

## **Operational changes enable Namdeb's Southern Coastal Mining Team to Reduce Risk and Increase Productivity as we advance deeper into the Atlantic Ocean.**

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12-13 June 2018

# AGENDA

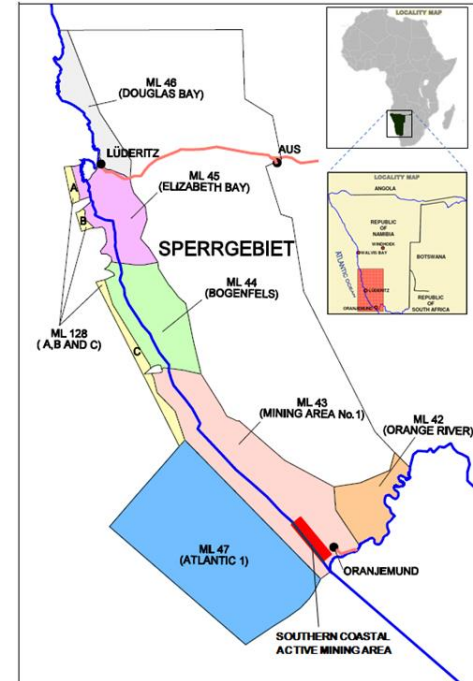
- Introduction to Namdeb
- How the diamonds got here
- SCM Production Pipeline
- Mining Method
- Theory of Constraints
- SCM Process Flow
- Planning and Execution
- L&H Improvements
- Bedrock Improvements
- Stripping Improvements
- Conclusion



# INTRODUCTION TO NAMDEB AND SCM

## A Namibian company...

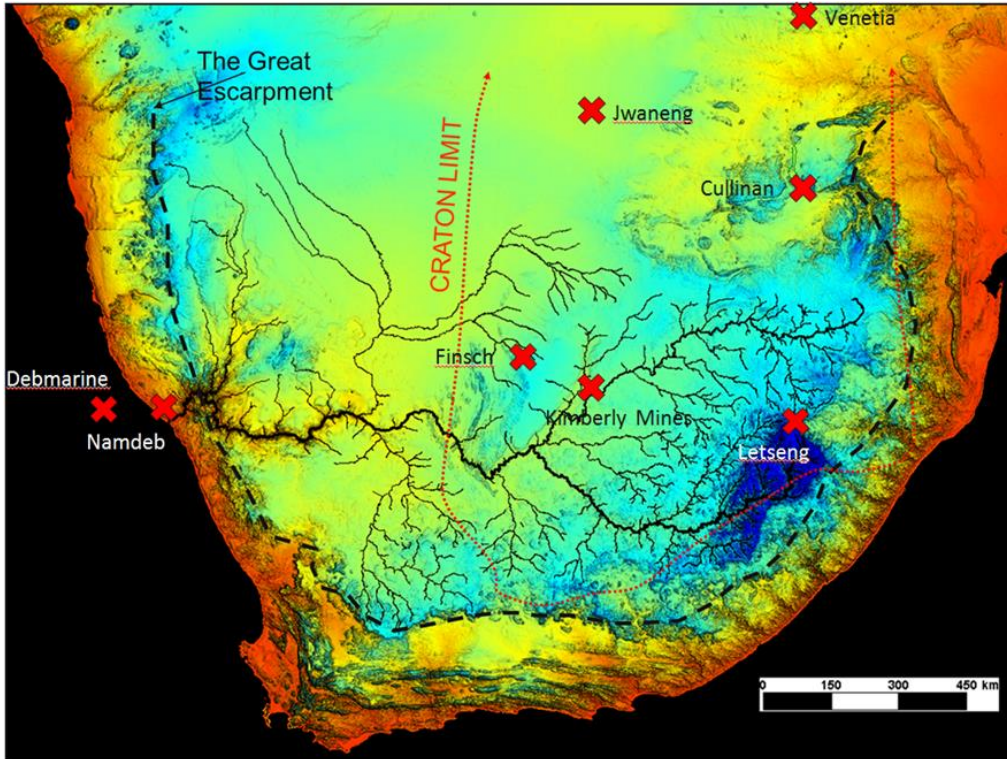
- Wholly owned subsidiary of Namdeb Holdings
- A 50:50 joint venture between De Beers and the Government of Namibia
- Southern Coastal Mine (SCM) stretches 120km north from the Orange River
- Only 30km of active mining areas
- Started in 1929
- Exposed to aggressive Atlantic Ocean storms.



...with a rich history and a challenging environment.

# GEOLOGY – HOW THE DIAMONDS GOT HERE?

Diamonds created inland and transported by the Orange River...



- Created in Kimberlite pipes.
- Erosion and transport by Orange River to the coast
- Deposited in the Atlantic Ocean
- Upgrade diamond concentrations:
  - Wave action,
  - Longshore drift and the
  - Rise and fall of sea level
- Diamonds trapped in gullies and potholes
- Overlain by over 30m of marine and accretion sand

...then deposited in unique deposits in Namibia.

# SCM PRODUCTION PIPELINE

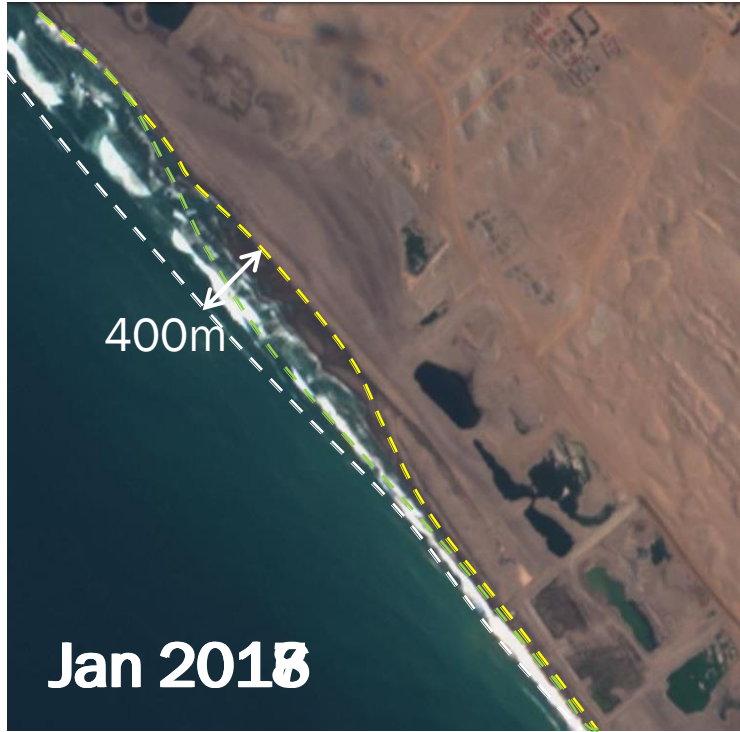
Pushing the sea back...



...to mine down to 30m below sea level.

# MINING METHOD - ACCRETION

Accretion has shown positive results...



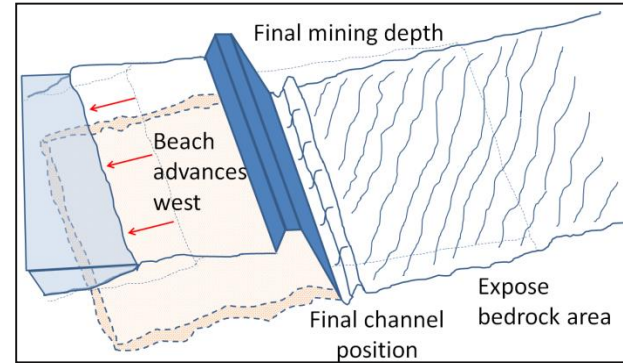
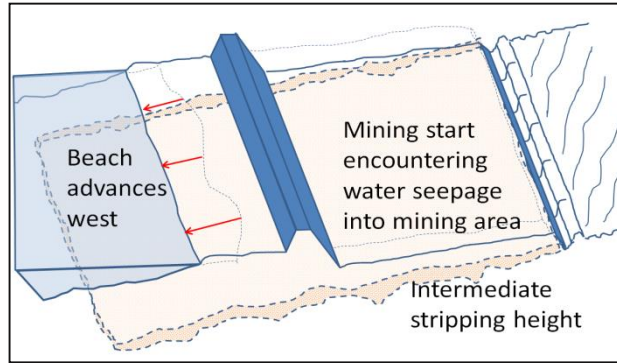
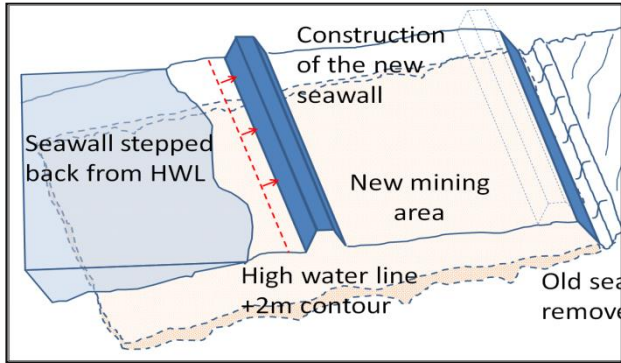
- Mining west of the high water line started in 1977
- We have now progressed between 300 - 1,000 meters west from original HWL
- Beach nourishment - new accretion technique used since Feb 2017
- Beach nourishment has improved accretion progress and protects seawalls against storm events

3 Conveyors	12.3 Mt per year
Accretion Stripping	8.6 Mt per year
Conventional Stripping	33.1 Mt per year
Processing plant tailings	+/-2 Mt per year
<b>Total</b>	<b>+56 Mt per year</b>

...and beach nourishment is assisting accretion and providing storm protection.

# MINING METHOD - STRIPPING

Initially building the seawall to protect workings....



....then accrete the beach to create future mining area.

# MINING METHOD - BEDROCK

**Bedrock Bulking** removes the majority of the diamondiferous gravels...

Gullied, potholed and undulating footwall with some cemented material.

**Two interdependent but linked processes:**

**Bulking** – removal of most material in the gullies/potholes



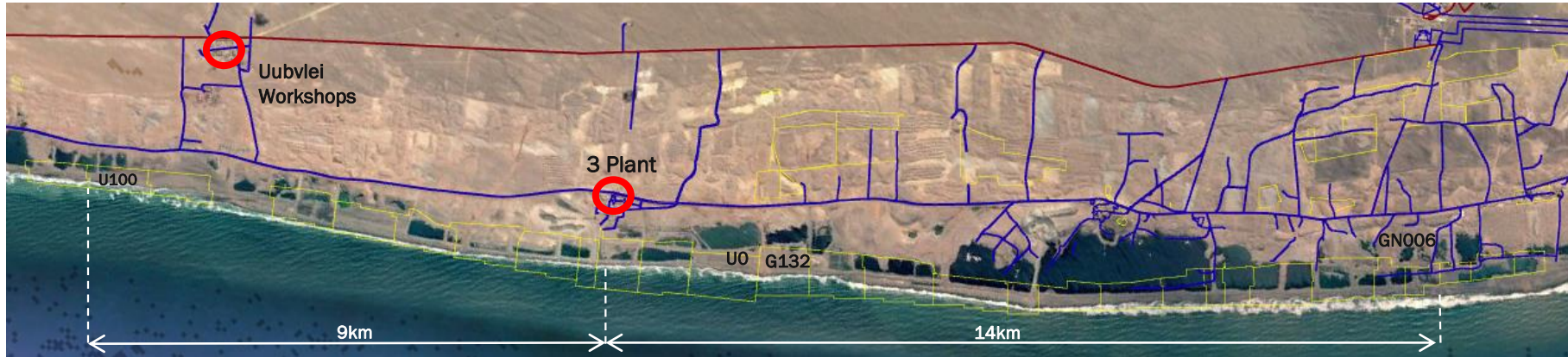
► **Transvac Cleaning** – cleaning the bedrock including cracks



...while **Bedrock Cleaning** ensures no diamonds are left behind.

# LOAD AND HAUL

Load and Haul tram material from the mining sites to the plant...



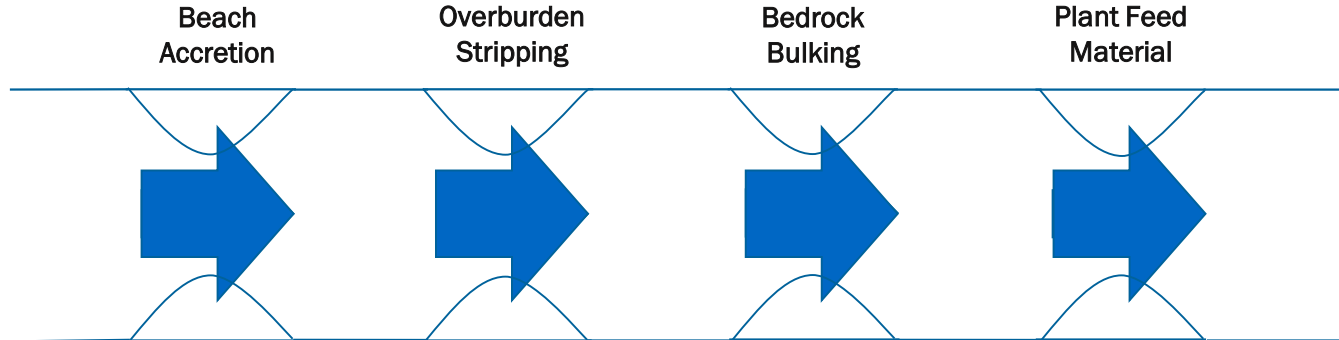
- Tram diamondiferous material from mining sites to 3 Plant
- Sites are situated:
  - 9km north (U100)
  - 14km south of the plant (GN006)
- Long hauls reduce efficiencies and compromise required plant feed rates.

...long tramming distances and low efficiencies constrain direct plant feed capacity.

# THEORY OF CONSTRAINTS

**System output is limited by one or more constraints....**

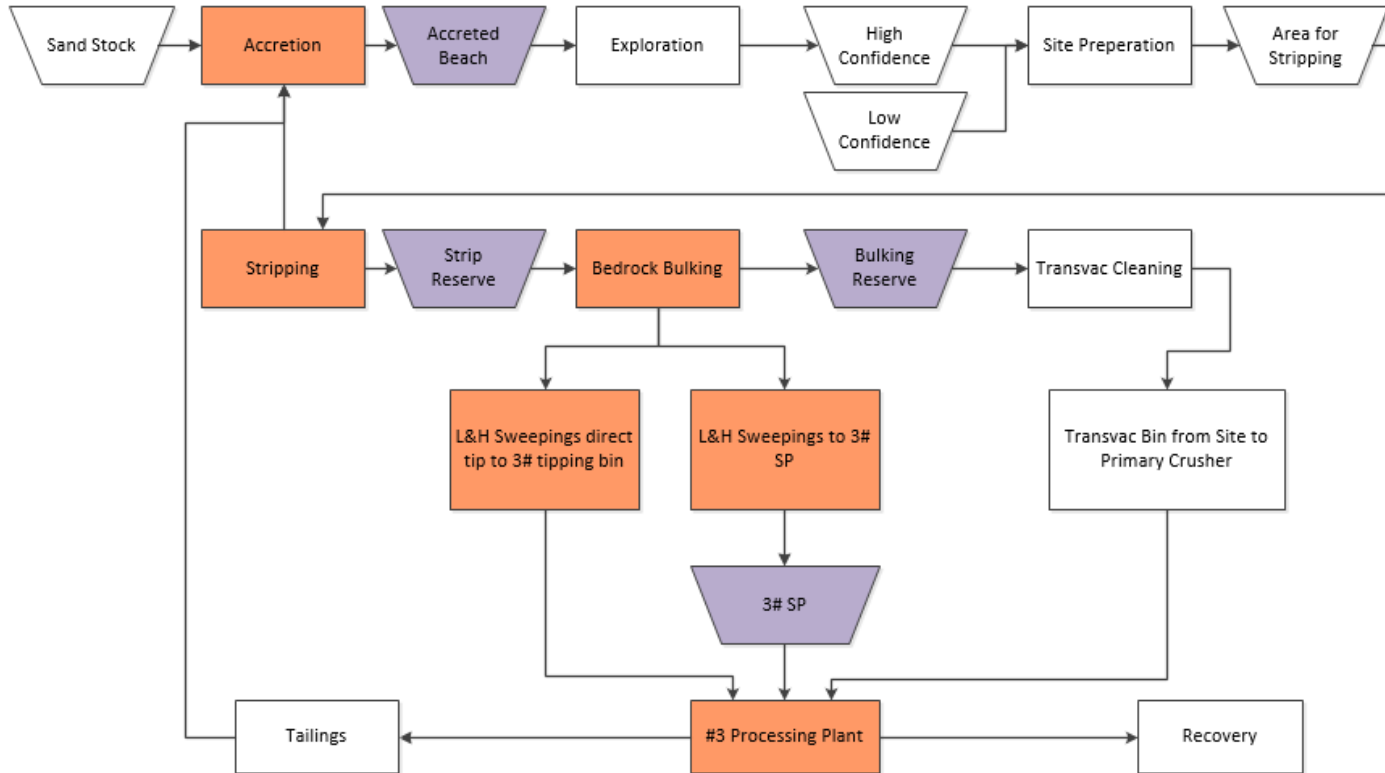
- The Theory of Constraints was first introduced by Eliyahu Godratt in 1984
- The system output is limited by one of more constraints and that an optimum system runs the constraint or bottleneck at maximum capacity
- All other processes therefore need to be focused on maximising throughput at the bottleneck



**....maximising throughput at the bottleneck optimises the system.**

# PROCESS FLOW FOR SCM

SCM process flow assisted in defining focus areas....



Buffers:

- Accreted Beach
- Strip Reserve
- Bulking Reserve
- 3# Buffer Stockpile

Other Bottlenecks:

- Stripping
- Accretion

Focus Area:

- Load and Haul Capacity
- Bulking – create material

Primary Bottleneck:

- Feed material to the plant

....and ensuring improvement focus was on the right functions.

# PLANNING AND EXECUTION

## Start with a solid Mine Plan....

### Planning:

- Solid mine plan – realistic targets and sufficient detail
- Inclusion of all relevant stakeholders
- Considered numerous options and associated risk



### Execution:

- Weekly drive through planning session
- All relevant stakeholder involvement
- Alignment of the plan
- Communication, Communication, Communication



....and using short interval control ensure you execute according to plan.

# LOAD AND HAUL

Building stockpiles has been a change in mindset at SCM....

SCM has traditionally been reluctant to build stockpiles as this generates additional cost

But:

Plant Feed Rates > L&H Fleet efficiencies

Plant Hours < L&H Fleet Hours

Result:

A significant number of mining delays



Looking at ToC the bottleneck was the ability of L&H to achieve required plant feed rates.

This justified the creation of a buffer stockpile ahead of the tipping bin.

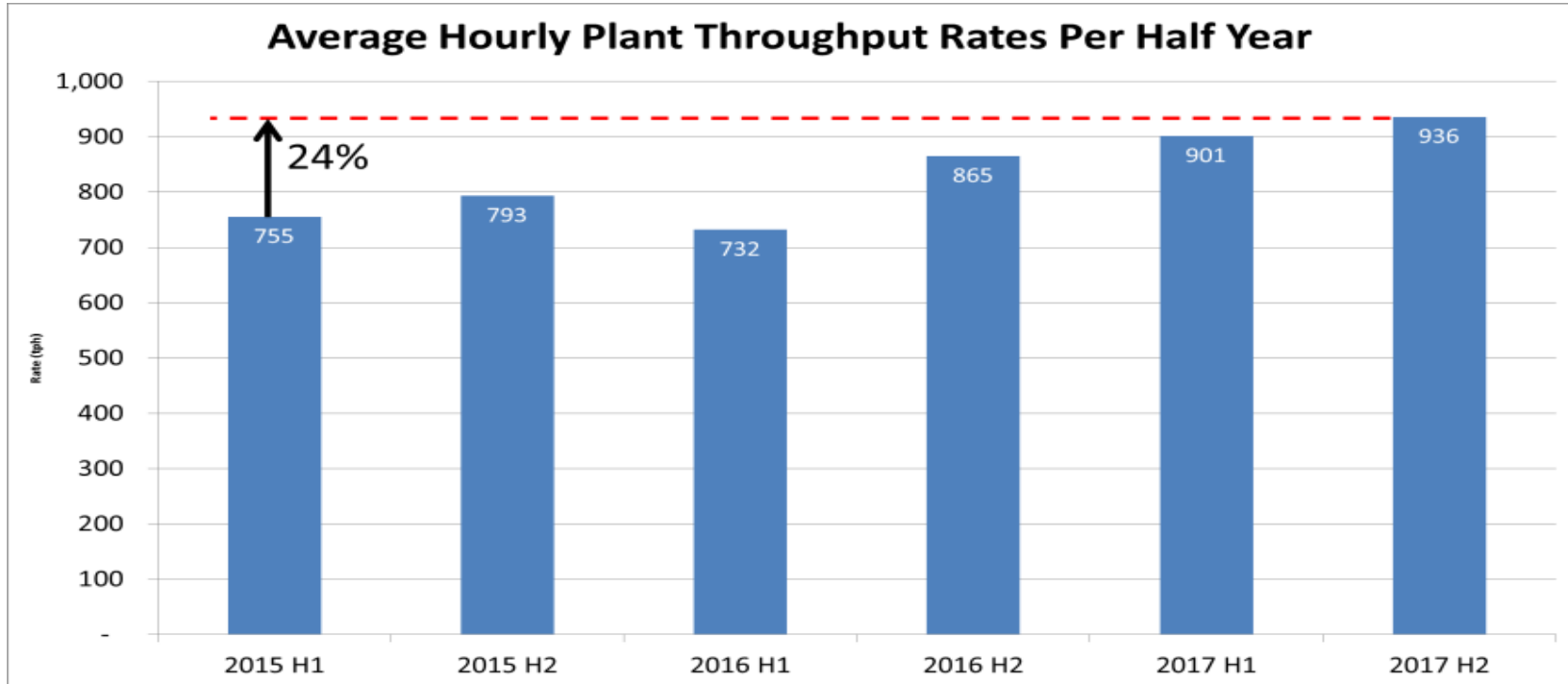
Resulted in reduced delays and increased overall throughput rates.

