GRP Pipeline Design for the Life of Mine of a Tailings Gravity Decant System

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# ABSTRACT

The design and implementation of a Glass Reinforced Plastic (GRP) pipeline as a gravity decant system presents an attractive solution for managing tailings facilities in a mining operation over the life of the mine. This paper presents a design case study in which the engineering principles, material advantages, and sustainability aspects of utilising GRP pipelines embedded at up to 30m depth below a tailings storage facility (TSF) are explored.

Tailings management is a critical aspect of mining operations, necessitating robust and long-lasting infrastructure to ensure environmental compliance and operational efficiency. The gravity decant system, which relies on the natural force of gravity to manage water decantation from the TSF, offers a low-energy, cost-effective solution. GRP, known for its high strength-to-weight ratio, corrosion resistance, and durability, emerges as an ideal material for constructing such systems.

In this study, the design criteria that underpin the effective use of GRP pipelines., including hydraulic performance, structural integrity, tolerable displacement and longevity, are discussed. Finite element analyses (FEA) simulations are undertaken to evaluate the soil-structure interactions and to further validate the standard based design assumptions and performance metrics. The paper also addresses the installation methodologies and maintenance protocols essential for optimizing the lifecycle cost and functionality of the GRP decant system.

Moreover, this paper presents a performance-based design approach in which the initial model and parameter assumptions will be further validate during construction via a field and laboratory testing programme, as well as during operations via a sophisticated instrumentation system.

In conclusion, the adoption of a GRP pipeline as a gravity decant system in TSFs signifies a progressive stride towards enhancing the efficiency, reliability, and sustainability of tailings management. This paper aims to provide a technical guide and case-based insights for engineers and decision-makers in the mining industry, advocating for the integration of advanced materials and design innovations in critical infrastructure projects.