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Gaverigan, Indian Queens
Agricultural Land Classification and Site Physical Characteristics

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MAFF

GAVERIGAN, INDIAN QUEENS

AGRICULTURAL LAND CLASSIFICATION

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GAVERIGAN, INDIAN QUEENS

AGRICULTURAL LAND CLASSIFICATION AND SITE PHYSICAL CHARACTERISTICS

SUMMARY

The survey was carried out by ADAS on behalf of MAFF as part of its statutory role in connection with a planning application to the Minerals Planning Authority under the Town and Country Planning Act 1990, for a proposed china clay tip at Gaverigan, Indian Queens. Fieldwork was completed in June 1995 for mapping at a scale of 1:10,000. Data on climate, soils, geology and from previous Agricultural Land Classification (ALC) Surveys was used and is presented in the report. The distribution of grades is shown on the accompanying ALC map and is summarised below. Information is correct at this scale but could be misleading if enlarged.

Distribution of ALC grades: Gaverigan, Indian Queens

Grade	Area (ha)	% of Survey Area	% of Agricultural Land (34.6 ha)
3b	17.8	27.3	51.4
4	14.0	21.4	40.5
5	2.8	4.3	8.1
Non Agricultural	30.7	47.0	
TOTAL	65.3		

None of the area was found to be best and most versatile, although the eastern block was considered to be at the better end of Subgrade 3b, and a few borings were borderline Subgrade 3a. Throughout the site, wetness was the main limitation.

Soil resource information is provided as the background to any restoration conditions which may be recommended.

1. INTRODUCTION

An Agricultural Land Classification (ALC) Survey was carried out in June 1995 at Gaverigan, Indian Queens on behalf of MAFF as part of its statutory role in connection with a planning application to the Minerals Planning Authority under the Town and Country Planning Act 1990, for a china clay tip. The fieldwork covering 65.3 ha of land was conducted by ADAS at a scale of 1:10,000 with approximately one boring per hectare of agricultural land. A total of 40 auger borings and 4 soil profile pits were examined.

The published provisional one inch to the mile ALC map of this area (MAFF 1961) shows the grades of the agricultural land on the site at a reconnaissance scale as Grade 3.

The area was also surveyed in 1976 (ALC St Austell China Clay Area) at a scale of 1:25,000 and found to be Grade 3b as defined at the time.

The recent survey supersedes these previous surveys having been carried out at a more detailed level and using the 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 agricultural use. The grading takes account of the top 120 cm of the soil profile. A description of the grades used in the ALC system can be found in Appendix 2.

2. CLIMATE

The grade of the land is determined by the most limiting factor present. The overall climate is considered first because it can have an overriding influence on restricting land to a lower grade despite other favourable conditions.

Estimates of climatic variables were interpolated from the published agricultural climate dataset (Meteorological Office 1989). The parameters used for assessing overall climate are accumulated temperature, a measure of the relative warmth of a locality, and average annual rainfall, a measure of overall wetness. The results shown in Table 1 indicate there is an overall climatic limitation which restricts the land to Grade 2.

Table 1:. Climatic Interpolations: Gaverigan, Indian Queens

Grid Reference		SW936583	SW928584
Altitude (m)		115	150
Accumulated Temperature (day °)		1506	1467
Average Annual Rainfall (mm)		1220	1249
Overall Climatic Grade		2	2
Field Capacity Days		238	242
Moisture deficit (mm):	Wheat	78	72
	Potatoes	64	55

Climatic data on Field Capacity Days (FCD) and Moisture Deficits for wheat and potatoes are also shown. These data are used in assessing the soil wetness and droughtiness limitations referred to in later sections.

3. RELIEF AND LANDCOVER

Altitude ranges from 115 to 150 m AOD. Slopes are mainly gentle and not limiting, with a mainly southerly aspect. Only a small bank of approximately 2 ha at the east of the site has short strong slopes of 8-11°. Landcover at the time of survey was mainly grass, much of it for silage, with some cereals.

4. GEOLOGY AND SOILS

The geology of the site is shown on the published 1:50,000 scale drift geology map, Sheet 347, Bodmin, British Geological Survey 1978 as calcareous slate, grit and thin limestone. The current survey found mainly shale parent material, more gritty in the west of the site.

The soils were mapped by the Soil Survey of England and Wales in 1983 at a reconnaissance scale of 1:250,000 and are shown as Laploy d and Hafren Associations, with Manod Association nearby.

Laploy d Association is described as permeable gritty coarse loamy upland soils with a wet humose or peaty surface horizon affected by groundwater.

Hafren Association is described as loamy permeable upland soils over rock with a wet peaty surface horizon and bleached sub-surface horizon, often with a thin iron pan.

Manod Association is described as well drained fine loamy or fine silty soils over rock, shallow soils in places.

The soils examined during the recent survey were found to fit the general description for Hafren Association in the western block, but in the eastern block were found to have a mid-brown mineral topsoil more typical of the Manod Association. The Laploy d Association is likely to be found in the wet valley basins of woodland and scrub which were not surveyed.

5. AGRICULTURAL LAND CLASSIFICATION

The distribution of ALC grades is shown in Table 2 and on the accompanying ALC map. This information could be misleading if shown at a larger scale.

Table 2: Distribution of ALC grades: Gaverigan, Indian Queens

Grade	Area (ha)	% of Survey Area	% of Agricultural Land (34.6 ha)
3b	17.8	27.3	51.4
4	14.0	21.4	40.5
5	2.8	4.3	8.1
Non Agricultural	30.7	47.0	
TOTAL	65.3		

Subgrade 3b

Subgrade 3b is the best grade of land found in the survey area, almost exclusively in the eastern block of agricultural land. It mainly suffers a more serious moderate limitation due to wetness, although one small area at the eastern side of the site also suffers a limitation due to gradient, with slopes of 8-10°. Topsoils are mainly medium clay loam and this may be found in combination with Wetness Classes ranging from II to IV to give Subgrade 3b. All three Wetness Classes are found on the site depending on the depth to gleying, or slowly permeable layer if present.

Grade 4

Land shown as Grade 4 suffers a severe limitation due to wetness. Profiles in this area are typical of upland areas, showing the characteristics of a weakly developed peaty iron pan soil profile. Organic medium clay loam or sandy silt loam topsoil over stony gleyed, typically heavy clay loam subsoil with clay or heavy clay loam slowly permeable layer arising in the middle subsoil gives rise to Wetness Class IV. Reference to Table 7 to determine the grade according to soil wetness for organic mineral and peaty soils leave the precise ALC grade open to judgement, and Grade 4 is believed to be correct in this situation.

Grade 5

A small area of the non-agricultural land has been reclaimed recently and examination of a soil profile pit within this area revealed 15-20 cm of peat or peaty loam directly over gleyed and compacted semi-permeable layer, Wetness Class V.

Other Land

The area shown as non-agricultural includes scrub and woodland in wet valley bottoms and also where this has colonised industrial workings and settlement lagoons. This area shows no evidence of grazing or any other agricultural use and was not surveyed.

6. SOIL RESOURCES

The soil resources on this site can be divided into 4 units as shown on the accompanying Soil Resources Map.

Topsoil

Topsoil is defined as the surface horizon which is relatively rich in organic matter.

At this site, topsoils in Units I and II are mainly medium clay loam, 25-35 cm deep, typically 10YR43 in colour and with weakly developed coarse sub-angular blocky structure. Stone content around 10%.

Topsoils in Unit III are more humic, 20-30 cm deep, typically an organic medium clay loam or sandy silt loam with moderately developed medium and coarse sub-angular blocky structure, colour 10YR31. Stone content variable; very low at the surface but rapidly increasing towards the base of the topsoil horizon and was assessed at one point as 37%. 10% may be average for the topsoils in the Unit.

Topsoils in Unit IV are mainly peaty loam, dark brown (10YR31) with weakly developed medium and coarse sub-angular blocky structure. Soils in this unit have been ploughed and now include turf and fibrous peat with some subsoil mixing. Typically 5% stone content.

Depths and volumes of topsoil resources are shown in the following table:-

Table 3: Topsoil Resources

Map Unit	Depth, cm	Area, ha	Texture	Stones, %	Volume, m^3
I, II	30	17.7	MCL	10 Hard rock	53 100
III	25	14.0	OMCL/OSZL	10 "	35 000
IV	20	2.8	Pty loam	5 "	5 600
			TOTAL		93 700

Subsoil

Subsoil is defined as the lower horizons which are less rich in organic matter.

Subsoils in Units I and II are mainly heavy clay loam, pale brown (eg 2.5Y53 or 54) with stone content ranging from 14 to 38%, typically 30%, and weakly developed coarse sub-angular blocky structure. However, Unit I is characterised by an upper subsoil of lighter texture, typically medium clay loam which is stronger brown in colour, 10YR43, 20-30% stone content and moderately developed coarse sub-angular blocky structure. The lower subsoil in Unit II is a clay or heavy clay loam slowly permeable layer which is gleyed, pale grey-brown in colour (2.5Y62), poor structural condition and weakly developed adherent or massive structure.

