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Land at Heath End, Petworth, West Sussex
Statement of Physical Characteristics
January 1995

STATEMENT OF PHYSICAL CHARACTERISTICS

LAND AT HEATH END, PETWORTH, WEST SUSSEX

1. INTRODUCTION

1.1 In September 1993, 5.1 hectares of land at Heath End near Petworth in West Sussex was surveyed in connection with MAFF's statutory input to the West Sussex Minerals Plan. This land is currently the subject of a planning application for sand extraction and consequently a statement of physical characteristics has been prepared.

1.2 The 1993 survey was undertaken at a detailed level of approximately one boring per hectare. A total of 5 soil auger borings and 2 soil inspection pits were assessed in accordance with MAFF's revised guidelines and criteria for grading the quality of agricultural land (MAFF, 1988). These guidelines provide a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on its use for agriculture.

1.3 The work was conducted by members of the ADAS Resource Planning Team in the Guildford Statutory Group. At the time of the survey the land was bare soil.

1.4 The distribution of grades and subgrades is shown on the attached ALC map which has been drawn at a scale of 1:5,000. It is accurate at this scale, but any enlargement would be misleading. This map supersedes any previous information for this site.

1.5 Appendix 1 gives a general description of the grades, subgrades and land use categories identified in the survey. The main classes are described in terms of the type of limitation that can occur, the typical cropping range and the expected level of consistency of yield.

2. CLIMATE

2.1 The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions.

2.2 A detailed assessment of the prevailing climate was made by interpolation from a 5km gridpoint dataset (Met. Office 1989). The details are given in Table 1 below and these show that there is no overall climatic limitation affecting the site.

Table 1 : Climatic Interpolation

Grid Reference:	SU 963185
Altitude (m) :	24
Accumulated Temperature (days) :	1514
Average Annual Rainfall (mm) :	906
Field Capacity (days) :	192
Moisture Deficit, Wheat (mm) :	102
Moisture Deficit, Potatoes (mm) :	95
Overall Climatic Grade :	1

2.3 The main parameters used in the assessment of the overall climatic limitation are average annual rainfall, as a measure of overall wetness, and accumulated temperature, as a measure of the relative warmth of a locality.

2.4 However, climatic factors do interact with soil factors to influence soil wetness and droughtiness limitations. At this locality, the average annual rainfall and field capacity days are high, thus increasing the likelihood of soil wetness.

2.5 No local climatic factors such as exposure or frost risk are believed to affect the site.

3. RELIEF

3.1 The site occupies gently undulating land, rising by 10m from 24m AOD in the south of the survey area to 34m AOD along the northern boundary. Nowhere on the site does gradient or relief impose any limitation to the land quality.

4. GEOLOGY AND SOIL

4.1 BGS Sheet 317, Chichester (1957) shows the entire site to be underlain by Folkestone Beds.

4.2 The soil type for the site, as shown on the Soil Survey map of South East England (SSEW, 1983, 1:250,000) comprises the Frilford Association. These soils are described as 'deep, well drained sandy and coarse loamy soils (SSEW, 1983)'.

5. AGRICULTURAL LAND CLASSIFICATION

5.2 The entire site has been assessed as Grade 2, very good quality agricultural land. However, it is limited by slight soil droughtiness. Along the western boundary and in the south-east corner of the site topsoils comprise medium sandy loams. These are underlain by a moderately structured deep medium sandy loam upper subsoil. At depth, profiles become sandier and better structured, changing from loamy medium sand into medium sand at approximately 90 cm depth. Pit 1 is representative of these profiles. Pit 2 is typical of the remaining profiles. Medium sandy loam topsoils are underlain by loamy medium sands to depth. The deep upper subsoil is moderately developed, but passes into a well developed lower subsoil at approximately 75 cm depth. Throughout the site, profiles were free draining and stoneless. However, the combination of coarse textures, substructural conditions

and local climate means that both soil types can be classified no better than Grade 2. The slightly restricted amount of water available in the profile for extraction by roots reduces the range of crops that can tolerate such conditions. The sandy nature of the soils is partially offset by the relatively moist climate prevailing at this locality, such that soil droughtiness is only slight.

