth
2	58	HCL	2.5Y64	25% HR (v)	CDMO 10YR56	0	WKCSAB	FR	M	G	FVF	-	Gradual Wavy
3	80+	C	7.5YR64	20% HR (v)	FDMO 10YR56	0	-	-	(M)	G(low)	0	-	-

Profile Gleyed From: 30 cm

Slowly Permeable Horizon From: No SPL

Wetness Class: III

Wetness Grade: 3a

Available Water Wheat: 112 mm

Potatoes: 91 mm

Moisture Deficit Wheat: 95 mm

Potatoes: 85 mm

Moisture Balance Wheat: +17 mm

Potatoes: +6 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): We

Remarks: H3 tightly packed : no structure sample available because of narrow pit between potato rows. See Pit 2 H3 for similar.

SITE NAME Camborne Sewage Works		PROFILE NO. Pit 2 (ASP 12)	SLOPE AND ASPECT 1° NW	LAND USE PGR	Av Rainfall: 1058 mm ATO: 1566 day °C	PARENT MATERIAL Mylor Slates	
JOB NO. 33.99		DATE 12.5.99	GRID REFERENCE SW 6308 4135	DESCRIBED BY PB	FC Days: 208 Climatic Grade: 1 Exposure Grade:	PSD SAMPLES TAKEN TS 0-25 cm: MCL (S31: Z43: C26%)	

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	30	MCL	10YR43	3% > 2 cm (s) 14% < 2 cm (s+d) 17% HR	0	0	-	-	-	-	MF, VF	-	Sharp Wavy
2	35	C	7.5YR63 10YR72	43% (v) as H3	MDMO 7.5 YR 58	0	WKCSAB	FR	M	G	CVF	-	Clear Wavy
3	80+	C	2.5YR54	16% > 2 cm (s+d) 27% < 2 cm (s+d) 43% HR, ZR	0	0	M	FR	P	G (low)	FVF	-	-

Profile Gleyed From: 30 - 35 cm

Slowly Permeable Horizon From: No SPL

Wetness Class: III

Wetness Grade: 3a

Available Water Wheat: 91 mm

Potatoes: 78 mm

Moisture Deficit Wheat: 95 mm

Potatoes: 85 mm

Moisture Balance Wheat: -4 mm

Potatoes: -7 mm

Droughtiness Grade: 3a (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): We, Dr

Remarks: H2 variable in thickness, ranging from vestigial ironpan to a gleyed horizon with pale matrix colours.

SITE NAME Camborne Sewage Works		PROFILE NO. Pit 3 (Nr Asp 35)	SLOPE AND ASPECT 5° NE	LAND USE Cer	Av Rainfall: 1060 mm ATO: 1560 day °C	PARENT MATERIAL Porthtowan Slate
JOB NO. 33.99		DATE 12.5.99	GRID REFERENCE SW 6309 4206	DESCRIBED BY PB	FC Days: 208 Climatic Grade: 1 Exposure Grade:	PSD SAMPLES TAKEN (Asp 31) TS 0-25 cm : HCL (S31: Z41: C28%)

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size, Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	35	HCL	7.5YR43	4% > 2 cm (s) 13% < 2 cm (s+d) 17% HR	0	0	-	-	-	-	MF	-	Grad Smooth
2	50	HCL	78YR54	5% > 2 cm (s) 26% < 2 cm (s+d) 31% HR	0	0	WKMSAB	FR	G	G	FVF	-	Grad Smooth
3	85+	C	5YR64	20% > 2 cm (s) 25% < 2 cm (s+d) 45% HR, ZR	0	0	Too stony ?M	FM	P	G(low)	FVF	-	-

Profile Gleyed From: Not gleyed

Slowly Permeable Horizon From: No SPL

Wetness Class: I

Wetness Grade: 3a

Available Water Wheat: 104 mm
Potatoes: 90 mm
Moisture Deficit Wheat: 95 mm
Potatoes: 85 mm
Moisture Balance Wheat: + 9mm
Potatoes: +5 mm
Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Wk

Remarks: