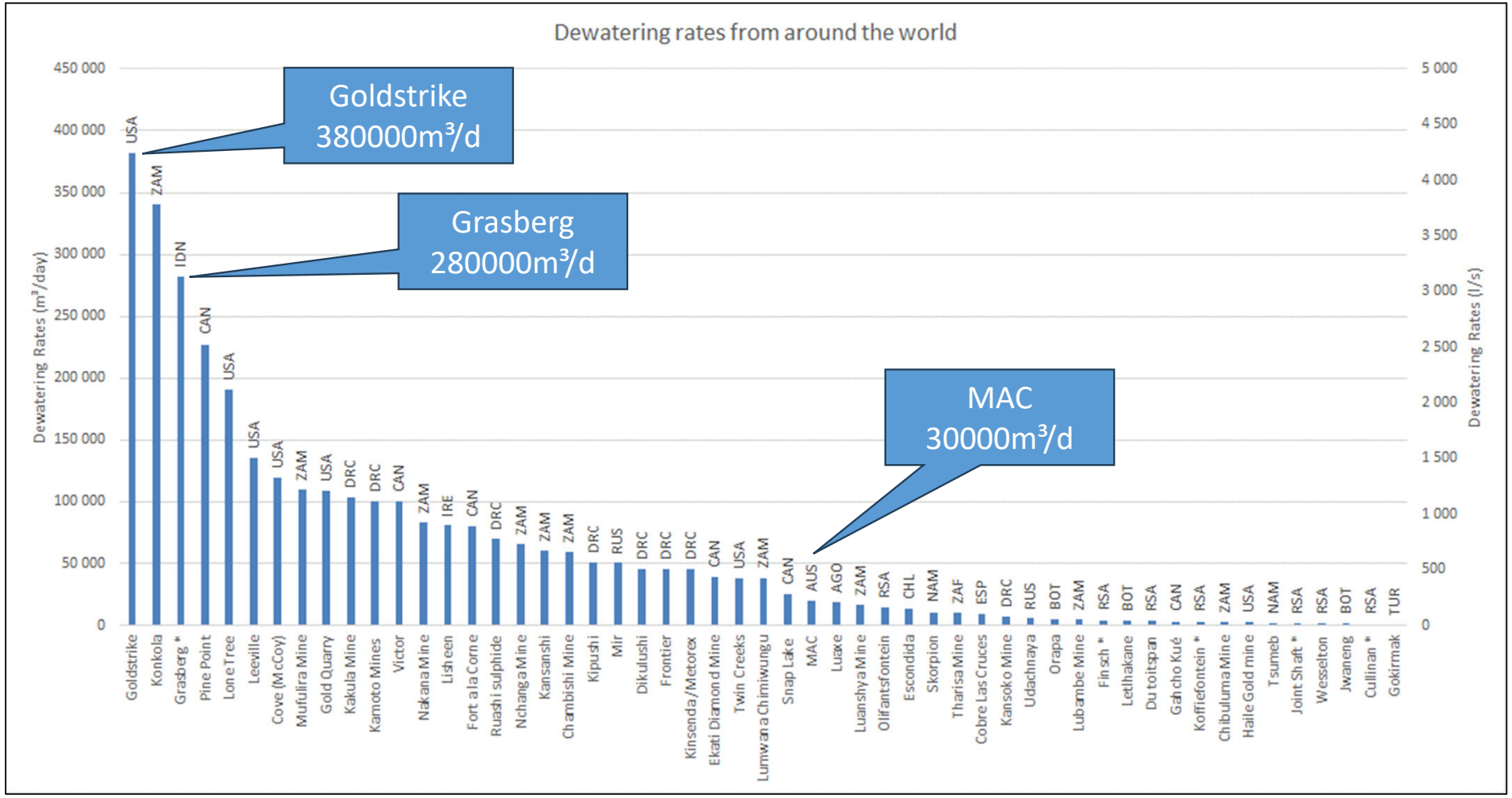
A phased approach to mine dewatering
Updated from IMWA 1993

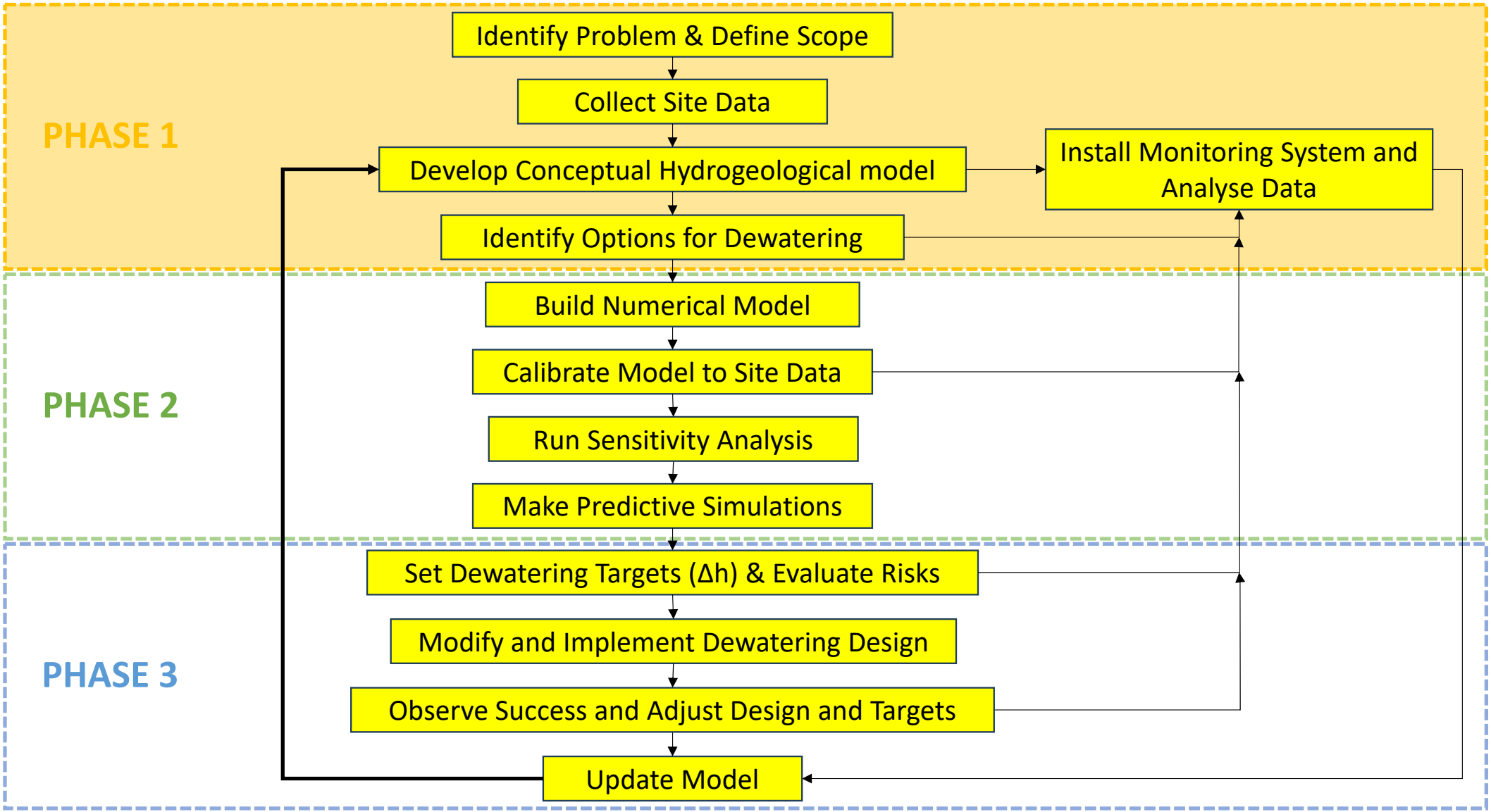
Dr Kym L Morton

“Prevention is better than a cure”

Inflow rates at various mines around the world



A PHASED APPROACH TO MINE DEWATERING DESIGN



Phase 1: Preliminary Assessment – Initial data collection and conceptual modelling

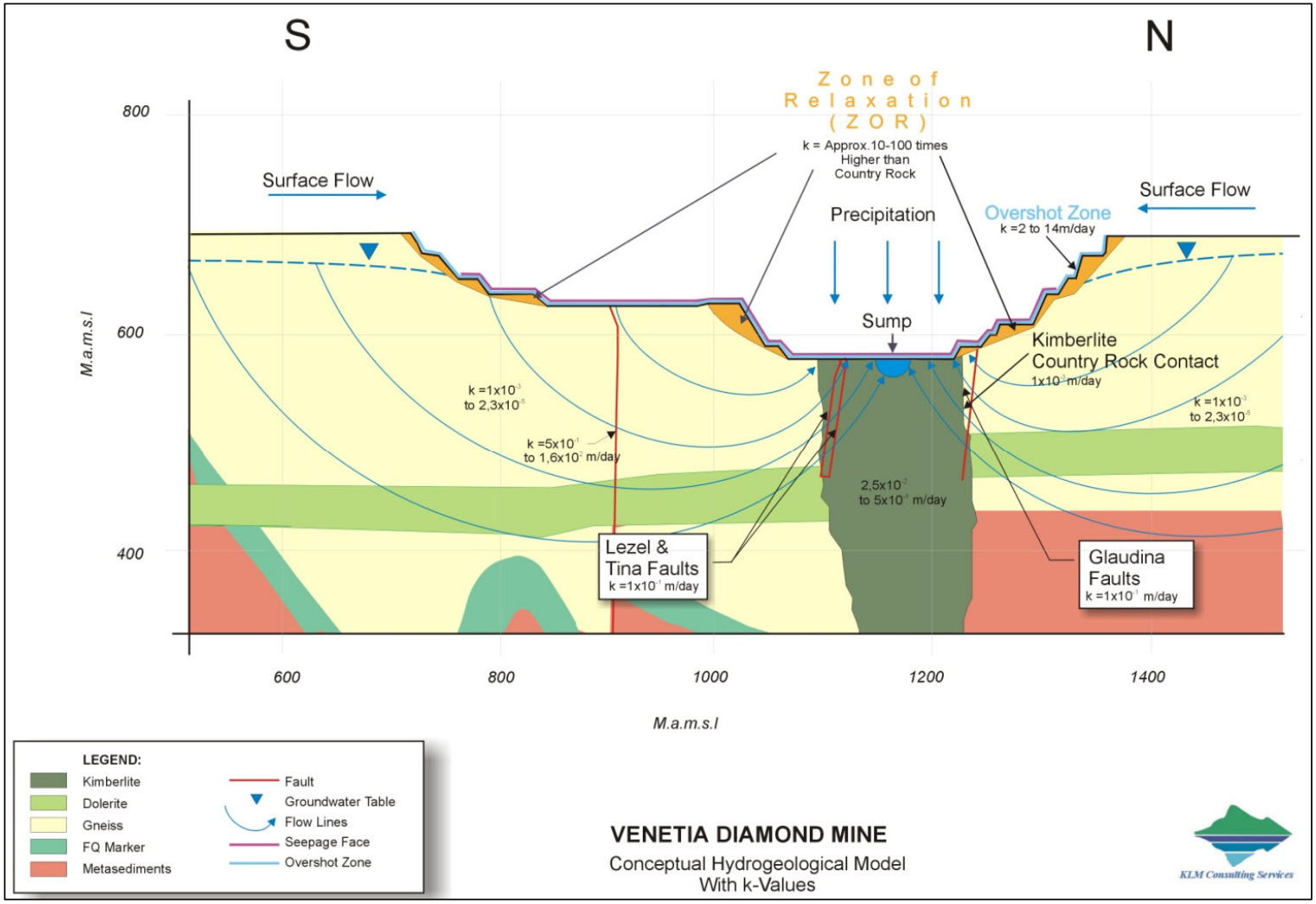
Key Considerations for Initial Dewatering System Design

- Dimensions of the area to be dewatered and timing.
- Depth to which the water levels must be lowered for each stage of mining – set targets for drawdowns Δs.
- Volumes of water to be removed.
- Chemistry of the water that must be removed.
- Plans for disposal of the water removed and opportunities for re-use.
- Whether the installation will be permanent or temporary.

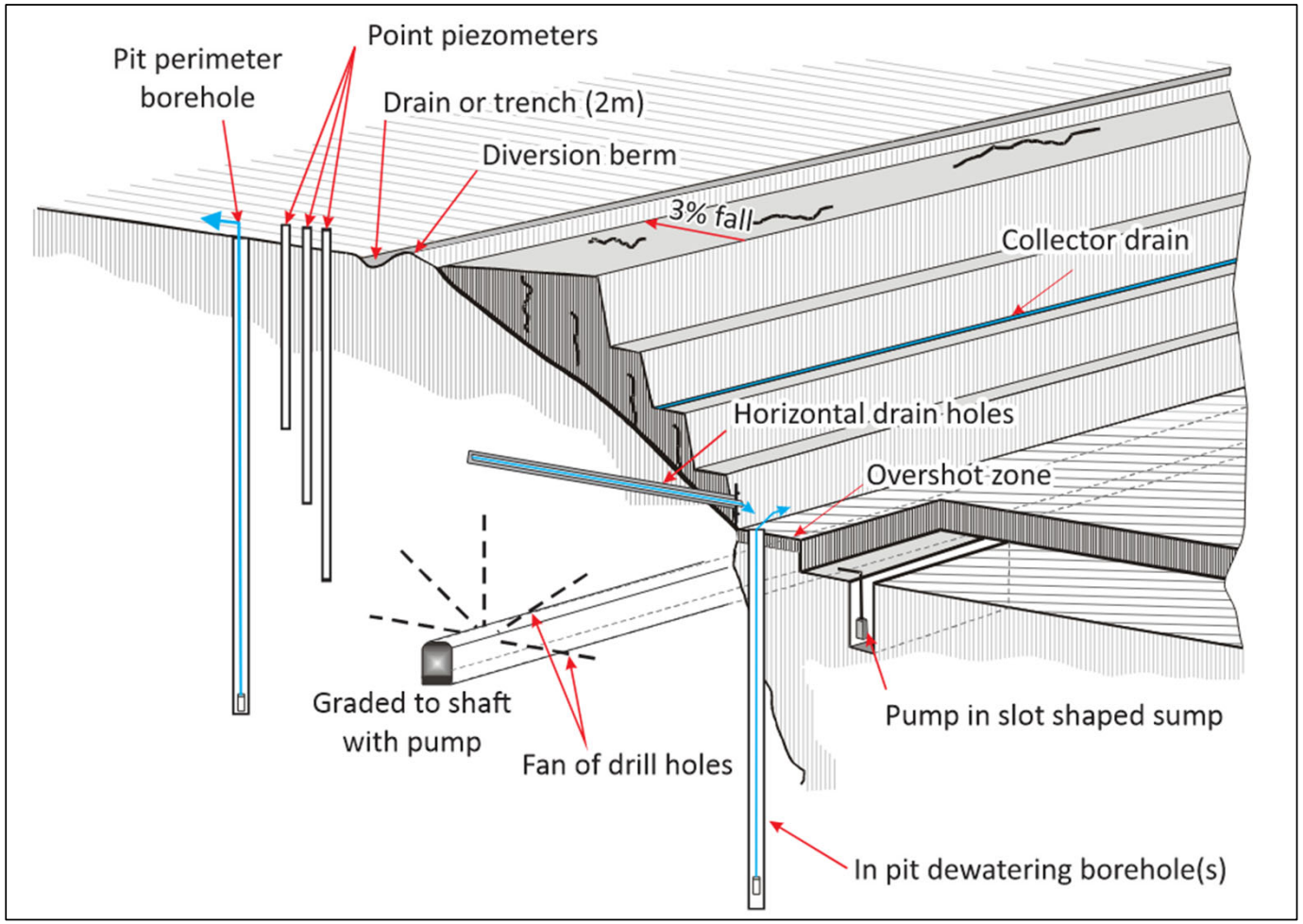
Groundwater Monitoring in Operating Mines

- **Vibrating Wire Piezometers (VWPs)**
  - Measure groundwater heads and understand aquifer behaviour.
  - Plot groundwater pressure and flow directions
- **Flow Gauges**
  - Flow rates at each mine level or specific sections.
  - Essential for quantifying inflow rates and managing water removal
- **Inflow/seepage Mapping:**
  - Combined with structural geological mapping to identify structures controlling inflows.
  - Crucial for understanding aquifer dynamics and planning dewatering strategies
- **Pore Pressure Grids**
  - Developed from VWP data to assess slope stability.
  - Can inform decisions to optimize mine design and reduce unnecessary waste stripping.

Conceptual Model- schematic



Dewatering methods (Passive and Active) Open pit



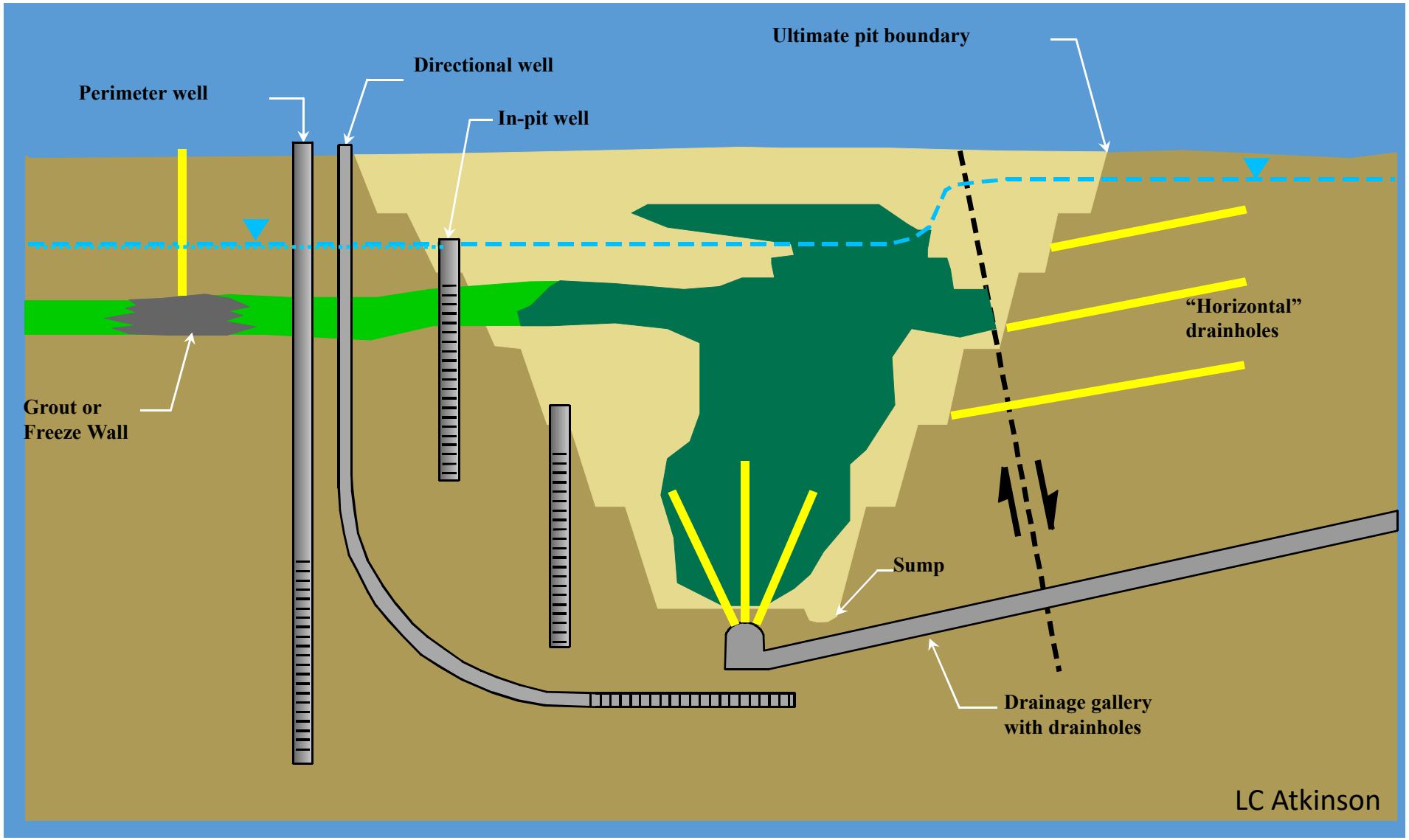
Passive (post-excavation)

- Sump pumping (preferably a deep slot not a scrape)
- Horizontal drain holes (+150m long)

Active (in advance of mining)

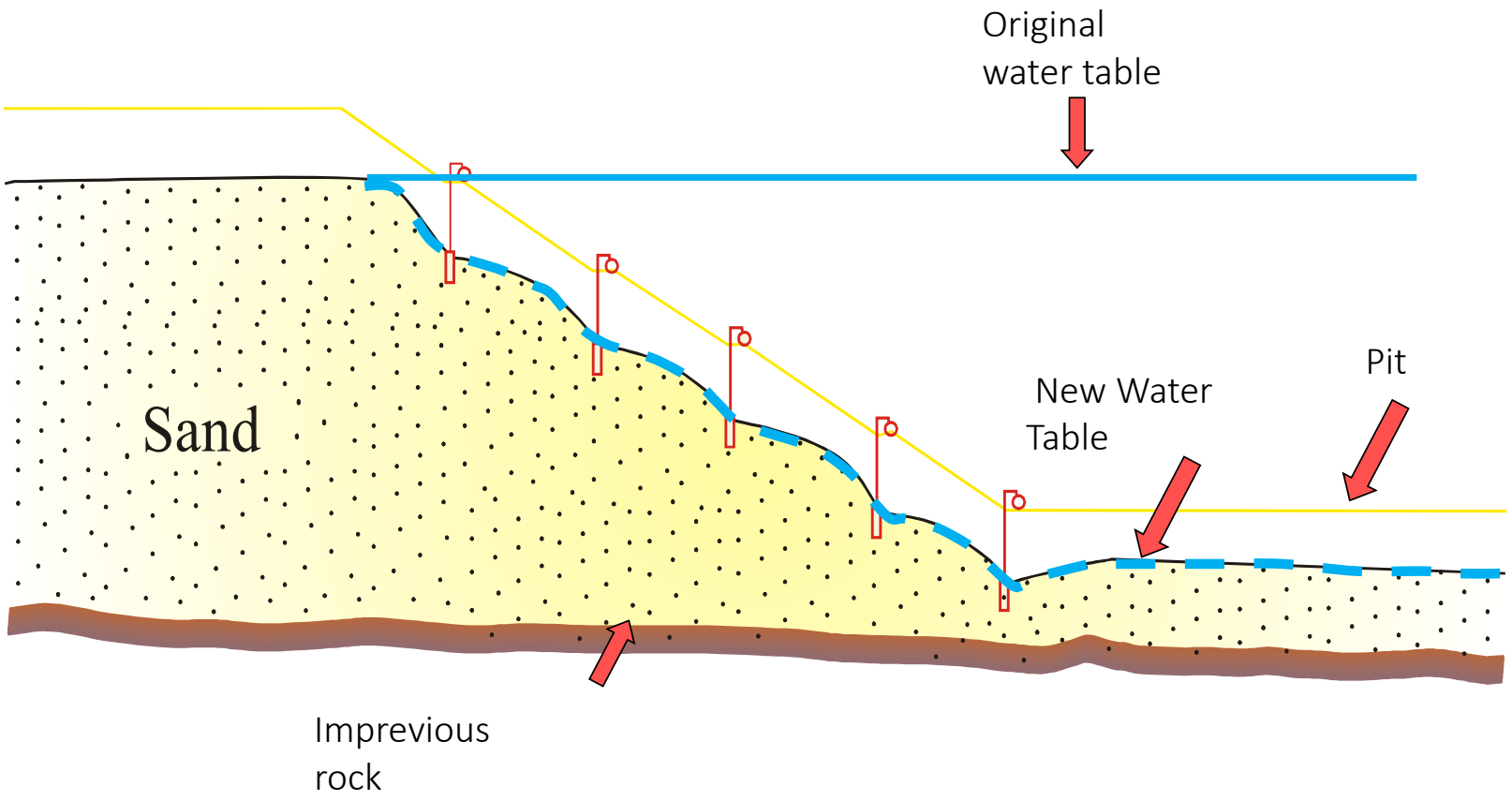
- Wellpoints (popular for coal mining)
- Pumping boreholes – pit-perimeter, bench or in-pit/pit floor and underground
- Dewatering galleries (popular for kimberlite mines)

DEWATERING METHODS



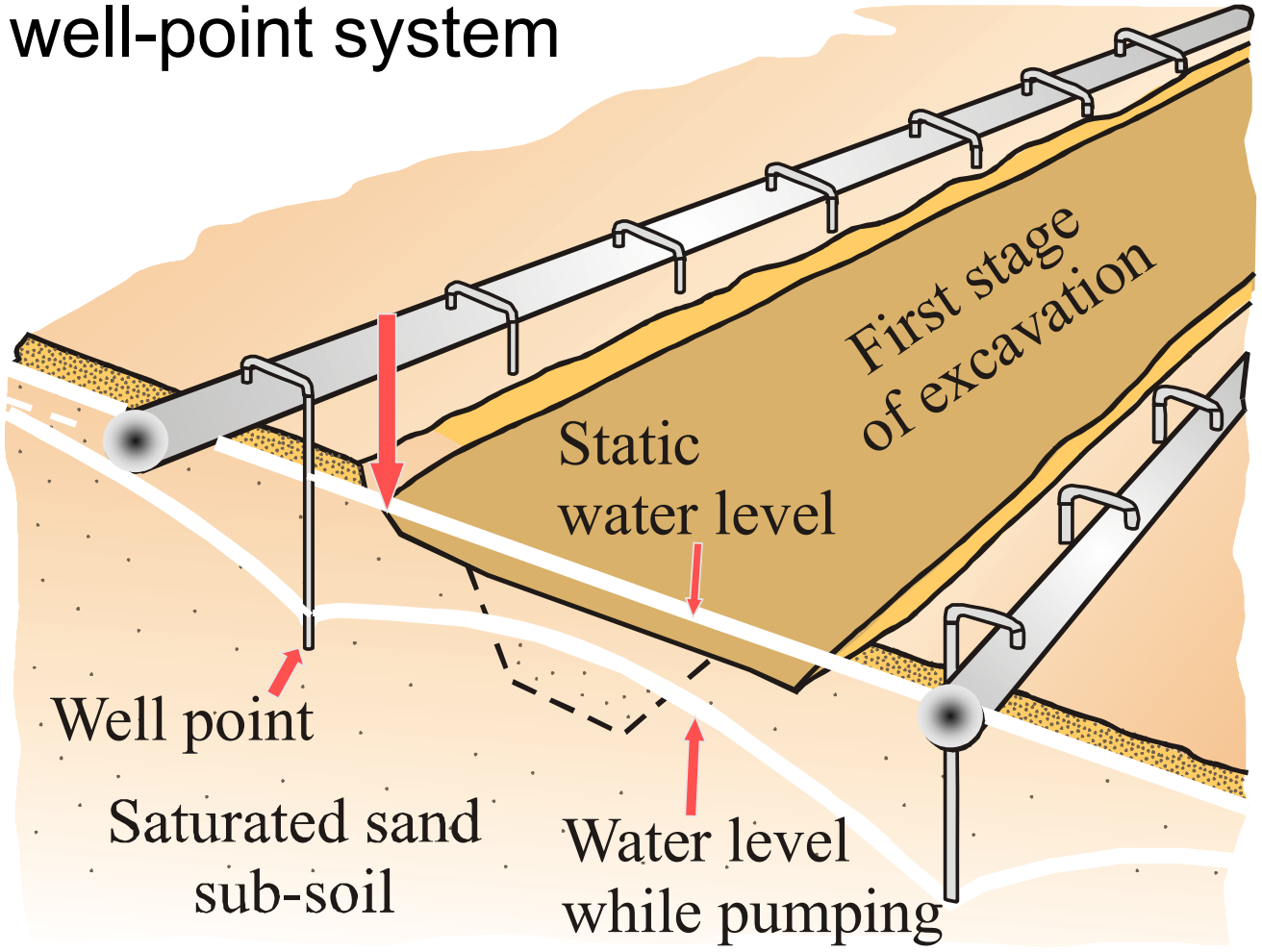
DEWATERING METHODS

Drainage of an open deep cut using a multiple–stage wellpoint system



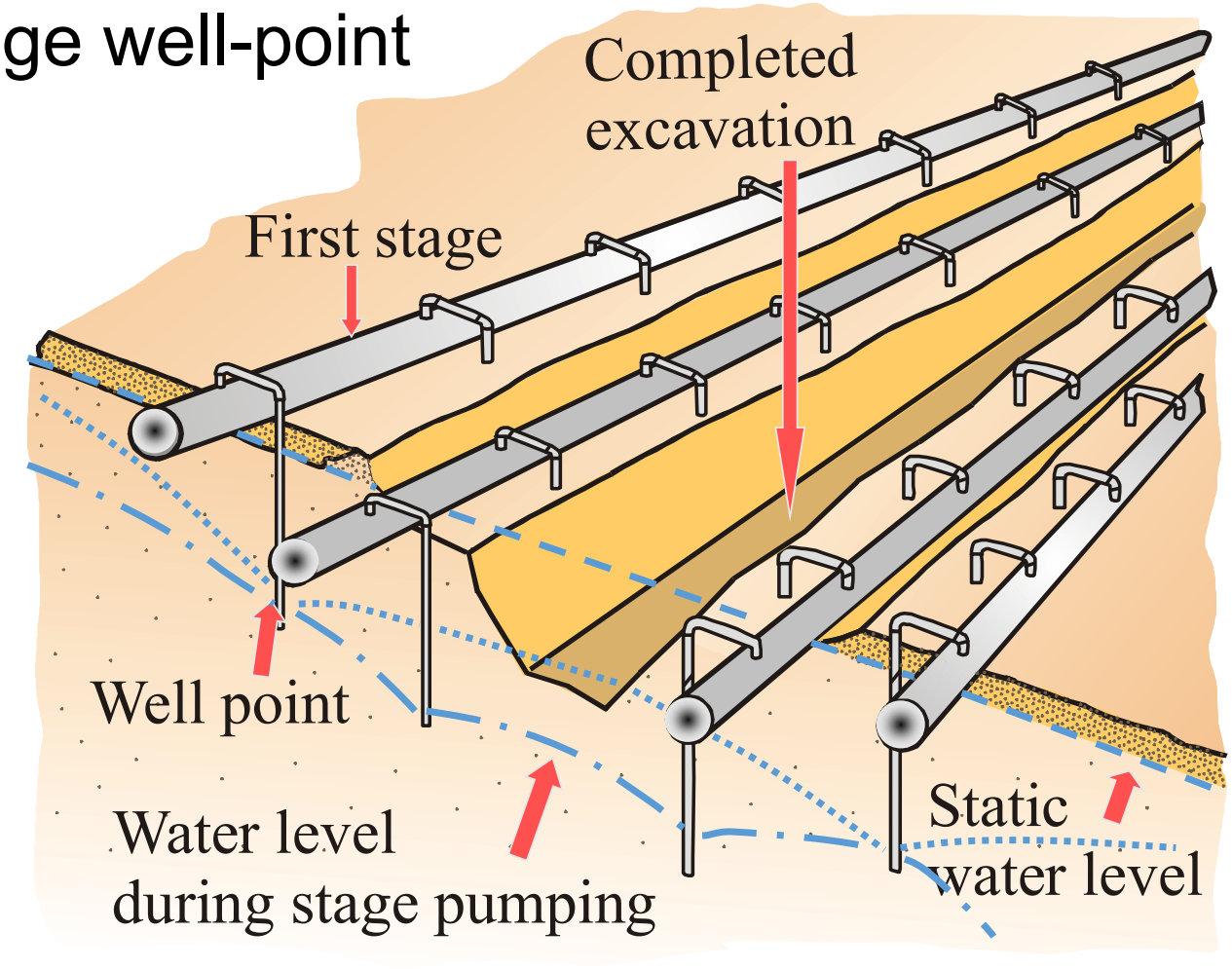
DEWATERING METHODS

First stage well-point system



Dewatering methods

Second stage well-point system



Open pit dewatering

Iron ore mine Pilbara Australia

Phase 2: Detailed Investigation – Advanced data analysis and hydrogeological modelling.

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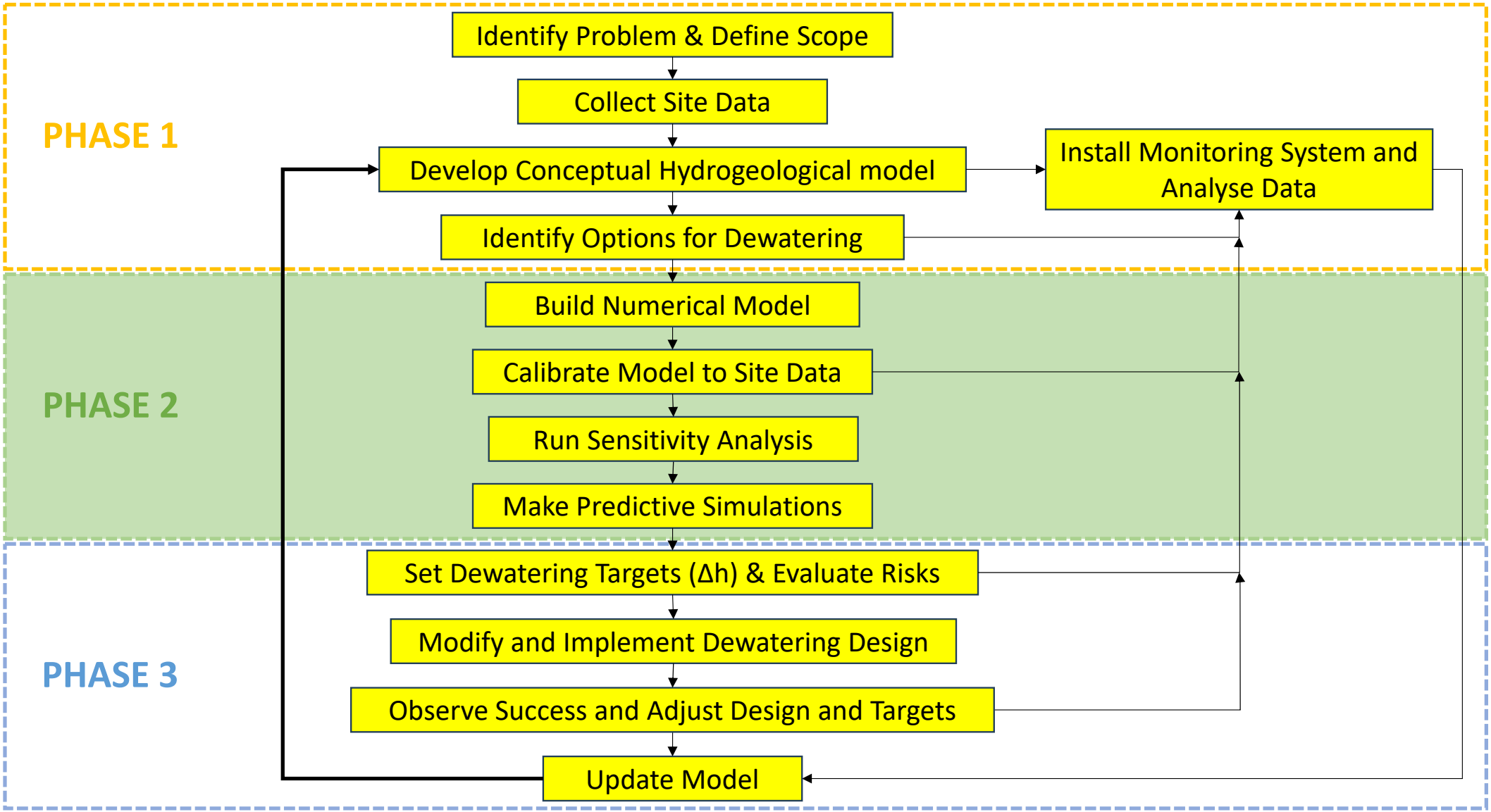
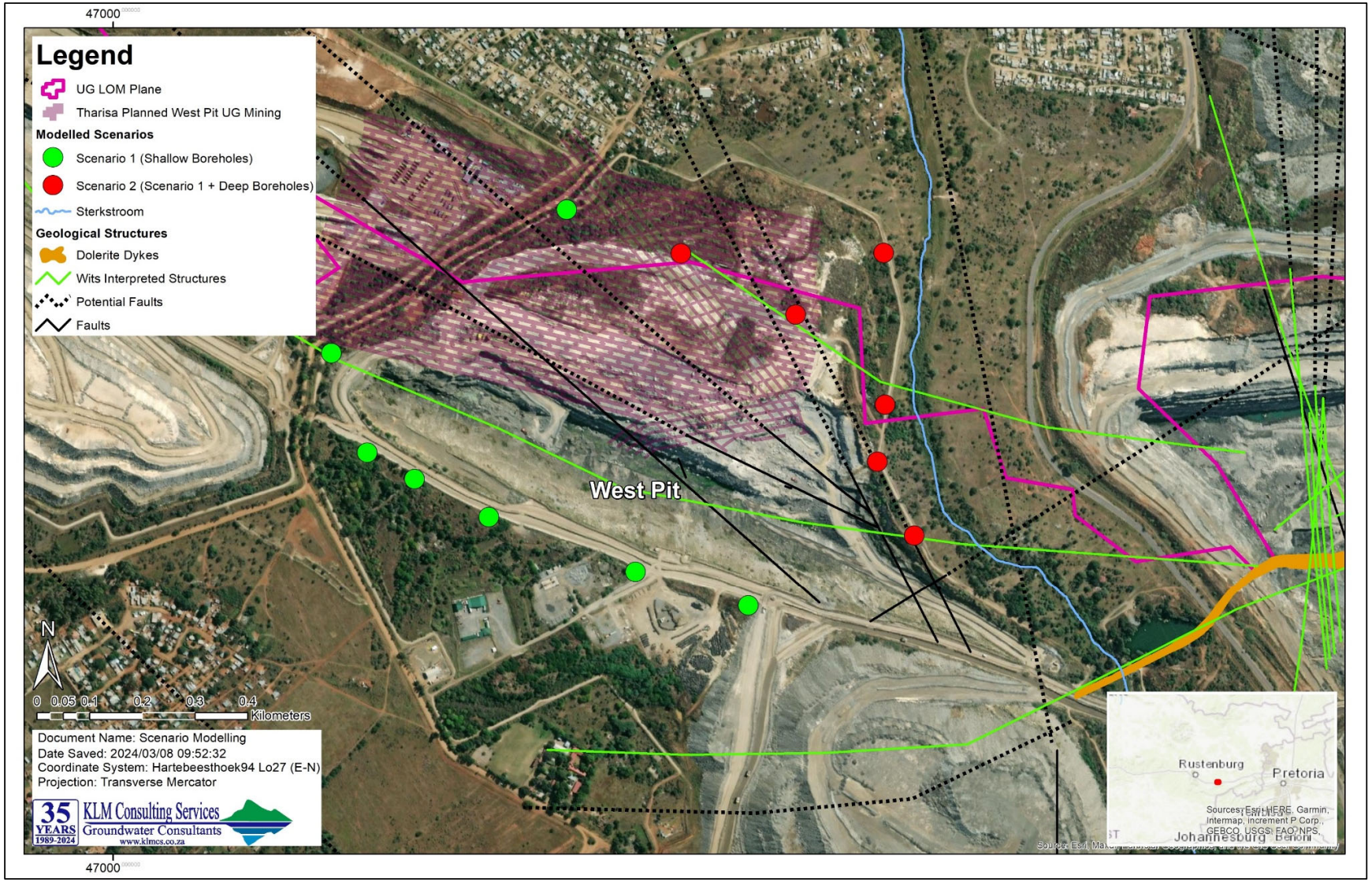


Phase 2 Objectives

- High Confidence Impact Assessment
- Numerical Hydrogeological Model
- Model Calibration and Updates
- Dewatering Scenarios Report
- Understand Modelling Uncertainty

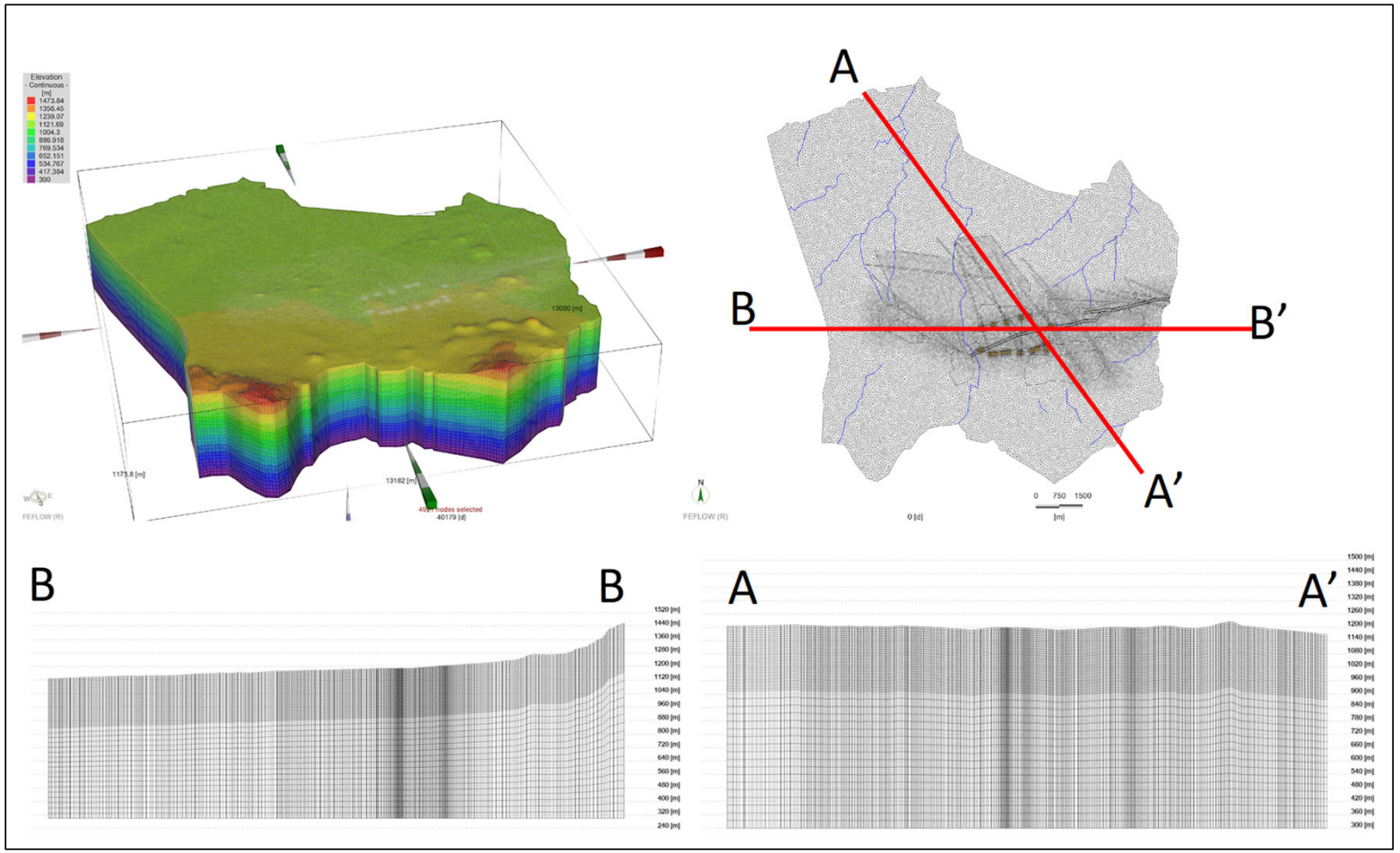
Modelled Dewatering Scenarios



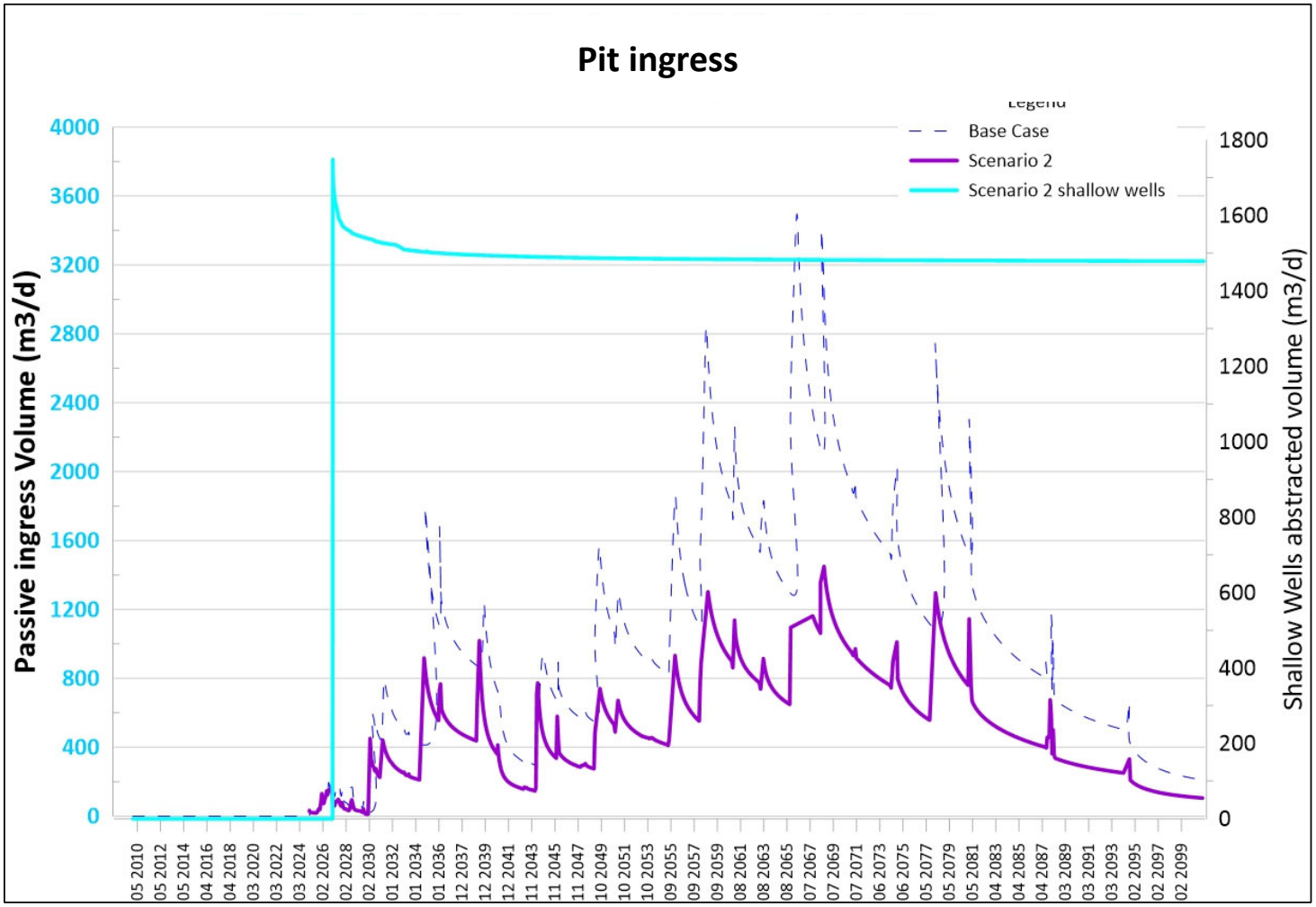
Example of a numerical model - plan

GEOMETRY

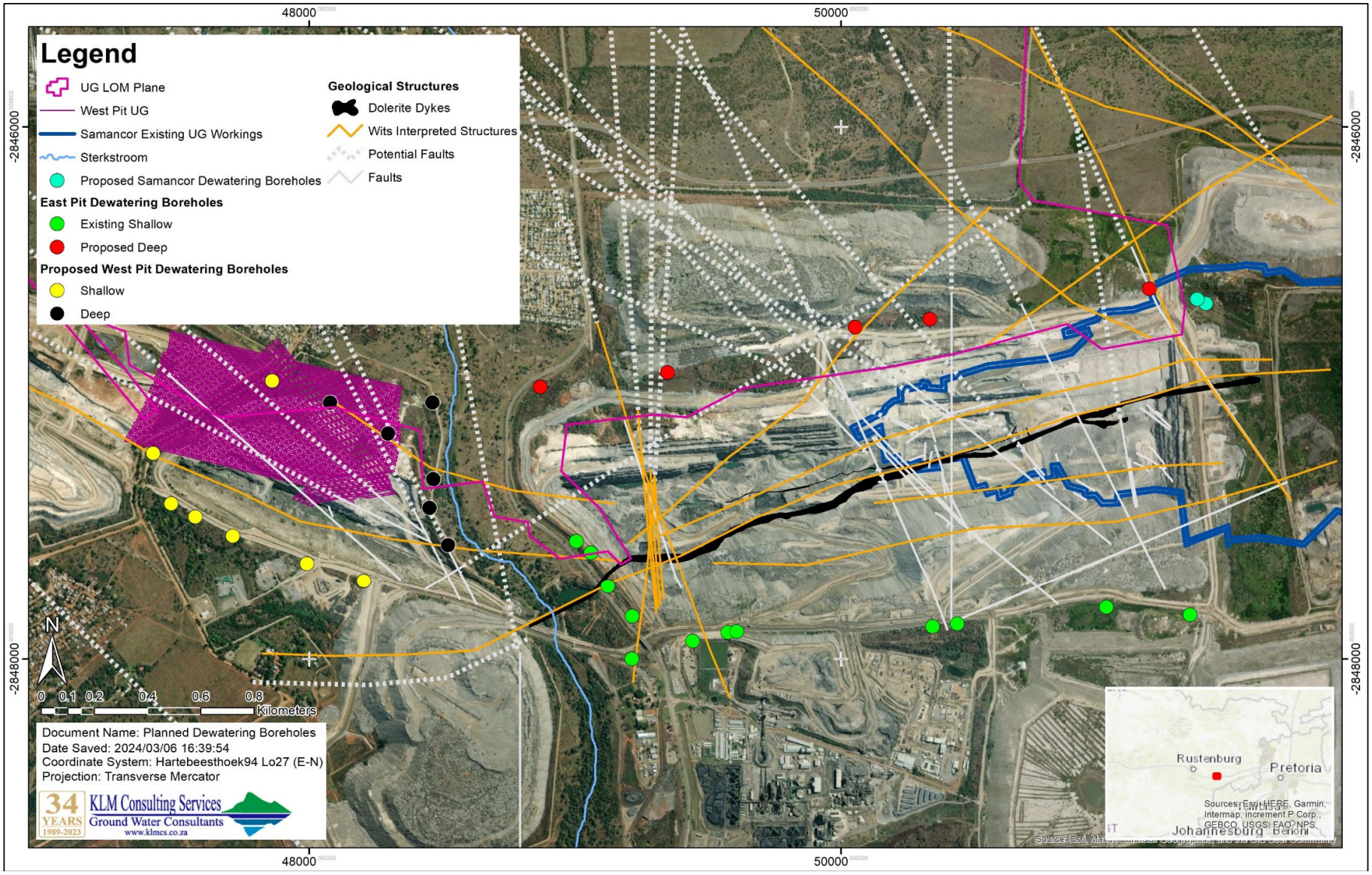
The 3D Model was made in FEFLOW 7.4 using the triangular prismatic mesh



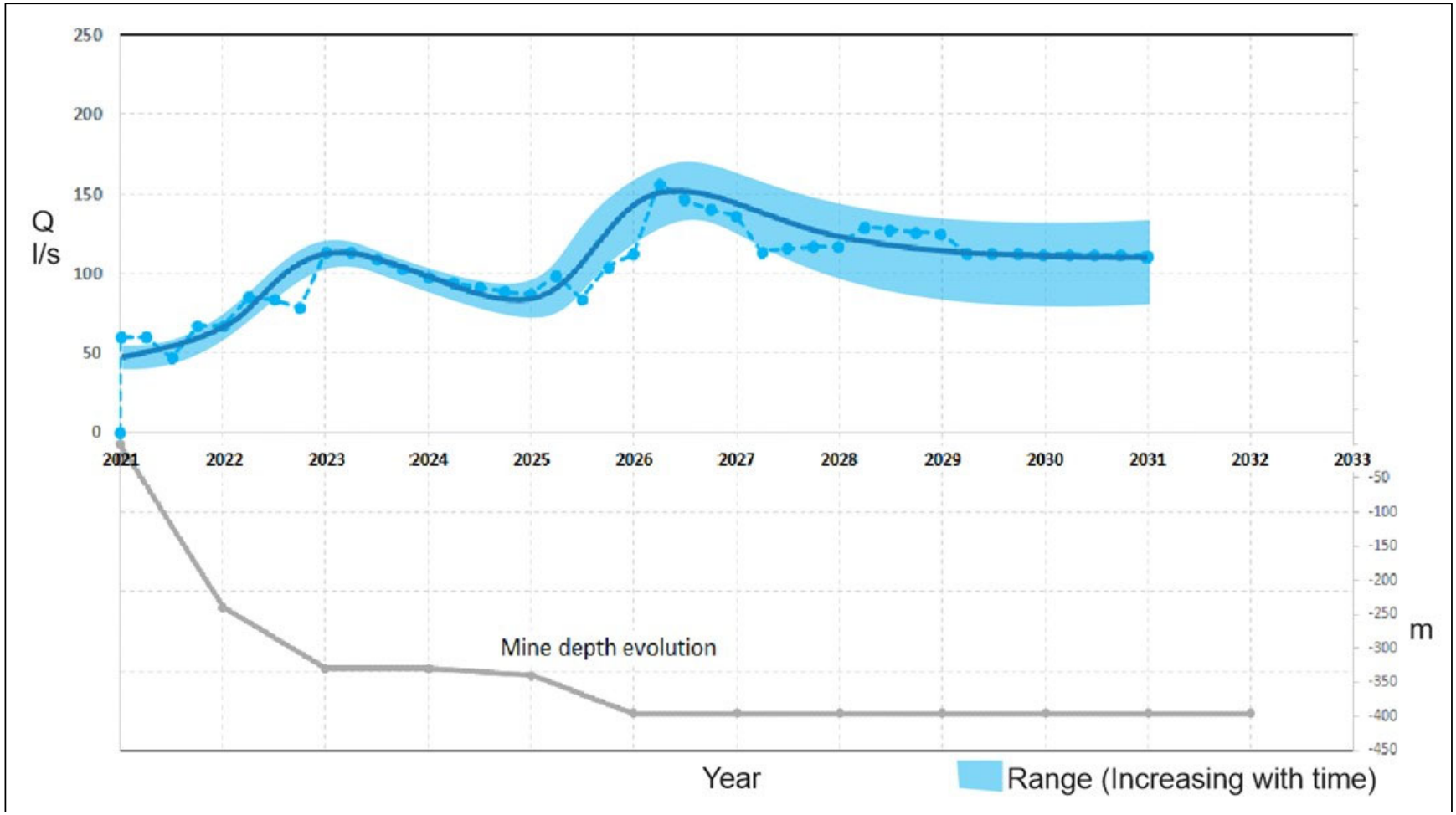
Scenario Inflow peaked at 1600 m^3/d



Planned and Drilled Dewatering Boreholes



Prediction of water levels and inflows for different scenarios



Phase 3: Dewatering targets to support the mine design

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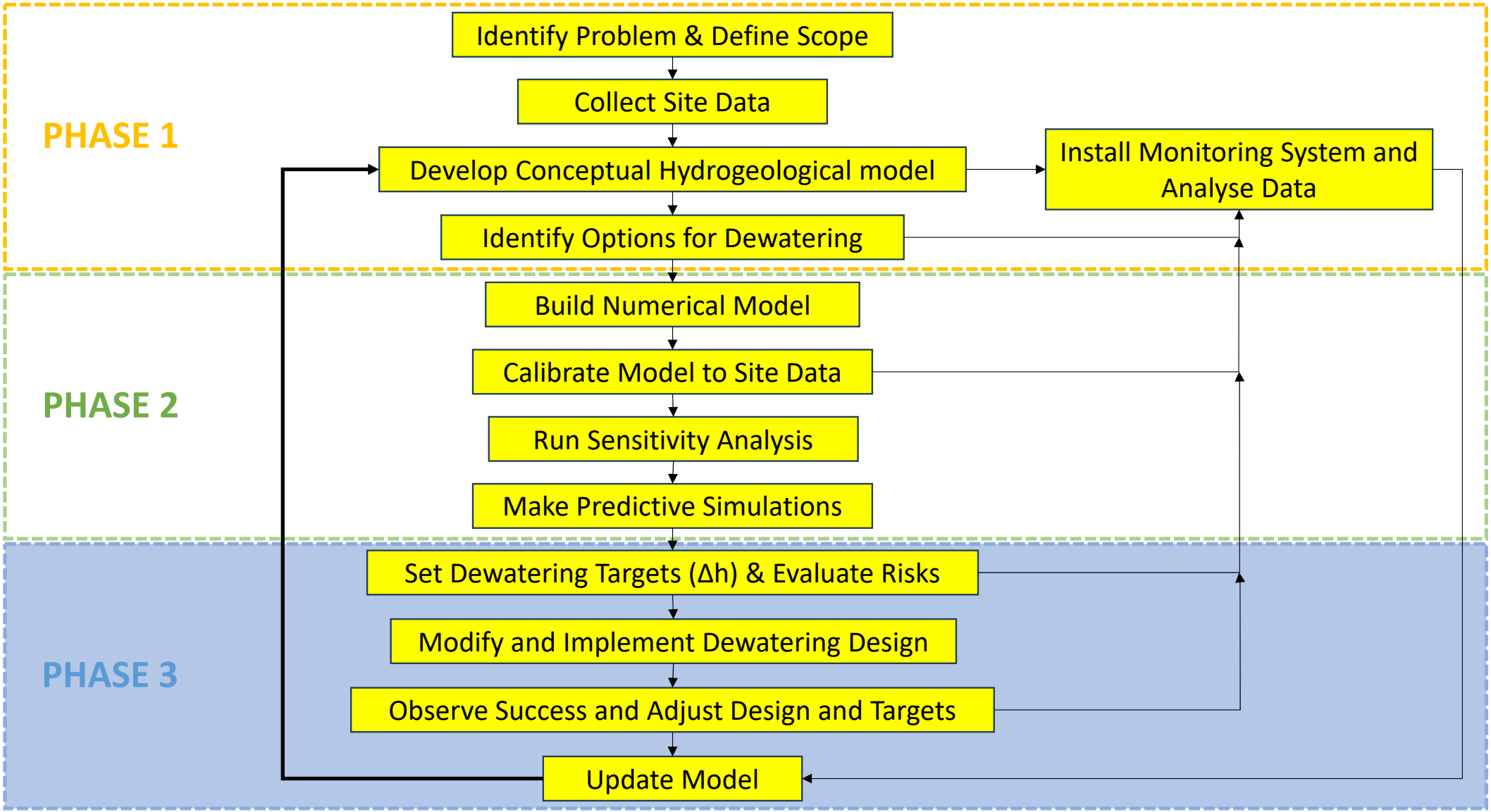
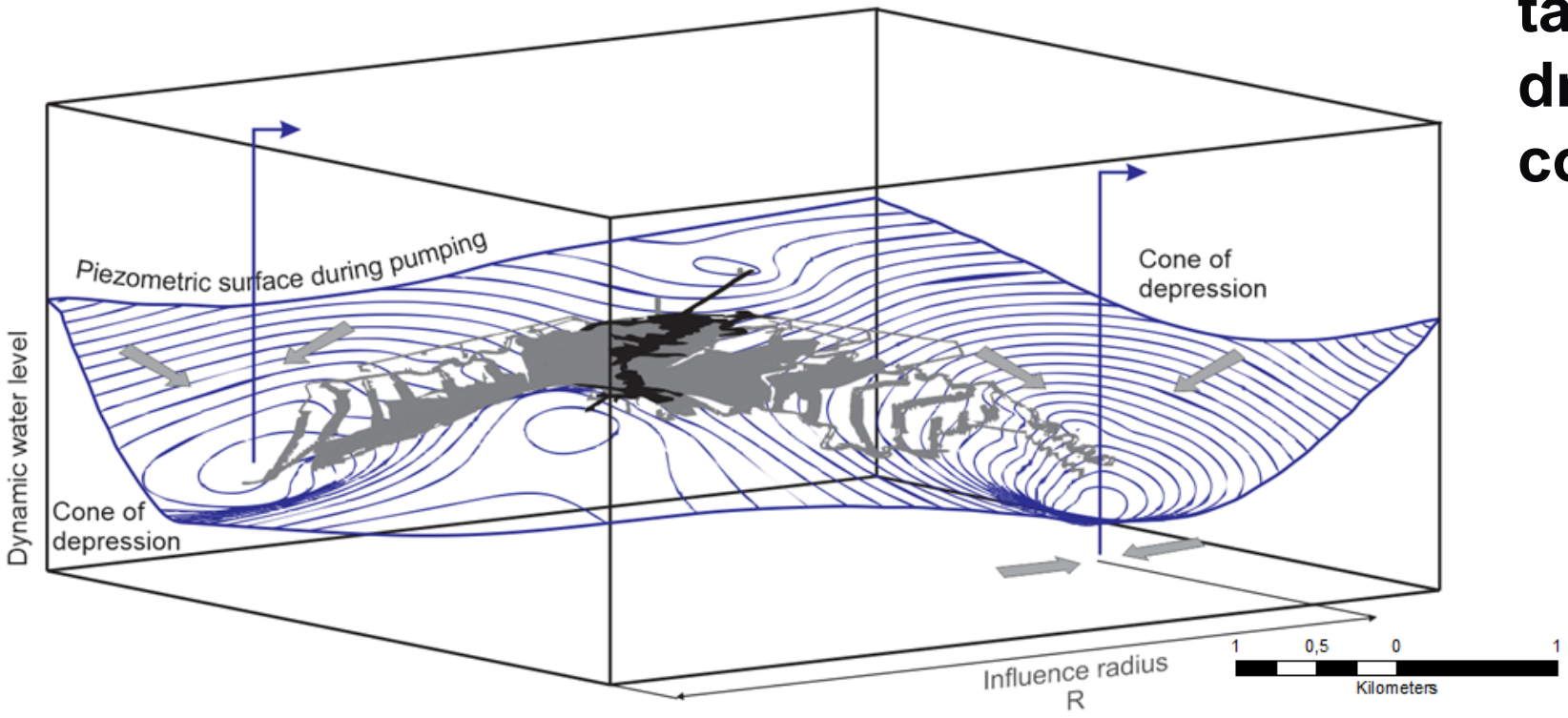


Phase 3 Objectives

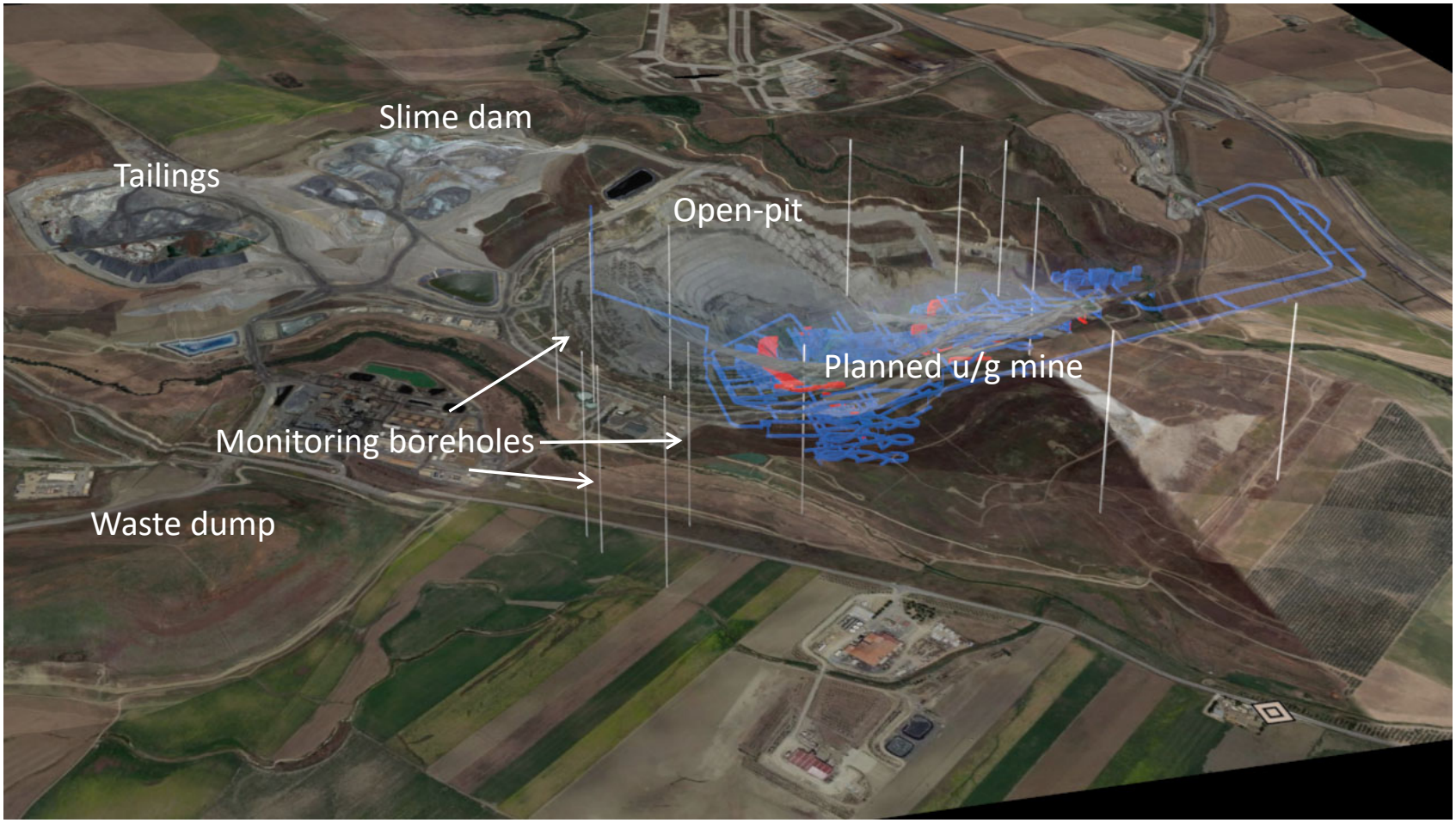
- **Dewatering Design Planning**
  - Planning and monitoring the effectiveness of dewatering designs
  - Setting and meeting water level drawdown targets (Δh) for different mining sectors and schedules
- **Monitoring and Model Updates**
  - Monitoring and numerical model updates are used to evaluate dewatering design effectiveness
  - Adaptive management in response to observed conditions.

Water level targets for a planned 600 m deep Congo underground copper mine



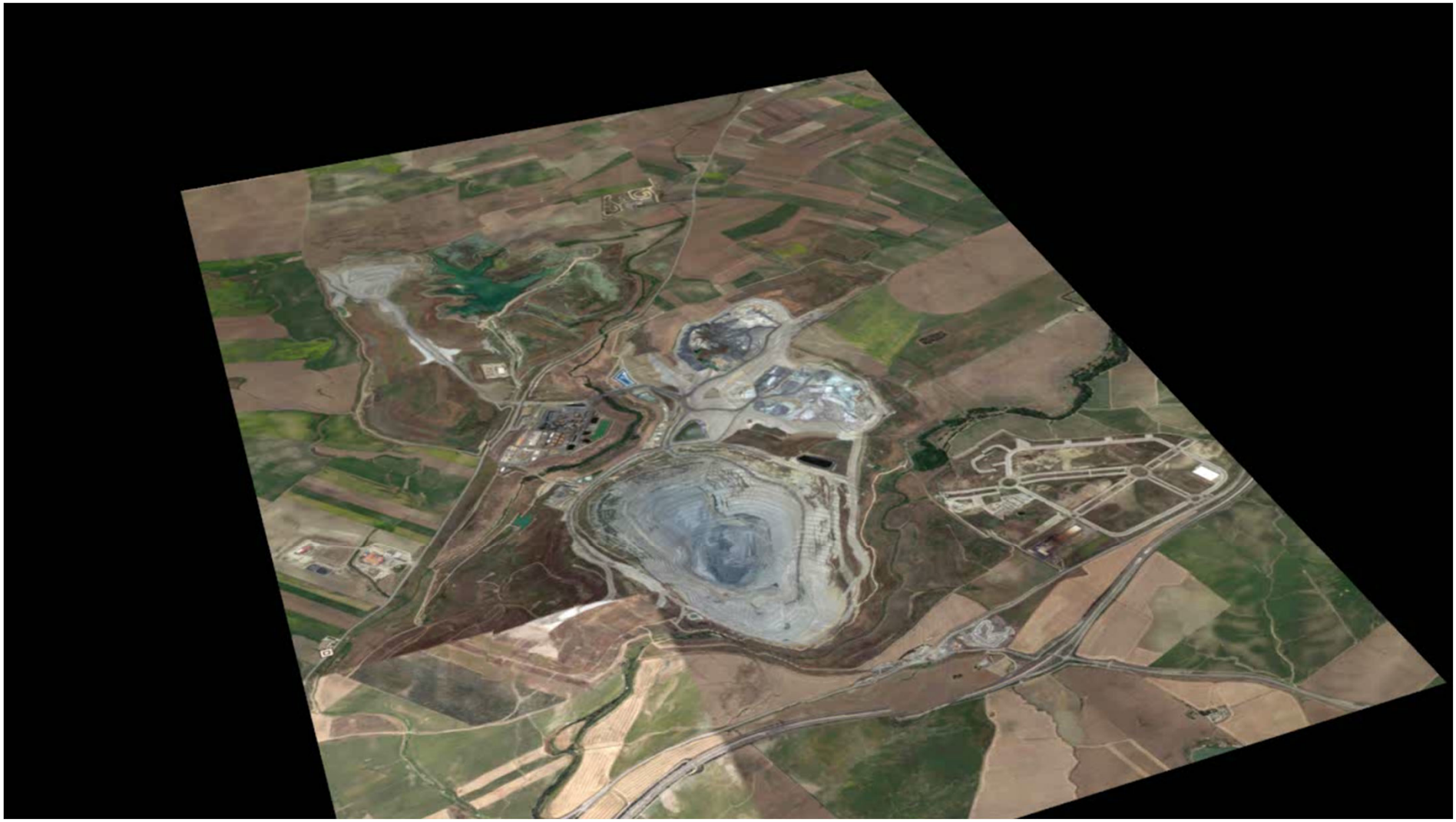
clear drawdown targets to maintain dry working conditions !!

Aerial view of open-pit with planned transition to underground mining

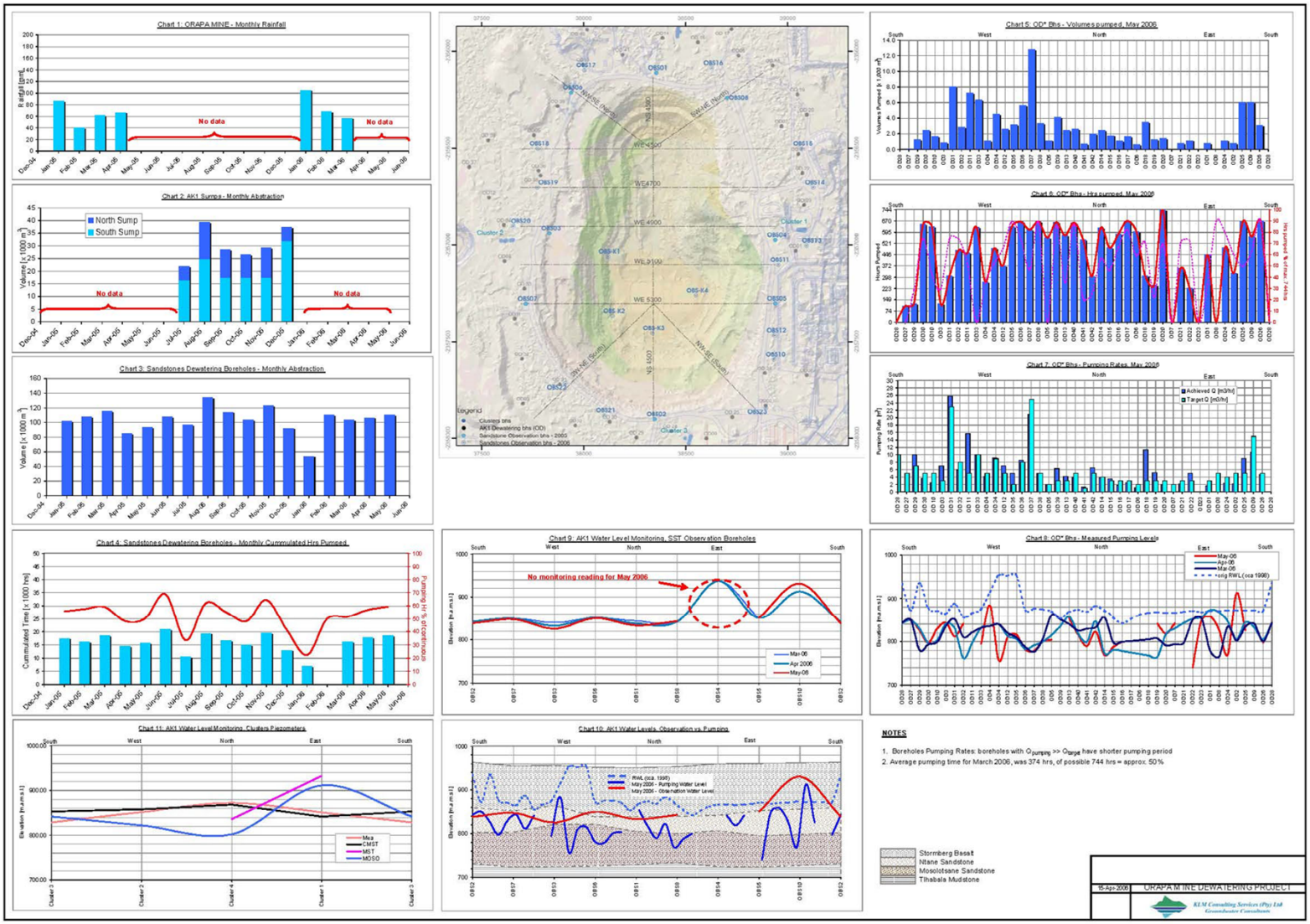


Monitoring boreholes are clearly seen around an open-pit

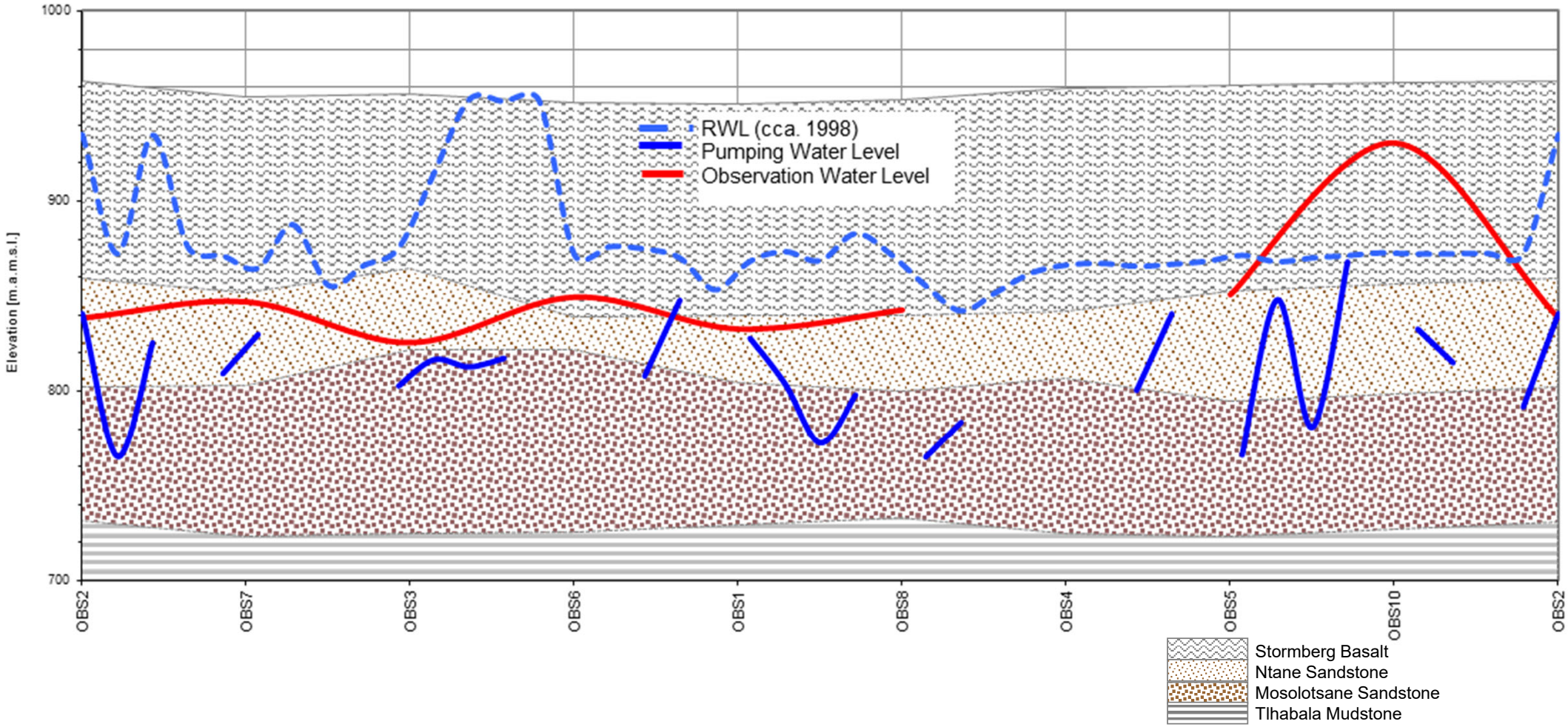
3D simulation open and underground copper mine



MONITORING DASHBOARD



Fence diagram showing geology and water levels



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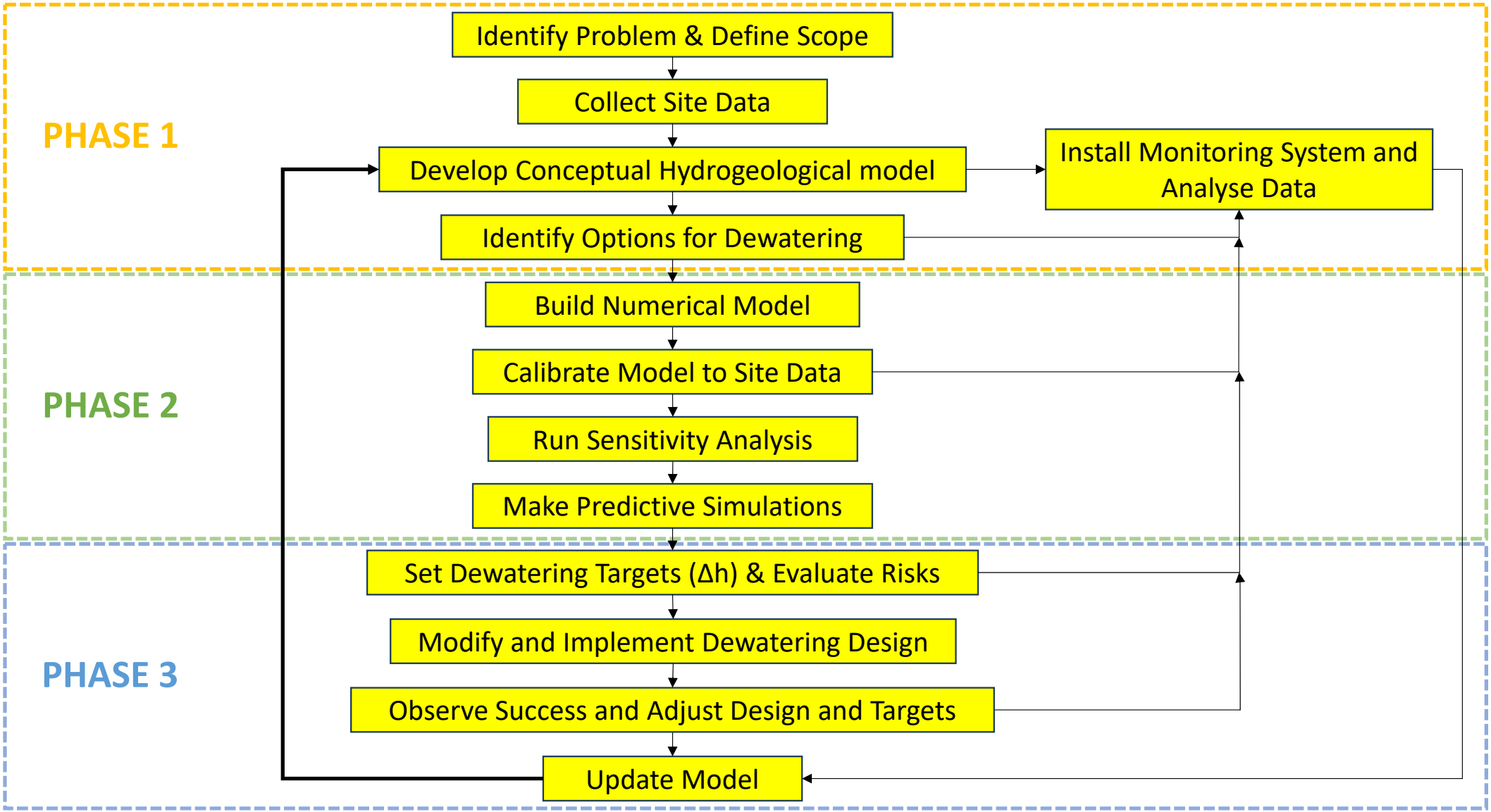

Summary

- **Phase 1**
  - Identifies the problem and defines the scope of the dewatering required
  - Identify options for dewatering

- **Phase 2**

  Models the options and makes predictive simulations

- **Phase 3**
  - Sets dewatering targets and then writes the road map to achieve them
  - Manage the dewatering operation with regular check backs to ensure the design is fit for the purpose


THANK YOU