6. SOIL RESOURCES

Soil Units : Consideration for Restoration

6.1 The following section describes the pattern of topsoil and subsoil resources on the site, and provides an illustration of the soil resources available for restoration. Due to the natural variability of soils, the depths and volumes of topsoil and subsoil units given below should be treated with caution. In general terms, all the available existing topsoil and subsoil resources should be retained for restoration purposes. When considering these details it is important to remember that soils were sampled to a maximum depth of 120 cm during survey work. In some cases soil resources will extend below this depth.

Table 2 : Topsoil and Subsoil Resources

RESOURCE	MEAN DEPTH (cm)	TEXTURE	AREA (ha)	Volume (M^3)
Topsoil	32	MSL	5.1	16320
Subsoil	88	MSL, LMS, MS	5.1	44880

Topsoil

6.2 One topsoil unit was identified. It comprises an average 32 cm (range = 30-37 cm) of black, very dark grey or very dark greyish brown (10YR 2/1 or 25Y 2/1, 10YR 3/1, 10YR 3/2) medium sandy loam. These topsoils were found to be non-calcareous and stone free.

Subsoil

6.3 One subsoil unit was identified. It comprises an average 88 cm (range = 83-90 cm) comprising various textures, typically medium sandy loams and loamy medium sand, occasionally passing into sand. Black, greyish brown, dark yellowish brown or yellowish brown (10YR 2/1 or 25Y 2/1, 10YR 5/2, 10YR 4/6 or 10YR 5/6) medium sandy loam horizons overlie loamy medium sand horizons. Colours of the loamy medium sand horizons vary, tending to be light brownish grey (10YR 6/2) when present at relatively shallow depths and black, brown, dark yellowish brown or yellow (i.e. 7.5YR 2/1, 7.5YR 4/4, 10YR 4/4 or 10YR 7/6) deeper in the profile. Where sand occurs at depth it is light grey or brownish grey (10YR 7/2 or 10YR6/2). These subsoils were found to be non-calcareous throughout and stone free.

These subsoils tend to be moderately to well structured with varying structural composition depending on sand content. Where described (pits 1 and 2) sandy loam horizons comprise weakly or moderately developed coarse sub-angular blocky peds of friable consistence, whilst loamy sands and sands tend to have weakly or moderately developed coarse sub-angular blocky peds which are very friable.

All the soils are permeable and freely draining.

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MAFF Ref: EL42/1073

Resource Planning Team
Guildford Statutory Group
ADAS Reading

SOURCES OF REFERENCE

British Geological Survey (1972), Sheet 317, Chichester, 1:50,000. Drift Edition.

MAFF (1988), Agricultural Land Classification of England and Wales : Revised guidelines and criteria for grading the quality of agricultural land.

Meteorological Office (1989), Climatic datasets for Agricultural Land Classification.

Soil Survey of England and Wales (1983), Sheet No. 6, Soils of South-East England, 1:250,000, and Accompanying Legend.

Soil Survey of England and Wales (1984), Soils and their use in South-East England. Bulletin No.15.

APPENDIX I

DESCRIPTION OF THE 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 includes 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 or horticultural crops can usually be grown but on some land of this 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 land.

Grade 3 : Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When 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 the 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 moist 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 severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religous buildings, cemetries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, *including mineral workings which are only likely to be reclaimed using derelict land grants.*

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including: private parkland, public open spaces, sports fields, allotments and soft-surfaced areas on airports. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland. A distinction may be made as necessary between farm and non-farm woodland.

Agricultural Buildings

Includes the normal range of agricultural buildings as well as other relatively permanent structures such as glasshouses. Temporary structures (eg. polythene tunnels erected for lambing) may be ignored.

Open Water

Includes lakes, ponds and rivers as map scale permits.

Land Not Surveyed

Agricultural land which has not been surveyed.

Where the land use includes more than one of the above, eg. buildings in large grounds, and where map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will be shown.

APPENDIX II

FIELD ASSESSMENT OF SOIL WETNESS CLASS

SOIL WETNESS CLASSIFICATION

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile. Six soil wetness classes are identified and are defined in the table below.

Definition of Soil Wetness Classes

Wetness Class	Duration of Waterlogging[1]
I	The soil profile is not wet within 70 cm depth for more than 30 days in most years.[2]
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 only wet within 40 cm depth for 30 days in most years.
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 present within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31-90 days in most years.
IV	The soil profile is wet within 70 cm depth for more than 180 days but not wet within 40 cm depth for more than 210 days in most years **or**, if there is no slowly permeable layer present within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.
V	The soil profile is wet within 40 cm depth for 211-335 days in most years.
VI	The soil profile is wet within 40 cm depth for more than 335 days in most years.

Soils can be allocated to a wetness class on the basis of quantitative data recorded over a period of many years or by the interpretation of soil profile characteristics, site and climatic factors. Adequate quantitative data will rarely be available for ALC surveys and therefore the interpretative method of field assessment is used to identify soil wetness class in the field. The method adopted here is common to ADAS and the SSLRC.

[1]The number of days specified is not necessarily a continuous period.
[2]'In most years' is defined as more than 10 out of 20 years.

APPENDIX III

SOIL PIT AND SOIL BORING DESCRIPTIONS

Contents :

SOIL PROFILE DESCRIPTIONS : EXPLANATORY NOTE

Soil pit and auger boring information collected during ALC fieldwork is held on a computer database. This uses notations and abbreviations as set out below.

Boring Header Information

1. **GRID REF** : national 100 km grid square and 8 figure grid reference.

2. **USE** : Land use at the time of survey. The following abbreviations are used.

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

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

4. **GLEY/SPL** : Depth in centimetres (cm) to gleying and/or slowly permeable layers.

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

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

7. **DRT** : Best grade according to soil droughtiness.

8. 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				

9. **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				

Soil Pits and Auger Borings

1. **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)

2. **MOTTLE COL** : Mottle colour using Munsell notation.

3. **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% +

4. **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

5. **PED. COL** : Ped face colour using Munsell notation.

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

7. **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/metamorphic rock		

Stone contents (>2cm, >6cm and total) are given in percentages (by volume).

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

degree of development	**WK** : weakly developed **ST** : strongly developed	**MD** : moderately developed
ped size	**F** : fine **C** : coarse	**M** : medium **VC** : very coarse
ped shape	**S** : single grain **GR** : granular **SAB** : sub-angular blocky **PL** : platy	**M** : massive **AB** : angular blocky **PR** : prismatic

9. **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

10. **SUBS STR** : Subsoil structural condition recorded for the purpose of calculating profile droughtiness : **G** : good **M** : moderate **P** : poor

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

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

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

14. **CALC** : If the soil horizon is calcareous, a 'Y' will appear in this column.

15. Other notations
APW : available water capacity (in mm) adjusted for wheat
APP : available water capacity (in mm) adjusted for potatoes
MBW : moisture balance, wheat
MBP : moisture balance, potatoes

SOIL PIT DESCRIPTION

Site Name : W. SSX,SITE 22 HEATH END Pit Number : 1P

Grid Reference: SU96401845 Average Annual Rainfall : 906 mm
Accumulated Temperature : 1514 degree days
Field Capacity Level : 192 days
Land Use : Ploughed
Slope and Aspect : 01 degrees S

HORIZON	TEXTURE	COLOUR	STONES >2	TOT.STONE	LITH	MOTTLES	STRUCTURE	CONSIST	SUBSTRUCTURE	CALC
0- 37	MSL	10YR21 00	0	0			WKCSAB	FR		
37- 75	LMS	10YR62 00	0	0			WKCSAB	VF	M	
75-120	LMS	75YR44 00	0	0			MDCSAB	FR	G	

Wetness Grade : 1 Wetness Class : I
Gleying :000 cm
SPL : No SPL

Drought Grade : 2 APW : 117mm MBW : 15 mm
APP : 087mm MBP : -8 mm

FINAL ALC GRADE : 2
MAIN LIMITATION : Droughtiness

SOIL PIT DESCRIPTION

Site Name : W. SSX,SITE 22 HEATH END Pit Number : 2P

Grid Reference: SU96351850
Average Annual Rainfall : 906 mm
Accumulated Temperature : 1514 degree days
Field Capacity Level : 192 days
Land Use : Ploughed
Slope and Aspect : 01 degrees S

