



GEOSS

Groundwater & Geo-Environmental Solutions



WEST COAST GROUNDWATER: THE HIDDEN BUT VITAL RESOURCE

Groundwater monitoring within the Greater Saldanha Bay Region

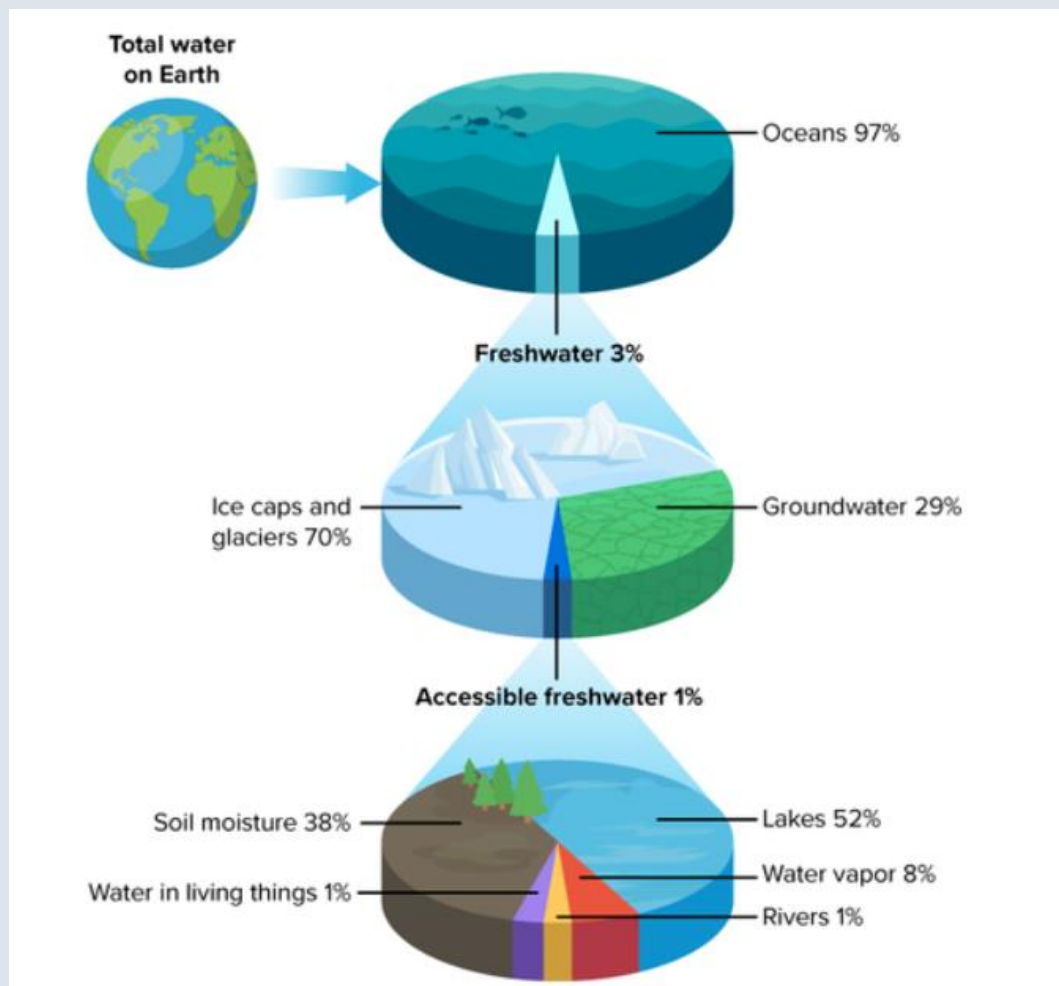
AQEELA PARKER

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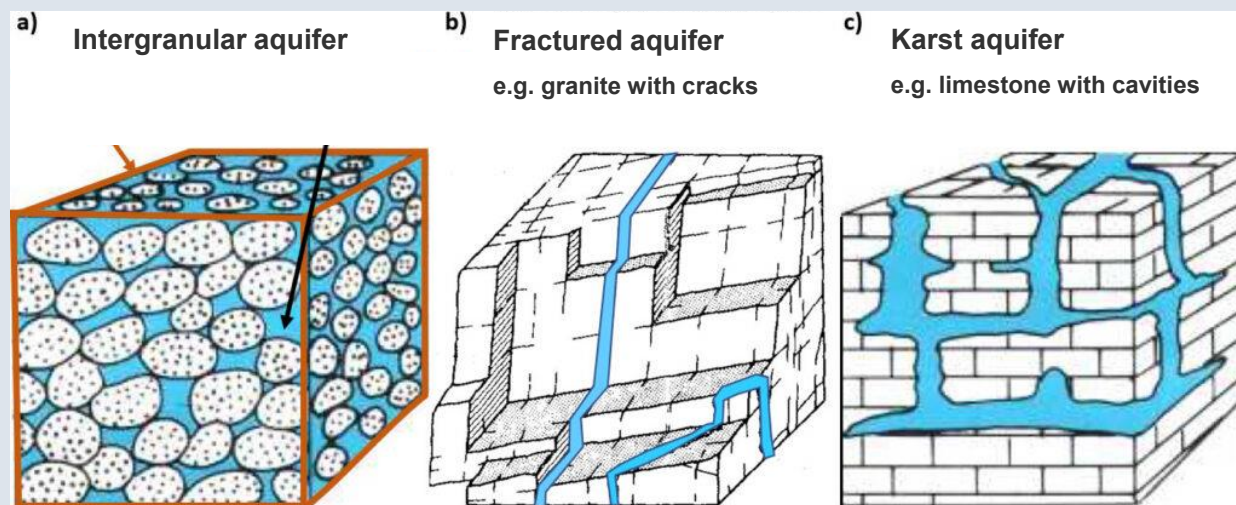
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GROUNDWATER OVERVIEW

