Bank of America SmartMine 4.0 Conference

June 2023

FutureSmart Mining™

Donovan Waller

Group Head of Technology Development

Slide 1: Introduction

Today I'd like to share a snapshot of FutureSmart Mining™ – some recent progress as well as what is happening in the pipeline.

Slide 2: Cautionary statement

Slide 3: Just imagine...

So first let me share a little bit of context.

Whilst the world around us is not what we might have predicted a few years back, the imperatives for mining are no different and if anything are more urgent than ever.

We must continue to change the future of mining, in service of our purpose – re-imagining mining to improve people's lives.

FutureSmart Mining™, our innovation-led approach to sustainable mining, is integral to building an industry that has a minimal physical footprint, goes beyond carbon neutral and works in partnership to achieve a greater goal.

Perhaps a future footprint could look something like this: where what used to be an ugly legacy is turned into stable landforms, generating power for surrounding industries and communities, themselves developed sustainably through our Collaborative Regional Development approach; where our current physical footprint is minimal on the surface, minimising impacts on ecosystems and people; where we have removed people from harm's way entirely through automation; where we mine only what we need, with precision and speed... It could be quite something.

To create the most impact, we are concentrating on:

- Moving less material
- Recovering full value from what we do disturb
- Thinking differently about our projects
- Creating adjacencies where possible - commercial and otherwise (by leveraging our IP across the wider industry as well as in other industries)

Slide 4: Proven & scaling up

Firstly, I'd like to recap on a few programmes you've heard of before and share some recent developments.

Slide 5: Envusa Energy

It's well known that South Africa is experiencing issues with reliable access to energy. We suffer at our sites, but mining is not the only industry with these challenges. That's why we're taking a regional approach to look at how we can harness renewable energy at scale.

To do this, last year we entered into partnership with EDF Renewables - creating Envusa Energy - and announced the first 600MW of wind and solar projects, intended to form the development of a broader regional renewable energy ecosystem (RREE) expected to generate 3-5GW over the next decade.

This regional renewable energy ecosystem that we are creating aims to supply surplus energy to the national grid supporting industries and communities, while opening a pathway to developing an entirely new renewable energy generation industry, and all the services that will support it. As you are aware, the programme has been given status as a Strategic Integrated Project for South Africa, consolidating the government's support.

- We have agreed commercial terms for two wind sites of 140MW each and one solar site of 200MW in the Eastern Cape. We aim for financial close in Q3 for these sites and commence construction immediately.
- Also, we are developing 2 large solar sites in our mines at Sishen and Mogalakwena.

This is only our first wave of projects, which will be followed by our much larger portfolio of projects we have in the development pipeline.

The build-out of the regional renewable energy ecosystem across South Africa will also aid us in reducing our Scope 2 emissions (currently 90% of South Africa's power generation is from thermal coal) and provide the foundation for developing a hydrogen economy through the production of green hydrogen. Alongside this, we piloted our integrated green hydrogen production, fueling and haulage system for our mine sites – the nuGen™ Zero Emission Haulage Solution.

Slide 6: Zero Emission Haulage System

Eliminating the use of diesel at our mine sites is fundamental to decarbonising our global operations. This objective was the driving force behind the nuGen™ Zero Emission Haulage Solution (ZEHS), an end-to-end integrated green hydrogen production, fueling and haulage system for mine sites. Following three years of extensive development with our engineering partner, First Mode, in 2022 we launched a prototype of the nuGen™ ZEHS at our Mogalakwena PGMs mine in South Africa.

During its year of operation, the truck was introduced into a mixed commercial fleet, including ore and waste haulage activities, alongside diesel vehicles, with over 1200 hours of operation.

To accelerate the development and commercialisation of this technology, at the start of 2023, we combined nuGen™ with our partners on the project, First Mode. First Mode are now focused on scaling and commercializing the nuGen™ Haulage Solution. We believe Julian is on your agenda later and we will leave the details to him.

We have also entered into a supply agreement with First Mode that sets out a pathway to decarbonise our global fleet of mine haul trucks over the next 10-15 years, subject to ongoing studies and other conditions.

Slide 7: Coarse Particle Recovery

Following its construction in 2021, the Coarse Particle Recovery unit at El Soldado was successfully handed over to operations, having exceeded targets in energy unit consumption and enabling a 16% increase in copper production without the need for additional energy. It beat every single metric we had set for it before we started the project.

The innovative flotation process, which permits material to be ground to a larger particle size, allowing the early rejection of coarse waste and greater water recovery, has already begun producing the coarse waste which is used in the nearby Hydraulic Dewatered Stacking (HDS) pilot – I'll speak about this more later on.

A full-scale CPR plant has been constructed at the Mogalakwena North concentrator (pictured here), with start-up anticipated in late 2023. Construction of a full-scale CPR plant at Quellaveco (Copper) to treat flotation tailings began in July 2022, with commissioning planned for late 2023.

Future plans for CPR include Los Bronces, Minas-Rio and Collahuasi.

CPR has not only demonstrated value, but, like many of our other technologies, provides a strong platform to build on going forward, demonstrating the systemic value of the FutureSmart Mining™ approach, as you will see later.

Slide 8: Hydraulic Dewatered Stacking

Turning to current work coming of age. We have successfully demonstrated Hydraulic Dewatered Stacking at the El Soldado mine. HDS was developed after the Brumadinho disaster as our engineers hypothesized that the fines free sand available from CPR (and readily available from many tailings) could be used to build a three dimensional drainage system to rapidly desaturated hydraulically placed tailings.

Slide 9: Hydraulic Dewatered Stacking

The idea has been iterated, developed and progressed to what you see here, a stable tailings stack that can dewater (and desaturate) in days and weeks rather than years and decades.

The 150,000m^3 capacity full-scale demonstration facility in El Soldado utilises fines-free sand from our CPR plant at El Soldado, the largest such plant currently in operation at a base metals mine.

Slide 10: Hydraulic Dewatered Stacking

Initial results demonstrate over 80% water recovery but more importantly, a final stack with lowered saturation levels, greatly reducing both the likelihood and consequence of liquefaction.

Slide 11: Hydraulic Dewatered Stacking

This is the Chilean Mining minister, together with the Chilean permitting authority, Sernageomin, walking on tailings less than a month old, but it is extremely stable.

During June this year, we initiated a second trial at our Mogalakwena mine in South Africa, targeting the application of HDS into an existing facility. This is significant in that existing facilities can, in some instances, be reconfigured mid-life to take advantage of HDS. We are currently assessing the possibility of this at Los Bronces.

Slide 12: Hydraulic Dewatered Stacking

The commercialisation of and acceleration of the development of the technology has started and agreements with geotechnical designers are expected to be signed in the next couple of months.

Discussions with mining companies are progressing and we are targeting at least two joint development trials to begin in 2024.

We are proposing a collaborative approach under license that accelerates the learning further and ensures that each application improves and hence we are able to quickly implement this technology, where applicable, to demonstrably reduce the risks of tailings management –

changing the conversation from one of risk mitigation to one of opportunity; where the land used for tailings storage can quickly and efficiently put to re-use and be of benefit to all stakeholders.

Slide 13: SandLix™

You will all be aware of the vigorous activity happening in the leaching space with a number of commercial and mining company entrants into an increasingly congested space. We have had developments in the works over the last few years which show significant benefits over what we have seen from others to date.

SandLix™, unlike others, considers three elements: particle size, temperature and chemistry. The method unlocks metal recovery from low-grade, refractory sulfide ore at low intensity.

Results on primary copper ores show recoveries of over 70% in half the time of traditional leaching methods. We ultimately see this technology replacing conventional concentrator circuits and delivering metal more responsibly – and, at roughly half the embodied water and energy intensity.

We have demonstrated excellent results in column tests of up to 18 metres and our team are currently progressing parallel work programs to scale the technology up. We are actively accelerating this work and are currently negotiating agreements with partners to explore outcomes commercially. Watch this space.

Slide 14: In the pipeline

I hope that what you have noticed is a purposeful progression of developed technologies, to partner within and across our industry and to accelerate delivery of benefits at scale.

It is about time to value and the limited time available to transform our industry at a pace expected of us by our stakeholders and the world in general for reduced input intensities with a drastic footprint reduction.

Whilst HDS and SandLix™ mature and hopefully deliver value faster than anything to date we continue to develop new concepts to fill the gaps in future of minerals extraction.

I will briefly touch on a few, two of which have a long way to go but in essence have the ability to shape the footprint discussion significantly.

Slide 15: Microwave

Preconditioning ores with microwaves weakens them for both rock cutting and downstream comminution processes. Specifically, directed and controlled microwave energy can induce thermal stress which fractures the rock mass and reduces its inherent strength.

The implication is the possibility of accelerated mining & development rates, hopefully allowing for access to ore bodies quicker and to mine them faster.

We have over the past few years tested application methods and the effect on in-situ ores in both underground and surface mines. We are currently testing a production cutter in a quarry and if successful we will install a first-generation microwave preconditioning system in a production environment at an Anglo American site in 2024.

Slide 16: Haulage re-defined

Mining has used trucks & shovels for the past one hundred years – probably the most successful combination of mining technology ever. I attribute their success predominantly down to flexibility, reliability & scalability.

We stepped into this hallowed ground and allowed ourselves a blank sheet exercise to address the shortcoming of mining trucks, namely: cost, speed & energy consumption.

By adjusting the base operational assumptions of loading, and working with vehicle designers and tyre producers we re-imagined weight distribution, symmetry, modularity and designing using only off the shelf components. We surprised ourselves and have created a unique alternative value proposition, using the vehicle as a sensor, almost halving the energy used, increasing speed & effectiveness, all at a reduced cost.

Whilst still early days – we have the makings of a future mining system focused on precision.

Slide 17: Intelligent logistics

In parallel to this - intelligent logistics seeks to redefine materials movement, efficiency and scalability. Using linear motor technology coupled with new powerful and cost-effective distributed computing technology we have developed the individual elements of a scalable, self-configuring, mine logistics system that is capable of handling typical material movement out of and logistics requirements into a mine. This novel system provides:

- High capacity (~40Mtpa) with a very small footprint
- Energy per ton kilometre material moved is an order of magnitude lower than conveyor systems
- Modular, flexible, easy to install within changing mine requirements
- High precision control of small strategic mining units to and from multiple destinations
- Ability to travel both horizontal and vertically

The result drives new thinking for both underground and surface mine designs.

With both this and the previous technology shown, we are looking to partners to progress the development and building of the first pilot systems to validate mine-ready systems.

Hopefully that gives you a sense of what's to come in a world of innovation embedded mining.

Slide 18: Next steps

It's not only about those individual ideas but rather about the systemic approach and how these ideas look set to revolutionise not only the mining industry, but an even wider ecosystem, that really inspires me and adds weight to our innovation portfolio.

Slide 19: The future is not so far away...

That vision of the minimal footprint I showed earlier? – well it's not so far away.

We built Quellaveco using the latest available technology, and now we are building Woodsmith using the next generation of technology and approach. This image shows what it will look like on the surface – what looks like just a few farm buildings – fitting in with its location in a national park.

And next up after Woodsmith will be the development of our Sakatti project – which again, will incorporate the latest technology and approaches.

We are constantly seeking to improve and redefine what mining is … and that's what really excites me to be part of this journey.

What is important is that we execute impeccably.

For the near term, our focus will be on 3 things:

1. Projects – building our own capability and executing projects well in order to realise full value of our potential. This includes those critical projects for the expansion of our portfolio, our technology development projects, and of course our Carbon Neutrality portfolio. Alison Atkinson has recently come on board as Projects & Development Director, bringing 30 years of track history in delivering complex, multi-billion pound projects.
2. Partnerships – by finding the right partners to execute we can accelerate the development of these ideas and potentially look at commercialisation options, where appropriate. By bringing the best of multiple partners together, we can do more, at scale and at pace.
3. Finally, Pipeline. It is imperative that we invest in innovation, take inspiration from outside our industry, in order to stay ahead of the game and continue to have a fantastic pipeline of new technologies that will disrupt our industry.

Slide 20: Q&A

Thank you. I'd be pleased to take any questions you have.

END