# AGRICULTURAL LAND CLASSIFICATION
# AND SOIL SURVEY
# N.E. OPEN CAST COAL SITES
# SURVEY OF RESTORED LAND AT
# LICKAR LEA, NORTHUMBERLAND
# DECEMBER 1995

ADAS
Leeds Statutory Group

Job No:- 223/95
MAFF Ref:- EL 31/36A
Commission No: N2220

## SUMMARY

An Agricultural Land Classification (ALC) and soils survey was carried out on the restored opencast coal site at Lickar Lea, Northumberland in December 1995.

Topsoils were medium to heavy textured and on average contained 15% volume of subsoil material. Topsoil depth showed considerable variation across the site. Subsoils were medium to heavy textured with a poor structure.

At present 9.9 ha are Subgrade 3b and a 4.8 ha Grade 4. Both areas are subject to a soil wetness and workability limitation which is more severe on the Grade 4 land.

Following aftercare and installation of drainage it is likely that all land on the site will be limited to Subgrade 3b again due to soil wetness and workability limitations. This is the same ALC grade as was found across 91% of the site in a pre working survey. (9% was formerly 3a).

CONTENTS



MAPS

# AGRICULTURAL LAND CLASSIFICATION REPORT ON LAND AND SOIL SURVEY N.E. OPEN CAST COAL SITES. RESTORED LAND AT LICKAR LEA, NORTHUMBERLAND

## 1. INTRODUCTION AND SITE HISTORY

Lickar Lea Opencast Coal Site is located 4 km west of the A1, approximately 10 km south of Berwick. It has a centroid grid reference of NU 015413

1.1 The site was operated by R J B Mining (formerly R & A Young Mining Ltd). Soil stripping information is not available. Soils were stored in storage mounds for a maximum of 3 years without progressive restoration. Topsoils were replaced by crawler-tractor and scraper box methods, and subsoils replaced in a single layer by loose tipping methods using dump truck and dozer. Restored profiles were specified to have 27 cm topsoil and 71 cm of subsoil. Restoration was completed in July 1994. Underdrainage is planned for 1996. The site is currently in a temporary grass ley (without clover) for cutting/grazing.

1.2 A pre-working ALC and Soils Report for the site conducted by the Resource Planning Team, ADAS Leeds, in 1989 identified 1.2 ha of Subgrade 3a land and 13.6 ha of Subgrade 3b.

1.3 One soil type was identified in the 1989 survey. Boulder clay deposits covered the whole site. Some of the Boulder Clay soils had been disturbed by past localised open casting. Undisturbed profiles consisted of medium clay loam topsoils over poorly drained (Wetness Class IV) slowly permeable clayey subsoils.

Disturbed areas identified in 1989 contained heavy clay loam topsoil over poorly drained (Wetness Class IV) clayey subsoils, overlying clayey overburden between 80 cm and 100 cm depth. During the original survey (1989), the pattern of disturbed and undisturbed soils was found to be too complex to delineate. As they had similar wetness and workability restrictions, these areas were grouped into one soil type.

## 2. CLIMATE DATA

| | |
|---|---|
| Grid Reference | : NU015413 |
| Altitude | : 50 |
| Accumulated Temperature above 0°C (January - June) | : 1276 |
| Average Annual Rainfall (mm) | : 649 |
| Climatic Grade | : 2 |
| Field Capacity Days | : 162 |
| Moisture Deficit (mm) Wheat | : 93 |
| Moisture Deficit (mm) Potatoes | : 79 |

## 3. SURVEY METHODS

Soils on the site were examined using hand auger borings to 120 cm depth and shallow profile pits deep enough to examine upper subsoil structure at a density of one observation per hectare at locations predetermined by the O.S. National Grid. A further four full profile pits were dug to 120 cm or overburden. Samples were collected for laboratory analysis of bulk density and particle size distribution.

Land quality was assessed using the methods described in "Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land" MAFF (1988).

Further guidance was provided by draft unpublished MAFF guidelines for the grading of restored and disturbed land.

## 4. SLOPES, ASPECT AND RELIEF

4.1 The site contains level to moderately steeply sloping land (0°-12°). The land towards the centre and north is undulating and of variable aspect. Remaining land in the South has a southerly aspect.

## 5. AGRICULTURAL LAND CLASSIFICATION

The ALC grades occurring on this site are as follows:

| Grade/Subgrade | Hectares | % of Total Area |
|---|---|---|
| 1 | | |
| 2 | | |
| 3a | | |
| 3b | 9.9 | 67 |
| 4 | 4.8 | 33 |
| 5 | | |
| (Sub total) | (14.7) | (100) |
| Other Land | | |
| TOTAL | 14.7 | 100 |

**This site was only restored in July 1994 and has not yet completed the Statutory Aftercare period. Underdrainage has not been installed and soil structures and plant roots have not had a chance to fully develop. ALC gradings therefore only *refer to soils in their present condition. A further assessment following aftercare is* needed to monitor land quality on the site.**

### 5.1 SUBGRADE 3B

This Subgrade is found on the moderate and gente slopes. Topsoils are medium clay loam textured over slowly permeable or very slowly permeable subsoils of clay, clay loam or sandy clay loam texture. These subsoils are very poorly structured with a high dry bulk density, both indicative of very poor porosity and permeability. However slopes over 2° in this area will encourage water to drain over the surface or through the topsoil reducing to some extent the wetness problem. Soil wetness and workability will limit the ALC grade of this land to 3b.

### 5.2 GRADE 4

Two areas of land are Graded 4, one larger area located centrally and a smaller area to the east. Topsoils on the larger area consist of medium and heavy clay loams overlying clay subsoils. Subsoils are very poorly structured with a high dry bulk density both indicative

of very poor porosity and permeability. This area does not contain slopes sufficient to encourage natural drainage either through the topsoil or over the surface.

Profiles are therefore likely to be wet for long periods of time. For this reason the land is limited to Grade 4.

## 5.3 LIKELY FUTURE ALC

Considering the texture and structural conditions now found in the subsoil, it is likely, following underdrainage and aftercare, that subsoils will still be slowly permeable. However, installation of an effective underdrainage scheme should help to reduce overall soil wetness and enable all land on the site to meet the criteria for Subgrade 3b. This is the same ALC grade as was observed over 91% of the site in the 1989 ADAS pre working survey.

## 6. DESCRIPTION OF RESTORED SOILS

6.1 The site contains one soil type, descriptions of which are given below. Topsoil and subsoil resources are also shown on the accompanying maps, along with soil thickness and volume information.

Soil Type 1

Medium over heavy textured restored soil (Unit T1/S1).
Full profile description, tables 1, 2, 3 and 4.
The soil is formed on restored medium to heavy textured boulder clay. It is characterised by medium to heavy textured topsoils over very poorly structured medium to heavy textured subsoils.

### 6.2 SOIL RESOURCES

(i) Topsoil T1.

This topsoil occurs across the whole site. It is medium to heavy textured usually medium clay loam or heavy clay loam and very slightly stony. Topsoils contained up to 15% volume of subsoil material. It has a mainly moderately developed medium angular blocky structure with occasional weakly to moderately developed medium platy structure. It contains many fine fibrous roots. Mean topsoil thickness is 27 cm, however this includes a wide variation in depth of between 12 cm and 40 cm.

(ii) SUBSOIL S1

This subsoil occurs over the whole site. It is medium to heavy textured and very slightly stony. It has a massive to weakly developed coarse platy structure and an extremely firm soil strength. Roots are present at between a minimum of 38 cm and a maximum of 58 cm. Dry bulk density is over 1.5 g/cm$^3$. This subsoil has a mean thickness of 70 cm.

## 7. DISCUSSION

7.1 Although the mean depths of topsoil and subsoil are similar to the planned restoration profiles quoted in the planning application, there is significant variation in topsoil and subsoil depth over the site. Topsoil texture has remained similar and structure is now medium angular blocky rather than the coarse subangular blocky before restoration. Subsoils comprise of one unit. It is massive to weakly developed coarse platy with a medium to heavy texture. Root penetration is limited to between 38 cm and 58 cm depth.

7.2 Macrofauna such as earthworms were not observed in the topsoil or in the subsoil.

7.3 Topsoils in places contained considerable volumes of subsoil up to 15%. Subsoils were generally poorer structured and heavier textured that the topsoil and incorporation of such material in the topsoil is likely to reduce the workability and increase the wetness limitation of the land. However the volume of subsoil mixed into the topsoil will not limit ALC grade to any worse than Subgrade 3b.

7.4 Evidence of severe anerobism, such as a foul smelling bluish grey subsoil was not found on the site.

7.5 Information from the four profile pits and examination of the working methods plan suggests that subsoil compaction is slightly less of a problem in the void compared with areas used to store soil and overburden.

7.6 Soils were stripped and stored as one topsoil and one subsoil. Soils on the land graded 3a (1.2 ha) prior to working were not treated separately and are likely to have become mixed with soils from the 3b land.