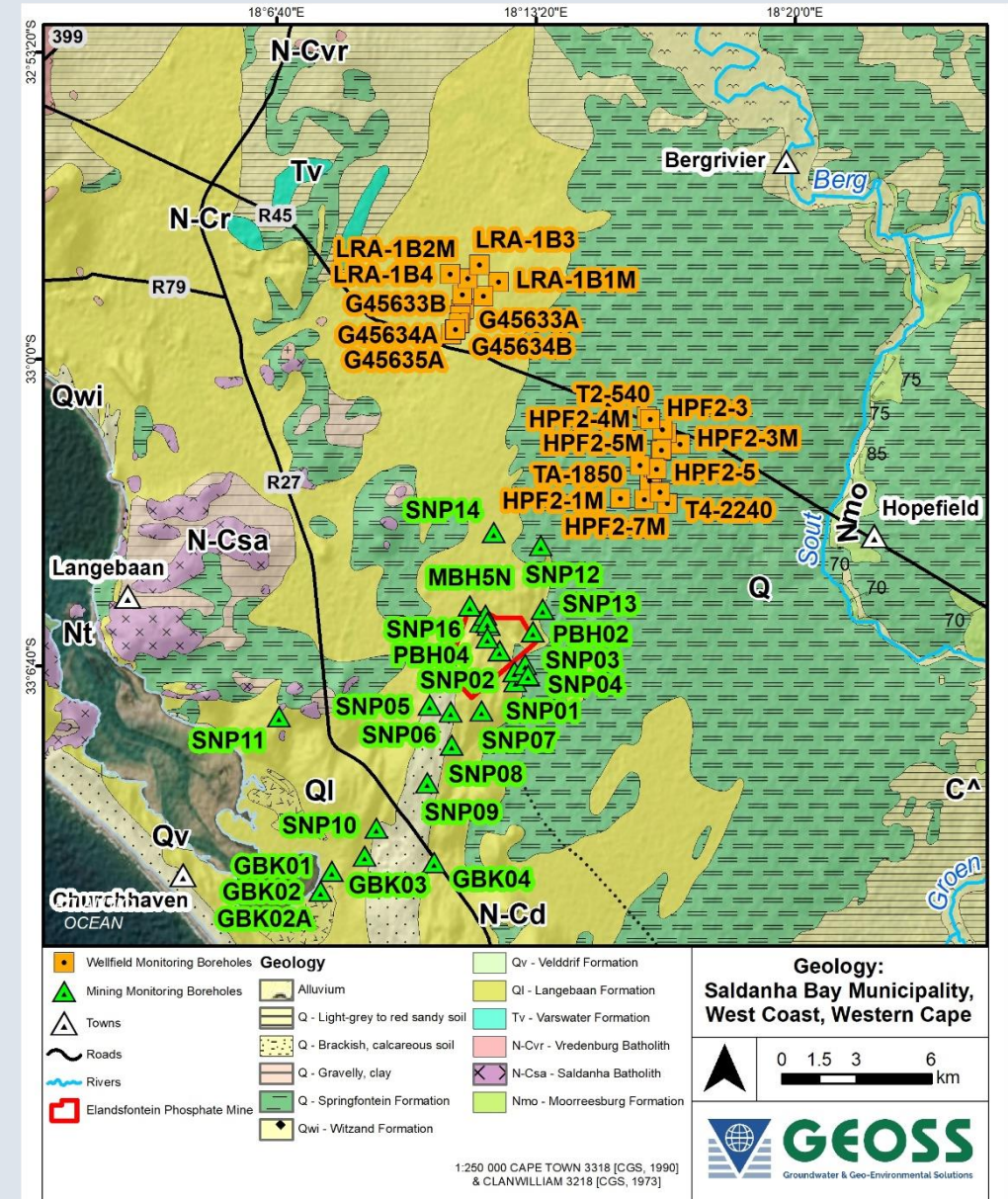
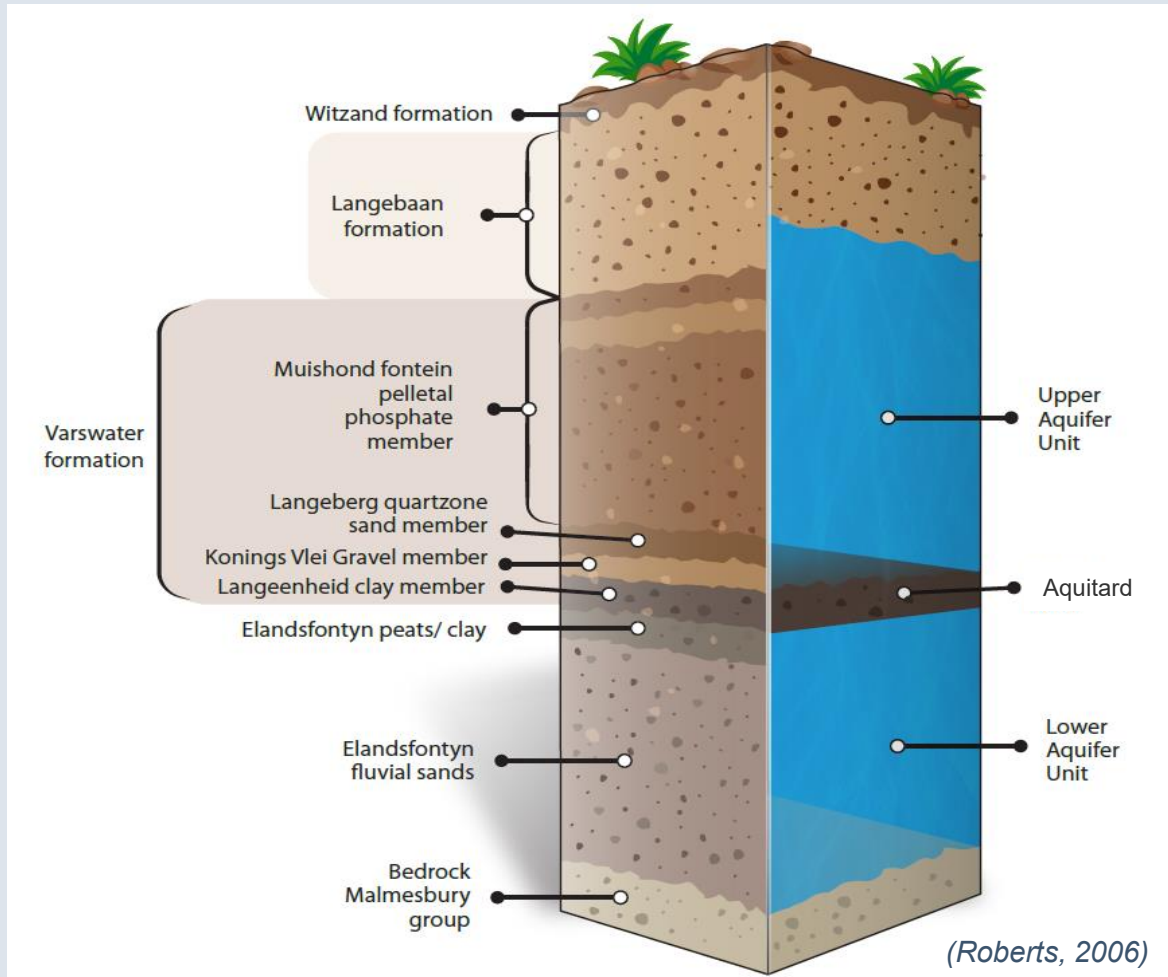


- Only 3% of all water on Earth is freshwater, with the remaining 97% being saline ocean water.
- Of that 3%, about 29% is stored underground as groundwater.
- Groundwater-bearing underground formations are known as aquifers.



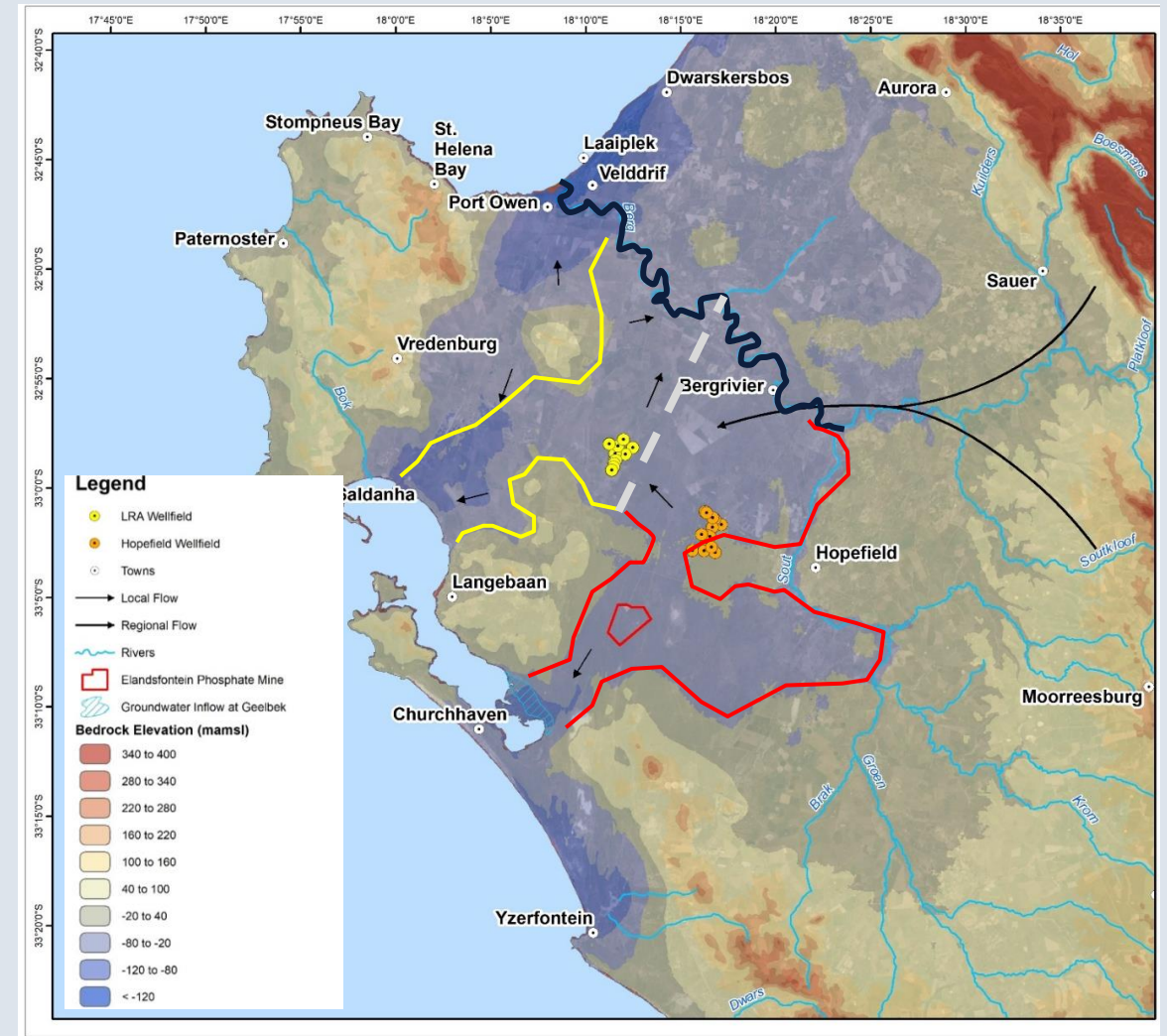
CK-12 Foundation (2013)

