Instope water handling strategies to achieve a Dry Mine

SAIMM PGM CONFERENCE 2025

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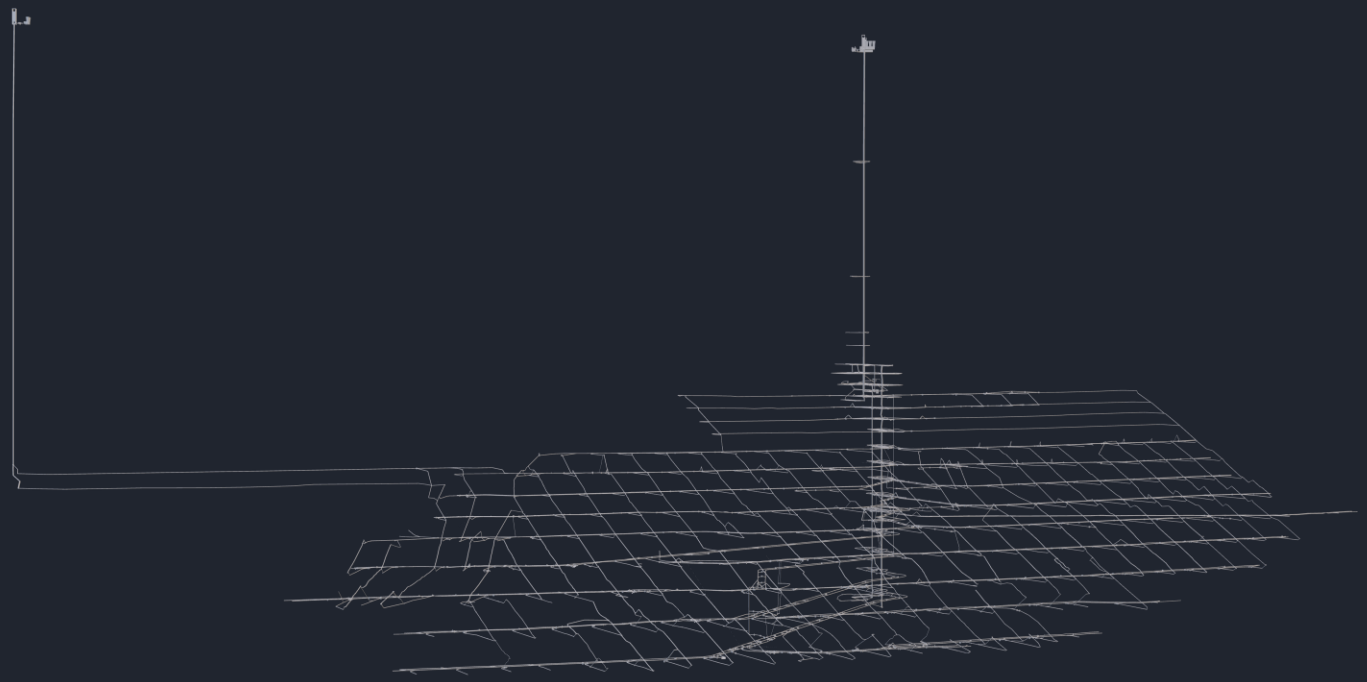
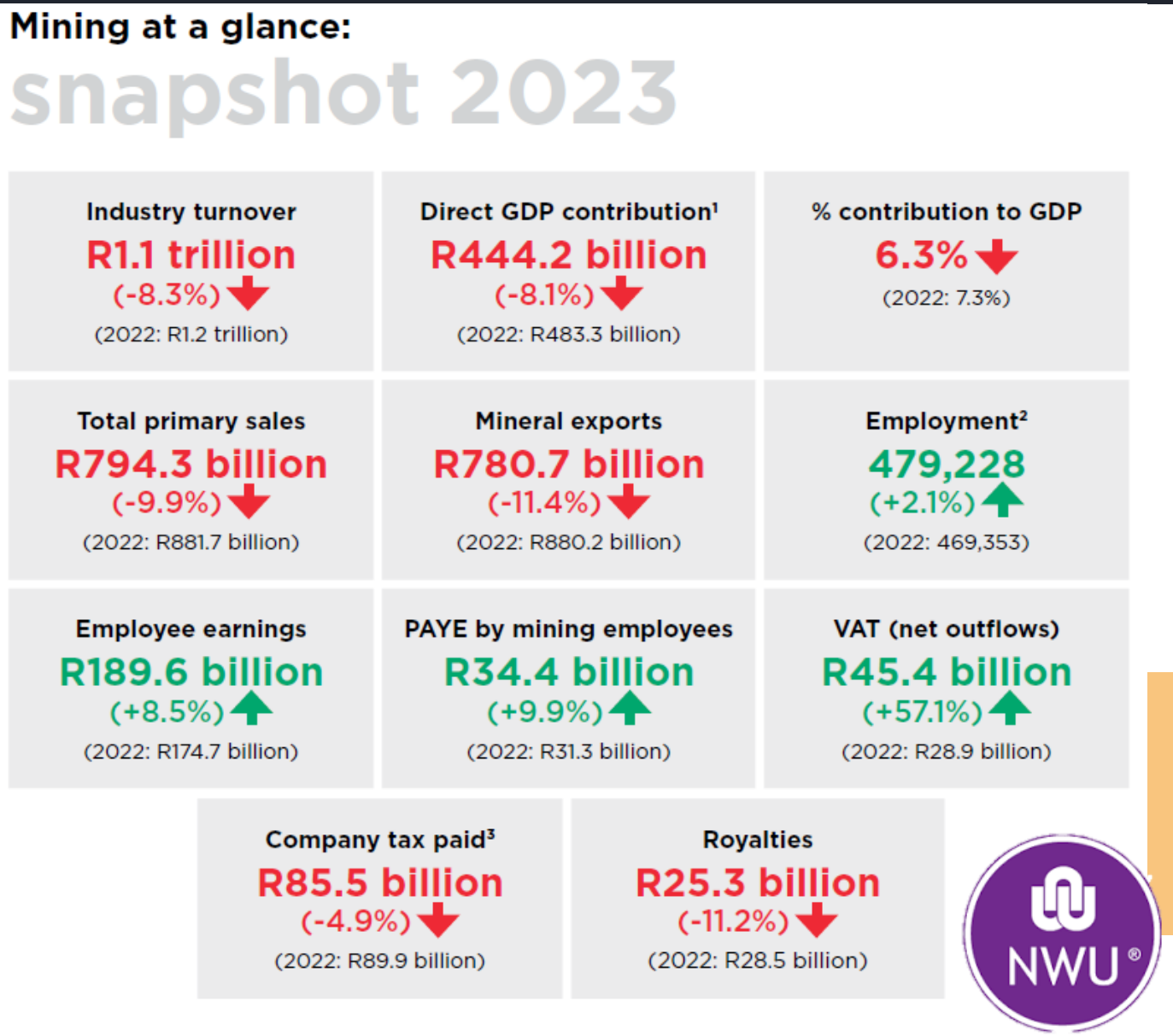


CONTENT

- Introduction – Mining background
- Factors affecting mines
- Use of Water
- Challenges
- Gap identified
- Methodology
- Methodology steps
- Results
- Conclusion

INTRODUCTION

- The South African PGM mining sector remains a significant contributor to the country's economy [1].
- Deep-level mines have seen a decline in production due to economic pressures.
- Mines are forced to expand their mining operations in search of more ore grades to remain profitable.
- The extension of the mining operations presents unique challenges, adding to the mine's economic pressures.

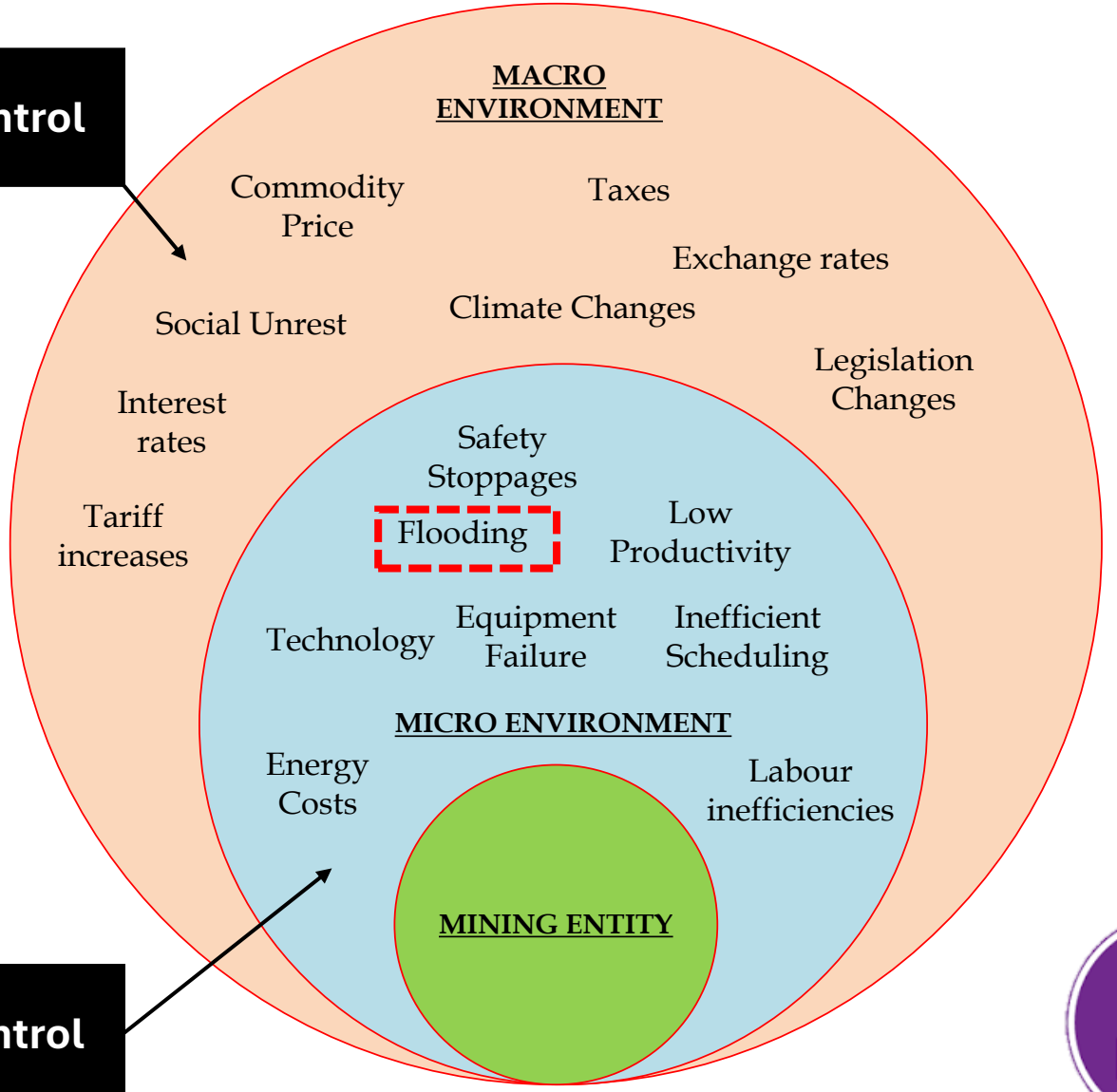


Factors affecting mines

Out of the mine's control

Engineering-related factors include:

- Underground equipment failure [2],[2]
- Deep-level mine flooding/ mismanagement [3]
- Continuous power cuts (Eskom load curtailment) [4]