HORIZON	TEXTURE	COLOUR	STONES >2	TOT.STONE	LITH	MOTTLES	STRUCTURE	CONSIST	SUBSTRUCTURE	CALC
0- 35	MSL	10YR32 00	0	0			MDCSAB	FR		
35- 72	MSL	10YR46 00	0	0			MDCSAB	FR	M	
72- 90	LMS	10YR76 00	0	0			WKCSAB	VF	M	
90-120	MS	10YR72 00	0	0			WKCSAB	VF	M	

Wetness Grade : 1
Wetness Class : I
Gleying :000 cm
SPL : No SPL

Drought Grade : 2
APW : 127mm MBW : 25 mm
APP : 112mm MBP : 17 mm

FINAL ALC GRADE : 2
MAIN LIMITATION : Droughtiness

SAMPLE NO.	GRID REF	USE	ASPECT	GRDNT	GLEY	SPL	--WETNESS-- CLASS	GRADE	-WHEAT- AP	MB	-POTS- AP	MB	DRT	M.REL FLOOD	EROSN EXP	FROST DIST	CHEM LIMIT	ALC	COMMENTS
1	SU96401860	PLO			000		1	1	111	9	092	-3	2				DR	2	
1P	SU96401845	PLO	S	01	000		1	1	117	15	087	-8	2				DR	2	PIT 120
2	SU96501860	PLO			000		1	1	097	-5	080	-15	3A				DR	3A	
2P	SU96351850	PLO	S	01	000		1	1	127	25	112	17	2				DR	2	PIT 120
3	SU96401850	PLO			000		1	1	124	22	107	12	2				DR	2	
4	SU96501850	PLO	S	02	000		1	1	136	34	111	16	1					1	
5	SU96501855	PLO	S	02	000		1	1	104	2	085	-10	3A				DR	3A	

SAMPLE	DEPTH	TEXTURE	COLOUR	MOTTLES COL	MOTTLES ABUN	MOTTLES CONT	PED COL.	GLEY	STONES >2	STONES >6	STONES LITH	STONES TOT	STRUCT/ CONSIST	SUBS STR	SUBS POR	SUBS IMP	SUBS SPL	SUBS CALC
1	0-30	msl	10YR32 00						0	0		0						
	30-45	msl	10YR52 00						0	0		0		M				
	45-120	lms	10YR62 00						0	0		0		M				
1P	0-37	msl	10YR21 00						0	0		0	WKCSAB	FR		Y		
	37-75	lms	10YR62 00						0	0		0	WKCSAB	VF	M	Y		
	75-120	lms	75YR44 00						0	0		0	MDCSAB	FR	G	Y		
2	0-30	msl	10YR32 00						0	0		0						
	30-90	lms	10YR62 00						0	0		0		M				
	90-120	ms	10YR62 00						0	0		0		M				
2P	0-35	msl	10YR32 00						0	0		0	MDCSAB	FR		Y		
	35-72	msl	10YR46 00						0	0		0	MDCSAB	FR	M	Y		
	72-90	lms	10YR76 00						0	0		0	WKCSAB	VF	M	Y		
	90-120	ms	10YR72 00						0	0		0	WKCSAB	VF	M	Y		
3	0-30	msl	10YR31 00						0	0		0						
	30-40	msl	10YR21 72						0	0		0		M				
	40-65	msl	10YR56 00						0	0		0		M				
	65-120	lms	10YR76 00						0	0		0		M				
4	0-30	msl	25Y 21 00						0	0		0						
	30-85	msl	25Y 21 00	10YR54 00	C				0	0		0		M				
	85-120	lms	10YR62 00						0	0		0		M				
5	0-35	msl	10YR21 00						0	0		0						
	35-70	lms	10YR62 00						0	0		0		M				
	70-75	lms	10YR44 00						0	0		0		M				
	75-120	lms	75YR21 00						0	0		0		M				