Ventsim DESIGN Application in Vale's Mine Ventilation Changeover

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Negar Saeidi, MSc P.Eng
Specialist Engineer - Ventilation
Vale Base Metals - North Atlantic Projects
Negar.Saeidi@vale.com

Ventilation design and management is a critical task in the current and future mines

- Ventilation accounts for 50% to 80% of the typical mine's energy expenditure
- As remote operations grow and mines get deeper, the energy demand for ventilation and cooling/heating increases. As a result, the operating costs of our mines increase
- In such conditions, effective management of the mine ventilation air for a safe and profitable operation becomes a challenging task

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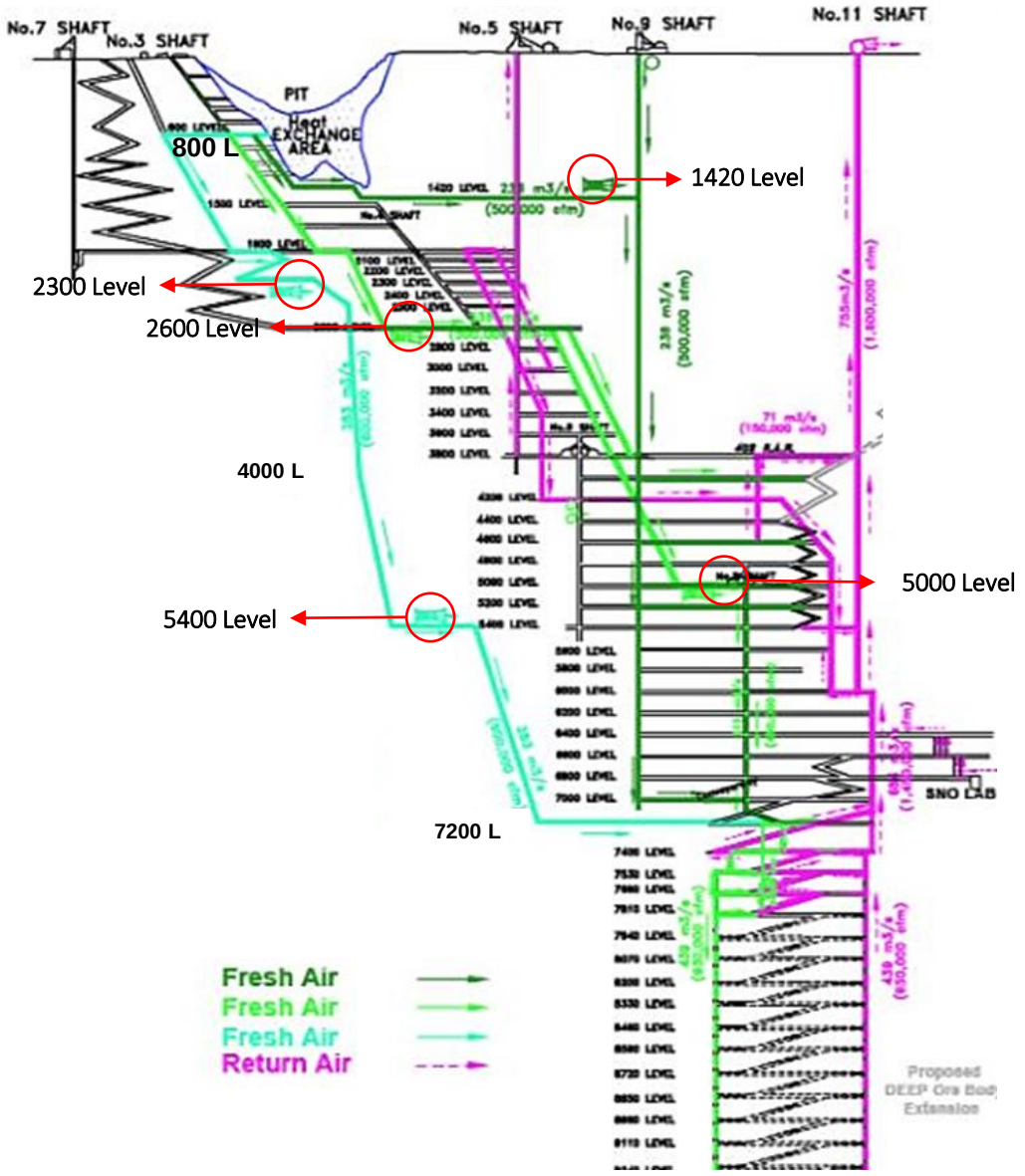
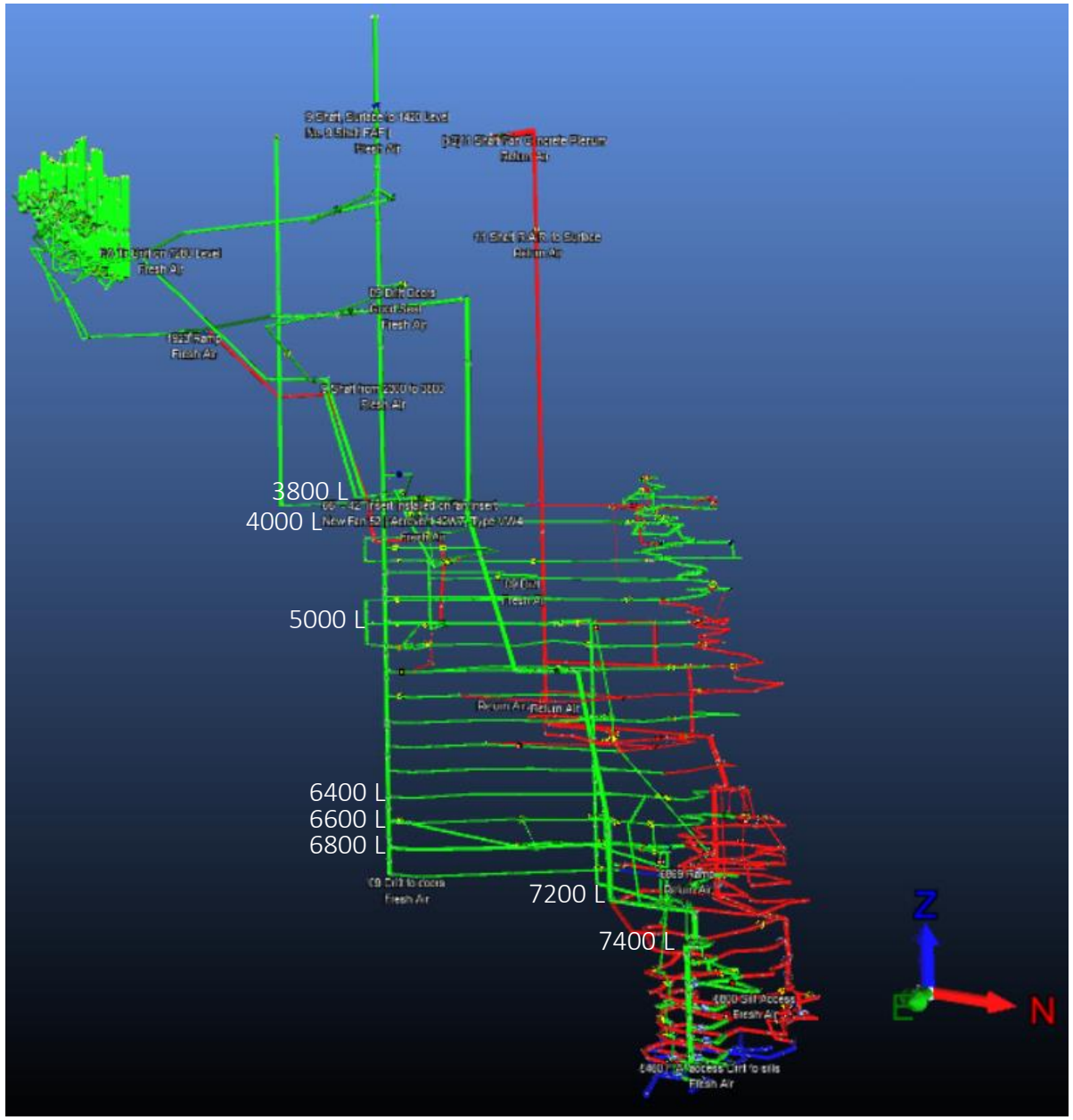
Mine Ventilation Schematic





Project:

- **Airflow Diversion**
  redirecting 150 kcfm of air from the old mining area (4000 L to 5000 L) to the mining zone below 7400 L.