Revenue generation significantly greater than the additional stockpiling and rehandling costs

**....resulting in higher throughput rates and positive financial return.**

# PLANT THROUGHPUT

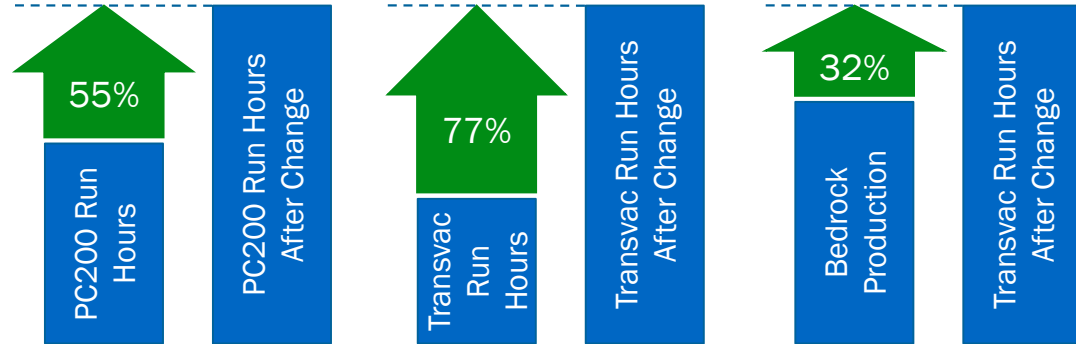
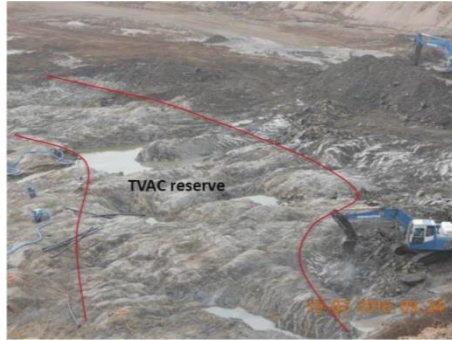
Improvement projects have increased the average throughput rate by 24%....



....increasing plant capacity and reducing unit costs.

# BACKSHIFT BEDROCK BULKING

Bedrock bulking was highlighted as a bottleneck....



Backshift bulking:

- Bulking the bottleneck
- Additional bulking created bulk reserve
- Increasing operating hours and m<sup>2</sup>
- Breakout if gullies increasing cleaning rates

....introducing a backshift has increased overall production by 32%.

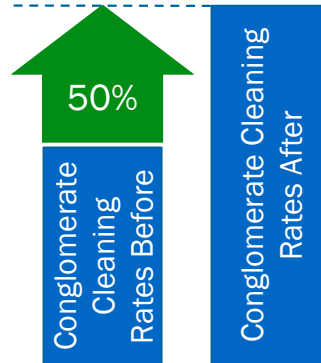
# INCREASED CLEANING RATES & BIG HAMMER

Additional bulking has impacted positively on bedrock cleaning rates...



## Cleaning Rates:

- Additional bulking capacity meant bulking teams broke open narrow gullies
- Increased transvac cleaning rates



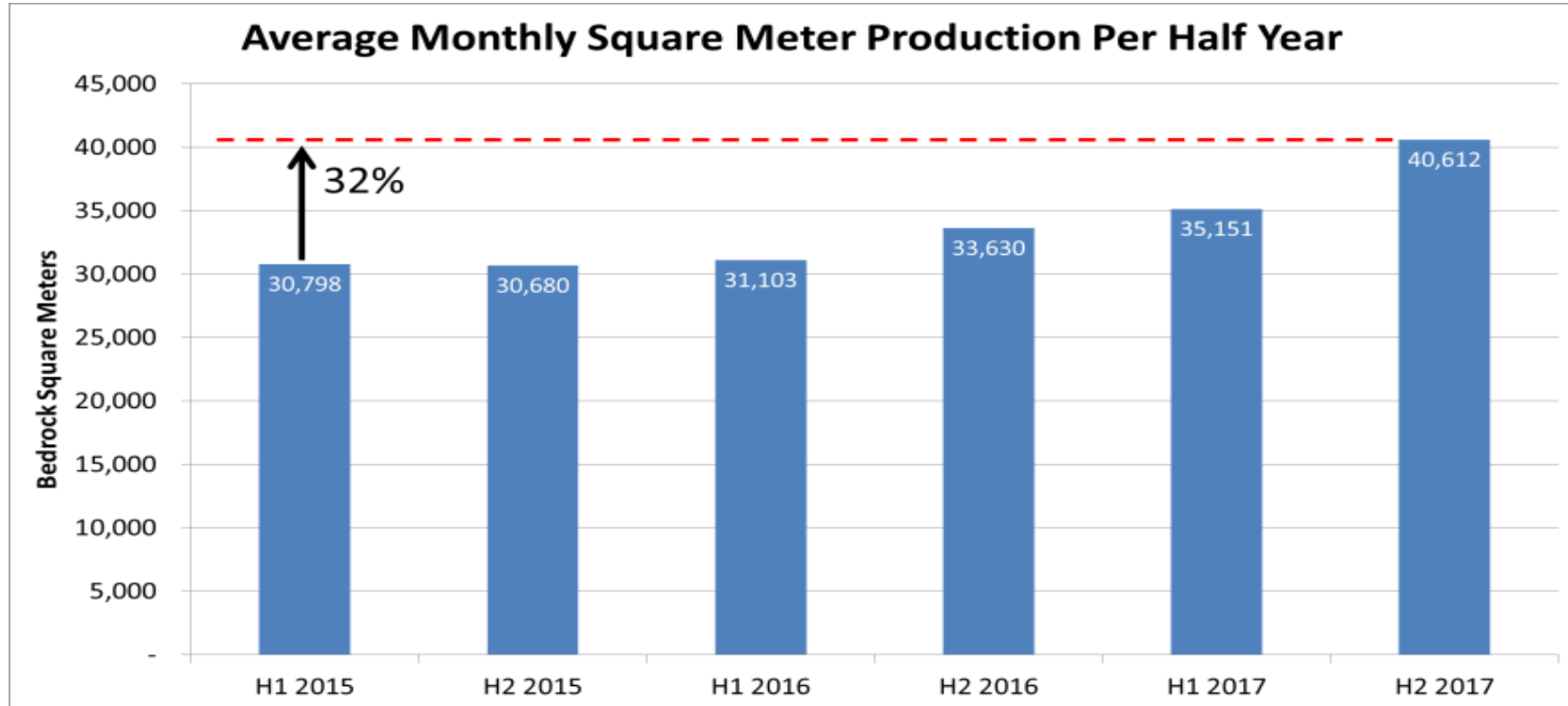
## Big Hammer:

- Previously no solution to conglomerate (more hours of hydraulic hammers)
- Bigger hammer provided a solution

...and the big hammer has provided a tool to break out conglomerate.

