Improving surface stability of elevated spoil landforms using natural landform analogy and geological information

Bevan Emmerton (1), Jon Burgess (2), Joan Esterle (3), Peter Erskine (1), and Thomas Baumgartl (1)

(1) University of Queensland, Environment Centres, Brisbane, Australia, (2) University of Queensland, School of Earth Sciences, Brisbane, Australia, (3) Department of Land Resource Management, Palmerston, Darwin, NT, Australia

Large-scale open cut mining in the Bowen Basin, Queensland, Australia has undergone an evolutionary process over the period of a few decades, transitioning from shallow mining depths, limited spoil elevation and pasture based rehabilitation to increased mining depths, escalating pre-stripping, elevated mesa-like landforms and native woody species rehabilitation. As a consequence of this development, the stabilisation of recent constructed landforms has to be assured through means other than the establishment of vegetative cover. Recent developments are the specific selection and partitioning of resilient fragmental spoil types for the construction of final landform surface. They can also be used as cladding resources for stabilizing steep erosive batters and this has been identified as a practical methodology that has the potential to significantly improve rehabilitation outcomes. Examples of improvements are an increase of the surface rock cover, roughness and infiltration and reducing inherent erodibility and runoff and velocity of surface flow. However, a thorough understanding of the properties and behavior of individual spoil materials disturbed during mining is required.

Relevant information from published literature on the geological origins, lithology and weathering characteristics of individual strata within the Bowen Basin Coal Measures located in Queensland, Australia (and younger overlying weathered strata) has been studied, and related both to natural landforms and to the surface stability of major strata types when disturbed by mining.

The resulting spoil classification developed from this study is based primarily on inherent geological characteristics and weathering behaviour of identifiable lithologic components, and as such describes the expected fragmental resilience likely within disturbed materials at Bowen Basin coal mines.

The proposed classification system allows the allocation of spoil types to use categories which have application in pre-mine feasibility investigations, landform design and material selection and placement. It finds its application by practitioners who find encouragement in using this approach of a relatively easy usable classification system to improve the overall outcome of rehabilitation through selection of optimal substrates.