Appendix 1 Definitions of coal resource areas

In 2006, the British Geological Survey were commissioned by the Coal Authority to provide coal appraisal maps to show the remaining potential for coal exploitation by opencast and deep mine methods in Great Britain (Jones, 2006b). The study built a series of GIS layers which identified potential resource areas. Three main orders of coal resources (primary, secondary and tertiary) were identified in the study. In addition a fourth category was identified; these are areas where coal is present in the subsurface, buried by less than 50 m. The definitions of the resource areas identified are included below. For the purposes of the current study, only primary and secondary (shallow) coal resources have been examined.

**Primary resource area**
The primary resource area constitutes the main target for opencast coal extraction and comprises a relatively closely spaced succession of variable but generally thick coals. These coals typically occur within a certain discrete stratigraphic interval, which comprises the succession from the middle to upper part of the South Wales and Pennine Lower Coal Measures formations to the lower part of the South Wales and Pennine Upper Coal Measures formations. In other areas e.g. North Staffordshire, the whole of the Pennine Upper Coal Measures Formation contains numerous thick coals and can also be ranked as primary.

**Secondary resource area**
The secondary resource represents one or more zones that contain opencast coal resources, but in which the coals are generally thinner and less concentrated in vertical and areal distribution. Coals from this resource zone have been exploited and continue to be worked, albeit on a smaller scale than the primary area coals.

**Tertiary resource area**
In certain coalfields (e.g. South Wales, Bristol-Somerset) coals are locally present in the Late Carboniferous Warwickshire Group succession. Here they typically occur interbedded with thick sandstones of the Pennant Sandstone Formation and Halesowen Formation. These coals form a resource and some of these coals have been previously deep mined. However, they do not generally form an attractive target for opencast mining due to factors such as high overburden ratios and hardness of the overburden. In the Midlands the Warwickshire Group typically comprises red-bed successions that locally contain individual coals. In other areas of England and Wales thin coals exist in the Namurian. All these types of coal occurrences are grouped together as tertiary resources.

**Fourth resource area - Buried coal resources overlain by up to 50m overburden**
In some areas, particularly down-dip of the main area of mapped resources, coals are present in the subsurface covered by younger strata. A fourth zone was identified, which represents the area where coals are present and overlain by less than 50 m of overburden. In this case the overburden is defined as bedrock; the thickness of superficial deposits was not considered here. In theory such areas may have opencast potential, depending on the thickness and type of overburden and the thickness of the coals below. These underlying coals were not further ranked in terms of whether they represent primary, secondary or tertiary resources.
Appendix 2  Case studies comparing the effects of separation zones

Figure 36 to Figure 40 are examples of the effects of separation zones on equidimensional urban settlements within the Midlands Coalfield when the settlement is analysed in isolation of other settlements. Figure 41 to Figure 45 show the effects on the linear urban settlements in the South Wales Coalfield when the settlement is analysed in isolation of other settlements.

Case studies within the Midlands Coalfield

<table>
<thead>
<tr>
<th>Eastwood</th>
<th>Area km$^2$</th>
<th>%</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban cluster</td>
<td>3.1</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>200m separation zone</td>
<td>8.2</td>
<td>204</td>
<td>104</td>
</tr>
<tr>
<td>350m separation zone</td>
<td>8.1</td>
<td>265</td>
<td>165</td>
</tr>
<tr>
<td>500m separation zone</td>
<td>10.0</td>
<td>325</td>
<td>225</td>
</tr>
</tbody>
</table>

Figure 36 Urban area of Eastwood with separation zones at 200, 350, 500 metres
Figure 37 Urban area of Dronfield with separation zones at 200, 350, 500 metres
Figure 38 Urban area of Sheffield with separation zones at 200, 350, 500 metres

Figure 39 Urban area Conisbrough with separation zones at 200, 350, 500 metres
Figure 40 Urban area of Alfreton with separation zones at 200, 350, 500 metres

Case studies within the South Wales Coalfield

Figure 41 Urban area of Maesteg with separation zones at 200, 350, 500 metres
Figure 42 Urban area of Pontycymer with separation zones at 200, 350, 500 metres

Figure 43 Urban area of Pontyates with separation zones at 200, 350, 500 metres
Figure 44 Urban area of Rhondda with separation zones at 200, 350, 500 metres

Rhondda

Urban Area
200 m separation zone
350 m separation zone
500 m separation zone

Figure 45 Urban area of Aberdare with separation zones at 200, 350, 500 metres

Aberdare

Urban Area
200 m separation zone
350 m separation zone
500 m separation zone
Appendix 3  Determining urban areas and their separation zones

The Ordnance Survey’s large-scale vector dataset, MasterMap®, is (Figure 46) was used to identify the settlements within the coalfield areas.