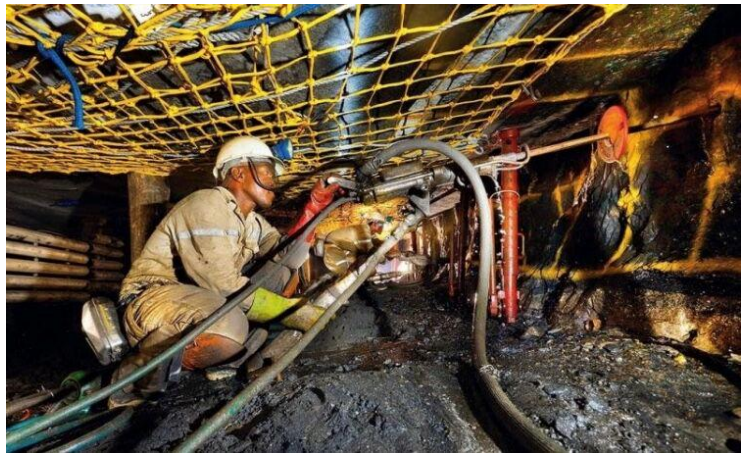


Within the mines control

Use of Water

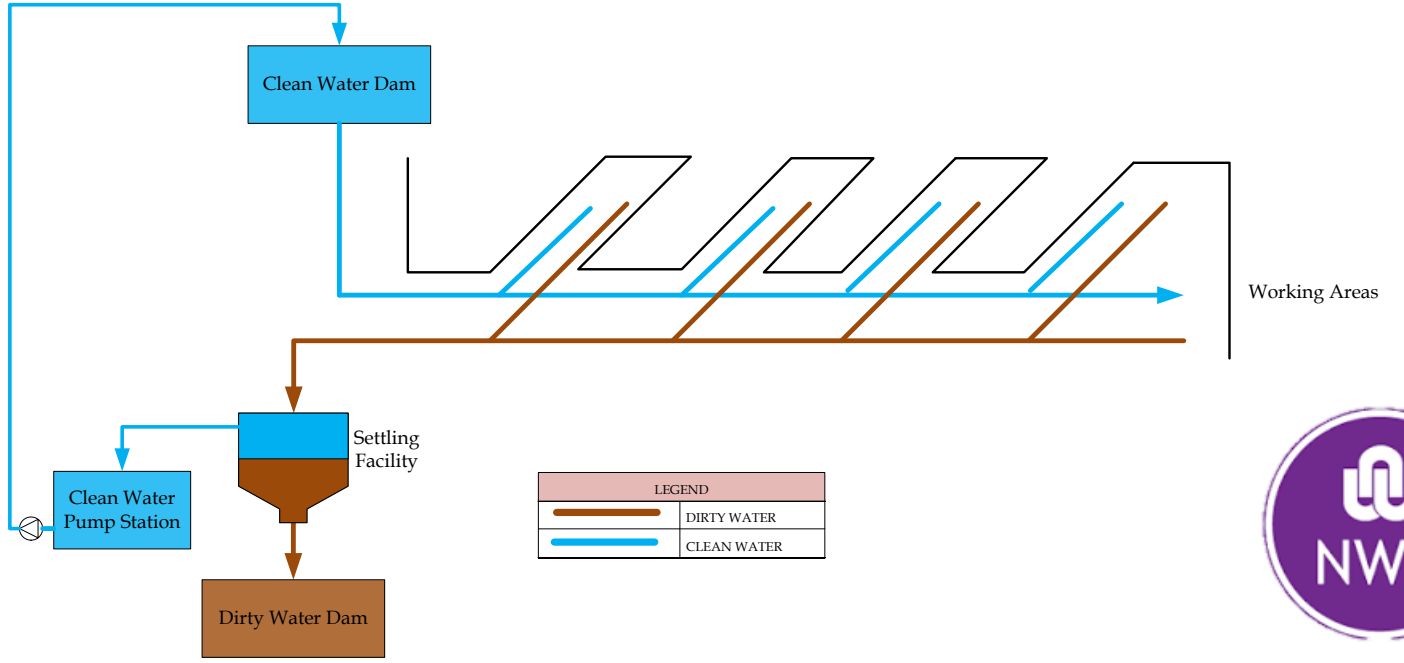
Water Uses In underground Mines:

- Lubrication
- Dust suppression
- Cooling
- Cleaning of panels

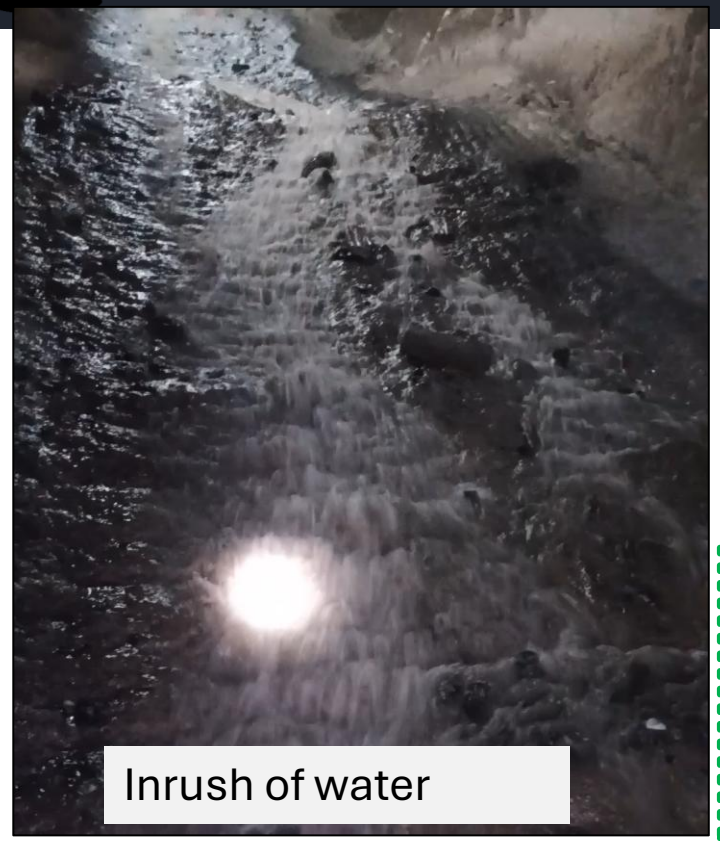


Deep Level Mining Infrastructure:

- Clean water systems: Used for production operation in stopes
- Dirty water : By product of production
- Settlers: Separation of clean and dirty water
- Pump stations: Movement of water to surface

