Conf 21/90

SOIL RESOURCES REPORT

HALVERGATE MARSHES, NORFOLK

1. BACKGROUND

1.1 The area surveyed (a total of 33.6 hectares) comprises six fields on Halvergate Marshes, Norfolk. The water levels of these fields are being monitored as part of the Broads Environmentally Sensitive Area Water Levels Monitoring Project. Details of the objectives of this project are included in Appendix 1 of this report. The purpose of this survey was to provide detailed information on soils in the fields monitored in the project. It was particularly important to confirm that there were no marked variations in soil conditions which would result in a different wetness status being assigned to the different soil types. MAFF carried out this soil resources survey in April 1990.

1.2 A total of 72 soil inspections were made on site using a hand held dutch soil auger (120cm in length). These auger borings were supplemented by observations from six soil profile pits (1 pit per field).

1.3 At the time of the survey the land was in permanent grassland. Fields 1, 2, 3 & 4 are under Tier 2 Agreement and fields 5 & 6 are under Tier 1 Agreement. Details of the prescriptions of these Tiers are included in Appendix 2.

2. SITE PHYSICAL CHARACTERISTICS

2.1 Climate

Climate data for the site was obtained from the published agricultural climatic dataset (Met Office, 1989). This indicates that for the site's median altitute of 0m AOD the annual average rainfall is 565 mm (22.2"). This data also indicates that field

capacity days are 105 and moisture deficits are 126 mm for wheat and 123 mm for potatoes.

2.2 Altitude and Relief

The land comprises fairly level marshes which lie at an altitude of 0m AOD. Microtopographic undulations occur as a result of the patterns created during the uneven deposition of the geological parent material and more recently, as a result of the siltation of old grips and the mechanical excavation of new grips.

3.0 SOIL PHYSICAL CHARACTERISTICS

3.1 Geology

The published ¼" to 1 mile geology map sheet 12 shows the survey area to comprise post glacial and recent alluvium, peat and fen silts.

3.2 Soils

The Soil Survey of England and Wales have mapped the soils in the area on a number of occasions. Firstly, in 1973, at a scale of 1:100,000 and secondly, in 1983, at a reconnaissance scale of 1:250,000. These maps show the occurrence of the Wallasea/Wisbech/Newchurch Series (*1) and the Newchurch 2 Association (*2). More recently in 1989, and as yet unpublished, the Soil Survey mapped the Eastern Norfolk area in more detail at a scale of 1:25,000. This map shows the occurrence of mainly the calcareous variant of the Wallasea Association with smaller areas of the non calcareous variant in the vicinity of fields 1 and 2 and the western quarter of field 4. During the current survey a detailed inspection of the soils identified two main soil types.

(*1) Wallasea/Wisbech/Newchurch Series: Calcareous and pelo-calcareous alluvial gley soils. Clayey and coarse silty.

(*2) Newchurch 2 Association: Deep stoneless mainly calcareous clayey. soils. Groundwater controlled by ditches and pumps. Flat land. Risk of flooding in places.

3.2.1 Soil Type A (refer to Soil Type Map)

These soils cover the majority of the survey area and occur in all fields except field 6. They typically comprise a thin humose layer of organic medium silty clay loam over an upper horizon of silty clay or heavy silty clay loam which overlies a silty clay subsoil (20/30cm +). Occasionally the humose layer comprises peaty loam or organic heavy silty clay loam material. This soil type is described below in full.

Humose Layer. Texture	:	organic medium silty clay loam or occasionally peaty loam or organic heavy silty clay loam.
Calcium carbonate	:	non calcareous
pH	:	5
depth	:	10 cm (occasionally 12/15 cm)

Apg Horizon

Texture	:	heavy silty clay loam or silty clay
Calcium carbonate	:	non calcareous
pH	:	6/6.5
Structure	:	moderately developed coarse and medium prisms
Consistence	:	firm
porosity	:	<0.5% Biopores, occasional reed channels
colour	:	10 yr 5/1 - 2.2 y 5/2.
mottles	:	many distinct ochreous
depth	:	20/30 cm

Bg Horizon

Texture	:	silty clay
Colour	:	10 yr 5/1
Calcium carbonate	:	non calcareous
pH	:	6/6.5

structure	:	as above
consistence	:	as above
porosity	:	<0.5% biopores
mottles	:	many distinct or prominent ochreous.
depth	:	120 cm or water table depth.

3.2.2 Soil Type B (refer to Soil Type Map)

The remainder of the survey area has been mapped as Soil Type B, these soils are essentially a calcareous variant of Soil Type A. The soils typically comprise an organic silty clay loam humose layer over heavy silty clay loam or silty clay upper horizons which overlie subsoils of silty clay. Profiles are generally calcareous from 40/70 cm depth depending on location. In field 6 profiles typically merge into heavy silty clay loams at depth 50/70 cm+. This soil type is described below in full.

