Netherhills Pit, Perry Way, Frampton-on-Severn

Agricultural Land Classification & Statement of Site Physical Characteristics

April 1997

Resource Planning Team
Bristol
FRCA Western Region

Job Number 22/97
Commission 1393
MAFF Reference EL 14/1398

NETHERHILLS PIT, PERRY WAY, FRAMPTON-ON-SEVERN

AGRICULTURAL LAND CLASSIFICATION SURVEY AND STATEMENT OF SITE PHYSICAL CHARACTERISTICS

CONTENTS

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AGRICULTURAL LAND CLASSIFICATION SURVEY AND STATEMENT OF SITE PHYSICAL CHARACTERISTICS

INTRODUCTION

1. This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 6 ha of land at Perry Way, Frampton-on-Severn. Field survey was based on 5 auger borings and 2 soil profile pits, and was completed in March 1997. 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 connection with an existing permission for gravel extraction.

3. Information on climate, geology and soils, and from previous ALC surveys was considered and is presented in the relevant section. Apart from the published regional ALC map (MAFF, 1977) the site had not been surveyed previously. The Regional map shows the western site and top part of the eastern site as Grade 2, and the southern part as Grade 3. 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. At the time of survey land cover was grassland. A small area on the western site had been excavated in connection with the planning application. The land quality has been assessed as that prior to start of working.

SUMMARY

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

Table 1: Distribution of ALC grades: Netherhills Pit

Grade	Area (ha)	% Surveyed Area (6.0 ha)
2	5.2	87
3b	0.8	13
Total site area	6.0	

6. The majority of the site is best and most versatile. These soils are well drained but have stony light textured subsoils. These subsoils impose a minor droughtiness limitation and the soils are Grade 2. A small area in the south of the larger site comprises poorly drained clays which have a moderate wetness limitation and it is mapped as Subgrade 3b.

CLIMATE

7. 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.

8. 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.

9. 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: Netherhills Pit

Grid Reference		SO 766 056
Altitude (m)		20
Accumulated Temperature (day °C)		1508
Average Annual Rainfall (mm)		767
Overall Climatic Grade		1
Field Capacity Days		169
Moisture deficit (mm):	Wheat	103
	Potatoes	96

RELIEF

10. Altitude ranges from 17 metres at the western site to 20 metres in the east. The land is relatively level.

GEOLOGY AND SOILS

11. The underlying geology of the site is shown on the published geology map (IGS, 1972) as all recent Third Terrace River Gravels although an area of Lower Lias Clay is mapped just to the south of the site. The recent survey found stony light textured soils developed on the Gravels and an area of heavier clays related to the Lower Lias Clay within the site area.

12. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW, 1983) as Badsey 1 Association for the western field and the top of the eastern, the rest being Evesham 2 Association.

13. Badsey 1 Association is described as well drained calcareous and non-calcareous fine loamy soils over limestone gravel with some deep fine loamy soils over gravel which may be affected by groundwater. Evesham 2 Association is described as slowly permeable calcareous clayey soils, some slowly permeable seasonally waterlogged non calcareous and fine loamy or silty over clayey soils. The soils identified during the recent survey were typical of the mapped associations.

AGRICULTURAL LAND CLASSIFICATION

14. The distribution of ALC grades found by the current survey is shown on the accompanying 1:10 000 scale map and areas are summarised in 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

15. The majority of the site is mapped as Grade 2, very good quality land. These soils have medium clay loam topsoils over clay upper subsoils. The lower subsoils are sandy loams and sands with 40-50% hard stones. The soils are well drained and are assessed as Wetness Class I (see Appendix II). The combination of light textures and stone content in the subsoil with the prevailing moisture deficits for the area imposes a minor droughtiness limitation on these soils. There is some variation in the depth to the stony horizons and at the pit there was found to be a moderate droughtiness limitation. At the scale of mapping it is considered that Grade 2 is most representative of this small site, whilst acknowledging some variation within the unit.

Subgrade 3b

16. A small area has been mapped as moderate quality land with a moderate wetness limitation. These soils are not stony and are developed over Lias Clay. A soil profile pit was dug within this area to assess the subsoil structure. The lower subsoil was found to be slowly permeable and assessed as Wetness Class III. A series of borings were made to establish the extent of this unit.

SOIL RESOURCES

17. The site has been divided into 2 distinct areas, shown as Soil Units on the attached map of soil resources. This is not a soil stripping map but is intended to illustrate the soil resources available for restoration.

Soil Unit I

18. The topsoil in Soil Unit I, 5.2 ha in area, is a medium clay loam with a depth that varies between 25 and 35 cm. The shallower area is located in the northern part of the larger block but it is impractical to identify a separate Soil Unit within this small site. The mode and the median topsoil depths for sample points are both 35 cm so this has been taken as the depth for the Unit whilst recognising there will be some areas where the topsoil is shallower. The topsoil colour was observed as 10YR43 and 10 YR42. The topsoil was friable with a weak coarse and medium subangular blocky structure. The soil had negligible stone content and was porous, with many very fine roots. The soil pit showed the boundary to the next horizon was abrupt and smooth.

