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# Cullompton and Willand

## Agricultural Land Classification

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# CULLOMPTON AND WILLAND

# 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 1304 ha of land at Cullompton and Willand Devon Field survey was based on 567 auger borings and 29 soil profile pits and was completed in January 1997

2 The survey was conducted by the Resource Planning Team of ADAS Taunton Statutory Group on behalf of MAFF Land Use Planning Unit in its statutory role in the preparation of the Mid 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 sites at a reconnaissance scale as mainly Grade 1 or 2 to the west of the Culm valley but mainly Grades 3 and 4 with only small patches of the best grades to the east and towards Willand Much of the current survey area was previously surveyed in 1984 at a scale of 1 25 000 (ADAS 1984) This shows a wide range of grades mainly Grades 1 2 and 3a, all evenly distributed across the survey area However the 1984 survey followed the previous guidelines for classification which are now superseded whereas the current survey uses the Revised Guidelines and Criteria for Grading the quality of agricultural land (MAFF 1988) and supersedes any previous ALC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 Two small previous surveys are found within the Cullompton site These are at Knowle Lane (ADAS 1988) on the south west side of town, and the other at Week Farm at King s Mill Road (ADAS 1994) The site at Knowle Lane is currently being developed for housing although the survey showed mainly Grade 2 while the sites at Week Farm are still in agricultural use The survey here shows mainly Grade 1 and it would appear from the current survey which virtually surrounds it that this is an isolated area of Grade 1 develolped on sandy alluvial deposits

5 A recent reconnaisance survey of land around Junction 27 at Waterloo Cross (ADAS 1994) shows mainly Grades 3a and 3b and lies adjacent to the north side of the Willand site across the Uffculme Road This survey also identified areas of the best grades of land on the sandy deposits north of Uffculme and around Hillhead Quarry A validation survey was undertaken (ADAS 1994) on a consultants report for the proposed waste site at Aller Barton Farm which lies just off the south east corner of the Cullompton site The consultants report shows mainly Grades 3a and 3b with a small area of Grade 4 This is on similar deposits to those found in the nearest part of the Cullompton site

6 At the time of survey land cover was mainly grass and cereals with smaller areas of maize and fodder crops all for mixed dairy farming Two small areas of agricultural land within the survey area were not surveyed one at Verbeer Manor as the owner reported that planning consent had already been obtained for a theme park The other small area which was not surveyed was grassland which was occasionally used as a horse gallop and the owner refused his consent for access as despite assurances he was concerned at the risk of injury to his horses from the auger borings Other land which was not surveyed because it was not in agricultural use included the motorway railway and other roads industrial and residential land sports grounds a golf course the covered glass nursery at Stoneyford various agricultural buildings and small areas of woodland

## SUMMARY

7 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 Cullompton and Willand**

| Grade | Area (ha) | % Surveyed Area (1029 ha) |
|---|---|---|
| 2 | 213 | 21 |
| 3a | 385 | 37 |
| 3b | 276 | 27 |
| 4 | 155 | 15 |
| Agricultural land not surveyed | 26 | |
| Other land | 249 | |
| Total site area | 1304 | |

8 This shows that 58 % of the survey area was found to be best and most versatile The best land mainly Grade 2 was found to the west of the Culm Valley while considerable areas of Subgrade 3a, which is also good quality were found on the east side of the Cullompton site The Willand site contains a large proportion of the flood plain of the River Culm and includes relatively little of the better quality land The minor limitations of the land shown as Grade 2 were due to wetness workability and droughtiness while the other grades of land were mainly limited by wetness However the flood risk in the various low-lying flood plains particularly of the river Culm, were frequently reported by local farmers and although difficult to quantify in relation to ALC grade this survey has considered this risk and has limited much such land to Subgrade 3b

## CLIMATE

9 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

10 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

11 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 Cullompton and Willand**

| Grid Reference | | ST 006077 | ST 039063 | ST 036092 |
|---|---|---|---|---|
| Altitude (m) | | 90 | 55 | 58 |
| Accumulated Temperature (day °C) | | 1489 | 1529 | 1524 |
| Average Annual Rainfall (mm) | | 949 | 920 | 948 |
| Overall Climatic Grade | | 1 | 1 | 1 |
| Field Capacity Days | | 194 | 188 | 193 |
| Moisture deficit (mm) | Wheat | 93 | 99 | 98 |
| | Potatoes | 82 | 91 | 89 |

12 Exposure and frost risk are not considered to be the primary limitation at any point, although the incidence of autumn frosts in the flood plain north of Cullompton was reported by one farmer

**RELIEF**

13 Altitude ranges from 48 metres below Cullompton to 125 metres at Bradninch Common with mainly gentle to moderate slopes which are not limiting However there are moderately steep and steep slopes on either side of the valley south of Cullompton which limit the land to Grade 4 and Subgrade 3b Elsewhere in the Cullompton site there are a few scattered short slopes which impose a very local limitation to Subgrade 3b

14 The risk of flooding in the various flood plains which run through the survey area was assessed from verbal reports based on local knowledge Where flooding is experienced it is reported to occur mainly in winter several times a year and with each event lasting for up to one day but rarely longer In Agricultural Land Classification terms this amounts to very frequent and very short duration flooding possibly equivalent to a Subgrade 3a limitation However the same reports indicate that such land is not suitable for winter cereals because of the risk of erosion as much as from inundation Indeed all such land is down to permanent grass In this area this seems to indicate more a Subgrade 3b limitation and this has been applied in this survey

## GEOLOGY AND SOILS

15 The underlying geology of the site is shown on the published geology map (IGS 1974) as mainly Lower Sandstone breccia and conglomerate to the west of the Culm Valley and Lower Marls with deposits of valley gravels and a small area of Culm measures to the east and towards Willand Alluvium is shown extensively through the various flood plains The current survey found the distribution of parent materials to be much as expected in the light of the above and also found the various types of parent material to have a profound effect on ALC grading which is clearly visible in the distribution of grades in the final survey report

16 Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1 250 000 (SSEW 1983) as mainly Bromsgrove and Crediton associations to the west of the Culm Valley with mainly Whimple 3 and Wigton Moor associations to the east Large areas of Hollington association are shown on the alluvium of the flood plains

17 Bromsgrove association is described as well drained reddish coarse loamy soils mainly over soft sandstone but deep in places and associated with fine loamy soils with slowly permeable subsoils and slight seasonal waterlogging Crediton association is described as well drained gritty reddish loamy soils over breccia, locally less stony Whimple 3 association is described as reddish, fine loamy or fine silty over clayey soils with slowly permeable subsoils and slight seasonal waterlogging with slowly permeable seasonally waterlogged fine loamy and fine silty over clayey soils on the lower slopes Wigton Moor association is described as permeable fine and coarse loamy soils variably affected by groundwater the drier soils being on slightly raised sites and Hollington association is described as deep stoneless reddish fine silty and clayey soils variably affected by groundwater on flat land with a risk of flooding

18 The more detailed 1 25 000 map showing soils series (SSEW 1987) is available for the north part of the Willand site This shows mainly Hollington series in the flood plain with Wigton Moor series on the higher ground and a small area of Whimple series now largely beneath Willand village

19 The published distribution of soils was largely borne out by the current survey although variation within soil associations on ALC terms continues to mask the distinction between associations

## AGRICULTURAL LAND CLASSIFICATION

20 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

21 Areas shown as Grade 2 are mainly developed on the Lower Sandstone breccia and conglomerate deposits in the west of the Cullompton area This mapping unit shows a variety of minor limitations Some are Wetness Class I with medium clay loam or sandy clay loam topsoil textures a minor limitation due to workability Many have a minor droughtiness limitation with stone contents assessed by sieving and displacement at pit sites ranging from 10

or 20% in the topsoil to perhaps 30 or 40% in the subsoil and frequently increasing with depth Stone content and the depths at which it changes can be highly variable and the combined evidence of borings and pits suggest that through the area shown as Grade 2 there may well be small areas and scattered borings which are more stony or more shallow which would be Subgrade 3a on droughtiness

22 Grade 1 profiles occur where the topsoil texture is lighter typically medium sandy loam or fine sandy silt loam, and there is no wetness limitation and the stone content is not enough to create a droughtiness limitation However such profiles were found to be isolated or scattered and nowhere consistent enough to make a mapping unit so they are not shown on the map

23 Several profiles are assessed as Wetness Class II normally with a slowly permeable horizon starting in the lower subsoil below 70 cm This is illustrated by several of the Grade 2 pits and can even be associated with a similar degree of droughtiness limitation as at Pits 27 and 24

24 Isolated Grade 2 profiles are found in the alluvial deposits north east of Cullompton around the King s Mill Road These are variably sandy and are illustrated by Pit 28 which has a fine sandy silt loam topsoil with ground water gleying indicating Wetness Class II and no slowly permeable layer However the only similar area large enough to be mapped is around the previously surveyed site at Week Farm, ASP 368 369 etc

**Subgrade 3a**

25 The great majority of observations shown as Subgrade 3a were found to be limited by wetness with sandy loam or clay loam topsoil textures at Wetness Class II or III most frequently with a slowly permeable layer starting in the middle to lower subsoil, occasionally with no slowly permeable layer but with gleying within 40 cm as at Pits 25 and 26 Because the depth to any horizon can be variable the areas shown as Subgrade 3a on wetness can include scattered profiles of other grades

26 The block of Subgrade 3a south of Aller Barton Farm is also mainly limited by wetness some observations showing a slowly permeable layer and some with a groundwater effect but the area is highly variable with a wide range of grades within the mapping unit from Grade 1 to Grade 4 and even includes Pits 7 and 28 which were finally graded as Grade 2 However Subgrade 3a was considered to be a fair average grading at semi-detailed intensity recognising that detailed survey of small areas may well identify other grades

27 The largest areas limited by droughtiness to Subgrade 3a are found on the ridge by Bradninch Common and on the ridge north of Paverstone Farm Droughtiness in this survey area is determined by stone content which can be highly variable and although Pit 23 at Bradninch Common is shown to be Subgrade 3a on droughtiness no doubt this mapping unit includes other borings with less stone which would be Grade 2 on droughtiness The ridge north of Paverstone Farm includes Pit 22 which was shown to be Subgrade 3b on droughtiness but this is taken to be exceptionally shallow and stony As Grade 2 borings are also included within this mapping unit Subgrade 3a is taken to be a reasonable average

28 Subgrade 3a borings assessed on droughtiness are included within the areas shown as Grade 2 but where these are believed to be larger or more consistent they have been mapped as small isolated areas of Subgrade 3a such as that north of Knowle Farm and another along Beacon Lane north of Growen Farm

29 The Willand site also includes a large area of Subgrade 3a, with a wetness limitation, but including scattered areas of stony soils developed on Valley Gravel deposits which again are highly variable in stone content and depth

30 Pits 26 and 20 are unusual in that each shows a slowly permeable layer which terminates at or above 50 cm, giving way to mixed stony reddish material which has good porosity At Pit 26 the slowly permeable layer under investigation proved to be porous and therefore not a slowly permeable layer and at Pit 20 the slowly permeable layer was shown to terminate at 42 cm In both cases there is clearly a very significant wetness problem but in neither case was there a true slowly permeable layer extending below 50 cm and each was assessed as Subgrade 3a although Pit 20 was subsequently included in a 3b mapping unit

**Subgrade 3b**

31 Much of the area shown as Subgrade 3b shows a more serious wetness limitation most frequently Wetness Class IV with a slowly permeable layer starting in the upper subsoil and medium clay loam topsoil texture although occasionally Wetness Class III with heavy clay loam topsoil texture Such profiles are found mainly in the low-lying areas and river valleys with clay parent materials

32 Small areas are shown to be Subgrade 3b because of a locally acute droughtiness limitation such as at Pit 6 in a deposit of Valley Gravel on the Willand Site and Pit 22 in sandstone of the Culm Measures at the south end of the Cullompton site There is also a Subgrade 3b pit on droughtiness in breccia deposits at Pit 29 Each of these is taken to represent an extreme situation in the range of stone content with many of the other observations showing lower stone content and less serious droughtiness limitations

33 Throughout the Cullompton site are several short slopes typically assessed at around 8° representing a gradient limitation to Subgrade 3b

34 Several observations in the flood plain of the River Culm are downgraded to Subgrade 3b because of a flood risk assessed as described earlier Several of these profiles were otherwise Subgrade 3a or even approaching Grade 2 on soil characteristics particularly in the area east of the motorway below Stoneyford Bridge and below Last Bridge

**Grade 4**

35 Much of the area shown as Grade 4 is found in the flood plain of the Willand site where Pits 3 and 5 were found to be Wetness Class III but with clay topsoil These pits also showed that the upper clay horizons which had appeared from auger borings to be slowly permeable were in fact porous Other pits dug in apparently Grade 4 situations in the south of the Cullompton site were shown to be Wetness Class IV but with medium clay loam topsoil texture Therefore the situation can only be described as variable and the distribution of Grade 4 as shown is based on the best evidence available

36 Two significant areas of steeper slopes limited to Grade 4 are found on either side of the Culm Valley at the south of the Cullompton site

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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 (In preparation) Soil Survey Field Handbook, Revised Edition

## 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, 1974)

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** | **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% | | | |

**STRUCTURE** Ped Development *

| | | | |
|---|---|---|---|
| **WA** | Weakly adherent | **M** | Moderately developed |
| **W** | Weakly developed | **S** | Strongly developed |

**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, 1974) for details

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | PARENT MATERIAL |
|---|---|---|---|---|---|
| Willand | Pit 1 (ASP 94) | 3° SE | Swedes | Av Rainfall 955 mm<br>ATO 1510 day °C | Lower Marl |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | FC Days 194<br>Climatic Grade 1<br>Exposure Grade 1 | PSD SAMPLES TAKEN |
| 36 94 | 10 12 96 | ST 0324 0990 | GMS/PB | | TS 0 25 cm FSZL (S38 Z46 C 16%) |

| 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 | FSZL | 10YR54 | 2% HR (vis) | None | None | | | | | CF VF | | Gradual smooth |
| 2 | 45 | C | 7 5YR62 | 5% HR (vis) | CDFOG 10YR72 58 | Few | WCSAB | Friable | Mod | Good | CVF | | Gradual smooth |
| 3 | 60 | SCL | 10YR73 | 10% HR (vis) | CDMOG 10YR58 72 | None | WCSAB | Friable | Mod | Good | CVF (mainly exped) | | Gradual smooth |
| 4 | 90+ | SCL (SC Pockets) | 7 5YR64<br>2 5YR36<br>(7 5YR64) | 2 % HR (vis) | CDMO 5YR58 | Common | WCSAB/ WCAB | Friable | Mod | Poor | FVF | | |

Profile Gleyed From 27cm

Depth to Slowly Permeable Horizon 60 cm

Wetness Class III

Wetness Grade 3a

Available Water Wheat 152 mm

Potatoes 113 mm

Moisture Deficit Wheat 97 mm

Potatoes 87 mm

Moisture Balance Wheat +55 mm

Potatoes +26 mm

Droughtiness Grade 1 (Calculated to 120 cm)

Final ALC Grade 3a

Main Limiting Factor(s) Wetness

Remarks

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | PARENT MATERIAL |
|---|---|---|---|---|---|
| Willand | Pit 2 (ASP 103) | 1° SW | PGR | Av Rainfall 955 mm<br>ATO 1510 day °C<br>FC Days 194<br>Climatic Grade 1<br>Exposure Grade 1 | Valley gravel |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | | PSD SAMPLES TAKEN |
| 36/96 | 10/12/96 | ST 0338 0975 | PB/GMS | | TS 0 25cm SCL/MSL (S54 Z28 C18%) |

| 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 | 22 | SCL | 10YR43 | 5 % HR (vis) | None | None | | | | | MF VF | | Clear smooth |
| 2 | 37 | HCL | 10YR43 | 10% HR (vis) | None | None | MM, FSAB | Friable | Good | Good | MF VF | | Clear smooth |
| 3 | 46 | C | 10YR53 | 30% HR (vis) | CDFOG 10YR72 5YR58 | Common | WCSAB | Friable | Mod | Good | CVF | | Abrupt wavy |
| 4 | 65+ | Cemented Gravel | | > 70% HR (vis) | | Many | | Impen | | P | 0 | | |

Profile Gleyed From 37 cm

Depth to Slowly Permeable Horizon no SPL

Wetness Class II

Wetness Grade 3a

Available Water Wheat 77 mm

Potatoes 77 mm

Moisture Deficit Wheat 97 mm

Potatoes 87 mm

Moisture Balance Wheat 20 mm

Potatoes 10 mm

Droughtiness Grade 3b (Calculated to 46 cm)
(would be 3a with a little of H4)

Final ALC Grade 3a

Main Limiting Factor(s) Dr We

Remarks Minimum Wetness Class II since pit impenetrable before 80cm

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | | PARENT MATERIAL |
|---|---|---|---|---|---|---|
| Willand | Pit 3 (ASP 118) | 0° | PGR | Av Rainfall<br>ATO | 948 mm<br>1524 day °C | Alluvium |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | FC Days<br>Climatic Grade<br>Exposure Grade | 193<br>1<br>1 | PSD SAMPLES TAKEN |
| 36/96 | 10 12 96 | ST 0338 0948 | PB/GMS | | | TS 0 25 cm ZC (S16 Z47 C37%) |

| 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 | 9 | HCL | 7 5YR42 | None | None | None | | | | | MVF | | Clear smooth |
| 2 | 24 | ZC | 7 5YR53 | None | CDFO 7 5YR46 | None | MCSAB | Friable | Mod | Good | CVF | | Grad smooth |
| 3 | 45 | C | 7 5YR52 | 1% HR (VIS) | CFFOG 7 5YR46 | Few | MMPR | Friable | Mod | Good | CVF | | Grad smooth |
| 4 | 68 | C | 7 5YR52 | None | CDFO 5YR44 | Few | MCSAB | Friable | Mod | Good | CVF | | Grad smooth |
| 5 | 90+ | C | 5YR64 7 5YR72 | None | ADMO 7 5YR58 | None | WACSAB | Firm | Poor | Poor | FVF | | |

Profile Gleyed From 9 cm

Depth to Slowly Permeable Horizon 68 cm

Wetness Class III

Wetness Grade 4

| | | |
|---|---|---|
| Available Water | Wheat | 132 mm |
| | Potatoes | 113 mm |
| Moisture Deficit | Wheat | 97 mm |
| | Potatoes | 87 mm |
| Moisture Balance | Wheat | +35 mm |
| | Potatoes | +26 mm |
| Droughtiness Grade | 1 | (Calculated to 120 cm) |

Final ALC Grade 4

Main Limiting Factor(s) Wetness

Remarks

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | PARENT MATERIAL |
|---|---|---|---|---|---|
| Willand | Pit 4 (ASP 72 79) | 1 °W | Ley | Av Rainfall 966 mm<br>ATO 1504 day °C | Lower marl (Disturbed) |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | FC Days 195<br>Climatic Grade 1 | PSD SAMPLES TAKEN |
| 36/96 | 10 12 96 | ST 0318 1025 | PB/GMS | Exposure Grade 1 | TS 0 25 cm MCL/MSZL (S42 Z40 C18%) |

| 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 | MSZL | 7 5YR43 | 2% HR (VIS) | None | None | | | | | MF | | Clear smooth |
| 2 | 27 | C | 7 5YR42 | 2% HR | CFFO 10YR46 | Few | WC MSAB | Friable | Mod | Good | CVF | | Abrupt smooth |
| 2 | 60+ | C | 2 5YR44 | 10 % HR (VIS) | None | Few | Massive | Very firm | Poor | Poor | None | | |

Profile Gleyed From 20 cm

Depth to Slowly Permeable Horizon 27 cm

Wetness Class IV

Wetness Grade 3b

| | | |
|---|---|---|
| Available Water | Wheat | 48 mm |
| | Potatoes | 48 mm |
| Moisture Deficit | Wheat | 97 mm |
| | Potatoes | 87 mm |
| Moisture Balance | Wheat | -49 mm |
| | Potatoes | 39 mm |
| Droughtiness Grade | 3b | (Calculated to 27 cm) |

Final ALC Grade 3b

Main Limiting Factor(s) Wetness

Remarks Disturbed land
Field waterlogged in parts
Water running into pit from H2

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | PARENT MATERIAL |
|---|---|---|---|---|---|
| Willand | Pit 5 (ASP 76) | 1°S | Maize | Av Rainfall 948 mm<br>ATO 1524 day °C<br>FC Days 193<br>Climatic Grade 1<br>Exposure Grade 1 | Alluvium |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | | PSD SAMPLES TAKEN |
| 34 96 | 13 12 96 | ST 0423 1032 | PRW/PB | | TS 0 25 cm C/ZC (S13 Z44 C43%) |

| 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 | 28 | C | 7 5YR52 | 0 | FDFO 7 5YR58 | 0 | | | | | MF VF | | Clear smooth |
| 2 | 65 | C | 7 5YR62 | 0 | MDMO 7 5YR58 | F | MCPr | Fr | M | G | CF VF | | Grad smooth |
| 3 | 76+ | C | 7 5YR62 | 0 | MDMO 7 5YR58 | F | MC MAB | Fr | M | P (low) | CF VF | | |

Profile Gleyed From 28 cm

Depth to Slowly Permeable Horizon 65 cm

Wetness Class III

Wetness Grade 4

| | | |
|---|---|---|
| Available Water | Wheat | 126 mm |
| | Potatoes | 118 mm |
| Moisture Deficit | Wheat | 97 mm |
| | Potatoes | 87 mm |
| Moisture Balance | Wheat | +29 mm |
| | Potatoes | +31 mm |
| Droughtiness Grade | 2 | (Calculated to 100 cm) |

Final ALC Grade 4

Main Limiting Factor(s) We

Remarks

| SITE NAME | PROFILE NO | SLOPE AND ASPECT | LAND USE | | PARENT MATERIAL |
|---|---|---|---|---|---|
| Willand | Pit 6 (ASP 46) | 2°SE | Fal | Av Rainfall 966mm<br>ATO 1504 day °C | Valley Gravel |
| JOB NO | DATE | GRID REFERENCE | DESCRIBED BY | FC Days 196<br>Climatic Grade 1<br>Exposure Grade 1 | PSD SAMPLES TAKEN |
| 34/96 | 13 12 96 | ST 0422 1088 | PRW/PB | | TS 0 25 cm MCL/SCL/MSZL (S49 Z32 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 | 24 | MCL | 10YR44 | 18%>2cm<br>5 %>2mm<br>23 Tot HR | 0 | 0 | | | | | MM +F | | GS |
| 2 | 48 | MSL | 10YR43 | 20%>2cm<br>40 % > 2mm<br>60% Tot HR | CFG 10YR62 | 0 | | | M | M | CF | | GW |
| 3 | 82 | LMS | 10YR53 | 55 %>2cm<br>28 % > 2mm<br>83 % Tot HR | CFFG | 0 | | | M | M | None seen | | AS |
| 4 | 84 | SC | 10YR71 | 40 % est | CDFO | 0 | | | M | M | None seen | | AS |
| 5 | 110 | C | 2 5YR46 (5YR64) | All seived | 0 | F | | | P | P | None seen | | |

Profile Gleyed From 82 cm

Depth to Slowly Permeable Horizon 84 cm

Wetness Class 1

Wetness Grade 2

| | | |
|---|---|---|
| Available Water | Wheat | 78 mm |
| | Potatoes | 52 mm |
| Moisture Deficit | Wheat | 97 mm |
| | Potatoes | 87 mm |
| Moisture Balance | Wheat | 19 mm |
| | Potatoes | 35 mm |
| Droughtiness Grade | 3b | (Calculated to 120 cm) |

Final ALC Grade 3b

Main Limiting Factor(s) Drought

Remarks 3b on stoniness