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Bradiford, Barnstaple

Agricultural Land Classification

July 1998

Resource Planning Team
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FRCA Western Region

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BRADIFORD, BARNSTAPLE

AGRICULTURAL LAND CLASSIFICATION SURVEY

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INTRODUCTION

1. This report presents the findings of a Agricultural Land Classification (ALC) survey of 222.7 ha of land at Bradiford, Barnstaple. Field survey was based on 66 auger borings and 2 soil profile pits, and was completed in July 1998. During the survey 3 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 the preparation of North Devon Local Plan.

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 site at a reconnaissance scale as mainly Grade 3 with a patch of Grade 2 centred around Bradiford House and extensive areas of Grade 4 in the river valleys. The site was previously surveyed in 1981 at a scale of 1: 25 000 (ADAS 1981) and this survey shows the same area of Grade 2 to be somewhat larger. However, the current survey uses the Revised Guidelines and Criteria for Grading the Quality of Agricultural Land (MAFF, 1988) and supersedes any previous ALC survey. Grade descriptions are summarised in Appendix I.

4. A small site off the end of Northfield Lane was also surveyed in 1993 (ADAS 1993) according to the Revised Guidelines for Classification. This is adjacent to the current survey area and shows Subgrade 3a limited by restricted workability, which is consistent with the findings of the current survey.

5. At the time of survey land cover was all grass. A large area of agricultural land in the north of the survey area, all under single ownership, was not surveyed because permission for access was not granted. Other land which was not surveyed included residential land, part of the industrial estate, woodland and farm buildings.

SUMMARY

6. The distribution of ALC grades is shown on the accompanying 1: 12 500 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 Table 1.

Table 1: Distribution of ALC grades: Bradiford

Grade	Area (ha)	% Surveyed Area (117.6 ha)
3a	61.9	53
3b	29.4	25
4	23.3	20
5	3.0	3
Agricultural land not surveyed	80.6	
Other land	24.5	
Total site area	222.7	

7. This shows that 53% of the area was found to be best and most versatile. This was mainly Subgrade 3a limited by restricted workability. The remaining land was found to be Subgrade 3b limited by wetness and gradient, Grade 4 limited by wetness, microrelief and gradient and Grade 5 limited by gradient.

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 2 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.

10. Climatic variables also affect ALC grade through interactions with soil conditions. The most important interactive variables are Field Capacity Days (FCD) which are used in assessing soil wetness and potential Moisture Deficits calculated for wheat and potatoes, which are compared with the moisture available in each profile in assessing soil droughtiness limitations. These are described in later sections. A critical boundary of 200 FC Days was found to run approximately along the 12 metre contour.

Table 2: Climatic Interpolations: Bradiford

Grid Reference		SS 543 345	SS 537 341	SS 540 343
Altitude (m)		45	5	10
Accumulated Temperature (day °C)		1538	1584	1578
Average Annual Rainfall (mm)		996	925	939
Overall Climatic Grade		1	1	1
Field Capacity Days		208	197	199
Moisture deficit (mm):	Wheat	92	101	99
	Potatoes	81	93	91

RELIEF

11. Altitude ranges from sea level to 50 metres at the top of Poleshill Lane with mainly gentle and moderate slopes which are not limiting, although smaller areas of strong and steeper slopes limit the land to Subgrade 3b, and Grades 4 and 5.

GEOLOGY AND SOILS

12. The underlying geology of the site is shown on the published geology map (IGS, 1982) as mainly Pilton shales with river terrace deposits and other alluvium in the river valleys. This was entirely borne out by the current survey.

13. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1: 250 000 (SSEW, 1983) as mainly Denbigh 1 Association, this is described as comprising well drained fine loamy and fine silty soils over rock with some similar soils having slowly permeable subsoils and slight seasonal waterlogging and shallow soils locally. The current survey found this description entirely consistent with those soils found on the Pilton shales parent material although soils found on the alluvial deposits were more variable.

AGRICULTURAL LAND CLASSIFICATION

14. The distribution of ALC grades found by the current survey is shown on the accompanying 1: 12 500 scale map and areas are summarised in Table 1. 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.

Subgrade 3a

15. The areas shown as Subgrade 3a were found to be heavy clay loam topsoil at Wetness Class I or medium clay loam topsoil at Wetness Class II, as at Pit 1. The area of Subgrade 3a also includes several isolated borings of medium clay loam topsoil at Wetness Class I, which are classified as Grade 2 with only a minor limitation due to restricted workability.

