8FCS 6189 B

31/98

Fremington, Barnstaple

Agricultural Land Classification

July 1998

Resource Planning Team
Bristol
FRCA Western Region

RPT Job Number: 31/98

FRCA File No: EL10/00178

FREMINGTON, BARNSTAPLE

AGRICULTURAL LAND CLASSIFICATION SURVEY

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INTRODUCTION

1. This report presents the findings of a semi-detailed Agricultural Land Classification (ALC) survey of 984.4 ha of land at Fremington, Barnstaple. Field survey was based on 357 auger borings and 13 soil profile pits, and was completed in May 1998. During the survey 18 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 current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF, 1988) and therefore supersedes any previous ALC survey. Grade descriptions are summarised in Appendix I.

4. The current survey shows a broad correlation with the published regional ALC map (MAFF 1997) where this shows Grade 3 and Grade 4. However, the current survey found no evidence on current criteria for the large area of Grade 2 which is shown on the published map to the west of Fremington village. Indeed, most of this area was found to be Wetness Class IV.

5. The eastern part of the current survey area was also surveyed in 1981 (ADAS 1981). However, this survey uses criteria for classification which have now been superseded and where the current survey shows little correlation with the 1981 survey this is mainly due to the revised criteria used, particularly the recognition of slowly permeable layers in the assessment of Wetness Class and the greater depth of profile examination required by the Revised Guidelines. The 1981 survey was also used as the basis for the 1982 assessment of the bypass route for Barnstaple proposed at that time.

6. A more recent survey was carried out to the Revised Guidelines on land adjacent to the current survey area at Penhill-Upcott (ADAS 1994). This found a mixture of grades from Grade 2 to Subgrade 3b, but all mainly limited by wetness and workability. It should be noted that the underlying geology of this area was not the same as for the current survey area.

7. At the time of survey land cover was mainly grass and cereals.

SUMMARY

8. The distribution of ALC grades is shown on the accompanying 1: 20 000 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 Table 1.

Table 1: Distribution of ALC grades: Fremington

Grade	Area (ha)	% Surveyed Area (621.1 ha)
3a	117.0	19
3b	327.7	53
4	176.4	28
Other land	363.3	
Total site area	984.4	

9. This shows that 19% of the area surveyed was found to be best and most versatile. This is shown as Subgrade 3a limited by wetness and workability. However, it should be noted that this was a semi-detailed survey with borings at a density of only 1 per 2 hectares and the mapping units shown are not necessarily homogenous. This applies particularly to the large area of Subgrade 3b in the south west of the site which contains several borings identified as Subgrade 3a but in a scattered distribution which did not permit the reliable mapping of the better grade. However, a more detailed survey within this area may well show smaller sites which may properly be described as Subgrade 3a.

CLIMATE

10. 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.

11. 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.

12. 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.

Table 2: Climatic Interpolations: Fremington

Grid Reference		SS502313	SS496332	SS538319
Altitude (m)		95	10	25
Accumulated Temperature (day °C)		1484	1580	1563
Average Annual Rainfall (mm)		942	890	918
Overall Climatic Grade		1	1	1
Field Capacity Days		195	187	193
Moisture deficit (mm):	Wheat	90	103	98
	Potatoes	78	96	90

13. A local exposure limitation was identified in the coastal strip. North of the disused railway and on the higher ground in the south of the site. However, the exposure limitation is unlikely to be more serious than to Grade 2 and therefore is not a primary limitation.

RELIEF

14. Altitude ranges from sea level at the coast to 99 metres at Cross Head near Bickleton, with mainly gentle and moderate slopes which are not limiting. However, there are small areas of short slopes, particularly in the south west of the site, which are limiting to Subgrade 3b or occasionally to Grade 4.

GEOLOGY AND SOILS

15. The underlying geology of the site is shown on the published geology maps (IGS, 1977 and 1982) as Crackington Shale through the south of the site with boulder clay and alluvium through much of the central area and small areas of pebbly clay and sand in the north. This was largely borne out by the current soil survey, although there appeared to be little distinction between the deposits of boulder clay, alluvium and pebbly clay. Native shale was observed in borings and a ditch cutting even in the area known as Home Farm Marsh in the north of the site.

16. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW, 1983) as mainly Neath association on the shale and Hallsworth 2 association on the alluvial deposits and boulder clay. A small area of Newnham association is shown in the area around Fremington Camp and extending east towards Muddlebridge.

17. Neath Association is described as comprising well drained fine loamy soils often over rock with small patches of similar soils with slowly permeable subsoils and slight seasonal waterlogging. Hallsworth 2 association is described as slowly permeable seasonally waterlogged clay of fine loamy and fine silty soils. Newnham association is described as well drained reddish, coarse and fine loamy soils over gravel, locally deep.

18. This description and distribution was entirely borne out by the current survey, which also identified the soils of the Newnham association as the best on the site.

AGRICULTURAL LAND CLASSIFICATION

19. The distribution of ALC grades found by the current survey is shown on the accompanying 1: 20 000 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.

Grade 2

20. Although not shown as a mapping unit, isolated Grade 2 profiles were found in the areas shown as Newnham Association, particularly around ASP 37 and at ASP 166. These are illustrated by Pit 10 which showed a sandy clay loam topsoil at Wetness Class I, limited by workability and droughtiness. Stone contents were assessed by sieving and displacement and found to be mainly hard rock pebbles ranging from 10% in the topsoil to 42% in the lower subsoil.

21. The area of Grade 2 shown on the 1994 survey at Muddlebridge is isolated from the current survey by a narrow valley with ASP 136 etc, shown as a small area of Subgrade 3b limited by gradient.

Subgrade 3a

22. The best of the areas shown as Subgrade 3a are those around ASP 65, 51 etc and around ASP 204. These include the Grade 2 borings described above and are further illustrated by Pit 12 which found medium clay loam topsoil at Wetness Class II with a slowly permeable layer starting at 75cm.

23. Other more or less homogenous patches of Subgrade 3a were found around Lower Yelland at ASP 144 etc and at West Yelland at ASP 339 etc, all limited by wetness with medium clay loam topsoil at Wetness Class II or III with a slowly permeable layer in the middle or lower subsoil.

24. The large area of Subgrade 3a shown at Lydacott Cross, ASP 480 etc was found to be mainly Subgrade 3a limited by wetness with medium clay loam topsoil at Wetness Class III as illustrated by Pits 6 and 9. However, this area is not entirely homogenous and several borings identified as Subgrade 3b were found within it.

25. The area shown as Subgrade 3b in south west of the site running from Instow to Cross Head north of Bickleton also contains several borings and even small groups of borings identified as Subgrade 3a limited by wetness as described above and also by workability with heavy clay loam topsoils at Wetness Class I. Subgrade 3a profiles limited by workability are illustrated by Pits 5 and 13. However, the occurrence of Subgrade 3a within this area was variable and inconsistent, in some cases interrupted by short slopes of Subgrade 3b due to gradient and in many cases by scattered patches of Subgrade 3b or even Grade 4 due to wetness within a field which would otherwise be Subgrade 3a. These patches could be seen in some cases where recent ploughing had brought the slowly permeable clay to the surface. The occurrence of Subgrade 3a in this area is most consistent in the extreme south where a

line of Subgrade 3a borings extends from ASP 490 to ASP 470, but even here it was considered too unreliable to be mapped as such.

Subgrade 3b

26. This is the main mapping unit of the survey area with 53% of the site shown as Subgrade 3b. This is mainly limited by wetness with medium clay loam topsoil at Wetness Class IV or occasionally with heavy clay loam topsoil at Wetness Class III and is illustrated by Pits 1, 2 and 11.

27. Smaller areas within the Subgrade 3b, particularly in the south west of the site, are limited by gradient, mainly with short slopes of only 8 or 9°.

