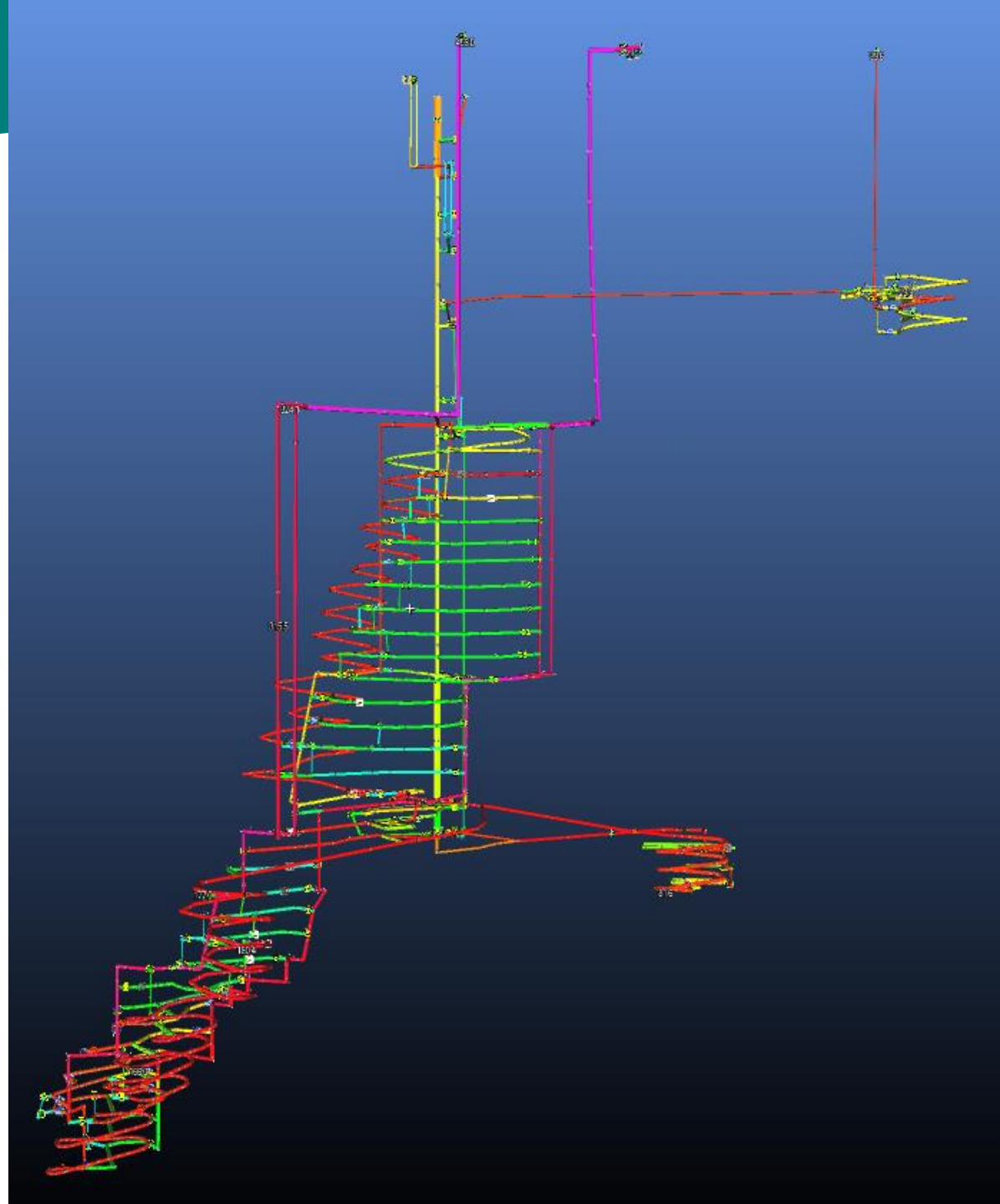
Experience In Using Ventsim Staging To Achieve Life of Mine Plans

#VUC2023



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Stefano Girardo, Lead – Reliability Engineering

I have worked with Vale's North Atlantic Central Engineering Ventilation group since October 2022 and have used Ventsim in various roles/capacities since 2017.