Unit III also has heavy clay loam subsoil, although this can be variable, colour 10YR52, 20-35% stone content and weakly developed coarse sub-angular blocky structure. However, this soon gives way in the profile to a gleyed clay or heavy clay loam slowly-permeable layer, pale brown or grey in colour (10YR52, 10YR63), 20-30% stone content and weakly developed adherent or *massive structure.*

The subsoil in Unit IV is a raw compact clay or heavy clay loam slowly-permeable layer starting immediately below the peaty topsoil. This was found to be pale grey, 10YR61, with 15-30% stone content and more or less massive.

Depths and volumes of subsoil resources are shown in the following table:-

Table 4: Subsoil Resources

Map Unit	Depth, cm	Area, ha	Texture	Stones, %	Volume, m^3
I	20	4.8	MCL	25 Hard rock	9 600
	70	4.8	HCL	35 "	13 600
II	50	12.9	HCL	15 "	64 500
	40	12.9	C	30 "	51 600
III	40	14.0	HCL	35 "	56 000
	55	14.0	C	25 "	77 000
IV	100	2.8	HCL/C	20 "	28 000
			TOTAL		300 300

Resource Planning Team
Taunton Statutory Unit
30 June 1995

APPENDIX 1

REFERENCES

ADAS Resource Planning Group (1976), Agricultural Land Classification, St Austell China Clay Area, Scale 1:25,000.

BRITISH GEOLOGICAL SURVEY (1978) Drift Edition, Sheet 347, Bodmin, 1:50,000.

MAFF (1961) Agricultural Land Classification Map, Sheet 85, Provisional 1:63,360 scale.

MAFF (1988) Agricultural Land Classification of England and Wales: Revised Guidelines and Criteria for grading the quality of agricultural land, MAFF Publications, Alnwick.

METEOROLOGICAL OFFICE (1989) Climatological Data for Agricultural Land Classification.

SOIL SURVEY OF ENGLAND AND WALES (1983) Sheet 5, Soils of South West England, 1:250,000 scale.

APPENDIX 2

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.

Descriptions of other land categories used on ALC maps

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, cemeteries. 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 park land, public open spaces, sports fields, allotments and soft-surfaced areas on airports/airfields. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

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 landcover types, eg buildings in large grounds, and where may be shown separately. Otherwise, the most extensive cover type will usually be shown.

Source: MAFF (1988) Agricultural Land Classification of England and Wales (Revised Guidelines and Criteria for Grading the Quality of Agricultural Land), Alnwick.

APPENDIX 3

DEFINITION OF SOIL WETNESS CLASSES

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).

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Gaverigan	Pit 1 (ASP 17)	4°E	Ley	Av Rainfall: 1220 mm ATO: 1506 day °C	Devonian slates
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 242 Climatic Grade: 2 Exposure Grade: 1	SOIL SAMPLE REFERENCES
38.95	6.6.95	SW935586	PB		PB286

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	MCL	10YR43	2% >2cm 9% <2cm 11% HR (S+D)	0	0	WCSAB	Fr	M	G	MF, VF	-	Gradual Smooth
2	48	MCL	10YR43	6% >2cm 22% <2cm 28% HR (S+D)	0	0	MCSAB	Fr	M	G	MF,VF	-	Gradual Smooth
3	65	HCL	25Y54	20% >2cm 14% <2cm 34% HR (S+D)	FFFGM (25Y63)	0	WCSAB	Fr	M	P(G)*	FVF	-	Gradual Smooth
4	95+	HCL	25Y53	18% >2cm 20% <2cm 38% HR (S+D)	CFFGM (25Y63)	0	WCSAB	Fr	M	P(G)*	0	-	

Profile Gleyed From: 65 cm

Depth to Slowly Permeable Horizon: -

Wetness Class: II

Wetness Grade: 3b

Available Water Wheat: 117 mm

Potatoes: 93 mm

Moisture Deficit Wheat: 70 mm

Potatoes: 53 mm

Moisture Balance Wheat: +47 mm

Potatoes: +40 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): Wetness

Remarks:

* H3 and H4 good fissures due to high stone content, therefore not an SPL even though biopores <0.5%.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Gaverigan	Pit 2 (ASP 7)	3° E	Ley	Av Rainfall: 1220 mm ATO: 1506 day °C	Devonian Slates
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 242 Climatic Grade: 2	SOIL SAMPLE REFERENCES
38.95	6.6.95	SW933587	PB	Exposure Grade: 1	PB287

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	35	MCL	10YR43	1% >2cm 7% <2cm 8% HR (S+D)	CRRCh	0	WCSAB	Fr	M	G	MF,VF	-	Gradual Smooth
2	65	HCL	10YR63	1% >2cm 13% <2cm 14% HR (S+D)	MDMOM (10YR68)	0	WCSAB	Fr	M	G	FVF	-	Gradual Smooth
3	95+	C	25Y62	1% >2cm 26% <2cm 27% HR (S+D)	MDMO,GM (10YR68) (25Y71)	0	WAdCSAB (± massive)	Fm	P	P	0	-	

Profile Gleyed From: 35 cm

Depth to Slowly Permeable Horizon: 65 cm

Wetness Class: III

Wetness Grade: 3b

Available Water Wheat: 121 mm

Potatoes: 105 mm

Moisture Deficit Wheat: 70 mm

Potatoes: 53 mm

Moisture Balance Wheat: +51 mm

Potatoes: +52 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): We

Remarks:

Borderline WC IV

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Gaverigan	Pit 3 (ASP 39)	3° S	PGR	Av Rainfall: 1249 mm ATO: 1467 day °C	Slates and Grit
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 242 Climatic Grade: 2 Exposure Grade: 1	SOIL SAMPLE REFERENCES
38.95	7.6.95	SW929583	PB		PB288

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	OMSZL	10YR32	15% >2cm 22% <2cm 37% HR (S+D)	0	0	MM+CSAB	Fr	G	G	MF,VF	0	Ab wavy
2	30	HCL	10YR32	As above (Vis)	MDMGM (10YR62)	0	MM+CSAB	Fr	G	G	MF,VF	0	Ab wavy
3	55	HCL	10YR52	As above (Vis)	MDMOM (75YR58)	0	WM+CSAB	Fr	G	P	FVF	0	Gradual Wavy
4	85+	C	10YR63	3% >2cm 21% <2cm 24% HR (S+D)	MDMOGM (75YR58) (10YR71)	0	WAdCSAB (± massive)	Fm	P	P	0	0	

Profile Gleyed From: 24 cm*

Depth to Slowly Permeable Horizon: 55 cm

Wetness Class: IV

Wetness Grade: 3b/4 (Table 7).

Table 7 does not give clear guidance on grade according to wetness. In view of the obvious wetness characteristics, and that OMCL topsoil textures were found elsewhere, Grade 4 is considered the appropriate wetness grade.

Available Water	Wheat:	118 mm
	Potatoes:	101 mm
Moisture Deficit	Wheat:	70 mm
	Potatoes:	53 mm
Moisture Balance	Wheat:	+48 mm
	Potatoes:	+48 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 4

Main Limiting Factor(s): We

Remarks:

* H1 contains bleached sand grains and may be regarded as gleyed even though it does not meet the ALC definition of a gleyed horizon.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
Gaverigan	Pit 4 (ASP 33)	4° SE	PGR	Av Rainfall: 1249 mm ATO: 1467 day °C	Slates and Grit
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 242 Climatic Grade: 2	SOIL SAMPLE REFERENCES
38.95	7.6.95	SW932584	PB	Exposure Grade: 1	PB289

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	Pty lm	10YR31	5% HR (Vis)*	0	0	WC+MSAB	Fr	M	G	MF,VF	-	Clear Smooth
2	55	C	26Y61	8% >2cm 15% <2cm 23% HR (S+D)	CDFOM (75YR58)	0	Massive	Fm	P	P	CF	0	Clear Wavy
3	80+	HZCL	10YR53	1% >2cm 14% <2cm 15% HR (S+D)	MDMOGM (75YR58) (10YR72)	0	Massive	Fm	P	P	FF		

Profile Gleyed From: 0 cm

Depth to Slowly Permeable Horizon: 18 cm

Wetness Class: V

Wetness Grade: 5

Available Water Wheat: 100 mm

Potatoes: 84 mm

Moisture Deficit Wheat: 70 mm

Potatoes: 53 mm

Moisture Balance Wheat: +30 mm

Potatoes: +31 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 5

Main Limiting Factor(s): We

Remarks:

*H1 ploughed and reseeded.