RAPID DEPLOYMENT PLANT (RDP) FOR TAILINGS TREATMENT AT JWANENG MINE

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1.0 Background

Debswana together with ADP as their design partner have embarked on an RDP project at Jwaneng Mine. The objective of the project is to install a 2 million ton per annum mineral processing plant that will fast track the recovery of diamonds from the Debswana tailings resource to ensure maximum return on investment for the company. Due to the prevailing economic conditions Debswana has had to review the way they used to build plants in the past and consider simple, fast and effective ways of doing things. The rapid deployment plant concept is therefore the most suitable means of achieving this objective.

Debswana is also considering an operating partner who will operate far more efficiently and cheaply compared to the larger more cumbersome and less agile Debswana.

2.0 Design Intent

The RDP concept is new and innovative in that the proposed plant must be modular and be able to be erected in minimal time. The concept is based on building mineral processing facilities which will generate early cash flows for an operation as compared to conventional plants due to the rapid deployment nature of the plant.

2.1 Rapid Deployment

Deployment is defined as the process of moving pre-designed modules of a plant to a new location, as well as erecting and commissioning of the facility. The rapid deployment concept presents opportunities that conventional plants do not have, which include; the ability to relocate, deploy and erect the plant along tight time frames through the use of pre-designed modules thereby reducing operational readiness and associated plant start up time that typically offsets early revenue opportunity.

2.2 Movability

Movability is a time related measure of how quick the plant can be moved from one location to another. This reflects the ease at which the plant system segments can be packed up and transported from one location to the next. The rapid deployment plant is semi-transportable which will enable relocation between operations on national Botswana roads within a ten to twelve week time frame. The flexible and semi-transportable nature will also enable the plant to be moved and deployed in other diamondiferous ore applications (hard rock kimberlite, exploration work, small remote satellite pipes etc) with minor front-end modifications.

2.3 Modularity - Plug and Play

This concept does not follow conventional stick plant design intents but utilises the modular construction principles to enable rapid deployment compared to the conventional approach.

The modules will be designed such that they are easily interchangeable (standardisation where possible) to adapt to different process requirements, with plug and play capability to enable seamless integration to form a processing system.

2.4 Expandable and Flexible

Scalability as well as flexibility are further opportunities that the RDP concept presents as modules can be easily added or taken out as and when required without having to redesign the whole system. Addition or removal of modules offers secondary benefits which include the ability to evaluate different technologies which might not have been part of the original design.

2.5 Low Capital Cost

The modular plant capital expenditure is considerably less compared to conventional plants due to minimal civil work (without compromising safety) and a smaller footprint. However, mobile crane maintenance which this concept utilises might require slightly higher Opex than conventional plants.

3.0 Process Description

The rapid deployment plant will be self contained as it will have a final recovery, self contained water treatment facility and other associated services facilities.

