

## **Technical Note 2 – Bulking of spoil**

Pursuant to Appeal Reference APP/U1050/W/16/3166227 (Hilltop Farm) Regulation 22 request dated 19 July 2017 the appellant is required to supply the following further information:

*Information to address how the proposed increase in levels referred to at ES paragraph 7.4.24 (which states that finished levels will increase by up to 2m relative to existing) would be achieved without importing additional material. The information should have regard to ES paragraph 5.5.2 which states “Only material that arises on site will be used in the restoration of the extraction void. There will be no waste material imported onto the site for restoration.” The information should confirm how the increased levels will be achieved when exporting 175,000 tonnes of coal and without importing fill. If additional fill is required, please state how this has been considered in the assessment particularly with regards to the transport, air quality and noise assessments.*

### **Backfill of Voids**

It is an established fact that placement of backfill materials leads to bulking whereby they will require a greater space than they occupied prior to excavation. In the case of surface coal mining, where the ratio of coal seam thickness is relatively low compared to the overall thickness of the overburden to be removed, the void left by the coal will be incorporated within the overall capacity required to take account of bulking of the overburden during backfill. Using this basic principle and based on previous experience of this specific geological sequence, there will be no requirement for the use of imported backfill materials in order to achieve the levels set out in the planning application.

The overburden materials will mainly comprise mudstones and sandstones which will be excavated and either moved to stockpile or placed directly into another part of the excavated area. Experience gained by the Appellant of working the same strata, on a site located 500m to the east of the current proposal site, indicates that the materials that are stockpiled (specifically the mudstones) will undergo further degradation through weathering leading to lower bulking during backfill.

Published information on surface mine backfill materials indicates that the mudstones and sandstones can bulk by up to 20% during end tipping processes, i.e. loosely placed back in earthworks bunds. This is based on DEFRA guidance<sup>1</sup>, research undertaken by ARUP in January 2015 (table reference attached), and A Geology For Engineers<sup>2</sup>. The precise extent and composition of the overburden materials have been investigated and are discussed within the Geology Chapter of the ES.

Site investigation borehole logs are located at Appendix D to this Chapter. The coal seams to be encountered are also discussed within this report and the coal seam thicknesses have been calculated and used to generate the expected volume of coal to be extracted (Appendix A to this Technical Note).

As the site is being returned to overall agricultural use, there is no requirement to engineer in the overburden soils in accordance with a specification such as the Specification for Highway Works. In fact, it will be a stipulation by the Coal Authority not to over engineer the overburden soils in order that the void spaces are suitable to support the overlying soils for future plant growth. This is

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<sup>1</sup> Guidance for Successful Reclamation of Mineral and Waste Sites, SW7 Sect 6

<sup>2</sup> Blyth and de Freitas seventh edition Chapter 16

stipulated within the Licence conditions by the Coal Authority for sites being returned to agricultural use.

The bulked spoil volumes to be generated have been calculated and are set out within a table in Appendix K to the Noise Report (Appendix 3 of the ES).

In the deepest locations, the Appellant will be removing up to 30m of overburden and a total combined seam thickness of coal up to 1m. This situation occurs within cuts 13 to 18. This will result in an excavation that is of 31m depth from original ground levels. In order to achieve the proposed final levels the operator will place all overburden soils in layers of between 500mm and 700mm thickness and track in with a bulldozer. The materials will also be rolled using a towed vibrating roller on the back of the bulldozer in order to remove air voids.

The proposed final restoration contours are up to 2m higher than those original ground levels. and represents a residual bulking factor of up to 10% (maximum).

The bulking factor is reduced from the loose tipped figure of 20% to 10% by the tracking and rolling of the spoil. Over time the replaced spoil will also naturally settle towards the original ground levels. This is reflected in the proposed final contours set out in the planning application.

On completion of the works field drainage will be placed across the fields to help improve the agricultural viability of the topsoil. Water infiltration will cause the groundwater levels to re-establish at depth which will also lead to some further settlement of the backfilled spoils below the groundwater table although this will have limited long-term effect at the surface.

#### Appendix A – Coal Quantity Calculations Spreadsheet

Enclosure:

Materials Densities and Bulking, Arup, 2015 Ladycross Groundworks Engineering Technical Note – by permission of Sirius Minerals