28. Although the area shown as Subgrade 3b everywhere contains individual borings of other grades, it is particularly variable in the south west of site where it contains several borings of Subgrade 3a, as described previously.

29. The area of Subgrade 3b shown on the slightly elevated land to the north of Home Farm Marsh at ASP 15 etc contains several borings of Grade 4 and also includes Pit 4 which was confirmed as Grade 4 with heavy clay loam topsoil at Wetness Class IV. However, this area was found to be quite distinct from the lower lying land to the south and west, and itself contains a majority of Subgrade 3b borings so it was considered reasonable to show it as Subgrade 3b.

Grade 4

30. The areas shown as Grade 4 were found to be mainly limited by wetness with heavy clay loam topsoil at Wetness Class IV and tend to be homogenous, including only a few Subgrade 3b borings. They are illustrated by Pits 3, 4 , 7 and 8.

31. Other small isolated areas of Grade 4 were found to be limited by gradient, with short slopes of 12 to 18°, mainly in the south west of the site.

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FRCA Bristol
27 July 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
Fremington	Pit 1 (ASP 216)	0°	Ley	Av Rainfall: 890 mm ATO: 1580 day °C	Boulder clay (alluvium)
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 187 Climatic Grade: 1 Exposure Grade: 2	PSD SAMPLES TAKEN
31.98	3.4.98	SS 4890 3197	PB		TS 0-25 cm MCL (S44:Z36: C20%)

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	27	MCL	10YR42,52	1% HR (vis)	0	0	-	-	-	-	CF, VF	-	Abrupt Smooth
2	37	C	2.5Y63	10%HR (vis)	FFFO 10YR56	0	MDCSAB	FR	M	G	CVF	-	Clear Smooth
3	63+	C	2.5Y62	10% HR (vis)	MDMO 10YR58 CDMG 1OY71	0	M	FM	P	P	FVF	-	

Profile Gleyed From: 37cm

Slowly Permeable Horizon From: 37 cm

Wetness Class: IV

Wetness Grade: 3b

Available Water Wheat: 122 mm

Potatoes: 102 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +22 mm

Potatoes: +7 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 2 (Asp 382)	3°N	PGR	Av Rainfall: 916 mm ATO: 1507 day °C FC Days: 190 Climatic Grade: 1 Exposure Grade: 2	Boulder clay
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY		PSD SAMPLES TAKEN
31.98	3.4.98	SS 4863 3145	PB		TS 0-25 cm: MCL (S29:Z46: 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	1%HR (vis)	CRRCH	0	-	-	-	-	MF,VF	-	Clear Smooth
2	30	HCL	10YR52	1% HR(vis)	0	0	MDMSAB	FR	G	G	CVF	-	Clear Smooth
3	35	C	2.5Y63,53	1%HR (vis)	FDFO 10YR56	C	WKCSAB	FM	P	G	CVF	-	Clear Smooth
4	69+	C	2.5Y71	0	ADMO, G 10YR58 N71	0	WKCPR	FM	P	P	FVF	-	

Profile Gleyed From: 35cm

Slowly Permeable Horizon From: 35 cm

Wetness Class: IV

Wetness Grade: 3b

Available Water	Wheat:	132 mm
	Potatoes:	109 mm
Moisture Deficit	Wheat:	100 mm
	Potatoes:	95 mm
Moisture Balance	Wheat:	+32 mm
	Potatoes:	+14 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 3 (Asp 306)	4° N	PGR	Av Rainfall: 916 mm ATO: 1507 day °C	Crackington shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	8.4.98	SS 5004 3169	PB		TS 0-25cm: HCL/MCL (S38:Z35:C27%)

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	HCL	10YR52	2% HR (vis)	0	0	-	-	-	-	MF,VF	-	Grad Smooth
2	43	C	2.5Y62	2%HR (vis)	CDFO 10YR56	F	MDCSAB	FM	M	G	CVF	-	Clear Smooth
3	66+	C	2.5Y72	1%HR (vis)	MDMO 10YR56	0	M	FM	P	P	FVF	-	

Profile Gleyed From: 30 cm

Slowly Permeable Horizon From: 43 cm

Wetness Class: IV

Wetness Grade: 4/3b

Available Water Wheat: 131 mm

Potatoes: 100 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +31 mm

Potatoes: +13 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 4/3b

Main Limiting Factor(s): We

Remarks: Borderline 3b becuase of TS texture.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 4 (Asp 14)	0°	Beans	Av Rainfall: 890 mm ATO: 1580 day °C	Pebbly clay (alluvium)
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 2	PSD SAMPLES TAKEN
31.98	22.4.98	SS 4976 3312	PB		TS 0-25 cm: HCL (S29:Z38: C33%)

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	25	HCL	10YR52	5%HR(vis)	0	0	-	-	-	-	CF,VF	-	Abrupt Smooth
2	33	C	2.5Y63	5%HR(vis)	CDFO 10YR66	0	MDMSAB	FR	G	G	FVF	-	Abrupt Smooth
3	65+	C	2.5Y72	5%HR (vis)	MDMO 10YR58	M	WKCPR	FM	P	P	FVF	-	

Profile Gleyed From: 25cm

Slowly Permeable Horizon From: 33 cm

Wetness Class: IV

Wetness Grade: 4

Available Water Wheat: 127 mm

Potatoes: 105 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +27 mm

Potatoes: +10 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 4

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 5 (Asp 470)	4° SW	FLW	Av Rainfall: 916 mm ATO: 1507 day °C	Crackington shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	23.4.98	SS 4990 3118	PB		TS 0-25cm: HCL/MCL (S43:Z30: C27%)

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	25	HCL	10YR43	5%HR (vis)	0	0	-	-	-	-	MF,VF	-	Grad Smooth
2	42	HCL	10YR43	20%HR ZR (vis)	0	0	MDCSAB	FR	M	G	CVF	-	Clear Smooth
3	72	C	10YR53	50%ZR (vis)	FDFO 10YR66	0	WKCSAB	FR	M	G	FVF	-	Clear Smooth
4	83+	C	10YR63	70%ZR(vis)	FDFO* 10YR58	0	Too stony	FR	(M)	G	FVF	-	

Profile Gleyed From: -

Slowly Permeable Horizon From: -

Wetness Class: I

Wetness Grade: 3a/2

Available Water Wheat: 105 mm

Potatoes: 99 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +5 mm

Potatoes: +4 mm

Droughtiness Grade: 2 (Calculated to 100 cm)*

Final ALC Grade: 3a/2

Main Limiting Factor(s): WK

Remarks: Few mottles in H4 associated with rotting stones.

Probed to 100 cm.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 6 (Asp 357)	4° N	PGR	Av Rainfall: 916 mm ATO: 1507 day °C	Boulder clay
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	29.4.98	SS 5131 3158	PB		TS 0-25 cm: MCL/FSZL (S39: Z42: C19%)

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	27	MCL	10YR43	10%HR (vis)	0	0	-	-	-	-	MF,VF	-	Abrupt Smooth
2	40	C	2.5Y63	10% HR (vis)	FFFO,G 10YR66	0	WKCSAB	FM	P	G	CF,VF	-	Abrupt Smooth
3	80+	C	2.5Y72	25% HR(vis)	MDMO,G 10YR58 N81	0	M	VM	P	P	FVF	-	

Profile Gleyed From: 40 cm

Slowly Permeable Horizon From: 40 cm

Wetness Class: III/IV

Wetness Grade: 3a/3b

Available Water Wheat: 107 mm

Potatoes: 89 mm

Moisture Deficit Wheat: mm

Potatoes: mm

Moisture Balance Wheat: +7 mm

Potatoes: -6 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 3a/3b

Main Limiting Factor(s): We

Remarks: H2 almost gleyed (CFFO): would be WCIV

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 7 (Asp 276)	3° N	PGR	Av Rainfall: 916 mm ATO: 1507 day °C	Boulder clay
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	12.5.98	SS 5158 3186	PB		TS 0-25 : HCL/MCL (S29:Z43: 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	23	HCL	10YR52	2%HR (vis)	FRRCH	0	-	-	-	-	MF,VF	-	Clear Smooth
2	30	C	2.5Y62	5%HR (vis)	CDFO 10YR56	0	MDCPR	FM	P	G(low)	CF,VF	-	Clear Wavy
3	70+	C	2.5Y72 7.5YR62	2%HR (vis)	MDMO 10YR58	O/C*	WKCPR	FM	P	P	FVF	-	

Profile Gleyed From: 23 cm

Slowly Permeable Horizon From: 30 cm

Wetness Class: IV

Wetness Grade: 4/3b

Available Water Wheat: 123 mm

Potatoes: 100 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +23 mm

Potatoes: + 5 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 4/3b

Main Limiting Factor(s): We

Remarks: H3 Manganese common in pinkish patches

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 8 (Asp 447-448)	3° NW	FLW	Av Rainfall: 918 mm ATO: 1563 day °C	Crackington shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	13.5.98	SS 5181 3126	PB		TS 0-25 cm: C/HCL (S26: Z38: C36%)

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	C/HCL	2.5Y52	1%HR (vis)	CRRC	0	-	-	-	-	MVF	-	Grad Smooth
2	55	C	2.5Y63	2%HR (vis)	MDMO 10YR58	0	MDCPR	FM	P	P	FVF	-	Grad Smooth
3	70+	C	2.5Y62	10%ZR(vis)	MDMOG 10YR58 10Y71	C	WKCPR	FM	P	P	FVF	-	

Profile Gleyed From: 30 cm

Slowly Permeable Horizon From: 30 cm

Wetness Class: IV

Wetness Grade: 4

Available Water Wheat: 127 mm

Potatoes: 104 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +27 mm

Potatoes: +9 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 4

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 9 (Asp 509)	3° NE	PGR	Av Rainfall: 916 mm ATO: 1507 day °C	Crackington shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	15.5.98	SS 5157 3089	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	8	MCL	2.5Y52	0	CRRC	0	-	-	-	-	MF,VF	-	Abrupt Smooth
2	40	MCL	10YR43	10%HR(vis)	FFFO 10YR56	0	MDMSAB	FR	G	G	CVF	-	Clear Smooth
3	50	C	2.5Y52	20%ZR (vis)	CDFO 10YR58	0	WKCAB	FM	P	(G)	CVF	-	Grad Smooth
4	65	C	2.5Y63	20%ZR(vis)	MDMO 10YR58	0	WKCPR	FM	P	P	FVF	-	Grad Smooth
5	80+	C	5Y62	30%ZR(vis)	MDMO 10YR58	0	M	FM	P	P	FVF	-	

Profile Gleyed From: 40 cm

Slowly Permeable Horizon From: 50 cm

Wetness Class: III

Wetness Grade: 3a

Available Water Wheat: 132 mm

Potatoes: 111 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +32 mm

Potatoes: +16 mm

Droughtiness Grade: (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 10 (Nr Asp 166)	1° N	FCD	Av Rainfall: 918 mm ATO: 1563 day °C FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	River gravel
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY		PSD SAMPLES TAKEN
31.98	19.5.98	SS 5243 3233	PB		TS 0-25 cm : SCL (S54: Z25: C21%)

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	20	SCL	10YR42	2%>2cm (s) 8%< 2 cm (s+d) 10% HR	0	0	-	-	-	-	CF,VF	-	Abrupt smooth
2	55	HCL	10YR54	10%>2cm (s) 16% <2 cm (s+d) 26% HR	0	0	MDM, FSAB	FR	G	G	FVF	-	Grad Smooth
3	90+	C	10YR53	18%>2 cm (s) 24% <2 cm (s+d) 42% HR	FFFO 10YR56	0	Too stony	(FM)	(M)	G	0	-	