# BEDROCK PRODUCTION

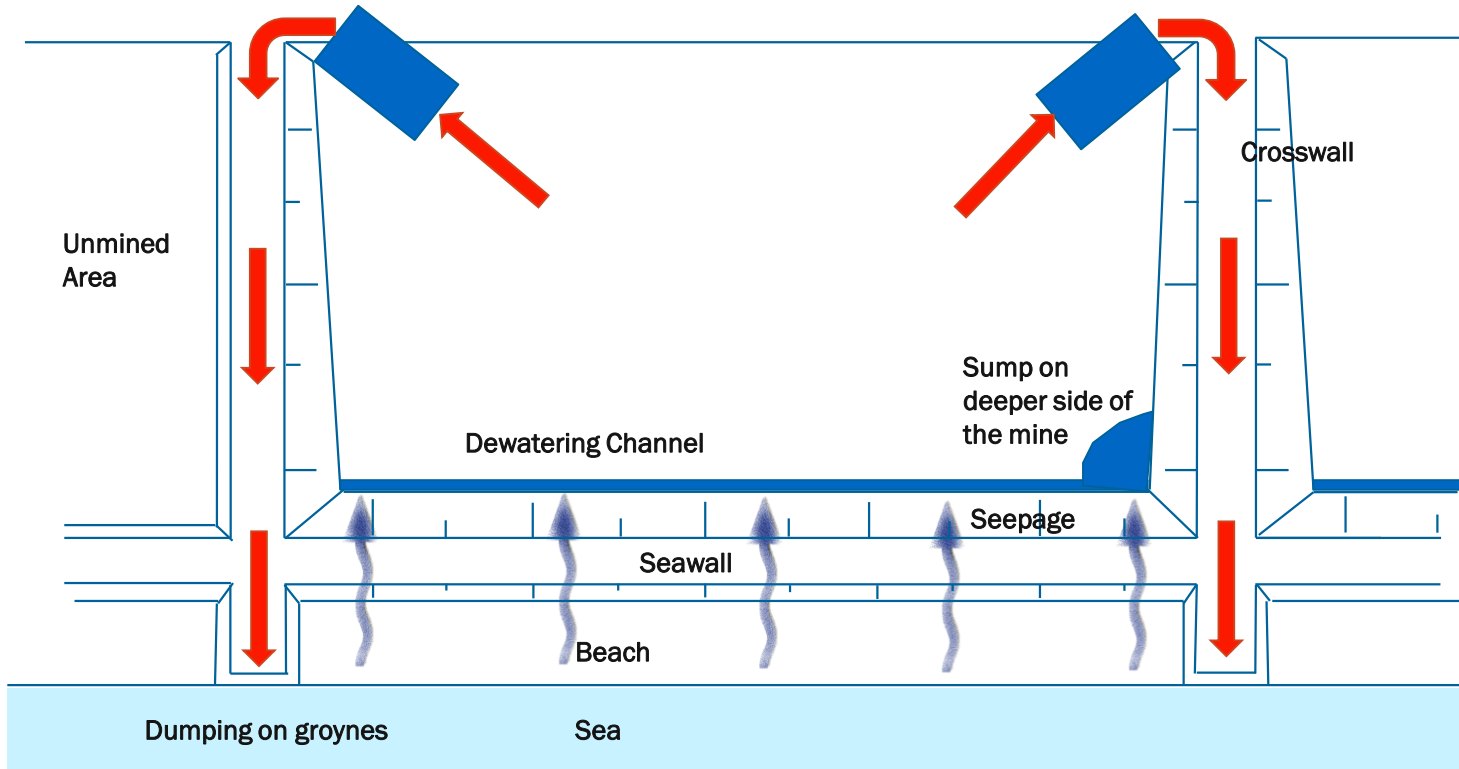
Improvement projects have increased average daily production by 32%....



....and has a direct impact on the Namdeb bottom line.