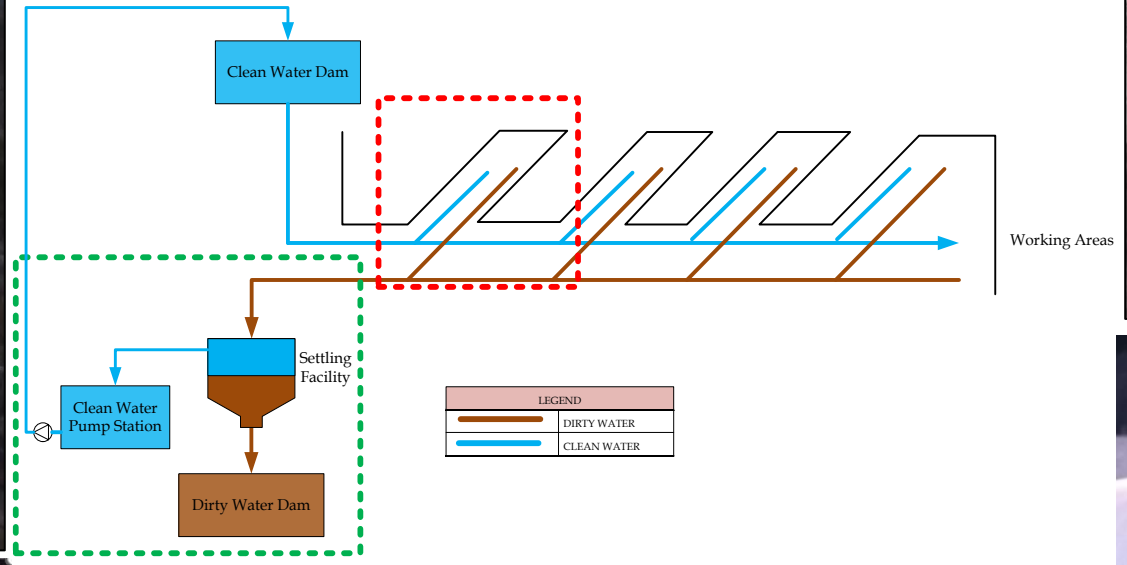


Challenges



Inrush of water

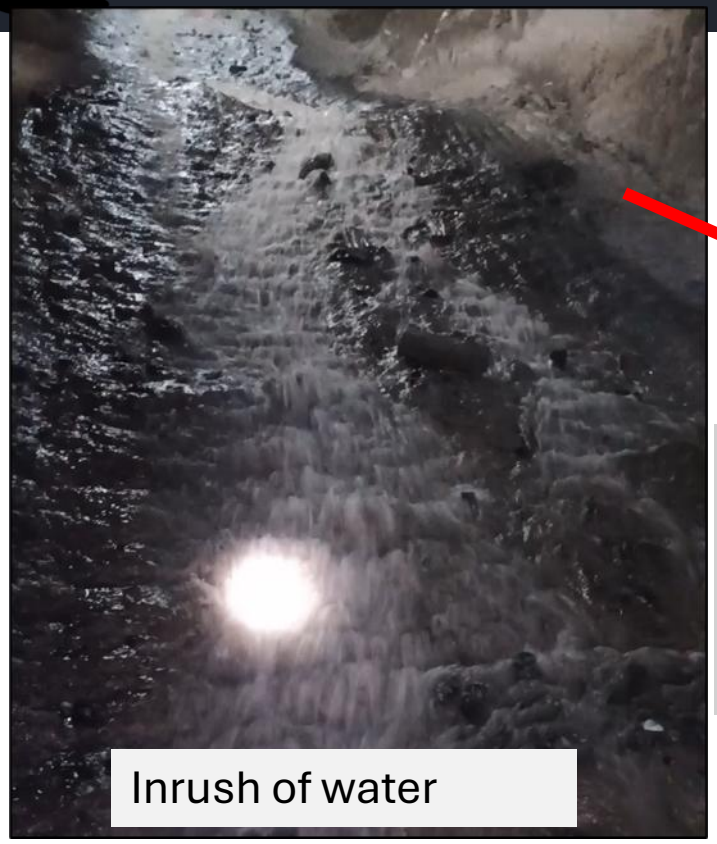
Lack of redundancy



Lack of system design

Water Impurities

GAP Identified



Inrush of water

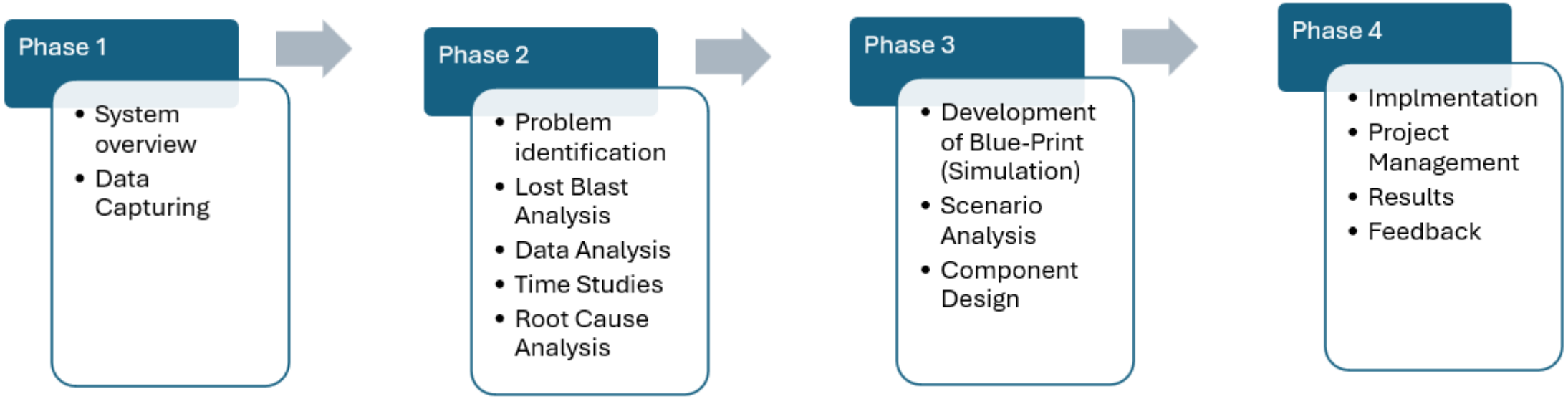
Lack of redundancy

Integrated design informed by simulation focusing on instope water handling

Lack of system design

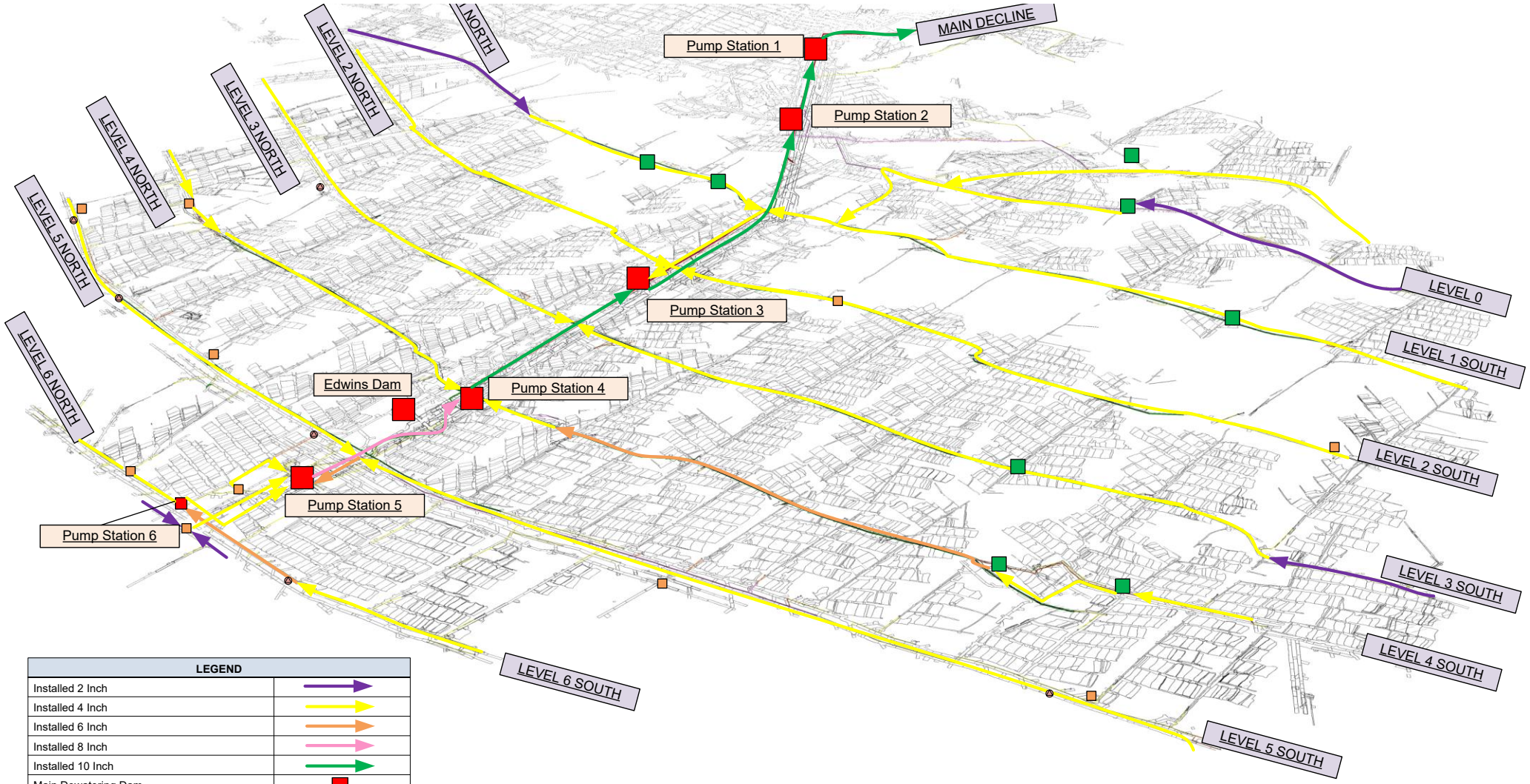
Water Impurities

Methodology



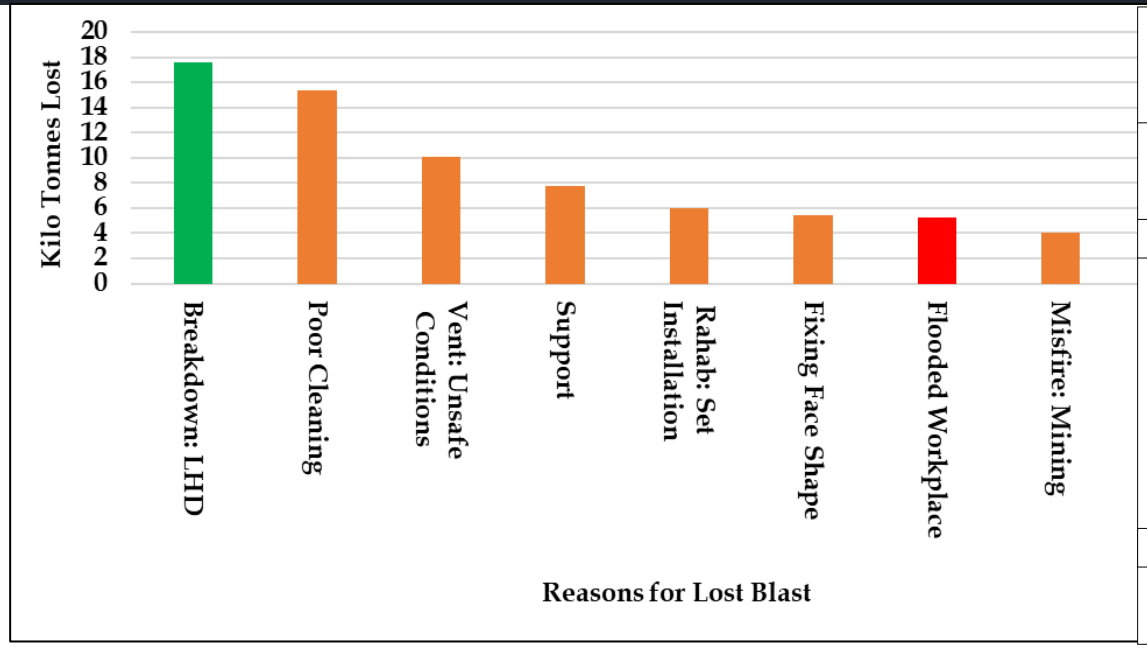
- A methodology was developed.
- Based on the case study methodology of a mine.
- This allows for real world data collection and contextualization of various challenges.

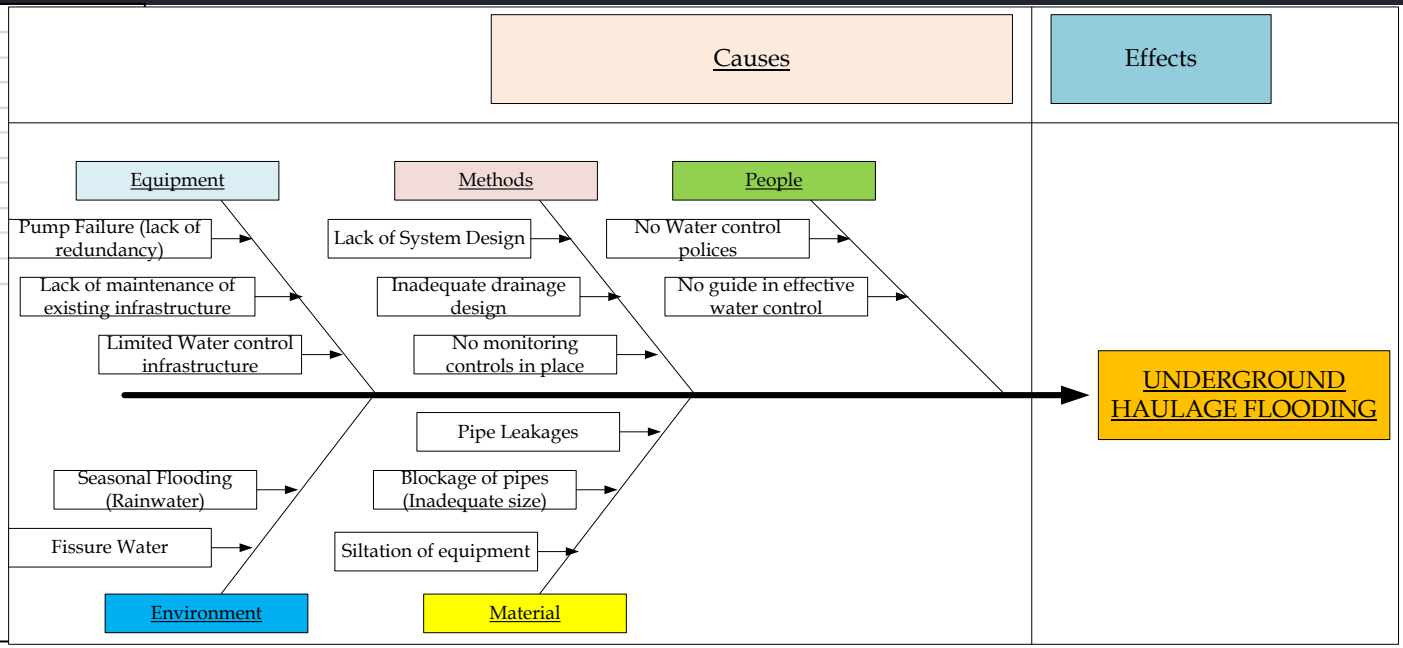
Phase 1: System Overview



LEGEND	
Installed 2 Inch	
Installed 4 Inch	
Installed 6 Inch	
Installed 8 Inch	
Installed 10 Inch	
Main Dewatering Dam	
Installed Catchment Dam	
Historic Steel Tank	
Half Level Name	XXX