Profile Gleyed From: -

Slowly Permeable Horizon From: -

Wetness Class: I

Wetness Grade: 2

Available Water Wheat: 117 mm

Potatoes: 102 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +17 mm

Potatoes: +7 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 2

Main Limiting Factor(s): Wk, Dr

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 11 (Nr Asp 164)	1° N	Ley	Av Rainfall: 918 mm ATO: 1563 day °C	Boulder clay
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
31.98	19.5.98	SS 5214 3228	PB		TS 0-25 cm : MCL (S32: Z43: 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	MCL	23	10YR53	2%HR(vis)	CRRC	0	-	-	-	-	MF,VF	-	Clear Smooth
2	C	35	2.5Y53	10% HR (vis)	CDFO 10YR56	0	WKMPR	FM	P	P	CVF	-	Clear Smooth
3	C	60+	2.5Y63,73	10%HR(vis)	MDMO 10YR58	C	WKMAB	FM	P	P	FVF	-	

Profile Gleyed From: 0 cm

Slowly Permeable Horizon From: 23 cm

Wetness Class: IV

Wetness Grade: 3b

Available Water Wheat: 117 mm

Potatoes: 96 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +11 mm

Potatoes: +1 mm

Droughtiness Grade: 2 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 12 (Asp 51)	1° N	PLO	Av Rainfall: 918 mm ATO: 1563 day °C FC Days: 190 Climatic Grade: 1 Exposure Grade: 1	Pebbly clay and sand (alluvium)
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY		PSD SAMPLES TAKEN
31.98	20.5.98	SS 5087 3285	PB		TS 0-25 cm : MCL (S47: Z31: C22%)

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	25	MCL	10YR43	1%> 2 cm (s) 4%< 2 cm (s+d) 5% HR	0	0	-	-	-	-	MF,VF	-	Grad Smooth
2	56	MCL	10YR44	4%>2cm (s) 2%<2 cm (s+d) 13% HR	0	0	MDM,FSAB	FR	G	G	CVF	-	Clear Smooth
3	75	HCL	10YR63,43	4%>2cm (s) 12%<cm (s+d) 16%HR	CDFO 10YR58	F	MDCSAB	FR	M	G	CVF	-	Clear Smooth
4	93+	C	2.5Y63	16%HR (vis)	MDMO 10YR58	C	WKCAB	FM	P	P	FVF	-	

Profile Gleyed From: 56 cm

Slowly Permeable Horizon From: 75 cm

Wetness Class: II

Wetness Grade: 3a

Available Water Wheat: 139 mm

Potatoes: 119 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +39 mm

Potatoes: +24 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): We

Remarks:

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Fremington	Pit 13 (Asp 491)	6° N	Ley	Av Rainfall: 896 mm ATO: 1523 day °C	Crackington shale
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 190 Climatic Grade: 1 Exposure Grade: 2	PSD SAMPLES TAKEN
31.98	21.5.98	SS 4895 3107	PB		TS 0-25 cm : HCL (S34:Z33:C33%)

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	20	HCL	10YR52	5%HR(vis)	0	0	-	-	-	-	MF,VF	-	Grad Smooth
2	55	C	2.5Y52	5%HR (vis)	0	0	MDMSAB	FR	G	G	CVF	-	Clear Smooth
3	65+	HCL	10YR53	70%ZR (vis)	0	0	Too stony	-	(M)	(G)	FVF	-	

Profile Gleyed From: -

Slowly Permeable Horizon From: -

Wetness Class: I

Wetness Grade: 3a

Available Water Wheat: 124 mm

Potatoes: 116 mm

Moisture Deficit Wheat: 100 mm

Potatoes: 95 mm

Moisture Balance Wheat: +24 mm

Potatoes: +21 mm

Droughtiness Grade: 2 (Calculated to 100 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Wk

Remarks: Pit dug to 65 cm, probed to 80 cm.