# STRIPPING PHILOSOPHY

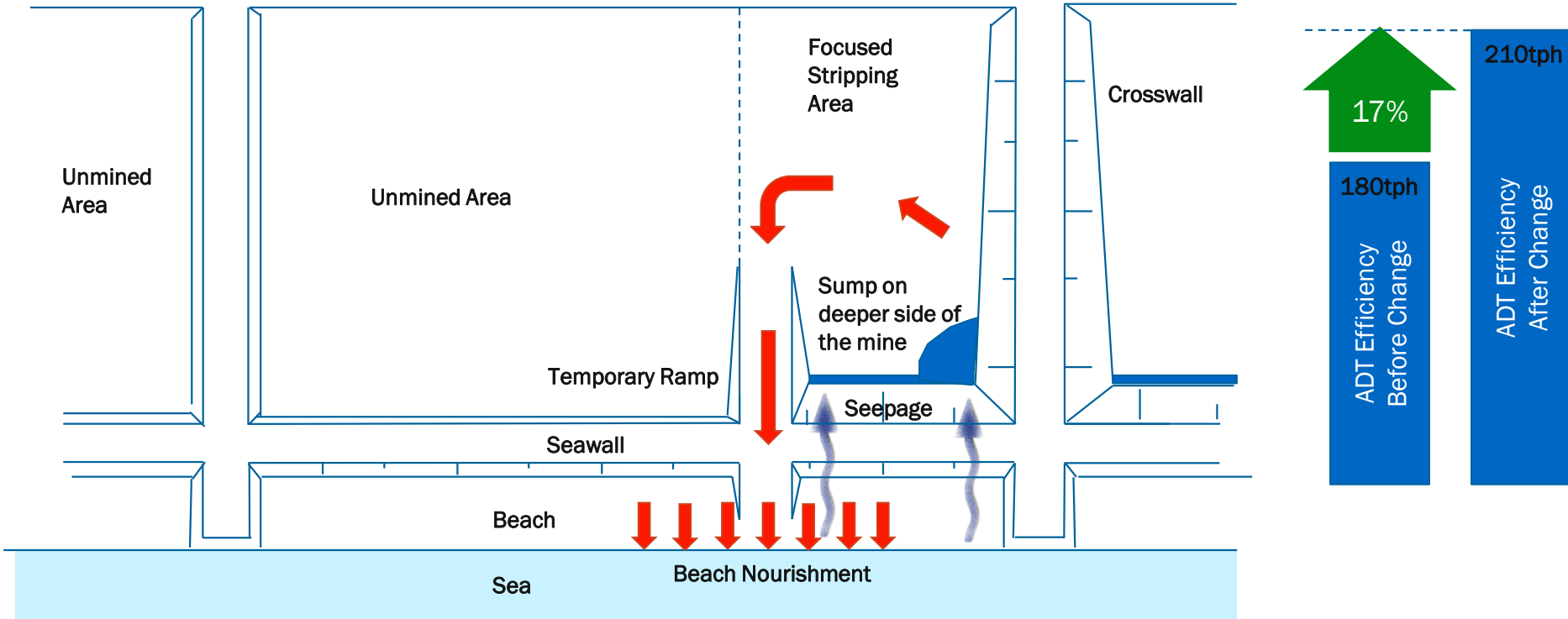
Previous mining method was to take material out on the east....



....dropping the whole cut at the same rate.

# STRIPPING PHILOSOPHY

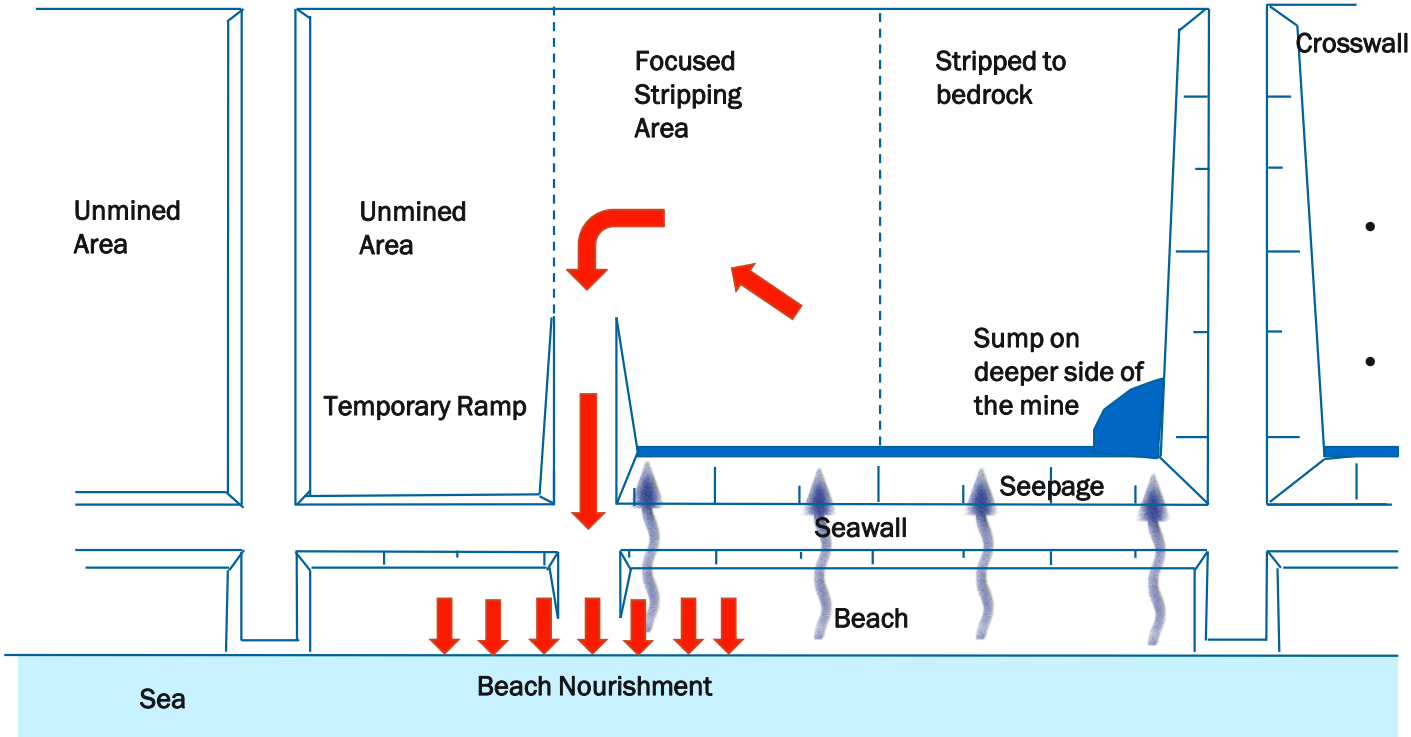
A change in mining philosophy with temporary ramps on the east ...



....reduced haul distances and increased efficiencies.

# STRIPPING PHILOSOPHY

New layout improved water management....