Humose Layer. Texture	:	organic medium or heavy silty clay loam.
Calcium carbonate	:	non calcareous
pH	:	6
depth	:	10 cm (occasionally 12/15 cm)

Apg Horizon

Texture	:	heavy silty clay loam or silty clay
Calcium carbonate	:	non calcareous
pH	:	7
colour	:	10 yr 5/1; 5/2
mottles	:	many distinct ochreous
structure	:	moderately or well developed very coarse angular blocky or coarse prisms
consistence	:	very firm
porosity	:	c. 0.1% (root channels)
depth	:	20/30 cm

Bg Horizon

Texture	:	silty clay (may become heavy silty clay loam 50/70 cm+)
colour	:	10 yr 5/1, 2.5y 5/0
Calcium carbonate	:	calcareous from 40/70 cm+.*
pH	:	7
Structure	:	moderately or well developed coarse or very coarse prisms or very coarse angular blocks**
consistence	:	very firm
porosity	:	<0.1% biopores
mottles	:	many prominent ochreous
depth	:	120 cm or water table depth

3.3 Conclusion

The soil resources work has identified two key soil types which differ primarily in their content of calcium carbonate in the lower horizons. Other factors such as textures, structural condition, presence of biopores etc remains constant between the two soil types. As a result both soil types exhibit the same wetness status using structural/textural characteristics and both are wetter in Tier 2 Agreement fields where dyke water levels are deliberately being maintained at shallower depths. Local variations in humose layer organic matter content may affect localised surface soil measurements. However, one can conclude that any difference in wetness status and surface soil conditions between fields is unlikely to be as a result of the differing soil types.

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RESOURCE PLANNING GROUP
Cambridge RO

* The depth to which these calcareous horizons extend varies with location.

** Structures may comprise coarse laminations (caused by the laying down of the alluvium) at depths 60/80 cm+.

APPENDIX 1

Water Levels Monitoring Project

Objectives:

To investigate the relationship between dyke water levels and marsh wetness in four sample ESA Tier 2** fields in an area where water levels have been recently raised. The work will comprise:-

(i) Monitoring dyke water levels.

(ii) Monitoring field water table by dipwell transects.

(iii) Assessing soil strength/penetrability.

(iv) Recording extent of surface flooding.

(v) Record of grass sward height.

(vi) Periodic surveys to identify any major vegetation change.

Comparative data to be collected for two ESA Tier 1 fields in the area on similar soils but where water levels have not been raised.

** The tiers are described in full in Appendix 2.

APPENDIX 2

THE BROADS

ENVIRONMENTALLY SENSITIVE AREA

TIER 1 GUIDELINES

Applies to all land covered by your agreement.

- Maintain grassland. Cultivate only with chain harrow or roller.
- Graze with cattle, sheep or horses at an average stocking rate not exceeding 1.5 livestock units/acre from April - September. Avoid poaching, under-grazing or over-grazing.
- No more than one cut of hay or silage each year. Graze the aftermath.
- Keep to existing levels of inorganic fertiliser provided that it does not exceed 100 units of nitrogen/acre. Do not use more than 75 units in any one application. Do not use more than 60 units of phosphate and 60 units of potash/acre per year.
- Do not use pesticides (fungicides or insecticides).
- Control nettles, spear thistle, creeping or field thistle, curled dock, broad-leaved dock or ragwort by means of herbicides or mechanical topping. Apply herbicides by weed wiper or spot treatment.
- Do not mole drain or install under-drainage. Do not use a subsoiler. Do not substantially modify existing drainage system.
- Maintain dykes by mechanical means, not sprays.
- Where dyke water levels are within your control: maintain water levels at suitable levels for grazing livestock; ensure at least 12" of water in the bottom of the dykes between 30 September and 1 April.

- Maintain hedges, ponds and reedbeds. Do not damage or destroy any features of historic interest.

- Obtain written advice from the Project Officer before constructing buildings, roads, or any other engineering operations.

- Within 2 years obtain written advice on the management of woodland or scrub.

TIER 2 GUIDELINES

Observe all the requirements of Tier 1 plus:

- No cultivations between 30 March - 16 July.

- Do not graze between 31 October - 1 April.

- Hay or silage should not be cut before 16 July.

- Keep to existing levels of inorganic fertiliser provided that it does not exceed 35 units nitrogen/acre per year. Do not apply phosphate or potash.

- Do not apply slurry or use lime, slag or any other substance to reduce soil acidity.

- Dykes should be slubbed out in rotation over a period of years. Do not dig or maintain foot drains and grips.

- Where dyke water levels are within your control ensure that the water is not more than 18" below marsh level between 31 March - 1 October.

Dairy cows	1.0 livestock units
Bulls or cattle over 2 yrs	0.7 livestock units
Cattle between 1 yr and 2 yrs	0.6 livestock units
Cattle under 1 yr	0.4 livestock units
Ewes incl. lambs	0.15 livestock units

REFERENCES

GEOLOGICAL SURVEY OF ENGLAND AND WALES 1953 Sheet 12 Scale ¼" to 1 mile.

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

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