



The Mineral Planning Group
Clayton, [REDACTED]

BD14 [REDACTED]

**Mineral Reserve Appraisal
At
Bolton Woods Quarry, Bradford**

JOB REFERENCE:

160/1

CLIENT:

[REDACTED]

[REDACTED]



SEPTEMBER 2013

**MINERAL RESERVE APPRAISAL
AT BOLTON WOODS QUARRY,
BRADFORD, WEST YORKSHIRE**

1. INTRODUCTION

- 1.1 The Mineral Planning Group have been commissioned by Berry and Marshall Limited (The Client) to undertake a Mineral Reserve Appraisal on the remaining reserves at Bolton Woods Quarry (Bradford, West Yorkshire).
- 1.2 The information used in this report is taken from geological investigations carried out between 2001 and 2012. The site is already well known to The Mineral Planning Group (having over 15 years experience dealing with planning applications, geotechnical assessments, quarry regulation appraisals and environmental monitoring). On top of this an extensive site visit was carried out with the site manager Mel Jackson on the 8th of September 2013, during which, the practicalities/viability of working the remaining mineral reserves were discussed along with the realistic reserves remaining on site.

2. SITE DESCRIPTION

- 2.1 Bolton Woods Quarry is located approximately 2.5km north east of the centre of Bradford, West Yorkshire. Access to the quarry is gained from Bolton Hall Road, which is a no-through road, restricting vehicular access around the perimeter of the site. The sandstone excavated from Bolton Woods Quarry is of Upper Carboniferous

in age and is part of the Lower Coal Measures (Langsettian – Westphalian A). The succession of rocks within the quarry consists of massive (widely spaced bedding) sandstone beds, known as the Elland Edge strata, interbedded with thin bands of dark grey to black mudstone. At some elevations within the quarry the sandstones are more thinly bedded and “flaggy”, product from these beds is referred to as Elland Flag. Currently the sandstone is sold as dimension (block) stone and the flaggy sandstones are sold as high quality riven flagstones. Stone that is unsuitable for the production of cut dimension stone or riven flags is utilised for the production of crushed rock aggregate. Stockpiles of mixed shale, overburden and stone are sold as a general fill material or deposited within the quarry as mineral waste.

2.2 At the present time the majority of the excavation is taking place in the centre of phase one, both in the floor of the quarry (flagstone) and from existing faces (Blockstone & Flagstone).

2.4 The layout of the quarry is shown on the most recent topographic survey, Drawing.1.

3. CURRENT EXTRACTION OPERATIONS

3.1 At present block and flagstone are being won from the central areas of Phase 1. Currently flagstone extraction, from a limited area of the floor of the quarry can be carried out without the need for blasting as the removal of overlying mineral/overburden has already been removed. The Elland Edge strata sandstone beds overlying the Elland flagstone beds are being worked in tandem with flagstone extraction although the lack of jointing within these beds means black-powder splitting is often required to release any significant quantities of the mineral.

3.2 At present there is very little aggregate production at the site, however, mobile crushing and screening plant remain within the quarry, capable of producing a variety of different sized aggregates (from stone unsuitable for the production of sawn dimension stone or flags), which are stored in stockpiles on the floor of the quarry.

4. DESCRIPTION & CLASSIFICATION OF MINERALS

4.1 Below is the *British Geological Survey Building Stone Index* Assessment of The blockstone reserves (Elland Edge Strata) at the site:

Geology: Sandstone

Colour: Buff

Colour Variation: Variable

Age: Carboniferous

Structure: Massive

Usage: Local

- 4.2 Below is the British Geological Survey Building Stone Index Assessment of the Flagstone reserves (Elland Flags) at the site:

Geology: Sandstone

Colour: Buff

Colour Variation: Variable

Age: Carboniferous

Structure: Flaggy, Micaceous

Usage: Along the entirety of the outcrop – Extensively in Leeds, Bradford and Calderdale

- 4.3 The shales interbedded with the sandstone layers have been described as appropriate for “*general fill*” only. It is largely uneconomic to work the shale layers at the site and for that reason their properties and economic viability are not assessed in this appraisal.