## 8. SOIL PROFILE DESCRIPTIONS

### 8.1 Table 1

Profile pit at Boring 10.
Slope and Aspect 1° East
Land Use: Ley Grass
Weather: Frosty, overcast

| Depth (cm) | Horizon Description |
|---|---|
| 0 - 18 | Dark greyish brown (10YR4/2); unmottled; heavy clay loam; stoneless; slightly moist; moderately developed medium angular blocky and moderately developed medium platy structure; firm; >0.5% biopores; mean dry bulk density 1.62 g/cm³; 15% subsoil mixing; many fine fibrous roots; macrofauna absent; non-calcareous; moderately stocky; moderately plastic; no evidence of anerobism; abrupt irregular boundary. |
| 18 - 54 | Brown (10YR5/3) with many brownish yellow (10YR6/8) mottles; heavy clay loam; very slightly stony with 2% hard stones; slightly moist; weakly developed coarse platy; extremely firm; <.5% biospores; mean dry bulk density 1.72 g/cm³; few very fine fibrous roots to 44 cm depth; macrofauna absent; non-calcareous; moderately sticky; very plastic; no evidence of anerobism; abrupt smooth boundary. |
| 54 - 100 | Grey (N/6) with common diffuse brownish yellow (10YR6/8) mottles; clay; very slightly stony with 2% hard stones; slightly moist; massive; extremely firm; <0.5% biopores; mean dry bulk density 1.77 g/cm³; no-roots; macrofauna absent; moderately sticky; very plastic; no evidence of anerobism; non-calcareous. |

8.2 Table 2

Profile pit at Boring 13
Slope and Aspect 4° South
Land Use: Ley Grass
Weather: Frost, light snow.

| Depth (cm) | Horizon Description |
|---|---|
| 0 - 38 | Greyish brown (10 YR5/2); unmottled; medium clay loam; very slightly stony with 2% hard stones; moist; compound: weakly developed coarse subangular and weakly developed medium angular blocky; firm; >0.5% biospores; mean dry bulk density 1.49 g/cm$^3$; no mixing of topsoil/subsoil; many fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky; moderately plastic; no evidence of anerobism; clear wavy boundary. |
| 38 - 120 | Reddish brown (5YR5/3) ped face with Grey (10YR56/1) and Grey (5YR5/1) matrix with many brownish diffuse (10YR6/8) mottles; medium clay loam; very slightly stony with 2% hard stones; moist; massive to weakly developed coarse platy; <0.05% biopores; mean dry bulk density 1.68 g/cm$^3$ very few fine fibrous roots to 58 cm; macrofauna absent; non-calcareous; very sticky, very plastic; no evidence of anerobism. |

8.3 Table 3

Profile pit at Boring 6
*Slope and Aspect 0°*
Land Use: Ley Grass
Weather: Frost, light snow.

| **Depth (cm)** | **Horizon Description** |
|---|---|
| 0 - 26 | Dark greyish brown (10YR4/2); unmottled; medium clay loam; very slightly stony with 1% hard stones; moist; moderately developed medium and coarse angular blocky structure; firm; >0.5% biopores; mean dry bulk density 1.41g/cm$^3$ 15% subsoil/topsoil mixing; many fine and very fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky, moderately plastic; no evidence of anerobism; abrupt wavy boundary. |
| 26 - 93 | Reddish brown (5YR5/3) with common distinct brown (10YR5/3) and brownish yellow (10YR6/8) mottles; medium clay loam; very slightly stony with 3% hard stones; moist; massive structure; very firm; <0.05% biopores; mean dry bulk density 1.69 g/cm$^3$; few fine fibrous roots to 38 cm; macrofauna absent; non-calcareous; very sticky, very plastic; no evidence of anerobism; abrupt smooth boundary. |
| 93+ | Grey (N/5) overburden. |

8.4 Table 4

*Profile pit at Boring 3*
Slope and Aspect 1° East
Land Use: Ley Grass
Weather: Frost, light snow.

| Depth (cm) | Horizon Description |
|---|---|
| 0 - 18 | Brown (75YR5/2) Ped and greyish brown (10YR5/2) matrix; unmottled; heavy clay loam; very slightly stony with 2% hard stones; moist; moderately developed medium platy and medium angular blocky structure; firm; >0.5% biopores; mean dry bulk density 1.41 g/cm$^3$; 15% subsoil/topsoil mixing; many fine fibrous roots; macrofauna absent; non calcareous; moderately sticky, moderately plastic; no evidence of anerobism; abrupt irregular boundary. |
| 18 - 60 | Brown (75YR5/4) with common diffuse brownish yellow (10YR6/8) mottles; sandy clay loam; very slightly stony with 2% hard stones; moist; massive structure; extremely firm; <0.05% biopores; mean dry bulk density 1.50 g/cm$^3$; very few fine fibrous roots to 41 cm; macrofauna absent; non-calcareous; very sticky; very plastic; no evidence of anerobism. |
| 60+ | Medium sand saturated with water. Water entering pit at 41 cm depth. |

RPT FILE: 2 FCS 11175
Leeds Statutory Group