Figure 46) was used to identify the settlements within the coalfield areas.

In MasterMap® Buildings (in orange) for separate polygons; the yellow areas are classified as General Surfaces – Multi Surfaces and the green areas are ‘General Surfaces Natural’.
In order to identify settlement areas, it was necessary to distinguish whether a property forms part of a settlement or whether it is an isolated property. This was best answered by defining a minimum separation distance between properties. A property that is separated from any other property by a distance greater than the minimum separation distance was classified as isolated. The Welsh study (Lott et al. 2006) set a separation distance of 100 metres (i.e. 50 m from each property) which was in line with that defined for other similar projects in the UK (e.g. Ordnance Survey AGENT project – (Revell, 2004), and Statistics Norway project (Schoning, 1997). Figure 47 shows how this methodology identifies isolated buildings in a small area within the Midlands Coalfield.

Having identified settlement clusters, the OS Address-Point® dataset was used to identify which clusters contained ten dwellings. For this study, as in the two previous BGS studies (Jones, 2006a and Lott et al, 2006), an urban area is defined as a settlement of ten or more properties. However, in rural areas where farms often have several outbuildings settlement clusters were being erroneously classified as urban. To eliminate this, address points were utilised. Only those address points with a relevant urban definition were used (see Appendix 6 for full listing). Finally, removal of the building separation distance (i.e. the original 50 m GIS buffer from each property) produced a dataset that defined the edges of urban areas (Figure 48). The resultant urban clusters match well against the urban areas within OS 10 K raster topography (Figure 49).

The buildings extracted from MasterMap® are shown in red. The pink zone is the 100 m separation zone. Small settlement clusters are formed but most of these would be eliminated as they each have less than 10 buildings.
Figure 47 Rural area showing clusters defined by 100 metres separation

Figure 48 Urban clusters defined by this study for SE30 tile of the Midlands Coalfield
There are a number of limitations of this methodology:

- Where there are areas with no (or few) addressable buildings within the urban area (e.g. such as playing fields, parks etc) they tend to produce small ‘non-urban’ polygons within what is essentially an urban area. However, the use of separation zones will eliminate most of these areas.

- Large building complexes and industrial sites such as power stations, waterworks, chemical works, hospitals, cemeteries and schools generally occupy large areas, but they typically have less than 10 address points associated with them and hence do not always classify as part of the defined settlement areas. If they were required to be included then further processing of the data would be needed.

GIS Methodology

The following methodology was used to define settlements and their separation zones:

1. The MasterMap® data files for all 100 km national grid squares covering the Midlands Resource area were extracted into an ESRI file geodatabase using Feature Manipulation Engine (FME) software.

2. All buildings (FeatureCode=‘10021’) were extracted from OS MasterMap® then clipped to the Midlands area shapefile to create a smaller subset making data manipulation easier. This also ensured that any urban areas that continue across the boundaries were included in the analysis. The curtilage of the properties are not identified in the MasterMap® dataset so were not included in the analysis.

3. Buildings were spatially joined to the OS Address-Point® dataset and only those buildings where BaseFunction had an urban attributed feature code (See Appendix 6 for list) were extracted. This created a dataset of only urban buildings.

4. These buildings were buffered by 50 m (i.e. a separation distance of 100 m) to generate clusters of buildings.
5. Individual building buffers were dissolved to formulate the clusters where buildings are within 100 m of each other.

6. OS Address-Point® data was joined spatially to the dissolved clusters so each had a count of address points within it.

7. The building clusters with 10 or more addresses were selected to produce urban clusters.

8. The buffer effect from the building clusters was removed by using a negative buffer (-50 m) producing a dataset that defines the edge of urban areas or clusters.

9. The urban clusters were then buffered by 200, 350, and 500 metres. This creates the separation zones described in Chapter 4.

10. The urban clusters and their separation zones were then clipped to the Midlands Coalfield study area.

This methodology was then repeated for the South Wales Coalfield.