I do not consider myself as an "expert" user, but rather as an experienced one and have found features such as Ventsim's staging functionality a great asset when comparing design options and generating LOM plans.

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This presentation discusses the use of Ventsim in developing long-range ventilation designs for some of Vale's underground hard rock mines.

The staging feature of Ventsim has been utilized to achieve life-of-mine production and development targets. Ventilation controls and infrastructure were staged based on the production and development profiles over the life-of-mine. This allowed the alignment of operations, project, and site technical services teams on the sequence of ventilation milestones to be achieved.

The use of Ventsim in long-range mine design and production target achievement is a valuable tool for mine planning and optimization.

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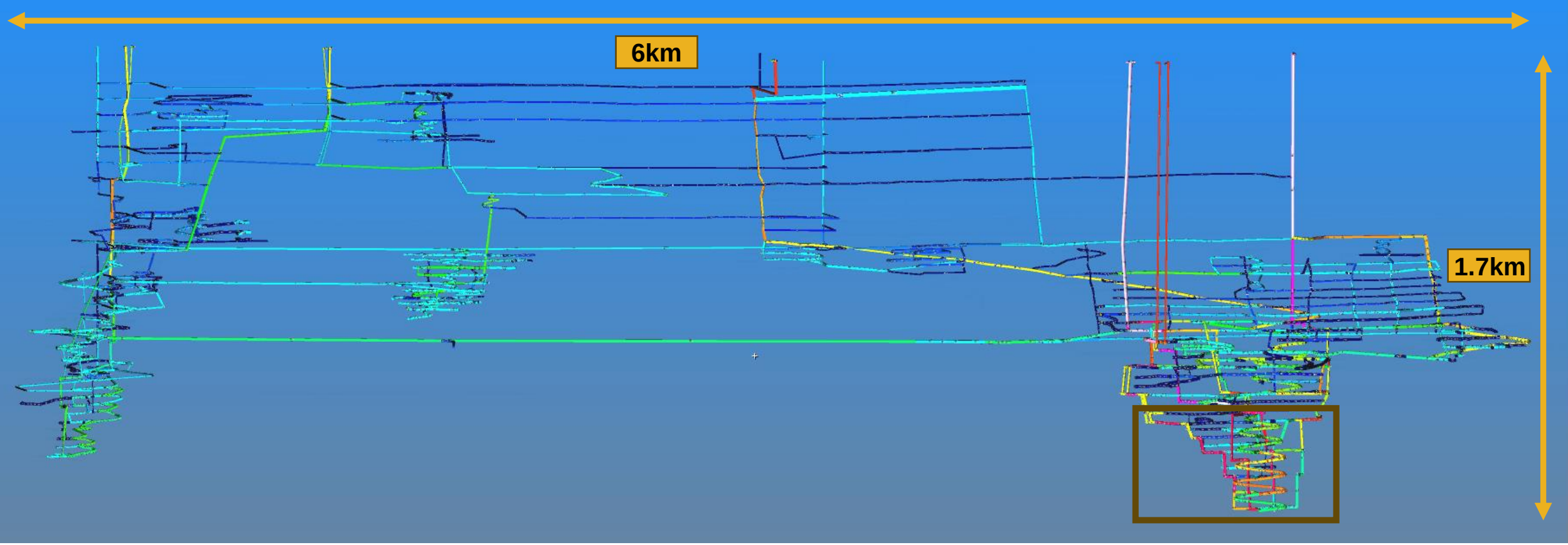
Agenda

1. Summary of Mines
2. Ventilation LOM Process
3. Staging Creation
4. Benefits of Ventsim Staging
5. Closing Remarks

1. Summary of Mines



Location

- Thompson, Manitoba

Vent System

- Push– Pull
- (9x) Surface fan station

Mining

- Cut and fill, as well as, Longhole Stoping
- Currently mining at 5200L (1.6km)

Future*

- Expansion to 5600L (1.7km)

*Studies being conducted to support expansion and extension of mine life

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1. Summary of Mines

Location

- Sudbury, Ontario

Vent System

- Push-Pull
- (2x) 1000HP Fans FAR
- (2x) 1000HP Fans RAR

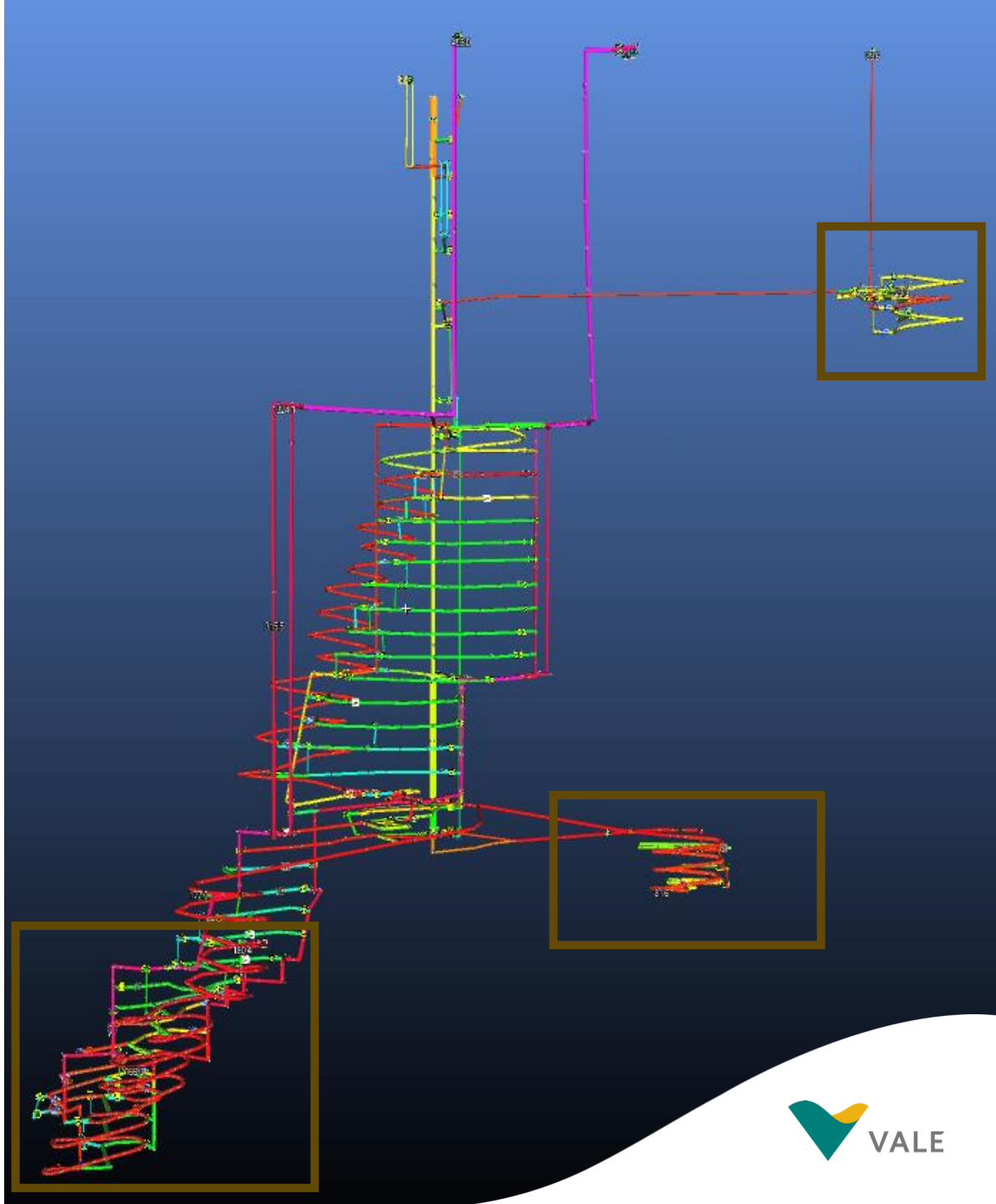
Mining

- Transverse Longhole Stoping
- Mining between 2330L-4650L (700m-1400m)

Future*

- Addition of (3x) new mining fronts
- Extension to 5650L+ (1.7km)

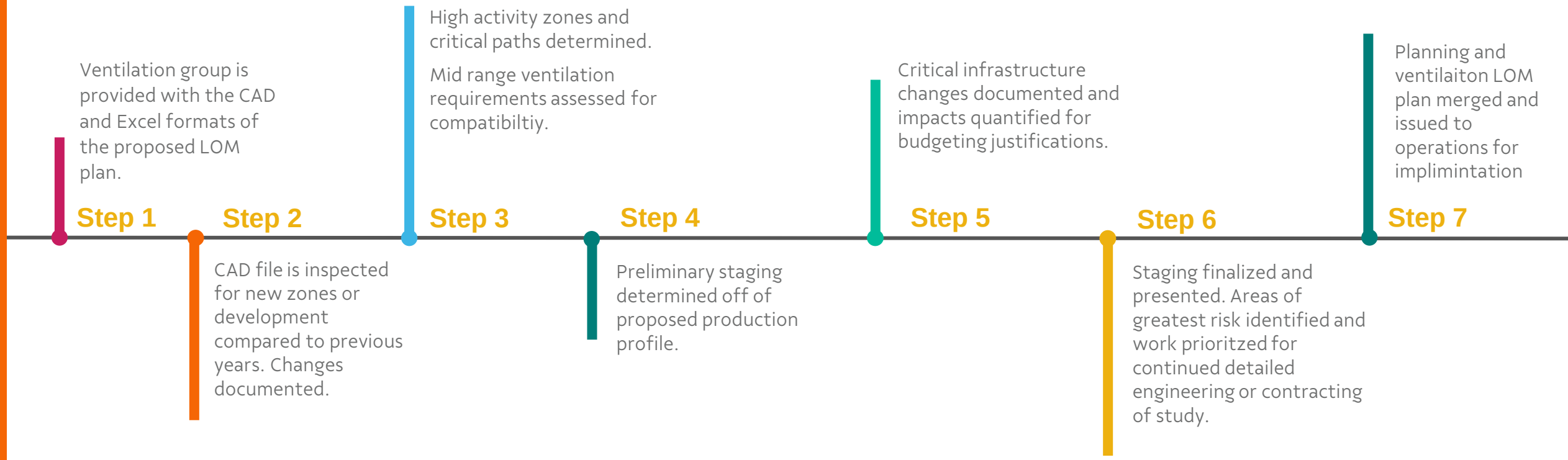
*Studies being conducted to support expansion and extension of mine life



2. Ventilation LOM Process

Mine planning and ventilation planning integration

2. Ventilation LOM Process



Should the schedule match the availability of flows, or should the availability of flow match the schedule?

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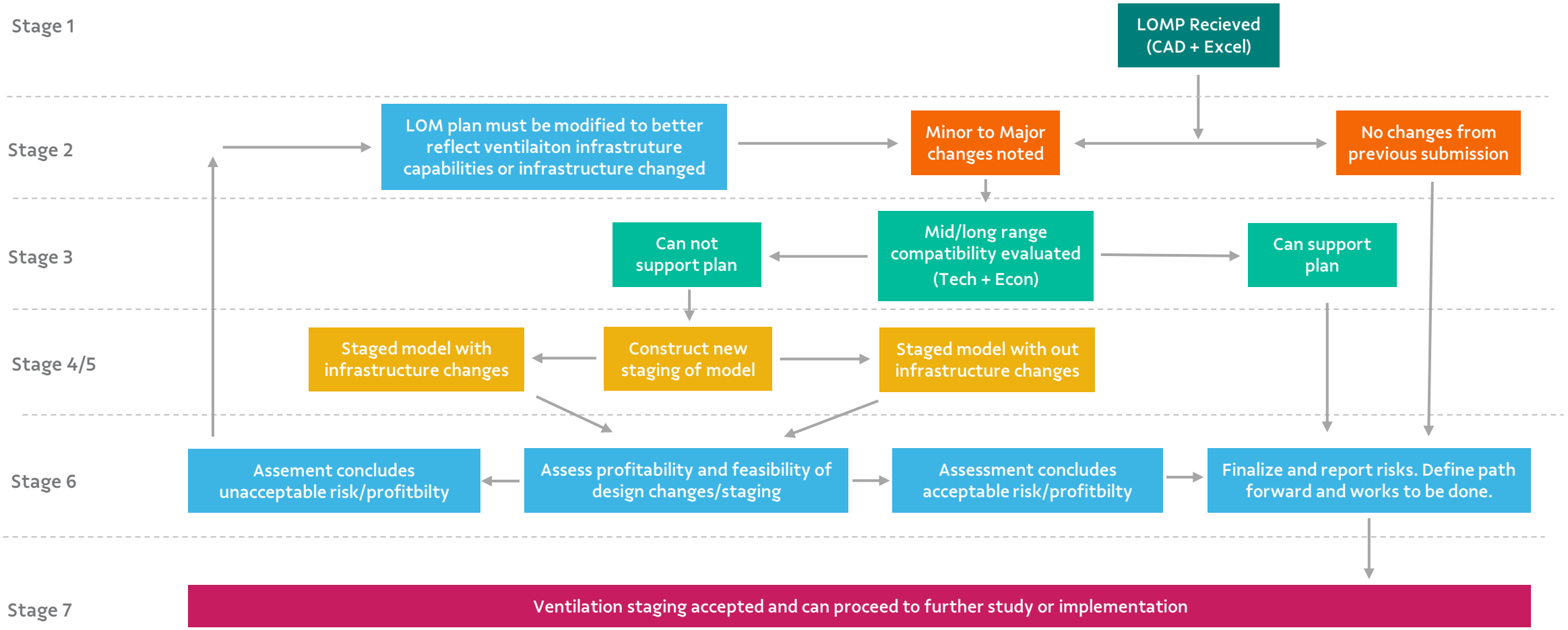
2. Ventilation LOM Process



3. Staging Creation

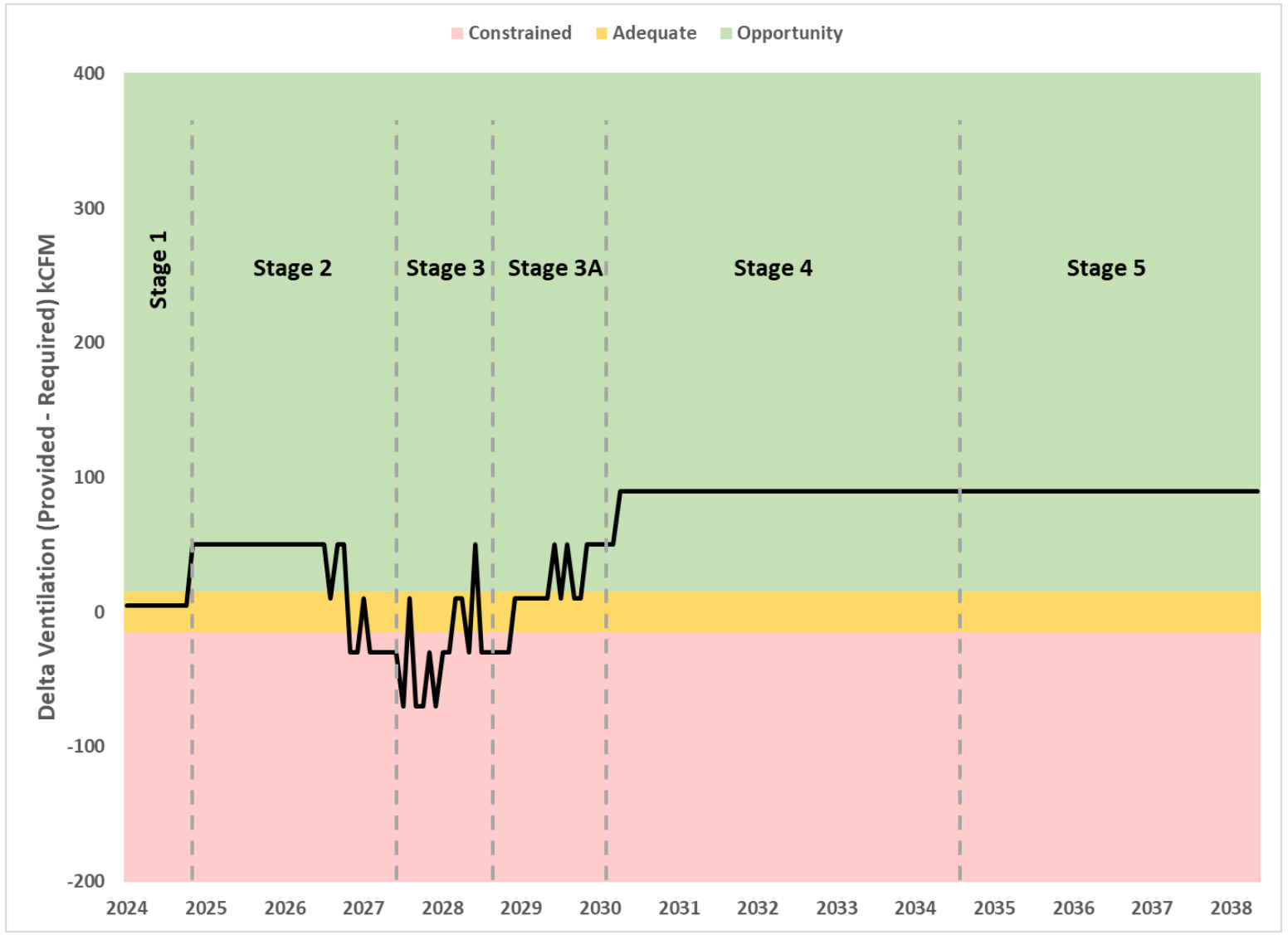
Air Determination – Availability and Requirements

Defining of Ventilation Staging

Stages are typically defined when there is:

- Increased activity within a zone
- Ventilation related milestone have been completed
- Infrastructure has been upgraded

The simplest way of determining a stage based on productivity is generating a heat map of material movement for each year/month.



Evaluation of Schedule Compatibility

The compatibility of the mid range to long range schedule can be evaluated by:

- Assigning scheduled tasks ventilation requirements
- Then comparing those values to the staged Ventsim modelled results

Note: Assessments should be done by zone/ventilation circuit to locally determine flow variance and better account for leakage and auto compression.

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4. Benefits of Ventsim Staging

How We Use Staging

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Record Keeping

Scenario Modelling

Communication

Risk and Opportunity

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Record Keeping

As multiple scenarios can be saved within the same model it reduces the complexity of having multiple working files. Having most if not all scenarios in a singular file reduces network clutter and increases the time used for actual modelling.

In using the stage manager and staging lock function, the group has been able to store over (20x) scenarios in a singular file without significantly: slowing down the model or increasing file size.

Communication

Having the future ventilation works tied directly to schedule events has made it easier for sites to understand works to be done and their priorities as they relate to development and production.

Scenario Modelling

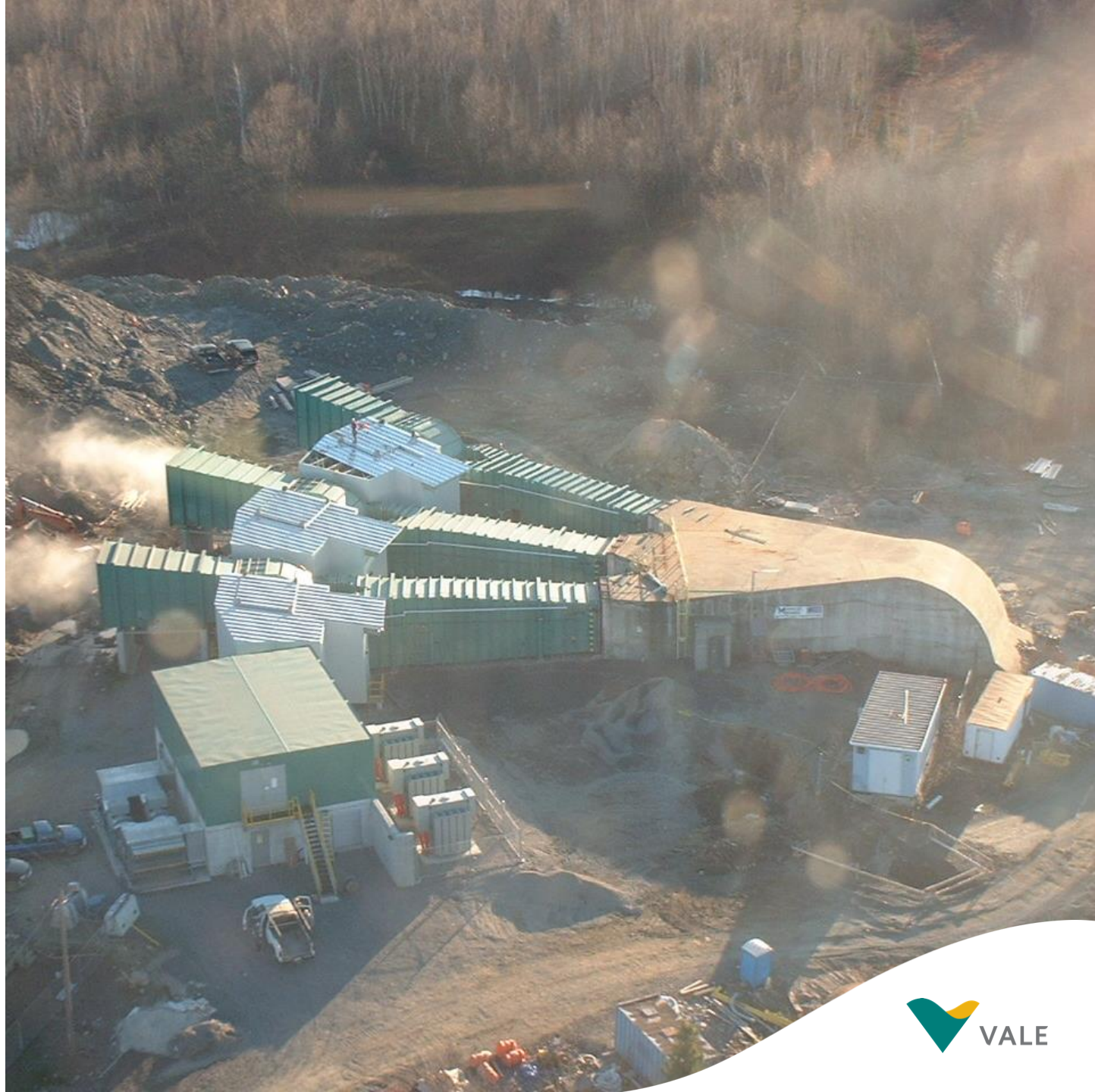
As Ventsim is first a foremost a modelling tool it is used to model the stages created. Vale has used staging extensively to:

- Select appropriately sized booster fans capable of operating across multiple stages of the mine life
- Evaluate various arrangements for blast clearing
- Project working at rest conditions for increased fleet size , working a greater depths and greater surface temperatures
- Optimize multi leg raise arrangements for sizing and minimization of shock losses
- Provide infrastructure recommendations to achieve LOM plans

Risk and Opportunity

As the staging process in done by mining front/ventilation circuit, over and under ventilated areas can be determined based on the long range schedule requirements.

In being able to model multiple scenarios of different types of infrastructure or production/ development profiles, schedules can be de-risked and optimized based on the resources present.



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Better Designs...

...For Safer Mines

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