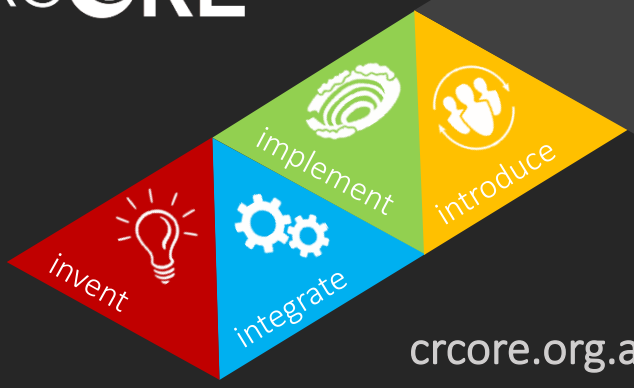
FINAL PROJECT SUMMARY

VALORISATION OF GRADE ENGINEERING BY-PRODUCTS

Project number:	P2-010
Program Coordinator:	Greg Wilkie
Project Leader:	Ewan Sellers, Amin Mousavi, Ebrahim F. Salmi
Timing:	September 2019 to March 2021
Participants:	Mining3, CRC ORE

CRC ORE



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PROJECT OUTCOMES

- Grade Engineering by-products valorisation can be expected to provide environmental and social benefits. Examples include: *1- Harmless coarse particle stream of material released early from the mine site can be used for alternative purposes generating jobs and secondary livelihoods, 2- Additional investment in areas seen to exemplify circular economy principles and business founded on sustainability ideals, 3- Alternative wealth streams and resource use supporting local development, 4- Greater structure to the opportunities for artisanal mining, 5- Increases opportunities for progressive rehabilitation and landform development pre-closure, 6- Reduction in waste volume due to greater efficiencies and the potential for waste use*.
- Re-use of waste rock is highly context-specific and requires a deep knowledge of the characteristics of the waste rock. The mine site location is also an important consideration for any valorisation project as it determines the type and nature of any prospective markets. The potential application of mining waste can be classified as: *1- In mine application for backfilling, road construction, and tailing dam stabilizing, 2- ARD control, 3-Concrete, ceramic, and bricks are the three main potential application of waste rocks in construction industries, 4- Metals for newly developed technologies are of high potential to be found in waste dumps.*
- A value analytical hierarchy process (V-AHP) was applied to mine site data to rank the social, environmental, and economic measures. Results show that the valorised GE is the most preferred option if there is any use for the coarse rock (see Figure 1). A valorisation stream has also been introduced to the mine operation as a destination for GE oversize (coarse). Then, a mixed-integer linear programming model was developed to revise the mine plan in the presence of valorisation streams. Sensitivity analysis has been performed on Valorisation capacity and its unit profit and numerical results have been reported for a case study over a 30-week horizon (see Figure 2)

RESEARCH COLLABORATION

- Mining3 is a world-leading research organisation, directed by its global mining industry members to develop and deliver transformational technology to improve the productivity, sustainability, and safety of the mining industry. Mining3 has expertise in Mining Engineering and Grade Engineering. CRC ORE implementation team also are experienced in Grade Engineering and can identify or create the data for the most suitable use cases for the assessment of the valorisation of GE by-products.

BACKGROUND TO THE PROJECT

- One of the desired outcomes of Grade Engineering, GE, is to produce additional streams of waste rejection as early as possible in the mining value chain. The benefit of this is experienced downstream; however, the separated engineered dry waste rock could potentially increase rehandling costs of coarse rejection. This project seeks to both identify methodologies within the scope of short-term mine planning to minimize the costs associated with early waste rejection and to find opportunities within the scope of long-term mine planning to make the best or beneficial use of additional coarse rock, which are called the GE by-products. Combined, this will facilitate a systematic approach to developing a sustainable waste management strategy with a clear pathway to maximize the value gained from GE, create opportunities to leave a sustainable socio-economic legacy, and help progressive rehabilitation activities.

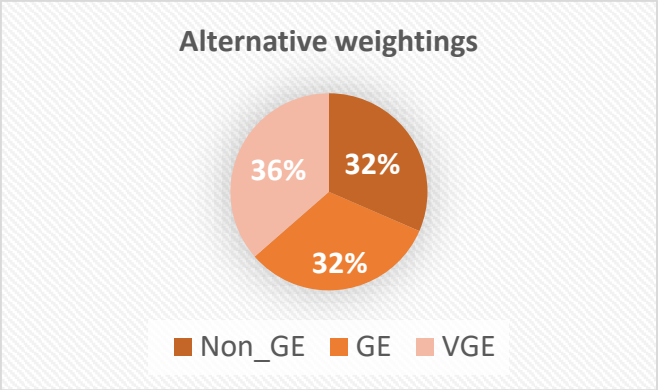

Figure 1: Comparison of valorisation alternatives resulting from application of V-AHP to a mine site

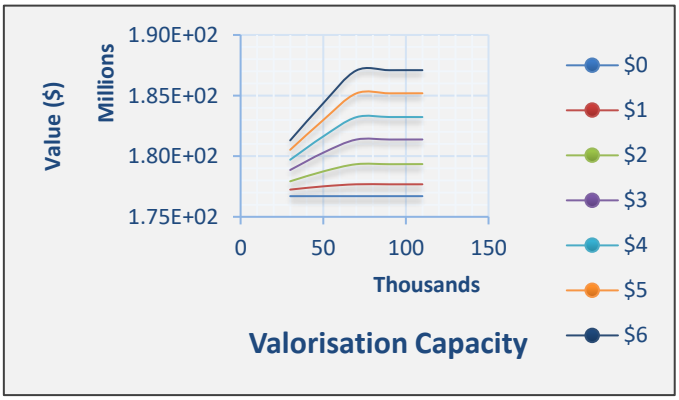

Figure 2: Valorisation capacity vs value for the case study operation

CRC ORE Optimising Resource Extraction

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