

Relationship between increased feed rates and grade recovery in alluvial diamond processing



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Introduction

- Niewejaarskraal Plant initially operated a DMS prior to final recovery (Flowsort X-ray machines)
- The plant was modified such that the DMS only treated a fines fraction, viz. +5mm –15mm and a coarse stream, +15mm – 33mm, was then sent to a newly installed BV (X-ray) machine
- The additional stream then allowed more ROM to be processed
- In alluvial diamond processing, it is critical to process large amounts of volumes per month so that the frequency of stone recovery is higher, which then leads to a more stable grade recovery
- This short investigation shows how grade recovery improved through the course of this project, from initiation when only the DMS was in place, to after the time when the BV was installed

Background

- Alluvial diamonds are diamond that have been removed from the natural primary source known as kimberlite
- This is by natural erosive action and deposited in a new environment
- They will undergo a process in which diamonds are recovered from such deposits of sand, gravel and clay
- Most alluvial diamond deposits are spread across huge geographic areas and large concentrations of those diamond are mined on an industrial basis
- Mining requires a considerable amount of material called the “over-burden” to be removed first to get to the gravel bed underneath, where diamonds are found

Plant layout

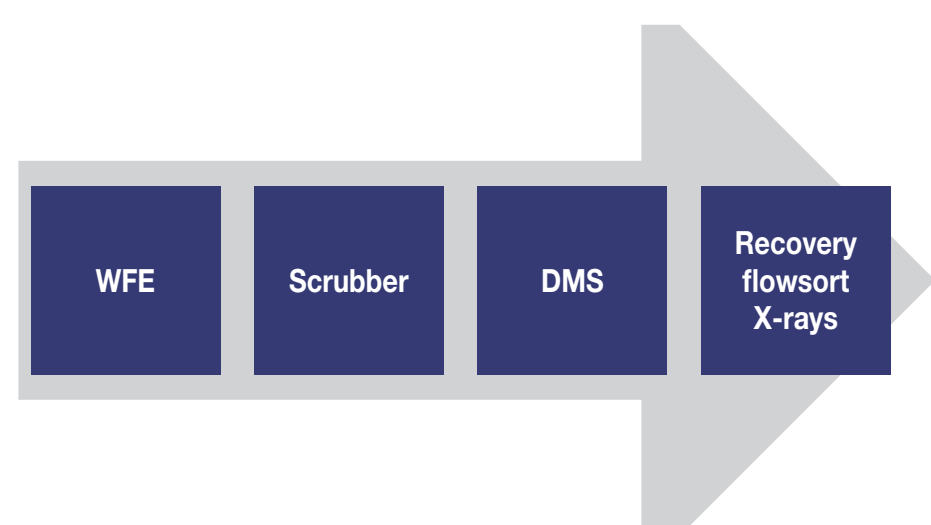


Figure 1: Initial plant layout

- Figure 1 shows a simplified flow sheet of NJK plant before introduction of the IFS and BV plant
- Initially, the plant used to treat gravel from as big as 70mm rocks and below to excessive sand at the Wet Front End section, as a way of screening the desired particle size gravel through to the scrubber section where washing took place before feeding the DMS section
- An average feed rate to the scrubber was about 100tph

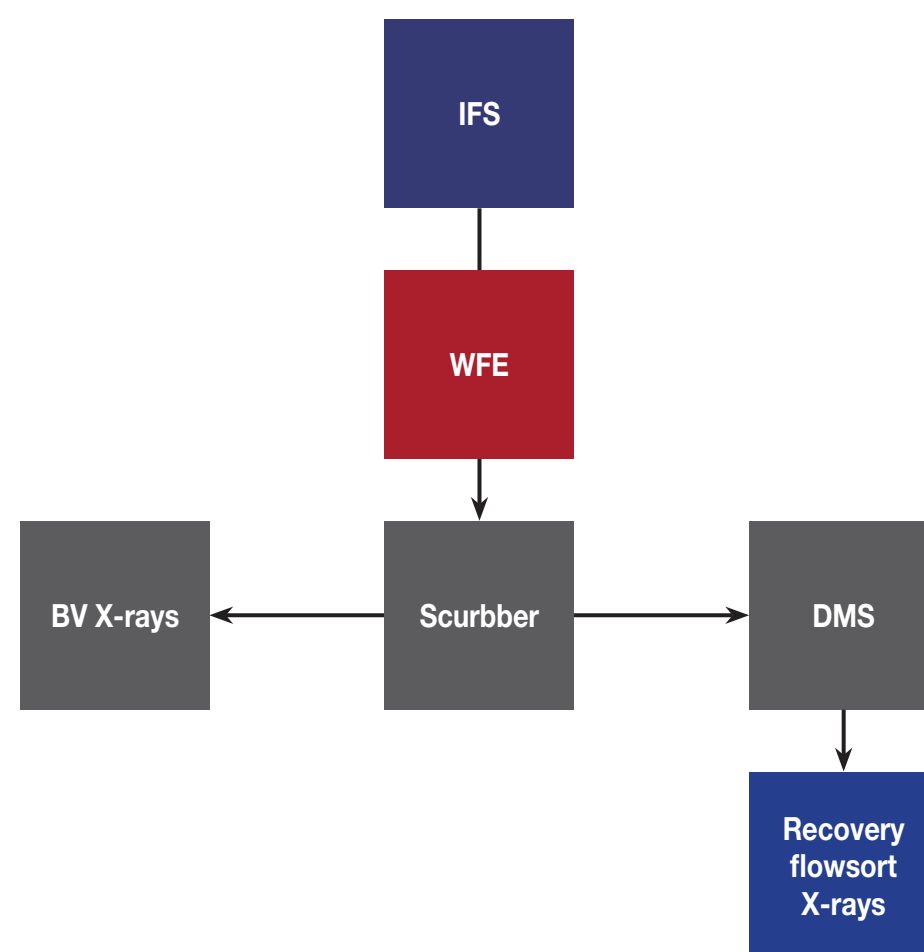


Figure 2: Current plant layout

- IFS now removes +50mm rocks and excessive sand
- A size fraction of +5mm and -35mm is treated at the plant
- Feed rates going to the scrubber section improved to +130tph on average
- BV plant treats a size fraction in between +15mm and -35mm and the DMS treats a size fraction in between +5mm and -15mm

Results and discussion

Table 1: Scrubber and DMS volume with grade recovery

Gravel type	Month	Volumes (m³)		Grade (cphm³)
		Scrubber	DMS	
ROM	1 Jan	10 805	7 114	0,38
	2 Feb	10 292	6 380	0,48
	3 Mar	15 792	8214	0,57
IFS	1 Apr	22 320	12 433	0,76
	2 May	35 652	10 316	0,40
	3 Jun	23 248	9 102	0,54

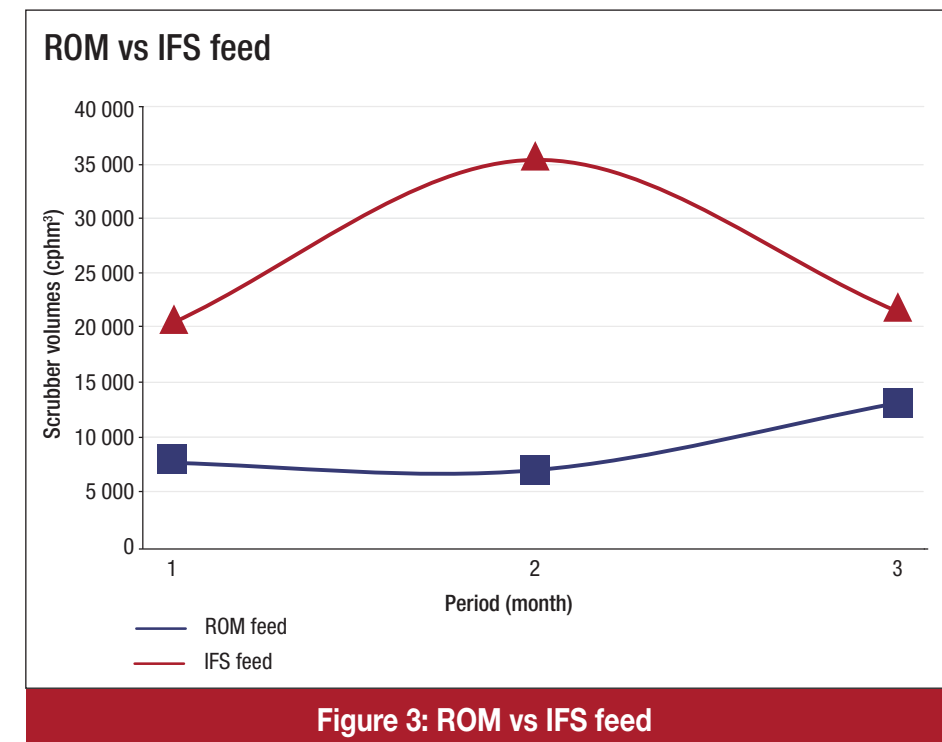


Figure 3: ROM vs IFS feed

- Introduction of the IFS improved overall monthly scrubber volumes considerably
- IFS simplified the product sent to the plant, by removing discard stream around the plant

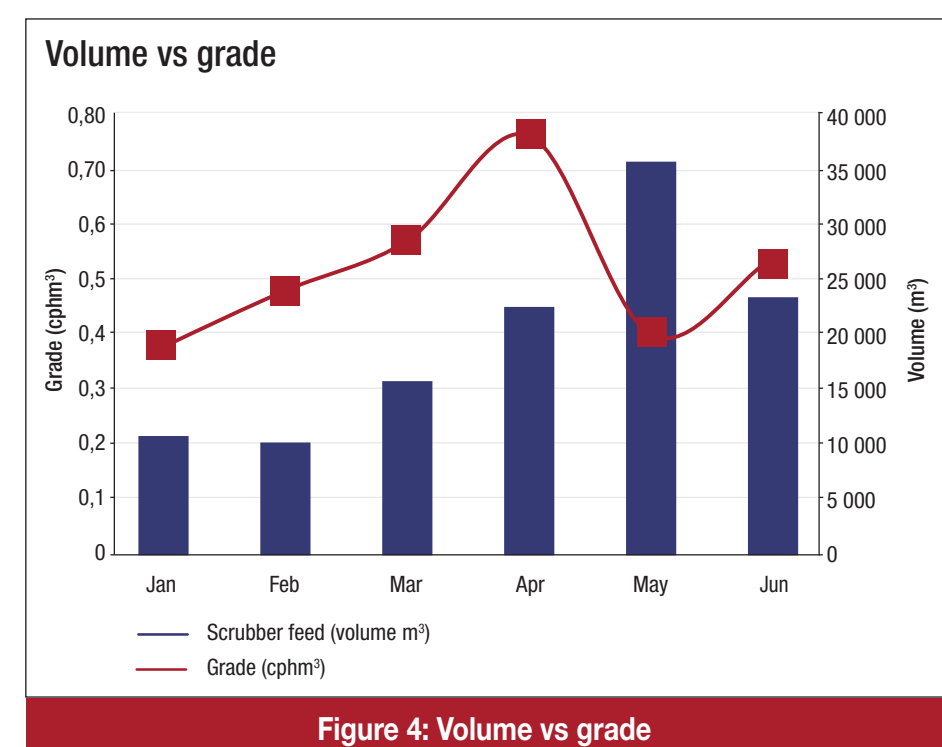


Figure 4: Volume vs grade

- Overall, there is a trend showing that increasing volumes increases grades
- This is due to a higher number of stones recovered, which allowed a more stable grade recovery
- Low volumes processed leads to a probability of not recovering stones

Conclusion

- Alluvial diamond processing is a volumes “game”
- If volumes processed is too low, then there will be long periods where stones are infrequently recovered
- Frequency of stone recovery improves with higher processing rates, then leading to a more stable production profile

REFERENCE

Alluvial Diamond Mining Sheet. Accessed online at http://www.diamondfacts.org/pdfs/media/media_resources/fact_sheets/Alluvial_Mining_Background.pdf

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