Phase 2: Problem Identification

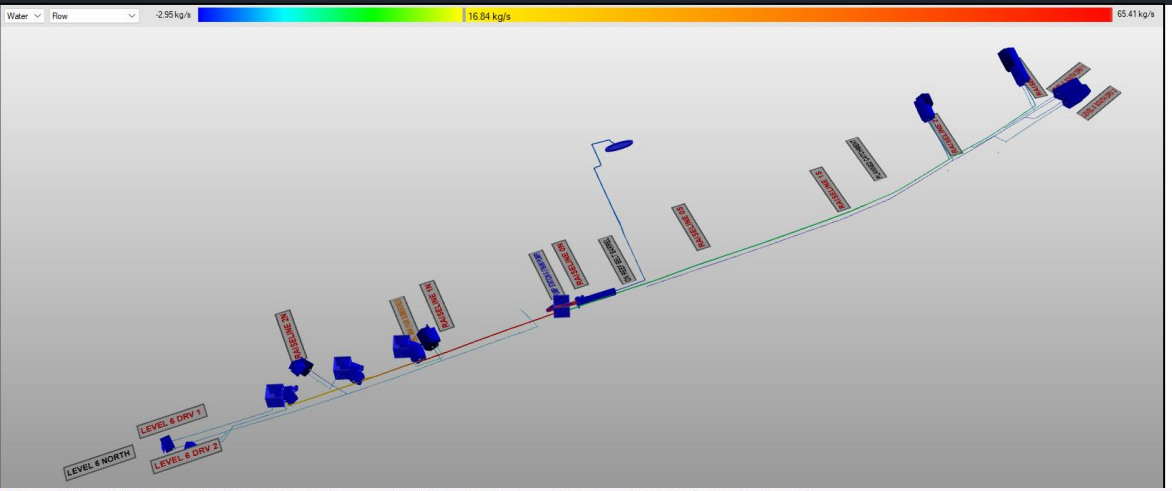




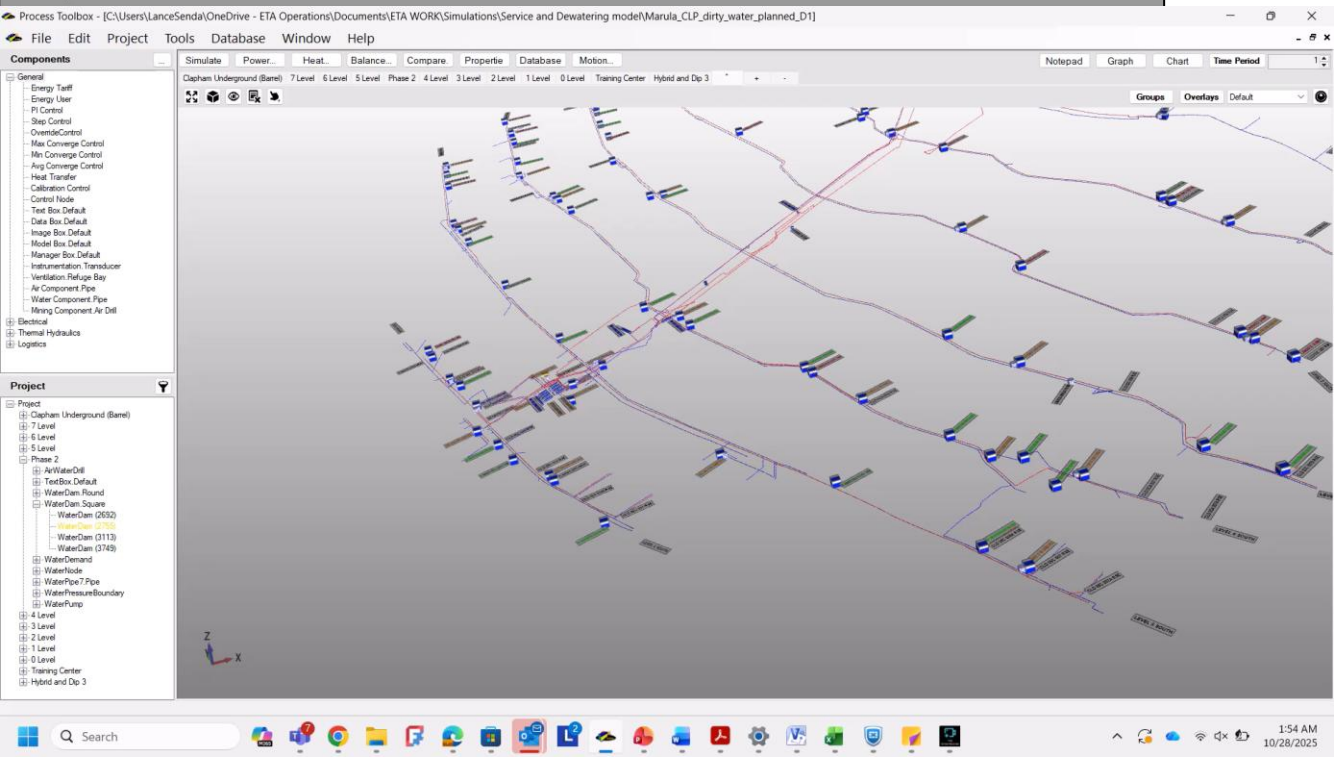
- Based on a lost blast analysis, flooding was placed as the 6th reason for lost blasts
- However most LHD breakdowns were due to water damage from flooded ends
- In some instances poor cleaning and unsafe ventilation conditions were attributed to flooding

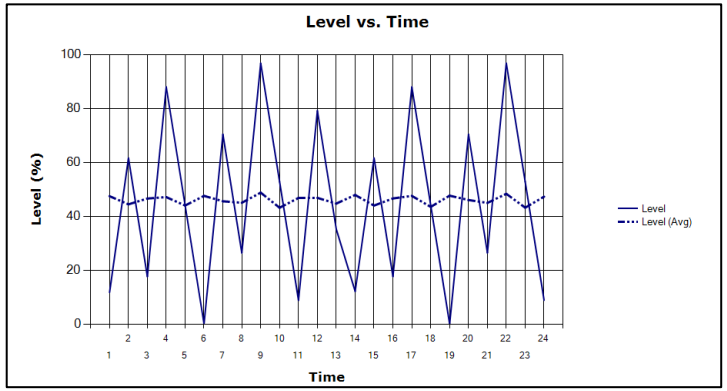
- Root cause analysis was performed based on underground audits.
- 5 pillars were identified that contribute to the problem.

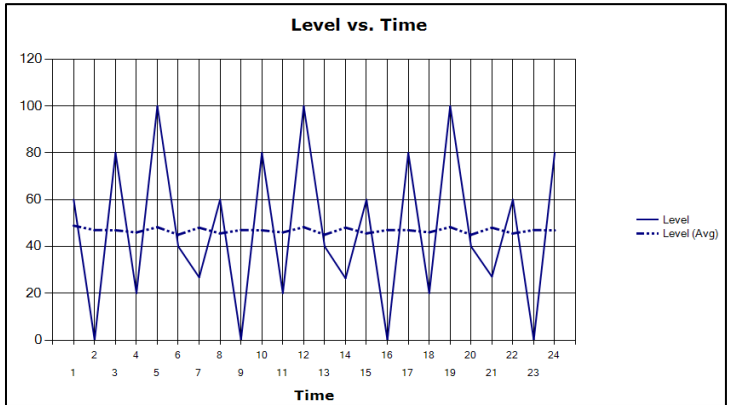
Phase 3: Solution Development



- Using data from system over view to build mine digital twin
- Using digital twin to simulate mine and have starting point to constraints







Flow (kg/s)

Chart | Copy | Paste

Values

Period	Final	Average
Adj A...		13.65727
1	0.00000	12.78892
2	0.00000	14.40122
3	0.00000	12.78723
4	0.00000	14.39619
5	46.84415	13.57572
6	0.00000	13.61144
7	49.25222	14.38815
8	0.00000	12.79746
9	0.00000	14.38344
10	0.00000	12.79370
11	0.00000	14.39374

Accept | Cancel

Flow (kg/s)

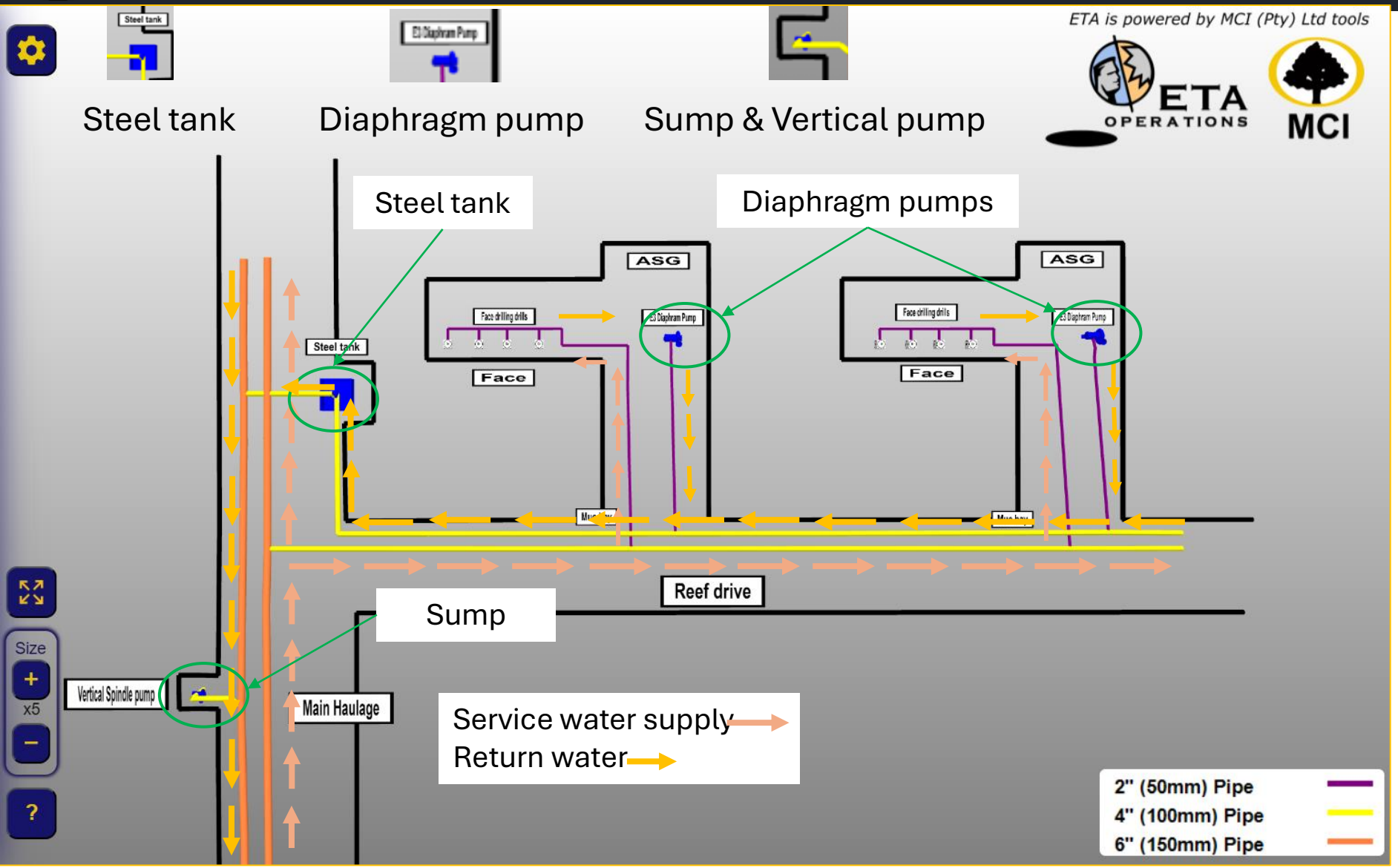
Chart | Copy | Paste

Values

Period	Final	Average
Adj A...		65.36044
1	65.40552	64.32363
2	65.40552	65.40552
3	65.40552	65.40552
4	65.40552	65.40552
5	65.40552	65.40552
6	65.40552	65.40552
7	65.40552	65.40552
8	65.40552	65.40552
9	65.40552	65.40552
10	65.40552	65.40552
11	65.40552	65.40552

Accept | Cancel

Phase 3: Solution Development

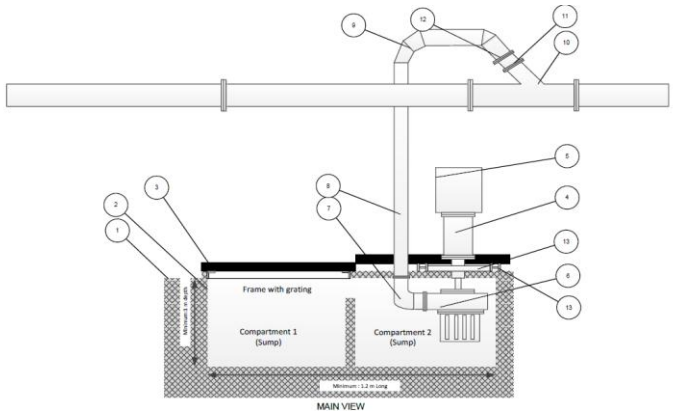


Proposed dewatering philosophy

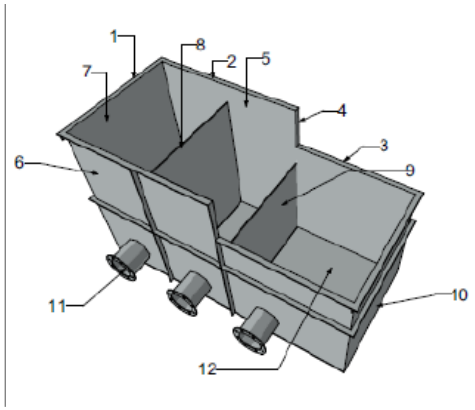
Infrastructure installation.

a) Install the E3 diaphragm pump on the ASG.
b) Install a 2-inch column from the ASG diaphragm pump to the reef drive. (HDPE pipe)
c) Install a 4-inch column on the reef drive. (Steel pipe)
d) Install a steel tank with a vertical spindle pump on the main haulage.
e) Install a 4-inch column from the steel tank to the 6-inch column.
f) Construct a sump and install a vertical spindle pump downstream from the active raise line. (For uncontrolled water on the driveways)
g) Install a 4-inch pipe from the sump to the 6-inch c
h) View in 3D on MTB.