GEOLOGY AND WEST COAST AQUIFERS



WEST COAST AQUIFERS AND FLOW PATHS

- The area hosts two major interconnected aquifer systems:
 - Langebaan Road Aquifer
 - Elandsfontein Aquifer
- These aquifers were created by paleochannels in the area, which originated from the Berg River's former course.
- Groundwater recharge primarily occurs through regional processes.
- The Langebaan Road Wellfield is situated within the Langebaan Road Aquifer paleochannel, and the Hopefield Wellfield is positioned at the top limb of the Elandsfontein Aquifer paleochannel
- The Elandsfontein Phosphate Mine is situated directly over the southern limb of the Elandsfontein Aquifer paleochannel.

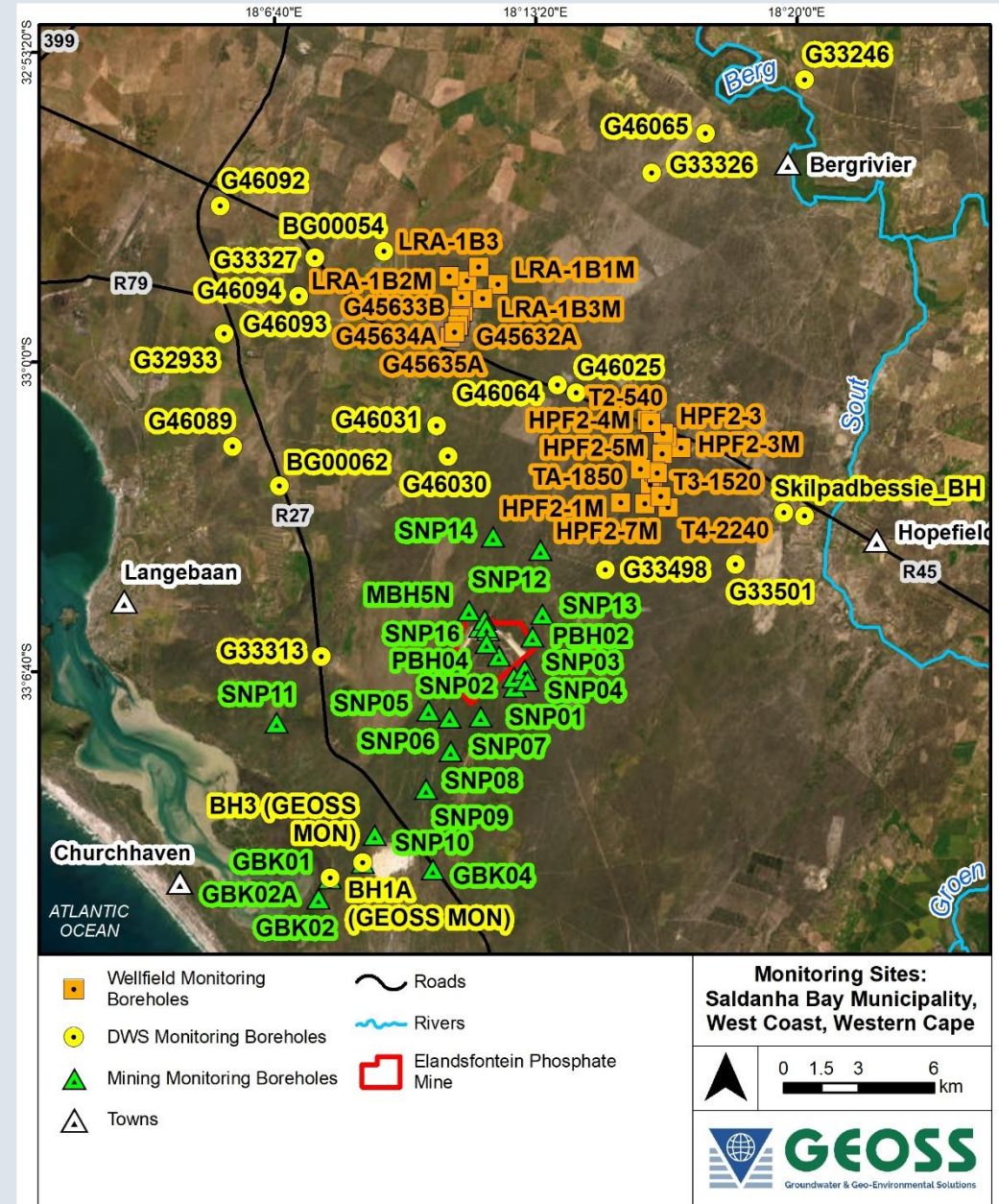
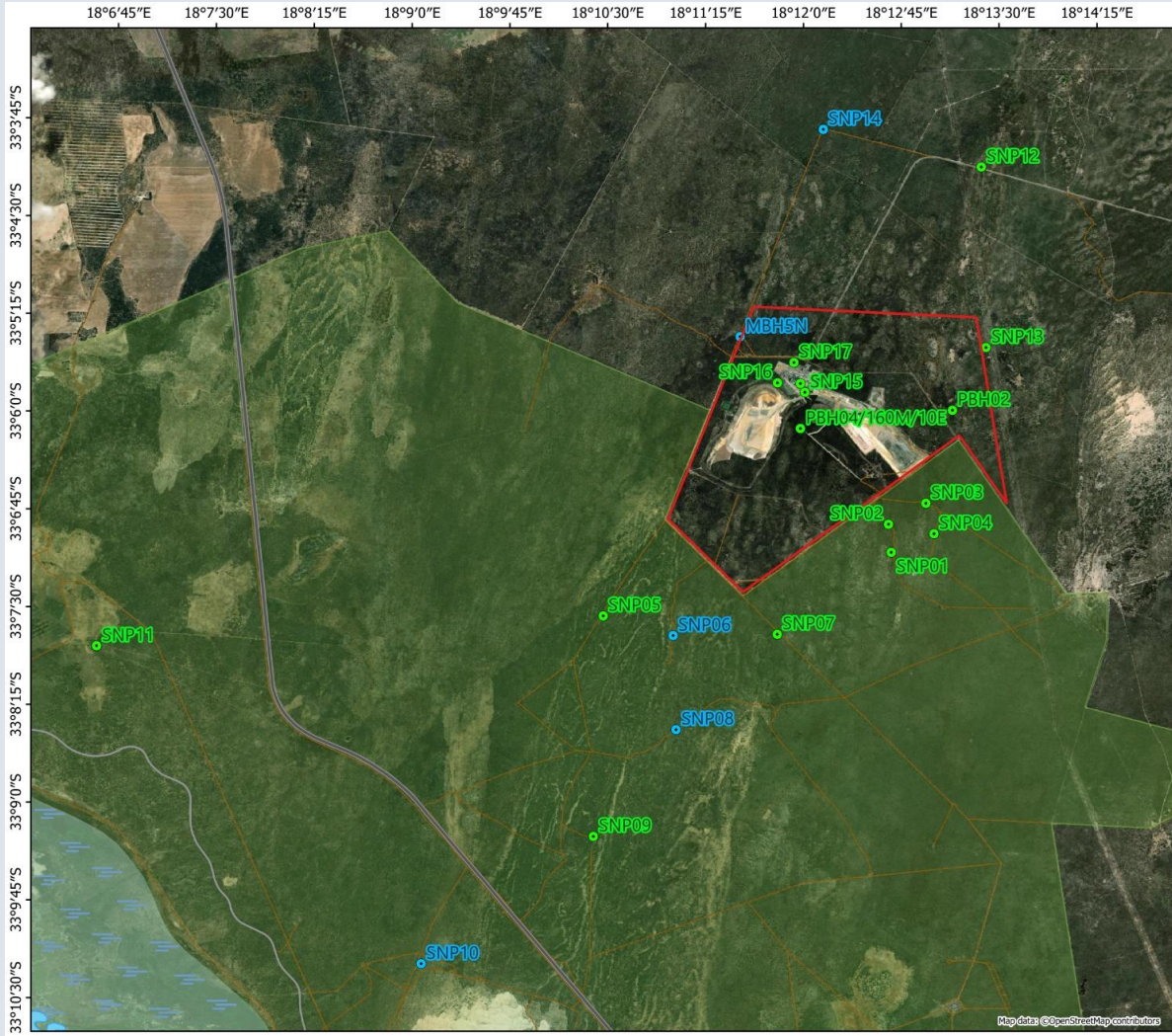