5. FUTURE MINERAL EXTRACTION & VIABILITY

- 5.1 The Elland flagstone currently being worked in the base of the quarry (Within Phase 1) has an expected supply life of 2 years, based upon current demand. There is an additional 2 years supply of Flagstone exposed (with overburden removed) in the eastern face of Phase 1. When combined, the two sources provide a further 4 years of supply. However, beyond this time a considerable volume of overburden and non-profitable mineral must be removed to release any further reserves. The removal of these overburden layers would require a significant increase in activity on site for an extended period of time with little or no return but high costs. The financial impact

of overburden removal is likely to substantially reduce the economic viability of winning the underlying Elland Flags. This effect is further exaggerated by the dip of the Elland Flag beds, which dip into the faces, therefore, reducing the exposed mineral if working was to remain at its current depth.

- 5.2 At present there is a reasonable demand for Elland Flagstone from the site. However, feedback from the operator suggest the product is subject to a degree of lamination, particularly during cold spells when “freeze-thaw” weathering takes place. Until recently there were few complaints regarding lamination of the product, but it has been noted that as flag extraction moves away from current operations in the quarry floor and into the beds partially exposed in the Phase 1 faces, a change in specification occurs. It is reasonable to infer that this geological change in specification (an increased tendency to laminate) continues as the beds dip into the faces, therefore reducing the potential usages, and value of any flags extracted from these areas.
- 5.3 The site manager has suggested that, at current working rates, there is approximately 4 years supply of exposed Elland Edge Strata blockstone. No overburden removal is required to access the limited quantity of exposed blockstone. However any further extraction would require the removal of several hundred thousand tonnes of overburden. As with the Elland Flagstone beds, the sandstone beds used for blockstone production dip into the faces, in turn increasing the overburden to mineral ratio and extraction costs.
- 5.4 Demand for Elland Edge Strata blockstone is significantly lower than the Elland flagstones extracted on site, due to high levels of regional competition. Elland Strata beds suitable for blockstone production are relatively abundant across

Bradford/Leeds/Calderdale whereas beds suitable for flagstone extraction are far less prevalent. The cost of overburden removal and a lack of significant demand for Elland Edge Strata blockstone has resulted in the operator determining that no further mineral reserves will be extracted once the presently exposed mineral has been won.

6. SUMMARY AND CONCLUSIONS

6.1 Bolton Woods Quarry currently produces Elland Flagstone predominantly for use as paving slabs, and Elland Edge Strata blockstone, which, once cut, is used in the construction/maintenance of locally distinctive buildings.

- Based upon current working rates and demand, it is expected that all exposed Elland Flag beds will be worked out by 2017.
- Based upon current working rates and demand, it is expected that all presently exposed reserves of Elland Strata blockstone will be removed by late 2016 or early 2017.
- Beyond 2017, any further mineral extraction will require the removal of several hundred thousand tonnes of overburden, which contains only a nominal volume of saleable material.
- Both the Elland Flag beds and Elland Edge Strata beds dip and narrow as they are worked back into the faces of Phase 1. This has the compound effect of increasing the volume of overburden to be removed and reducing mineral reserves.



- The approximate overburden/mineral waste to profitable mineral ratio is 2:1. This ratio will worsen as the current faces are worked back as the beds dip and narrow into the current exposures.
- Upon review of geological cross-sections submitted as part of a reserve assessment in September 2001, it is apparent that the current working direction is approaching a fault zone, beyond which the presence of Elland flag bearing beds cannot be confirmed.
- In light of the above, planning permission for mineral extraction in the field adjacent to/east of phase 1 is unlikely to be pursued.
- The client has stated that beyond 2017 (or upon exhaustion of exposed mineral reserves) they do not intend to work any additional Elland flag or Elland Edge Strata blockstone, due to their increasingly marginal profitability.

THE MINERAL PLANNING GROUP

MILLMORE (DIRECTOR)