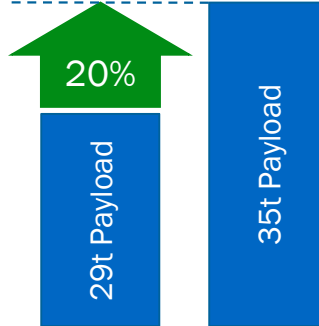


- New Layout also improved water management and loading set-up
- Increase in top loading

....and allowed for more efficient 'top-loading'.

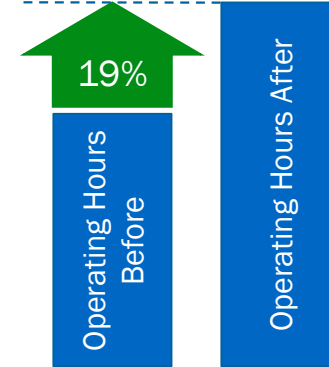
# GREEDY BOARDS AND REDUNDANCY

Greedy boards increased ADT payload....



## Greedy Boards:

- Effective 20% increase in payload
- Low maintenance
- Maintained loading through the tailgate



## Redundant Excavator

- Maintain 3 excavators in production at all times
- Better maintenance scheduling
- 4<sup>th</sup> excavator used for digging channels (non-production tasks) occasionally
- Big hammer for bedrock option

....while increased excavator redundancy increased operating hours.

# ACCRETION AND BEACH NOURISHMENT

Newly implemented Beach Nourishment reduced tramming distances....

What changed:

- Change from tipping on the groyne to...  
    dumping along the length of the beach.
- Create a platform and advance westwards

Results

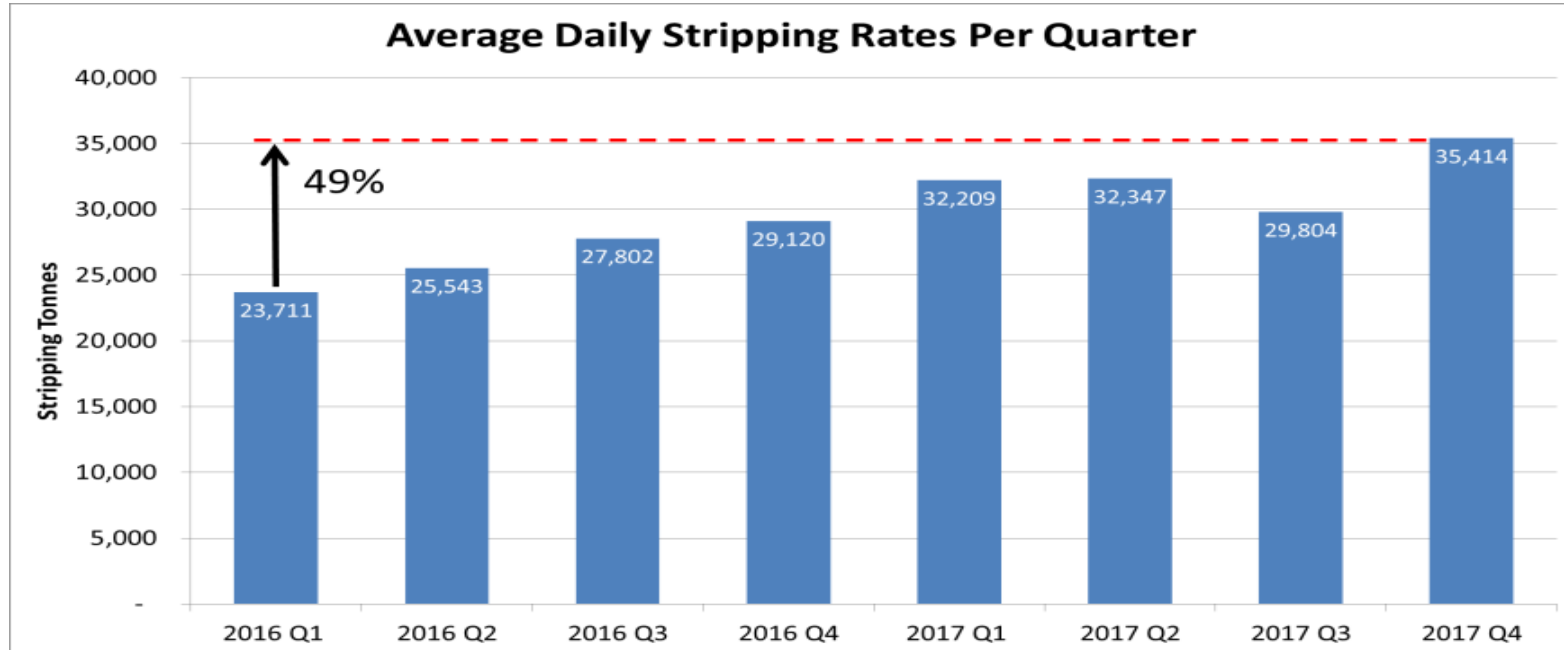
- Reduced tramming distances when combined with new mining philosophy
- Increased dumping area – less queuing
- Accelerated accretion
- Provided a buffer to protect against storms



....while also protecting workings against the risk of storms.

# STRIPPING IMPROVEMENTS

Improvement projects have increased average daily production by 49%....



....increasing strip reserve and opening up new opportunities to increase bedrock production.

# CONCLUSION

The Theory of Constraints puts focus on key bottlenecks....

- ToC highlighted focus areas across the mine.
- Developed a stable mine plan and execution methodology (Drive Through)
- Developed and Implemented Improvement Projects
- Subsequently we have ramped the bedrock cleaning from 3 to 5 teams improving Primary Bottleneck
- SCM have achieved more carats in 2018 YTD than in 2017



....to ensure value adding improvements are made in the right areas.

**Thank You  
and Questions...**