16. Borings in the areas to the west of Bradiford House (Asp 146 etc) were found to be mainly medium clay loam topsoil at Wetness Class I, Grade 2 as described above, but as the area also includes several borings limited to Subgrade 3a by wetness, and as the PSD results show the topsoil to be borderline to heavy clay loam, the whole area is shown as Subgrade 3a overall. It is quite possible that detailed survey of a small site within this area would find Grade 2.

17. The area shown as Subgrade 3a in the river valley below Westaway Farm, ASP 129 etc, were frequently found to be impenetrable at around 70cm and were mainly assessed as Wetness Class II with gleying starting below 40cm in the middle subsoil and with no evidence of a slowly permeable layer within the depth which it was possible to examine.

Subgrade 3b

18. Much of the area shown as Subgrade 3b was found to be heavy clay loam topsoil at Wetness Class III with a slowly permeable layer starting in the middle or lower subsoil and these are illustrated by Pit 2.

19. The rest of the area shown as Subgrade 3b was found to be limited by gradient, although with soil profiles similar to those described for Subgrade 3a above.

Grade 4

20. Most of the area shown as Grade 4 was found to be limited by wetness with heavy clay loam topsoil at Wetness Class IV with a slowly permeable layer starting in the upper subsoil, Wetness Class IV. The lower estuary around ASP 219 and 215 was also found to be limited by microrelief due to the presence of relict creeks and river bends.

21. Smaller areas of Grade 4, as at ASP 192 and 178, were found to be limited by gradient with slopes of 12 - 18°.

Grade 5

22. The two small areas shown as Grade 5 were found to be limited by gradient with slopes of around 20° and were used only as rough grazing.

P Barnett
Resource Planning Team
FRCA Bristol
3 September 1998

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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.

GLEY: 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

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

Degree of development	**WA:**	Weakly developed Adherent	**WK:**	Weakly developed
	MD:	Moderately developed	**ST:**	Strongly developed
Ped size	**F:**	Fine	**M:**	Medium
	C:	Coarse	**VC:**	Very coarse
Ped Shape	**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

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		PARENT MATERIAL
Bradiford	Pit 1 (Asp 180)	2° N	PGR	Av Rainfall: 990 mm ATO: 1540 day °C	Pilton shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 205 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
32.98	14.7.98	SS 5600 3455	PB		TS 0-25 cm : MCL(S33:Z42:C25%)

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	18	MCL	10YR52	5%HR (vis)	CRRCh	0	-	-	-	-	MF,VF	-	Abrupt Wavy
2	35	HCL	2.5Y53	10%HR (vis)	0	0	MDFSAB	FR	G	G	MVF	-	Clear Smooth
3	63	HCL	2.5Y63	15%HR, ZR (vis)	0	0	WKMSAB	FR	G	G	CVF	-	Clear Smooth
4	80+	HCL	2.5Y62	69%ZR(vis\)	CDFO* 10YR56	0	Too stony	-	(M)	(G)	FVF	-	

Profile Gleyed From: -

Slowly Permeable Horizon From: -

Wetness Class: II/I

Wetness Grade: 3a/2

Available Water Wheat: 130 mm

Potatoes: 121 mm

Moisture Deficit Wheat: 95 mm

Potatoes: 82 mm

Moisture Balance Wheat: +35 mm

Potatoes: +39 mm

Droughtiness Grade: 1 (Calculated to 100 cm)

Final ALC Grade: 3a/2

Main Limiting Factor(s): WK

Remarks: H4 mottles common in parts but associated with rotting stones therefore horizon borderline gleyed.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Bradiford	Pit 2 (Asp 216)	0°	PGR	Av Rainfall: 925 mm ATO: 1584 day °C	Alluvium
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 195 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
32.98	15.7.98	SS 5367 3415	PB		TS 0-25 cm : MCL (S40:Z37:C23%)

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	23	MCL	10YR42	10%HR (vis)	0	0	-	-	-	-	MF,VF	-	Clear Smooth
2	50	HCL	10YR43	20%HR (vis)	0	0	WKFSAB	FR	G	G	MVF	-	Grad Smooth
3	65	C	2.5Y63	30%HR, ZR (vis)	CDFO 10YR56	0	WKCSAB	FM	P	G(low)	CVF	-	Grad Smooth
4	80+	C	2.5Y63	30%ZR ,HR(vis)	MDFO 10YR56	F	M	FM	P	P(low)	FVF	-	

Profile Gleyed From: 50 cm

Slowly Permeable Horizon From: 65 cm

Wetness Class: III

Wetness Grade: 3a

Available Water Wheat: 126 mm

Potatoes: 103 mm

Moisture Deficit Wheat: 95 mm

Potatoes: 82 mm

Moisture Balance Wheat: +31 mm

Potatoes: +21 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): We

Remarks: