FURNACE HILLOCK, OPENCAST COAL SITE, CHESTERFIELD

## Introduction

This 42 hectare site lies 2 km southeast of Chesterfield centre adjoining the built up edge of the town and sandwiched between the B6038 to the south and the B6039 to the north. The site adjoins residential development to the north and a formally restored opencast coal site to the south, part of which forms part of this site.

The site is gently sloping in form of a very shallow valley with the lowest part running through the centre of the site taking the drainage water away from the site both northwards and southwards. The highest point is at 115 m at the western end of the site from which the site falls gently towards the middle which is also the lowest point at 96 m. There are no site limitations to the agricultural use of this land.

The area receives an average annual rainfall of approximately 745 mm and has a mean accumulated temperature above $0^{o}C$ (January-June) of 1,330 making the site very marginal for grade 1 land. The rainfall is relatively evenly distributed throughout the year with a slightly drier period from February-June. The balance between summer rainfall and evapo transpiration creates a moisture deficit of 94 mm for wheat and 80 mm for potatoes, the mean date of last frost is mid May and the growing season lasts about 240 days from late March to late November. The natural soils found on the western part of the site derive from the Middle Coal Measures of inter-bedded sandstones, shales and coal seams. The eastern part of the site forms part of a former opencast coal site and the soils are considerably disturbed. The natural soils typically have a clay loam topsoil overlying heavy clay loam and clay in the lower subsoils. A Small area in the centre of the site encountered rock between 50 and 80 cms of the surface and in some profiles large flags of sandstone were

encountered (see Pit 1). The main limitations to the agricultural use of the land is soil wetness which restricts the the range of crops that can be grown and the period during which non-damaging mechanical operations can be carried out.

The land was surveyed during March and April 1990 using a 110 cm dutch soil auger with borings taken on a 100 m grid with two soil pits dug to examine subsoil structures found on site. At the time of survey the undisturbed soils were growing winter barley and the restored opencast coal site was under a fairly patchy grass crop.

Agricultural Land Classification

**Grade 3A Land** occupies 2·5 ha and accounts for 6 % of the site. This land occurs near the western edge of the site where the clay loam topsoils overlie subsoils of variable composition with rock or flaky sandstone layers and associated lighter sandy silt loam lenses within 80 cm of the surface. However other soils have clay subsoils.

Most of the soils fall into wetness class III with gleying occurring from between 25-45 cm and slowly permeable layers occurring between 45 and 65 cms. The soils are very slightly stony in the topsoil and have stony, flaggy sandstone layers throughout the subsoil. The main limitation to the agricultural use of this land is soil wetness allied to the moderately heavy topsoil textures which reduce the period during which non damaging farm operations can be undertaken.

**Grade 3b Land** covers 16·6 ha and accounts for 39·5 % of the site. This land covers the majority of the undisturbed part of the site. The soils are relatively uniform having either clay loam or heavy clay loam topsoils overlying heavy clay loam subsoils with clay usually encountered within 50 cm of the surface. In some places the clay is encountered below this depth and in other

isolated instances the auger hit rock with in 100 cms of the surface. The soils are generally wetness class III or IV, the latter having a clay loam topsoil whilst the former can have either clay loam or heavy clay loam topsoils. The main limitation to the agricultural use of this land is soil wetness the soils generally being wetter or having a heavier topsoil texture than the grade 3a land.

**Grade 4 Land** Occupies 20.4 ha and accounts for 53.3 % of the site. This single block of land occupies the eastern end of the site and corresponds to the former opencast coal site. The topsoils exhibits similar variation to that found on the undisturbed land though within the clay loam or heavy clay loam topsoils there are frequent inclusions of grey clay subsoil. The gleyed, often compacted clay subsoil lies immediately below the topsoil. These soils suffer from prolonged water logging and are generally only suitable for growing grass.

**Non Agricultural Land** Occupies 0.5 ha and accounts for 1.2 % of the site. This small parcel of land in the southwest corner is composed of scrub woodland and waste ground on the site of a former railway.

REPORT OF SOIL RESOURCES

Soils found on site can readily be divided into two; the undisturbed and the recently restored opencast land.

Soil Unit I covers 20 ha and accounts for 48 % of the site. These "natural" soils are relatively uniform having either clay loam or more rarely heavy clay loam topsoil textures passing into heavy, gleyed subsoil textures and with clay normally encountered within 50 cms. There is a small area (borings 2, 7, 8, 14, 19 and 25) where flaggy sandstone layers (rock) is encountered within the soil profile and this prevented augering to a full 100 cms.

The soil profiles associated with these sandstone layers do tend to have lenses of lighter textured (sandy silt loam or sandy loam) material but it is too sporadic and not sufficiently extensive to warrant separate treatment or mapping. Soil pit 1 provides a fairly typical profile of this soil unit and is described below:

Pit 1

0-27 cms 10 YR 3/2 clay loam. No mottles observed. Occasional coal fragments. Moderately developed coarse sub-angular blocky structures. No stone observed. Few to common roots. Less than 0.1% porosity within peds. Slight soil compaction detectable at 22 cms.

27-61 cms 10 YR 5/4 and 6/4 clay loam with some sandy loam and sandy silt loam lenses. Common distinct ochreous mottles (10 YR 6/8 in colour) common roots at the top of the horizon becoming few at the base of the horizon. Moderately developed coarse sub angular blocky structures. 1% porosity within peds. Moderately stony below 35 cms with large (greater than 8 cms) stones.

61-90 cms plus 7.5 YR 5/8 and 7.5 YR 7/2 clay with many distinct grey mottles. Few roots though locally common. Porosity less than 0.1%. Weakly developed very coarse prismatic structure. A few soft weathering sandstone fragments.

Soil Unit II covers 22 ha and accounts for 52.% of the site. This area corresponds to the restored land from the previous phase of opencast working. The soils are relatively uniform with clay loam or heavy clay loam topsoils often of considerable depth eg borings 11, 18, 23, 24, 33, 34, 39, 43 and 44) all have at least 35 cms of topsoil and many have at least 30 cms. Many of the topsoils, although dark brown and organic rich do have lenses of grey clay subsoil. Underlying topsoil is a heavy, often compacted clay subsoil, although in other locations the upper subsoil was relatively well structured and showed signs of soil development. This is particularly well illustrated in soil pit II which is described below.

Soil Pit II

0-22 cms brown 10 YR 3/2 clay loam. Well developed fine sub angular blocky structure to medium granular structure. Abundant root throughout. Few stones. Approximately 0.5% ped porosity. No mottles observed. Inclusions of clay subsoil. Uneven lower boundary bearing from 22-34 cms below the surface.

22-100 cms 10 YR 5/6 clay with 10 YR 5/1 clay inclusions. Many grey and ochreous mottles. Common roots to 50 cms with few roots below 50 cms.

Upper subsoil (22-50 cms) structural development is moderately well developed to cause sub angular blocky structures. Approximately 0.5% pores and less than 2% stones.

Lower subsoil (50-100 cms) structural development is very coarse sub-angular blocky structures. Porosity approximately 0.1%.

Pronounced boundary between topsoil and subsoil with increase in compaction. Many roots penetrating the compacted upper subsoil with few reaching below 50 cms.