MAFF Ministry of Agriculture Fisheries and Food

AGRICULTURAL LAND CLASSIFICATION
AND SOIL SURVEY
N.E. OPEN CAST COAL SITES
SURVEY OF RESTORED LAND AT
DEWLEY MILL, TYNE & WEAR

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SUMMARY

A survey of land and soils at the restored opencast coal site at Dewley Mill, Tyne and Wear, was carried out in November and December 1995.

One relatively uniform soil type was identified by the survey. It comprises a light to medium textured topsoil over a generally medium textured poorly structured upper subsoil and a medium to heavy textured lower subsoil.

Currently 9.8 ha are Subgrade 3b and 6.6 ha Grade 4. Soil wetness and workability limitations limit the ALC grade in both cases. This limitation is however more severe on the Grade 4 land which does not benefit from slopes significant enough to assist drainage.

However following aftercare it is possible that some land could meet the criteria for Subgrade 3a and land currently graded 4 will meet the criteria for 3b. This process will depend upon the degree of improvement in subsoil structure that occurs during aftercare.

These results at present suggest an overall lowering of land quality on the site following restoration when compared to ALC grades observed on the pre-working survey.

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AGRICULTURAL LAND CLASSIFICATION REPORT AND SOIL SURVEY N.E. OPEN CAST COAL SITES. RESTORED LAND AT DEWLEY MILL, TYNE & WEAR

1. INTRODUCTION AND SITE HISTORY

Dewley Mill Opencast Coal Site is located approximately 2km beyond the western outskirts of Newcastle upon Tyne just to the north of the A69(T) and east of the B6328. It has a centroid grid reference of NZ159 679.

1.1 The site was operated by H.J. Banks & Co Ltd. Soils were stripped by tractor and box methods and stored in storage mounds for up to 3 years without progressive restoration. Topsoils and all upper subsoils were replaced by tractor and scraper box method. Some lower subsoils were replaced by wheeled motor scraper, the remainder by tractor and scraper box. Subsoils were replaced in two layers with poor quality material used in the lower subsoil and at least 45cm of higher quality material used in the upper subsoil. Restored profiles were specified to have 26cm topsoil and 90cm subsoil. Part of the original site was a waste (non-agricultural) area. During restoration soils were spread over the whole site including this waste area. Restoration was completed in June 1994. Underdrainage is planned for 1996. Currently, most of the site is in a grass clover ley with some areas designated for amenity, a pond, and woodland.

1.2 A pre-working ALC and Soils Report for the site conducted by Resource Planning Team, ADAS Leeds in 1989 identified 14 ha of Grade 2 land, 3 ha of Subgrade 3b and 6 ha of derelict land and existing quarry. However 5 ha of the 14 ha of Grade 2 land around the Dewley Hill tumulus surveyed originally, were never worked for O.C.C. and are not covered by this restoration survey. Therefore the area covered by this survey contained in 1989, 9 ha Grade 2, 3 ha 3b and 6 ha derelict or urban.

1.3 One soil type was identified in the 1989 survey. It was a well drained soil with a sandy loam topsoil. Subsoils over the whole site contained 50% volume light textured material (sandy loam) and 40% volume medium and heavy textured material and 10% waste. The light textured soils were found in the Grade 2 areas. However these figures probably overestimate the volume of light textured subsoils as they include the 5 ha of light textured Grade 2 soils around the tumulus that were never worked. The presence or type of any soil types stored in the quarry being worked in 1989 are not known. However a 1982 RPT survey of this area for which auger boring records exist, show it to contain sandy clay

loam topsoils over clayey textured subsoils, and it was classed as Subgrade 3b. It is, therefore, estimated that the site finally worked comprised approximately half/medium to heavy textured soils originally from 3b land and half light to medium textured soils from Grade 2 land.

2. CLIMATE DATA

Grid Reference	: NZ 159 679
Altitude (m)	: 80
Accumulated Temperature above 0°C (January - June)	: 1271 day °C
Average Annual Rainfall (mm)	: 691
Climatic Grade	: 2
Field Capacity Days	: 176
Moisture Deficit (mm) Wheat	: 88
Moisture Deficit (mm) Potatoes	: 73

3. SURVEY METHODS

Soils on the site were examined using hand auger borings to 120cm depth and a shallow profile pit 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 three full profile pits were dug to 120cm 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 sloping land with fields sloping towards the Dewley Burn which bisects the site and flows in an easterly direction. The north of the site has a southerly aspect and the south of the site faces north. Slopes are greatest within 100m of the burn.

