AGRICULTURAL LAND CLASSIFICATION
AND SOIL SURVEY
N.E. OPEN CAST COAL SITES
SURVEY OF RESTORED LAND AT
DAISY HILL EXTENSION,
COUNTY DURHAM
DECEMBER 1995

ADAS
Leeds Statutory Group

Job No:- 224/95
MAFF Ref:- EL 10840
Commission No:- N2220

SUMMARY

Soils on the restored opencast coal site at Daisy Hill (Extension) were surveyed in December 1995. Soils were examined with hand auger borings and shallow profile pits at a density of one per hectare and full depth soil profile pits at a density of one per four hectares.

Over most of the site light textured topsoils overlie compacted, very slowly permeable light textured subsoils. The site is currently in aftercare but provisional ALC gradings have been made. The moderate and gentle slopes found in the south of the site contain land in Subgrade 3b subject to a soil wetness and workability limitation. More level slopes in the north contain land which is likely to receive water from upslope. Also reduced slopes will make drainage of water over the surface and through the topsoil very slow and lead to a more severe soil wetness limitation of Grade 4.

In future following aftercare the ALC grade of the land will depend largely on the degree of structural development in the subsoil. Were subsoils to remain very coarse or massive structured the land will remain Subgrade 3b. However if subsoils show significant structural improvement so that they became slowly permeable rather than very slowly permeable the land would mostly meet the requirements for Subgrade 3a.

CONTENTS

MAPS

AGRICULTURAL LAND CLASSIFICATION REPORT FOR NE OPENCAST COAL SITES. RESTORED LAND AT DAISY HILL EXTENSION, COUNTY DURHAM

1. Introduction and History

1.1 Daisy Hill Extension Opencast Coal Site is located 6 km north west of Durham City centre between the villages of Sacriston and Nettlesworth. It has a centroid grid reference of NZ249479. This report refers to a 18 ha extension to the main Dewley Hill site which comprised over 100 ha of land.

1.2 The extension site received planning permission for open cast coal extraction in March 1992 and was operated by British Coal Opencast. Soils were stripped by wheeled motor scraper and stored in mounds round the periphery of the site in 1992. Progressive stripping and restoration was not attempted. Topsoils and subsoils were replaced during early summer 1994 by wheeled motor scraper. Soils were stored in mounds for a maximum of 2 years. Topsoils once replaced were cultivated and stones larger than 100 mm were removed. Subsoils were replaced in two 450 mm layers each ripped and stones larger than 300 mm removed. The site was underdrained in late July, early August 1995 following subsoiling in August that year.

1.3 It was sown to grass in late September to early October 1995, following a grass crop that year. When inspected in December 1995 this reseed was only just emerging and the soil had a very poor crop cover. Part of the site has been restored to woodland.

1.4 A pre working ALC and Statement of Physical Characteristics report for the site was produced by Resource Planning Team, ADAS Leeds, in 1991. This identified 16.9 ha of Subgrade 3a land and 0.8 ha of Non Agricultural land.

1.5 One soil type was identified by the 1991 survey. It consisted of a medium textured topsoil (usually medium clay loam) over a medium to heavy textured subsoil (medium to heavy clay loam or sandy clay loam).

2. Climate

Grid Reference	: NZ249479
Altitude (m)	: 100
Accumulated Temperature above 0°C (January - June)	: 1255 day °C
Average Annual Rainfall (mm)	: 697
Climatic Grade	: 2
Field Capacity Days	: 174
Moisture Deficit (mm) Wheat	: 88
Moisture Deficit (mm) Potatoes	: 73

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 O.S. National Grid. A further three full profile pits were dug to 120 cm or overburden. Samples were collected for laboratory analysis of bulk density and particle size distribution. Attempt was made to dig a fourth pit in the north of the site but this filled up with water almost to the surface before it could be described.

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. Slope, Aspect and Relief

The south of the site contains moderate or gentle slopes with a northerly aspect. Land in the north is level in places. Altitude ranges from 115 A.O.D. in the south to 90 m in the north.

5. AGRICULTURAL LAND CLASSIFICATION

The ALC grades occurring on this site are as follows:

Grade/Subgrade	Hectares	Percentage of Total Area
1		
2		
3a		
3b	9.1	51
4	5.6	31
5		
(Sub total)	(14.7)	(82)
Other Land	3.3	8
TOTAL	18.0	100

The site was only restored in Summer 1994 and has not yet completed its Statutory Aftercare period. Underdrainage has not been installed and soil structure 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 confirm land quality on the site.

5. Subgrade 3b

This Subgrade is found on the moderate and gently sloping land predominantly found in the south of the site. Topsoils are typically medium sandy loam over coarse or massive structured subsoils with a high bulk density which are likely to have low porosity and permeability. However this part of the site does contain slopes up to 7° which will encourage the drainage of water over the surface and through the permeable topsoil. This will help to improve drainage which would otherwise be severely impeded. Soil wetness and workability will still limit this land to Subgrade 3b.

5.2 Grade 4

This land is found on the level or almost level slopes in the north of the site. Again topsoils are typically medium sandy loam. Subsoils are similar textured, with a high bulk density and generally a massive structure. Water is likely to permeate through subsoils very slowly and horizontal movement of water is restricted by a lack of gradient. Consequently this land is likely to be wet for long periods of time. This soil wetness and associated soil workability problems limit this land to Grade 4.

5.3 Other Land

This includes land recently planted with tree saplings.

5.4 Likely Future ALC

Topsoils and subsoils on the site are both predominantly light textured. Generally light textured topsoils suffer less from wetness and workability problems than soils with a greater clay content. Also light textured subsoils are inherently better drained than those of more clayey soils. However, during the process of restoration subsoils have developed very coarse or massive structures and have high bulk densities. Drainage of water through the subsoil is likely to be very slow so long as these conditions prevail. It is the structural condition of the subsoils that is critical to the likely future ALC grade of this land. Unless subsoil structures improve (become less coarse or cease to be massive) the whole site is likely to be classified 3b subject to wetness and workability limitations. However were structures to improve significantly during aftercare this land could meet the criteria for Subgrade 3a.

6. Description of Restored Soils

6.1 The site contains one soil type descriptions of which are given below.

Soil Type 1

Light textured soil (T1/S1) Full profile description tables 1, 2 & 3.

This soil is formed on restored light textured drift deposits. Topsoils and subsoils are relatively uniform in character. Topsoils are typically light textured over similar or occasionally medium textured poorly structured subsoils.

6.2 SOIL RESOURCES

(i) Topsoil T1

This soil occurs across the whole site. It is light textured, typically medium sandy loam and very slightly stony. It has a moderately developed medium to coarse angular blocky structure and many fine fibrous roots. Mean topsoil depth is 26 cm.

(ii) Subsoil S1

This subsoil occurs below topsoil T1 and is found across the whole site. It is light or very occasionally medium textured and very slightly stony. It has a poorly developed massive to very coarse platy structure and extremely firm soil strength. Roots were absent below 60 cm depth and the bulk density over 1.8 g/cm^3. The subsoil has a mean thickness of 74cm.

7. Discussion

7.1 Restoration has achieved a relatively uniform distribution of soils across the site. Topsoils

show only minor variations in thickness and appear to have retained most of their structural conditions. Topsoil and subsoil textures as confirmed by laboratory analysis appear lighter on the restored land than was observed on the pre-working survey. Samples suggest restored topsoils and subsoils were mostly a medium sandy loam (average 16% clay) but the pre-working survey found topsoils and subsoils to be mostly sandy clay loam with an average 20% clay. However, these results are based upon only six sets of samples from each survey. No material is known to have been either imported or exported from the site during mineral workings but some lighter textured (sandy) material from below the subsoil could have been incorporated with topsoils and subsoils during the normal process of stripping and restoration.

7.2 The subsoil appears to have lost much of its original structural condition. Roots penetrated to a maximum of 60 cm depth and the bulk density was 1.8 to 1.9 g/cm^3. These bulk density values are similar to those observed in subsoils in other sites where wheeled motor scrapers were used.

7.3 Survey of the site has followed a period of very wet weather. The site had only been recently reseeded and grass cover was very poor. During the survey topsoils were mostly wet and cracks appeared in the topsoil parallel to the slope contours suggesting that topsoils were starting to become plastic and flow downhill. Earlier establishment of a grass crop may help to reduce this problem by both holding the topsoil peds together and reducing wetness via increased transpiration over the autumn.

7.4 Study of the 3 profile pits and the working methods plan indicate that the highest subsoil bulk density value was found in the north east of the site which was used for soil storage. The lowest value was observed in the south of the site in an area shown as part of the void.

8. Soil Profile Description

8.1 Table 1

Profile pit at boring 1

Slope and Aspect 0°

Land Use Recent Grass reseed

Weather Wintery showers.

Depth cm	Horizon Description
0 - 32	Very dark greyish brown (10YR3/2); unmottled; medium sandy loam with 10% volume subsoil; slightly stony with 6% sandstones and shales; very moist, moderately developed medium subangular blocky; friable; >0.5% biopores; mean bulk density 1.42 g/cm³; many fine and very fine fibrous roots; macrofauna absent; non calcareous; moderately sticky; moderately plastic; no evidence of anerobism; abrupt wavy boundary.
32 - 92	Greyish brown (10YR5/2) and brown (10YR4/3) matrix with common distinct yellowish brown (10YR5/6) mottles; medium clay loam/medium sandy silt loam (18% clay, 37% silt, 45% sandy by PSD determination); slightly stony with 8% sandstones and shales; slightly moist; very coarse platy to massive, extremely firm; <0.05% biospores; mean bulk density 1.90 g/cm³; common fine fibrous roots to 43 cm none below 43 cm; macrofauna absent; non calcareous; moderately sticky moderately plastic; no evidence of anerobism; abrupt wavy boundary.
92+	Grey (NS) overburden.

8.2 Table 2

Profile pit adjacent to boring 8

Slope and Aspect 0°

Land Use Recent Grass reseed

Weather Snow showers.

Depth cm	Horizon Description
0 -20	Dark brown (10YR3/3) unmottled; medium sandy loam; very slightly stony with 5% sandstones; wet; moderately developed medium angular blocky; firm to very firm; >0.5% biopores; mean bulk density 1.32 g/cm^3; many fine and very fine fibrous roots; macrofauna absent; non calcareous; moderately sticky; moderately plastic; no evidence of anerobism; clear smooth boundary;
20 - 56	Brown (10YR5/3) with a few distinct brownish yellow (10YR6/6) mottles; medium sandy loam; very slightly stony with 5% sandstones; moist; massive; extremely firm; <0.05% biopores; mean bulk density 1.91 g/cm^3; few fine fibrous roots to 30 cm, none below 30 cm; macrofauna absent; no evidence of anerobism; moderately sticky; moderately plastic; smooth clear boundary.
56 +	Grey (N5) overburden.

8.3 Table 3

Profile pit adjacent to boring 18

Slope and Aspect 3°S

Land Use Recent Grass reseed

Weather Snow showers.

Depth cm	Horizon Description
0 - 29	Dark grey (10YR4/1); unmottled; medium sandy loam with 5% volume of subsoil; very slightly stony with 5% sandstones; wet; moderately developed coarse subangular blocky; firm; >0.5% biopores; mean bulk density 1.76 g/cm^3; many fine and very fine fibrous roots; macrofauna absent; non calcareous; moderately sticky; moderately plastic; no evidence of anerobism; clear smooth boundary water seeping into pit at 29 cm.
29 - 120	Brown (10YR4/3) with common distinct yellowish brown 10YR5/6) mottles; medium sandy silt loam; very slightly stony with 4% sandstones; moist; weakly developed very coarse platy; extremely firm; <0.05% biopores; mean bulk density 1.76 g/cm^3 few very fine fibrous roots to 60 cm non below 60 cm; macrofauna absent; non calcareous; moderately sticky; moderately plastic; no evidence of anerobism.

RPT FILE: 2 FCS 11176

Leeds Statutory Group

MAPS