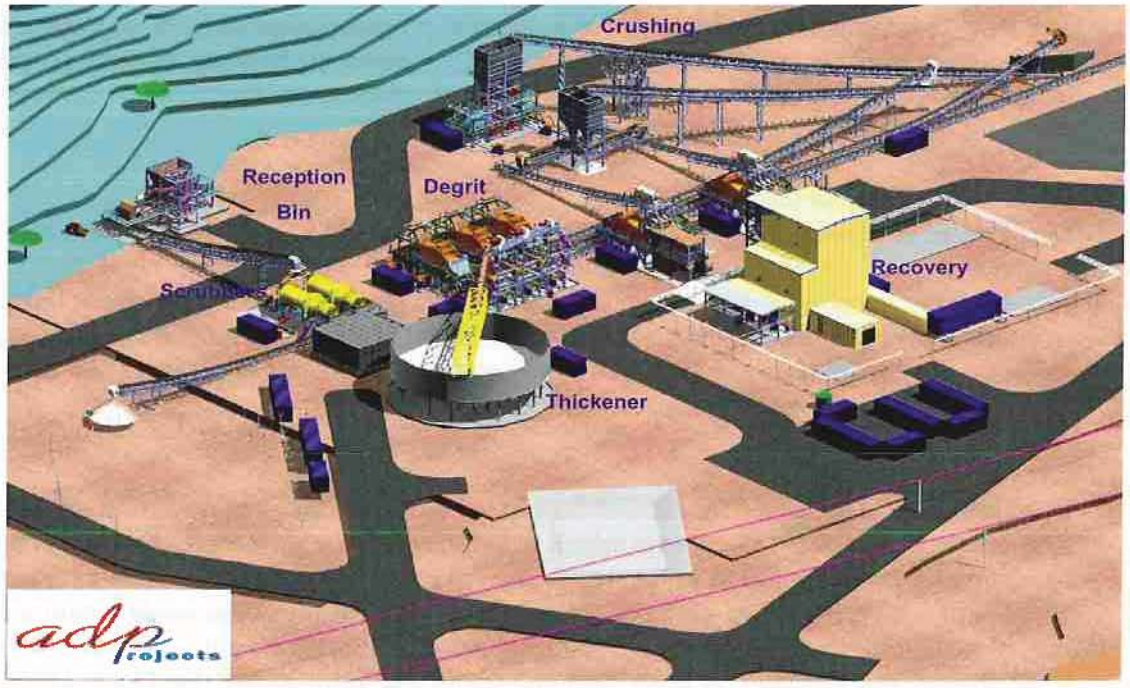

Figure 1: Process Overview

3.1 Scrubbing Module

From the reception bin, ore is fed to scrubbers where material disintegration occurs due to washing as well as particles rubbing against each other within the scrubber while it rotates. Scrubber product reports to a trommel screen for further washing and sizing. Undersize material from the trommel is pumped to the dense medium separation (DMS) feed preparation plant via a jet pump whilst the oversize is conveyed to the oversize stockpile.

3.2 DMS Feed Preparation Module

This module is responsible for washing as well as sizing of the scrubber and crusher products in preparation for dense medium separation.

3.3 Crusher Module

The oversize from the feed preparation module is conveyed to the crushing module for diamond liberation and the crusher product is jet pumped to the DMS feed preparation module for further processing.

3.4 DMS Module

The oversize from the feed preparation screens goes to a mixing box where the material comes into contact with ferrosilicon (FeSi) which acts as a medium for the DMS process and the mixture is then pumped to cyclones for separation on the basis of density.

The overflow from the cyclones goes to float screens for sizing as well as FeSi drainage and rinsing. The oversize from the float screens is either sent to the tailings conveyor or diverted for re-crushing.

The underflow from the cyclones goes to sink screens for sizing as well as FeSi drainage and rinsing. The oversize from these sink screens is jet pumped to the final recovery plant.

3.5 Final Recovery Module

Pre-sized material from the DMS module is fed using jet pumps to a dewatering screen. Material from this screen is routed to further processing by either X-ray (middles and coarse) or bulk magnetic reduction (fines) prior to X-ray recovery.

The objective of bulk magnetic reduction on the fines stream is to lower the material quantities prior to down stream processing to cut down on handling costs as fines are normally produced in large quantities compared to the other streams.

Non-magnetic material from bulk magnetic reduction is fed to X-ray machines which utilise their luminescence technique to separate diamonds from gravel as diamonds luminesce when exposed to X-rays.

Tailings from the X-ray machines are sent for grease scavenging for further recovery in case the diamonds were missed by the X-ray machines.

3.6 Degrit Module

Feed to the degrit plant is pumped from the effluent sump to degritting cyclones. The degrit cyclone overflow goes to the thickener while the underflow goes to degrit screens. The overflow from these screens is discarded via a tailings conveyor whilst the underflow is pumped to the thickener for water recovery.

3.7 Thickener module

The thickener feed is laundered from the degrit plant to the thickener feed well where flocculent is added to aid settling. The thickener underflow is pumped to slimes dams for water recovery whereas the overflow goes to the process water tank for re-use in the plant.

3.0 Jet Pumping

Jet pumping has been extensively used within this plant; this was done for the scrubber product, crusher product as well as the DMS concentrate. The advantage of jet pumping is that it assists in breaking down the clayey material hence the material is pulped and scrubbed extensively prior to sizing. This is quite important since ore (tailings) that is going to be treated in this plant has been stockpiled for a very long time and has since weathered and agglomerated. The other advantage of jet pumping is that it is less complex and less costly to operate since jet pumps have no moving parts hence they are low maintenance equipment. These pumps are also self priming.

4.0 Conclusion

In summary, the RDP is designed to meet the low Capex requirement, accept generic feed but at the same time has the potential to be debottlenecked and the flexibility to be optimised for specific feed (customisation). This plant will serve as a 'pilot' facility to demonstrate the modular plant concept within Debswana. The success of this 'pilot' facility will potentially lead to the deployment of additional plants at the other Debswana mines.

The Author

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Eunice is currently working as the Project Manager for the RDP project for Jwaneng Mine at Debswana. The Jwaneng Mine RDP is set to further process tailings that were generated from Jwaneng Mine's Main Treatment Plant between 1982 and 1990 prior to the Recrush Plant. She previously worked as a Technical Assistant to the Debswana Deputy Managing Director, where she provided technical advice and strategic support, as well as facilitated and enhanced the decision making process for the Deputy Managing Director. Eunice has worked at both Orapa and Jwaneng Mines as a Process Engineer where she provided process engineering support and quality assurance to main plants, the Completely Automated Recovery Plant (CARP) as well as the Fully Integrated Sort House (FISH).