5. AGRICULTURAL LAND CLASSIFICATION

The ALC grades occurring on this site are as follows:

Grade/Subgrade	Hectares	% of Total Area
1		
2		
3a		
3b	9.8	54.4
4	6.6	36.7
5		
(Sub total)	(16.4)	91.1
Other Land	1.6	8.9
TOTAL	**18.0**	**100**

This site was only restored in June 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 gently sloping land either side of the Dewley Burn and more extensively in the south-west of the site. Topsoils are typically either medium sandy loam or sandy clay loam textured. Upper subsoils are typically a slowly permeable medium clay loam or sandy clay loam over a very poorly structured sandy clay loam or heavy clay loam lower subsoil which has very low porosity and permeability. However slopes of over 2° will allow excess water to drain either over the surface or through the permeable topsoil. Soil wetness and workability does however still impose a considerable limitation on ALC grade.

5.2 GRADE 4

Two areas of land are graded 4, one in the north, the other in the south-east of the site. Both areas contain level or almost level slopes. Topsoils are typically medium sandy loam or sandy clay loam over sandy clay loam or heavy clay loam upper and lower subsoils. Upper and lower subsoils are both very poorly structured and have a high bulk density, and are likely to have very low permeability. These areas do not contain slopes that will encourage the drainage of excess water. Soils are therefore likely to be wet for considerable periods of time and soil wetness and workability will limit the ALC to Grade 4.

5.3 OTHER LAND

This includes land fenced off for woodland and a pond.

5.4 *LIKELY FUTURE ALC*

Survey evidence suggests that lighter textured soils from land previously Grade 2 have been mixed during either soil stripping, storage or replacement with heavier textured subsoils from both land formerly Subgrade 3b and the soils stored at quarry being worked in 1989. Subsoils on the site are now all medium to heavy textured and 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. Combined with sandy loam or sandy clay loam topsoils and a slowly permeable subsoil, it is likely that all agricultural land on the site will meet the criteria for Subgrade 3b.

5.5 However were subsoils to show a considerable improvement in structure over time so that they were permeable to within at least 40 cm depth and slowly permeable below this depth then it is possible the land would meet the criteria for Subgrade 3a. Again soil wetness and workability would still be limiting but to a lesser extent. For land to meet the criteria for Grade 2 soil wetness and workability limitations would have to be less than for Subgrade 3a land. As explained in 5.4 above, although the site did contain lighter textured land Graded 2 prior to working it appears those soils have been mixed with other heavier textured material. The benefit they provide to land quality is therefore effectively lost. It is also unlikely that existing subsoils will improve in structure over the long term sufficiently to meet the requirements for Grade 2 which are even stricter than those for Subgrade 3A. For these reasons, it is very unlikely that any land on the site will meet the criteria for Grade 2 in the long term.

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

Light to Medium textured restored soil (T1/US1/LS1) Full profile description tables 1, 2 and 3.

This soil is formed on restored medium to light textured drift. It is characterised by medium to light textured topsoils over poorly structured medium textured subsoils.

6.2 SOIL RESOURCES

(i) Topsoil T1

This soil occurs across the whole site. It is medium to light textured, usually medium sandy loam or sandy clay loam and very slightly stony. It has a moderately to strongly developed medium subangular blocky structure and abundant fine fibrous roots. Mean topsoil thickness is 30cm.

(ii) Upper Subsoil US1

The upper subsoil is found below topsoil T1. It is usually medium textured and very slightly stony. The structure is weakly developed coarse or very coarse angular blocky with a firm consistence. Mean upper subsoil thickness is 35cm.

(iii) Lower Subsoil LS1

The lower subsoil occurs between upper subsoil US1 and grey overburden below. It is medium to heavy textured and very slightly stony. It has a poorly developed very coarse platy or angular to massive structure and an extremely firm soil strength. Roots are absent and the bulk density is over 1.7gcm^{-3}. The lower subsoil has a mean thickness of 45cm.

7. DISCUSSION

7.1 Restoration has achieved a relatively uniform distribution of soils across the site. Topsoils have retained most of their textural and structural conditions. Subsoils appear to comprise an upper and lower subsoil. The upper subsoil is usually medium textured with weakly developed coarse structure. The lower subsoil is medium to heavy textured with a very poor to massive structure. Roots have not yet penetrated this horizon.

7.2 It would appear that during restoration, the lighter and heavier textured subsoils were mixed. The better structure and drainage originally observed in soils on the Grade 2 land seems to have been lost when this material was combined during restoration with the heavier soils from the other half of the site which was originally Subgrade 3b.

7.3 Lower subsoils have a higher bulk density, higher clay content and generally a coarser structure than the upper subsoil. Some lower subsoils were restored with a wheeled motor scraper and remaining lower subsoils were replaced using a shovel and dump truck. Upper subsoils were replaced with a shovel and dump truck. It is likely that the use of a wheeled motor scraper has contributed towards the worse structure and high bulk densities found in the lower subsoils.

7.4 Macrofauna such as earthworms were observed in some but not all topsoils examined on the site. However there was no evidence of macrofauna in any subsoil horizons.

7.5 Evidence of a servere anerobic problem, such as a foul smelling, bluish-grey subsoil was not found on the site.

7.6 A study was made of the 3 profile pits dug on the site and the working methods plan. Attempt was made to identify differences in soil structure between void and storage areas. There is no significant difference in subsoil structure between void and storage areas on the site.

8. SOIL PROFILE DESCRIPTIONS

8.1 Table 1
Profile Pit at Boring 6
Slope and Aspect 2°S
Land Use : Ley grass
Weather : Dull, overcast, cool

Depth (cm)	Horizon/Description
0-27	Very dark grey (10YR3/1); unmottled; sandy clay loam; very slightly stony with 2% sandstones and coal fragments; very moist; moderately developed medium subangular blocky; friable; >0.5% biopores; mean bulk density 1.19 gcm-³; abundant fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky; moderately plastic; no evidence of anerobism; abrupt wavy boundary.
27-72	Greyish brown (10YR5/2) with common district grey (10YR6/1) and brownish yellow (10YR6/8) mottles; clay; very slightly stony with 2% sandstones; moist; weakly developed very coarse angular blocky; firm; <0.05% biopores; mean bulk density 1.72 gcm-³; common fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky; very plastic; no evidence of anerobism; clear irregular boundary.
72-98	Brown (10YR5/3) with many reddish yellow (7.5YR6/8) and grey (10YR6/1) mottles; clay; very slightly stony with 2% sandstones; slightly moist; massive; extremely hard; <0.05% biopores; mean bulk density 1.94 gcm-³; no roots; macrofauna absent; moderately sticky, very plastic; no evidence of anerobism; non-calcareous; abrupt wavy boundary to grey (5Y5/1) overburden

8.2 Table 2

Profile Pit at Boring 19

Slope and Aspect 1°N

Land use : Ley grass

Weather : Dull, overcast and cold

Depth cm	Horizon/Description
0-26	Very dark greyish brown (10YR3/1); unmottled; medium clay loam; with 2% heavy clay loam subsoil/mixing; very slightly stony with 2% sandstones; moist; moderately developed medium subangular blocky; friable; >0.5% biopores; mean bulk density 1.35 gcm^{-3}; many fine fibrous roots; macro fauna absent; non-calcareous; moderately sticky; moderately plastic; no evidence of anerobism; abrupt smooth boundary;
26-63	Very dark greyish brown (10Y3/2) with common distinct reddish yellow (7.5YR6/8) and grey (10YR6/1) mottles; medium clay loam; very slightly stony with 3% sandstones; wet; weakly developed coarse angular blocky; firm; <0.5% biopores; mean bulk density 1.71 gcm^{-3}; common very fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky; moderately plastic; no evidence of anerobism; clear smooth boundary.
63-113	Dark greyish brown (10YR4/2) with common distinct brownish yellow (10YR6/8) and grey (10YR6/1) mottles; heavy clay loam; very slightly stony with 4% sandstone; slightly moist; weakly developed angular blocky to massive; extremely firm; <0.05% biopores; mean bulk density 1.72 gcm^{-3}; no roots; macrofauna absent; non-calcareous; moderately sticky; very plastic; no evidence of anerobism; clear smooth boundary to grey (N5) overburden.

8.3 Table 3

Profile Pit at Boring 17

Slope & Aspect 0°

Land Use : Ley grass

Weather : Dull, overcast and cool

Depth cm	Horizon/Description
0-24	Very dark greyish brown (10YR3/2); unmottled; medium sandy loam; very slightly stony with 4% sandstones; moist; strongly developed medium subangular blocky; friable; >0.5% biopores; mean bulk density 1.22 gcm^{-3}; abundant fine fibrous roots; earthworms present; non-calcareous; moderately sticky; moderately plastic; no evidence of anerobism; sharp smooth boundary.
24-53	Brown (10YR5/3) with few distinct brownish yellow (10YR6/6) mottles; sandy clay loam; very slightly stony with 3% sandstones; very moist; weakly developed coarse angular blocky; firm; <0.05% biopores; mean bulk density 1.42 gcm^{-3}; common fine fibrous roots; macrofauna absent; non-calcareous; moderately sticky; very plastic; no evidence of anerobism, clear way boundary.
53-120	Very dark greyish brown (10YR3/2) with few distinct grey (2.5Y5/1) and light olive brown (2.5Y5/6) mottles; heavy clay loam; stoneless; slightly moist; weakly developed very coarse platy; extremely firm; <0.05% biopores; mean bulk density 1.83gcm^{-3}; no roots; macrofauna absent; non-calcareous; moderately sticky, moderately plastic; no evidence of anerobism; water seeping laterally into pit at 53 cm (base of 2nd horizon).

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MAPS