Assessment:

- **Infrastructure Requirement**
  raises, drifts, fans, ventilation control, etc.
- **Implication to Life of Mine Infrastructure**
  evaluation of the main fans' performance and ventilation requirement in the old mining area, including sumps, garages, electrical substations and refuge stations
- **Project Costs vs Benefits**
  assessment of expenses associated with infrastructure development vs. benefits, such as increased mining, improved air quality, and enhanced safety measures.

Outcome:

- **Sequence of Events**
  for infrastructure development/construction and for airflow diversion commissioning

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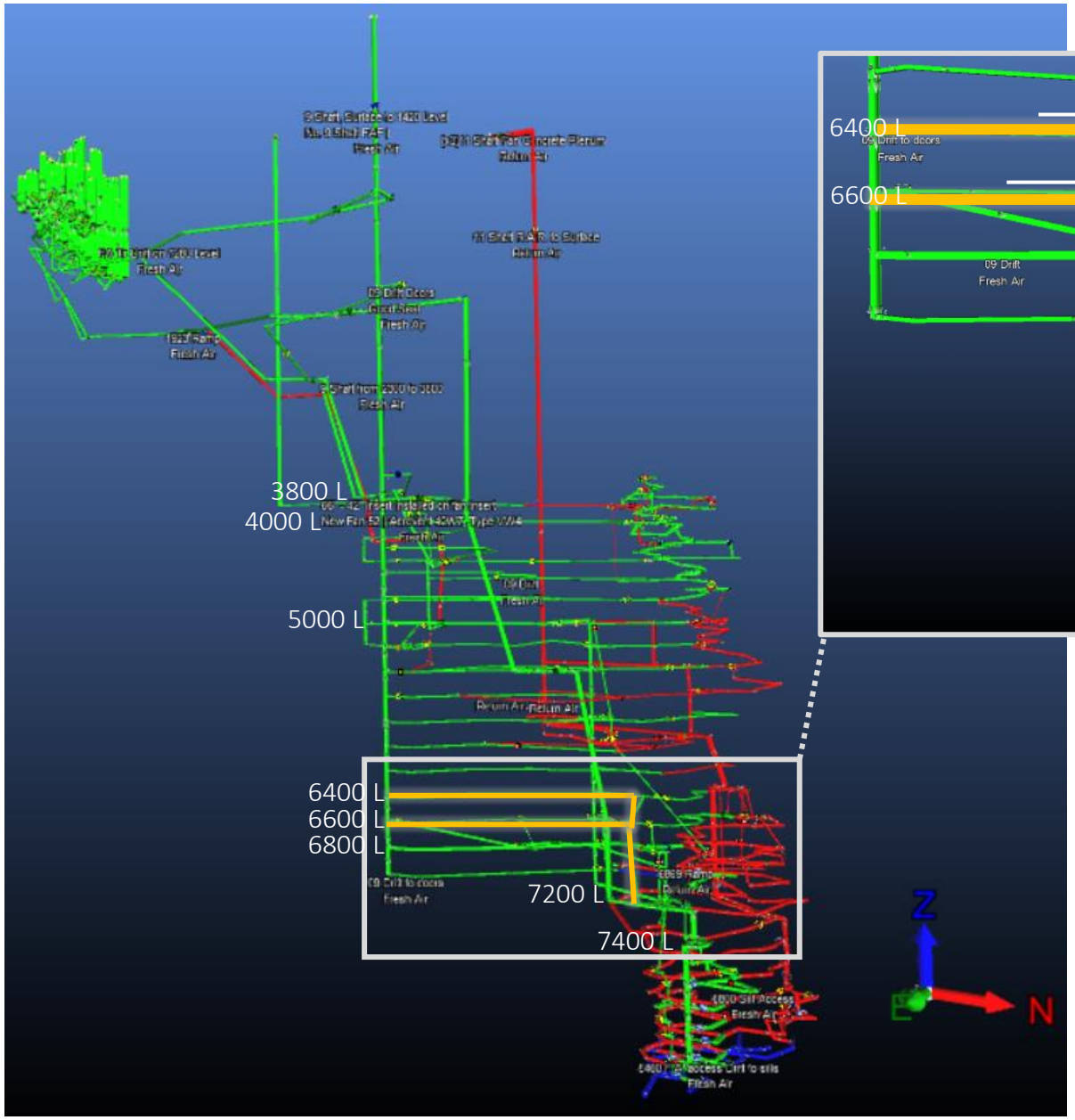
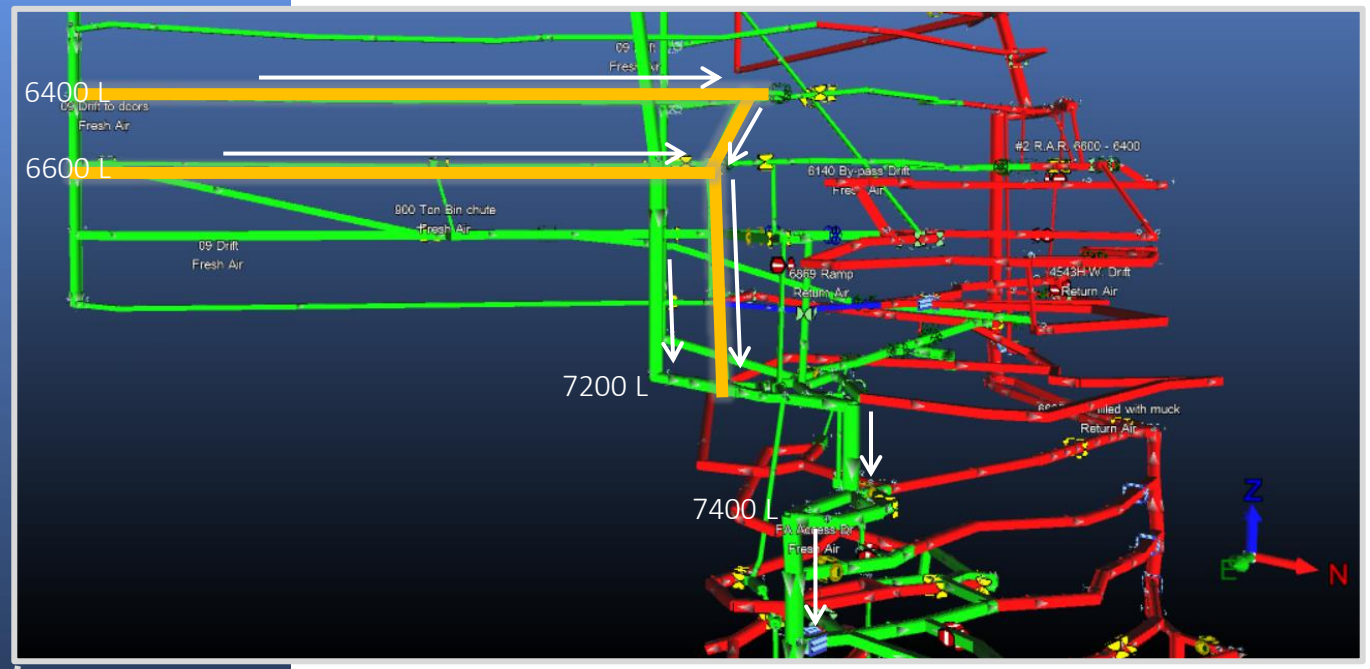
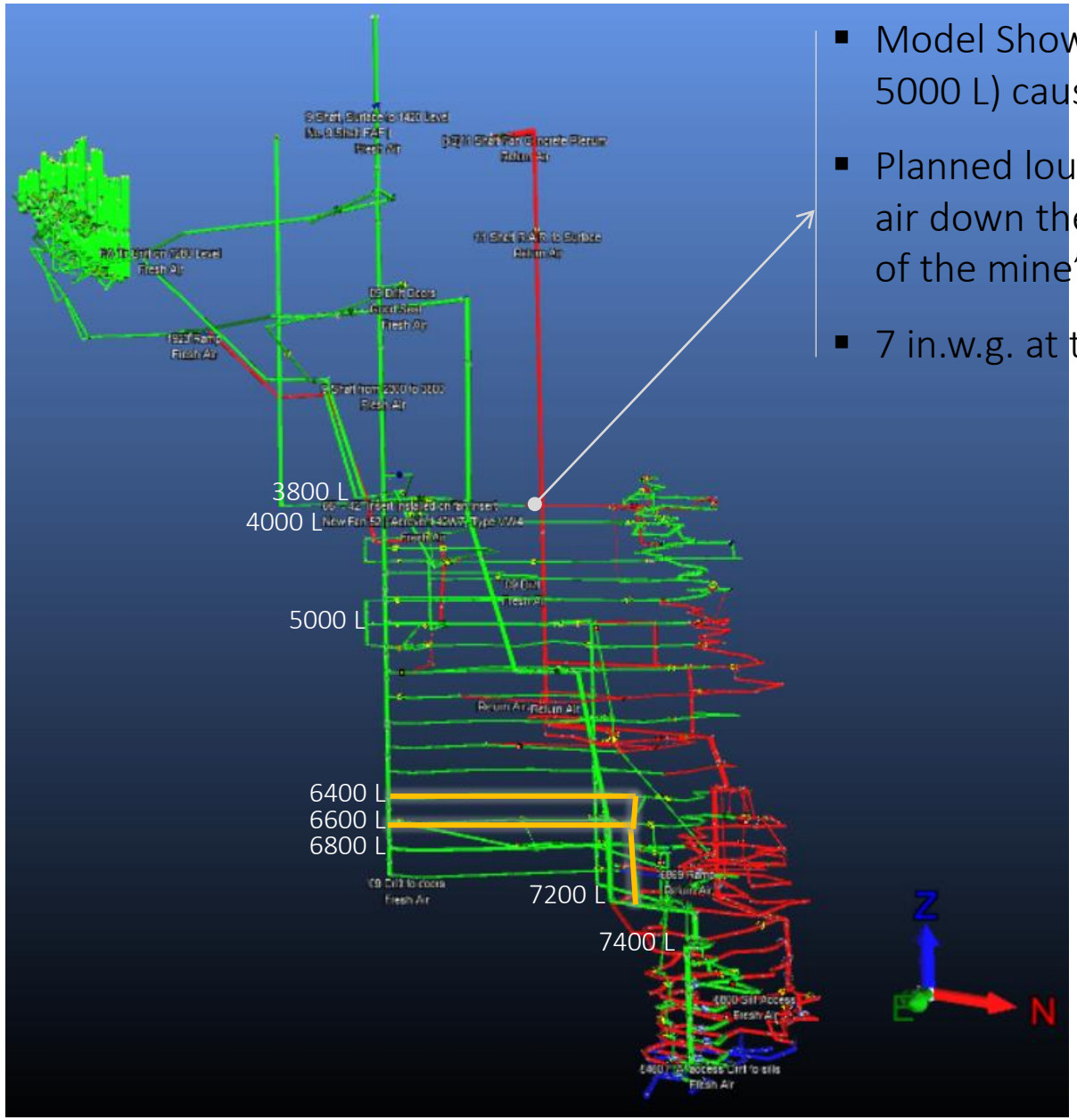




- A 10’ dia. raise-bore from 6400 L to 7200 L with a connection to 6600 L.
- 2x150 hp was selected for installation at the fresh air raise access on each level
- ~ 80 kcfm of fresh air is supplied from each set of fans at ~ 9 in.w.g. fan total pressure
- No changes to the main mine fans performances



- Model Showed: reducing ventilation to the old mining area (4000 L to 5000 L) caused ~200 kcfm leaking to return air raise on 3800 L
- Planned louver adjustment to reduce to ~30 kcfm and push remaining air down the fresh air raise – minimum airflow requirement as it is part of the mine's emergency access
- 7 in.w.g. at the louver when adjusted to lower ventilation to 30 kcfm

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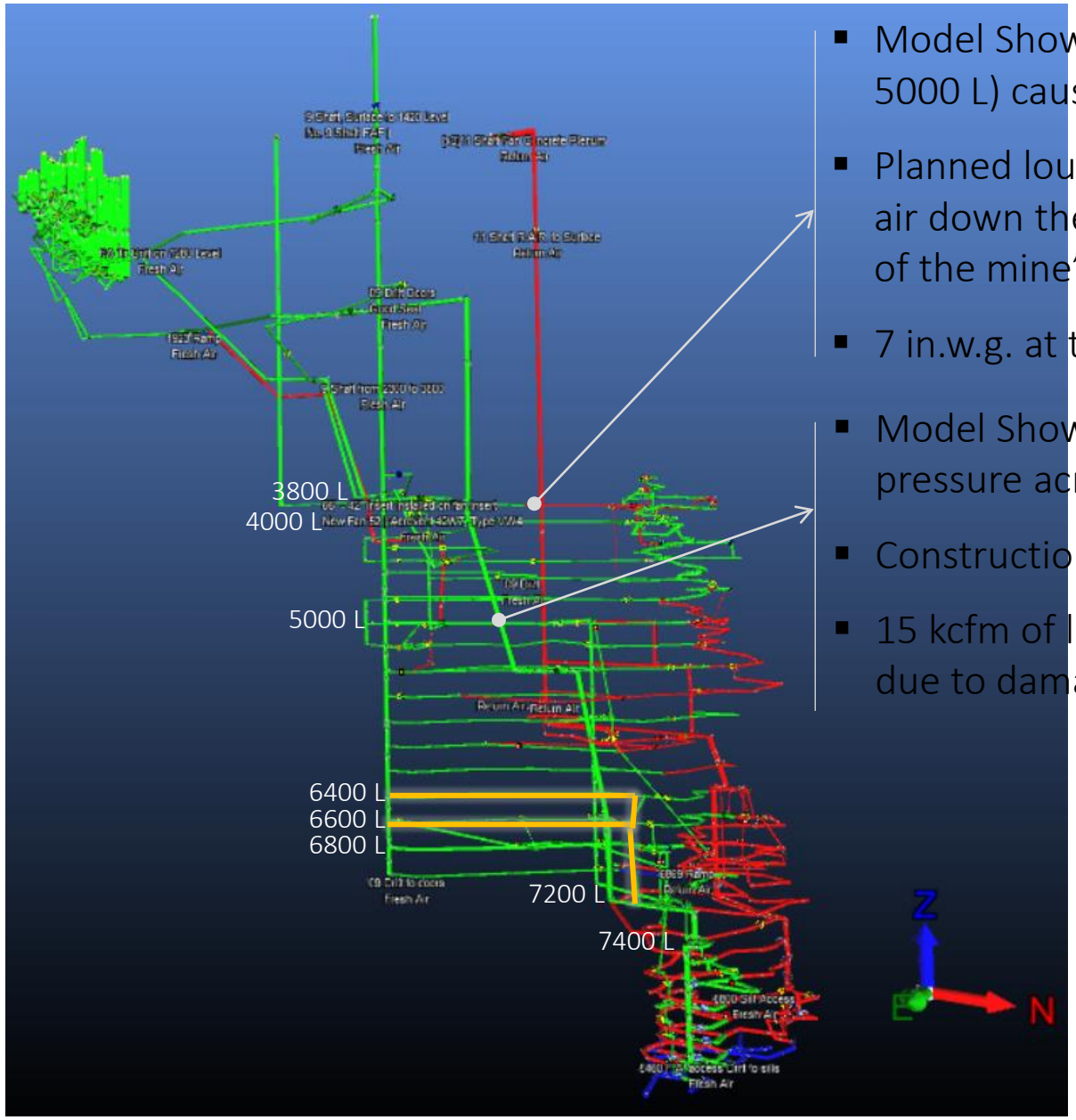

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- 7 in.w.g. at the louver when adjusted to lower ventilation to 30 kcfm
- Model Showed: commissioning of 6400 L & 6600 L fans increases pressure across airlock doors on 5000 L fresh air booster fan station ☒
- Construction crew were to get involved pending changeover results
- 15 kcfm of leakage measured in the field from the booster fan station due to damaged air lock door