19. Soil Unit I has two subsoils for soil handling purposes. The upper subsoil is clay and extends to depths ranging from 45 cm to 60 cm in the profiles examined. Again the shallower depths were found in the northern part of the larger block. A typical depth of 55 cm has been taken as the base of this horizon. The upper subsoil is a clay generally 10YR54 in colour with some tendency to 7.5YR colour. The clay was friable with a moderate coarse subangular blocky structure, negligible stone content and was porous with common very fine roots. The boundary to the next horizon was abrupt but wavy. The second subsoil comprises two horizons which have a gradual transition. In the soil profile pit, in this Unit, a medium sandy loam with 42% hard small stones extended to 65 cm over medium sand with 51% hard small stones. In terms of soil handling these soils can be treated as one horizon since visual distinction by an operator would be difficult. These sandy soils were 7.5YR42 and 10YR54 in colour with few very fine roots observed. The porosity was good. The structure of the sandy loam was weak coarse and medium subangular blocky and friable whilst the sand was a weak medium and fine granular structure with a very friable consistence. The soils in Unit I were well-drained and assessed as Wetness Class I.

Soil Unit II

20. The topsoil in Soil Unit II, 0.8 ha in area is a heavy clay loam with a depth of 30 cm. The colour of the soil was greyish, 10YR42. The topsoil structure was a weak medium and coarse subangular blocky with friable consistence. All the horizons in this unit had negligible stone contents. The topsoil had many fine and very fine roots with good porosity. The transition to the subsoil was clear and smooth. Two subsoil horizons were observed but both were clay and for soil stripping purposes can be treated as one. The colours of the clays were 10YR54 and 10YR53, the lower being mottled. The structures were medium coarse subangular blocky and angular blocky, both with friable consistence. Rooting was common in the upper subsoil with few very fine observed in the lower horizon. Porosity deteriorated with depth. The soils in Soil Unit II were assessed as Wetness Class III.

Table 3: Soil Resources: Netherhills Pit

Map Unit	Depth, cm	Area, ha	Texture	Stones %	Volume, m^3
Topsoil					
I	0-35	5.2	MCL	0	18200
II	0-30	0.8	HCL	0	2400
				Total Topsoil	20600 m^3
Subsoil					
I	35-55	5.2	C	0	10400
I	55-120	5.2	MSL/MS	40-50%	33800
II	30-120	0.8	C	0	7200
				Total Subsoil	51400m^3

21. Depths and volumes quoted should be treated with caution due to soil variability. Soil resources may extend below 120cm.

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April 1997

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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		
Netherhills Pit, Perry Way	Pit 1	0°	PGR	Av Rainfall:	767 mm	Terrace Gravels		
				ATO:	1508 day °C			
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days:	169	PSD SAMPLES TAKEN		
22/97	18/3/97	SO 766 056	GMS	Climatic Grade:	1	Topsoil	S49;Z28;C23	MCL
				Exposure Grade:	1	Horizon 3	S72;Z11;C17	MSL
						Horizon 4	S90; Z4: C6	MS

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	10YR42	Neg (vis)	None	None	WC + MSAB	Friable	Mod	Good	MVF	-	Abrupt smooth
2	45	C	7.5YR42	Neg	None	None	MCSAB	Friable	Mod	Good	CVF	-	Abrupt wavy
3	65	MSL	7.5YR42	2% HR > 2cm (s) 40% HR> 2mm (S+D) 42% HR Total	None	None	WC + MSAB	Friable	Mod	Good	FVF	-	-
4	90+	MS	10YR54	2% HR > 2 cm (S) 49% HR> 2mm (S+D) 51% HR Total	None	None	WM + FG	V. Friable	Good	Good	FVF	-	-

Profile Gleyed From: Not gleyed

Depth to Slowly Permeable Horizon: No SPL

Wetness Class: I

Wetness Grade: 1

Available Water Wheat: 103 mm

Potatoes: 97 mm

Moisture Deficit Wheat: 103 mm

Potatoes: 96 mm

Moisture Balance Wheat: 0 mm

Potatoes: +1 mm

Droughtiness Grade: 3A (Calculated to 120 cm)

Final ALC Grade: 3a

Main Limiting Factor(s): Droughtiness

Remarks: H1 and H2 shallower than most borings on site hence 3a rather than Grade 2 droughtiness

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Netherhills Pit, Perry Way	Pit 2	0°	PGR	Av Rainfall: 767 mm ATO: 1508 day °C	Lias clay
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 169 Climatic Grade: 1 Exposure Grade: 1	PSD SAMPLES TAKEN
22/97	18/3/97	SO 765 055	GMS		-

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	10YR42	None	None	None	WM+CSAB	Friable	Mod	Good	MF, VF	-	Clear smooth
2	55	C	10YR54	None	None	None	MCSAB	Friable	Mod	Good	CVF	-	Clear smooth
3	120	C	10YR53	None	CDFO 10YR58	Few	MCAB	Friable	Mod	Some but poor	FVF	-	-

Profile Gleyed From: 55 cm

Depth to Slowly Permeable Horizon: 55 cm

Wetness Class: III

Wetness Grade: 3b

Available Water	Wheat:	142 mm
	Potatoes:	118 mm
Moisture Deficit	Wheat:	103 mm
	Potatoes:	96 mm
Moisture Balance	Wheat:	39 mm
	Potatoes:	22 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): Wetness

Remarks: