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Optimizing Dewatering Pipeline Routes In Centrifugal Pumping System: A Case Study at Karowe Diamond Mine

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Abstract

This case study delves into optimizing dewatering processes at the Karowe Diamond Mine by reconfiguring pipeline routing, with a specific focus on leveraging centrifugal pumps to alleviate frictional head loss. Through meticulous analysis, a novel pipeline route was proposed, significantly shortening the distance from the pit sump to the discharge dam. The original span of 2444.215 meters was successfully reduced to 1831.886 meters, representing a substantial improvement in operational layout. By strategically utilizing centrifugal pumps, the proposed route demonstrated enhanced performance, increasing the total discharge from the existing 120m³/h to 168m³/h. These results underscore the significant advantages of the new pipeline route in terms of efficiency, capacity, and cost-effectiveness. Additionally, the study suggests incorporating stage tanks between the two centrifugal series-connected pumps to prolong the lifespan of mechanical seals. Overall, this research provides a valuable blueprint for mining operations seeking to streamline dewatering processes, leading to notable performance enhancements and cost savings. Moreover, it's essential to highlight the financial aspect: the total cost of the current pipeline stands at P3,825,115.00, whereas the proposed pipeline's total cost amounts to P2,728,495.00. Consequently, the proposed pipeline achieves a total cost reduction of P1,096,620.00, further emphasizing its economic feasibility and benefits.

Keywords
Centrifugal pumps, Tanks, Series configuration, Sump, Stage tank, Cavitation

Biographies

Katuve Tie is a graduate Mechanical Engineer currently employed at Trollope Mining Services, stationed at the Karowe Diamond Mine. With a bachelor's degree in mechanical engineering and experience as a former Lab Demonstrator at Botswana International University of Science and Technology (BIUST) and a Solar Energy Engineer at Engineering Services Africa (ECSA), Katuve brings a wealth of expertise to his role. Currently pursuing a master's degree in mechanical and Energy Engineering, his research focuses on enhancing the solar energy efficiency of crystalline silicon wafers through surface modification. Katuve is dedicated to advancing renewable energy technologies and envisions a future where sustainable practices power industries like mining, driving both economic growth and environmental responsibility.

Tshepang Tshekiso, serving as both a Senior Mining Engineer and Assistant Mine Manager at Lucara Botswana, specializes in Mine Planning, Drill & Blast, and Load and Haul operations. He holds a Master of Engineering with Honors in Mining Engineering from the University of Exeter's Camborne school of Mines and a European Mining Course qualification from the Federation of European Minerals program. Alongside his roles, he conducts pioneering research on Machine Learning applications in mining, aiming for safer, more efficient, and sustainable practices. Tshepang envisions a future where advanced technologies seamlessly integrate into mining operations, driving positive change, and setting new standards. Passionate about innovation, he's dedicated to shaping a more efficient, safer, and sustainable future for the industry.