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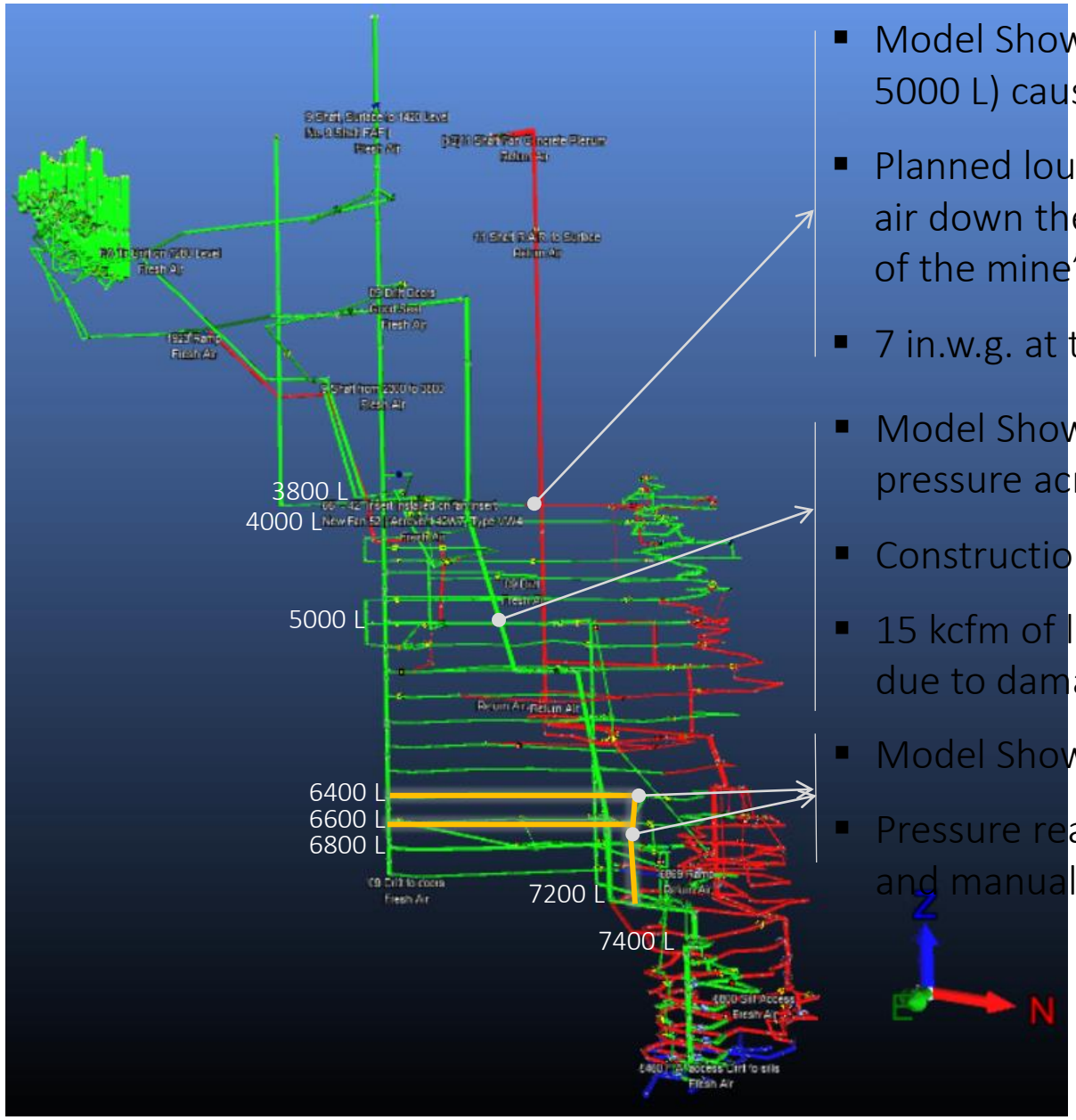

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- 15 kcfm of leakage measured in the field from the booster fan station due to damaged air lock door
- Model Showed 6400 L & 6600 L fan performances matching the field ☑
- Pressure reading sensor installation issue was verified against model and manual pressure reading

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Conclusions

- Ventsim DESIGN is a good tool for simulating and analyzing underground mine ventilation systems.
- It is important to remember that a computational model's accuracy heavily relies on the quality of the input data provided.
- First principles, the fundamental laws and concepts governing ventilation, should always be considered and applied when setting up the simulation.
- Calibration of the model is essential to fine-tune its parameters and settings so that it aligns well with the actual conditions observed in the field.
- Field data, collected from real-life ventilation measurements in the mine, should be used to validate and cross-check the model's predictions.
- Blindly accepting simulation results without considering their reasonableness or comparing them to real-world data can lead to inaccuracies and misinterpretations.
- The expertise of mining and ventilation professionals is critical to interpreting the results and making informed decisions based on the simulation outcomes.

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