Phase 4: Implementation

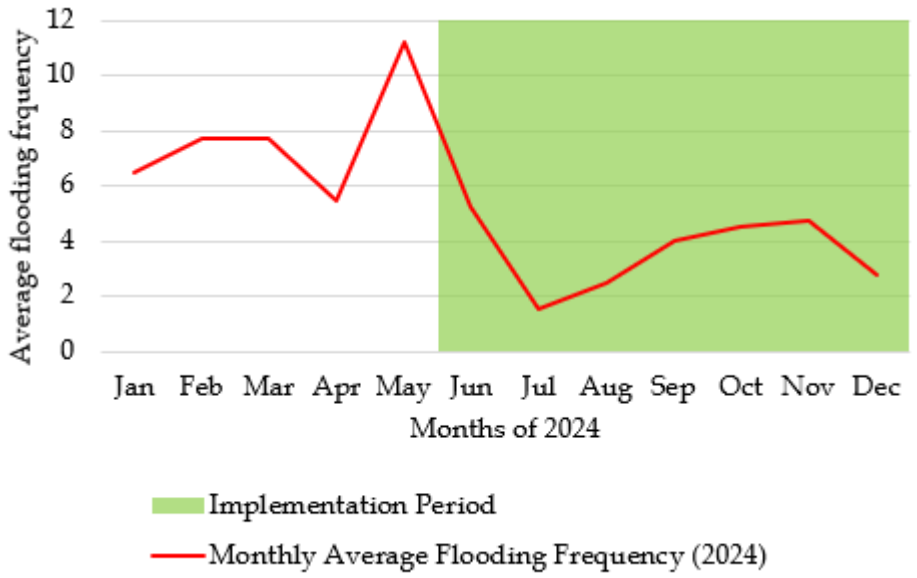


- Designed and installed sump
- Partitioned to allow for silt management
- Installed in low areas where water naturally flows
- Approximately 30 installed



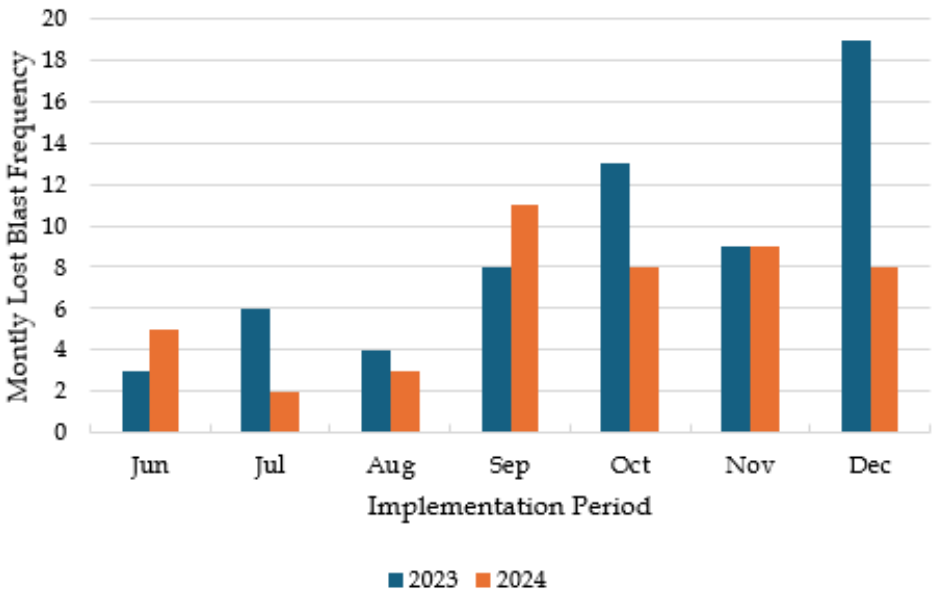
- Main dewatering point for active areas.
- 3 compartments to allow interchange and silt management

Phase 4: Implementation



- Key Results and lessons:

- Decrease in flooding frequency (34%)
- Increase primarily due to :
  - Maintenance
  - Rainy reason
- Additional focus on maintenance was needed to be fully effective



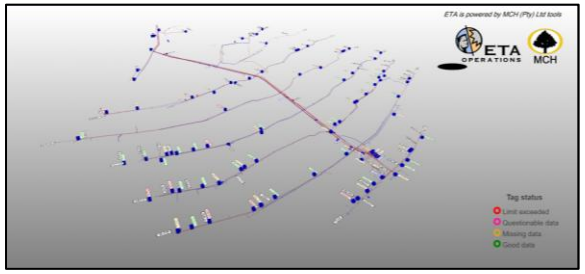
- Key Result and lessons:

- Decrease in lost blast frequency (27%)
- Direct revenue loss avoidance, R2.8 million
- Indirect savings from TMM maintenance, close to R20 mil per annum
- Increase primarily due to :
  - Maintenance
  - Rainy reason

CONCLUSION

Phase 1

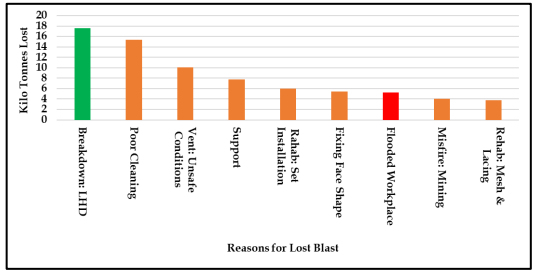
- System overview
- Data Capturing



- Deepening mines place pressure on existing water handling systems
- Systems face multiple challenges
- Part of the method is to understand the system

Phase 2

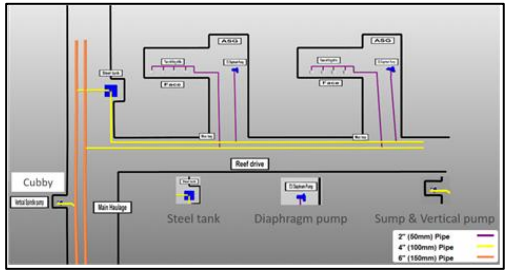
- Problem identification
- Lost Blast Analysis
- Data Analysis
- Time Studies
- Root Cause Analysis



- Flooding affects production related activities
- RCA and audits allowed for problem identification
- Problem was defined

Phase 3

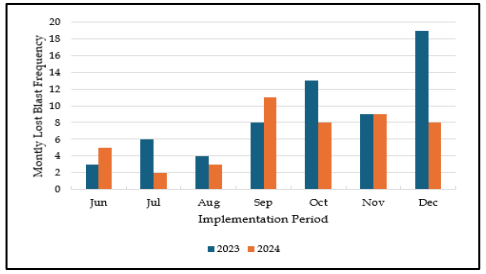
- Development of Blue-Print (Simulation)
- Scenario Analysis
- Component Design



- Digital twin was used to create blueprint
- Simulation allowed for scenarios analysis
- System was designed

Phase 4

- Implmentation
- Project Management
- Results
- Feedback



- Implementation results saw:
- 27% decrease in Lost blast (R2.8 million revenue)
- 34% reduction in flooding reports

THANK YOU