SIGNIFICANCE OF GROUNDWATER

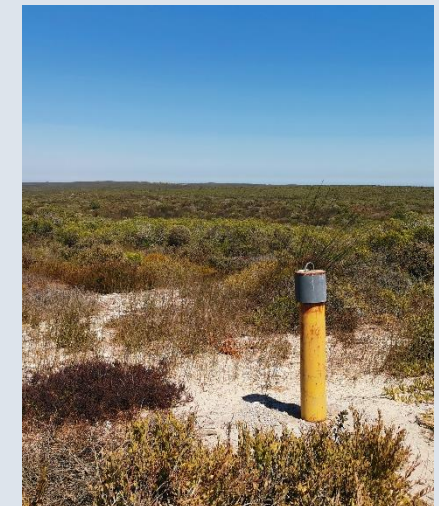
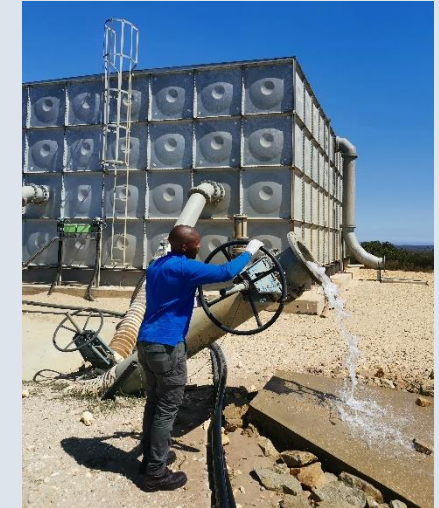
- The Langebaan Lagoon Ramsar site was officially declared on April 25, 1988.
- Groundwater flows past the mine and discharges into the southern tip of the Langebaan Lagoon (Geelbek).
- The lagoon presents a fascinating case as it is an estuarine environment, a feature typically found at river mouths.
- The inflow of fresh groundwater into the lagoon plays a critical role in supporting the area's ecology.
- This highlights the vital importance of monitoring within the area.

GROUNDWATER MONITORING NETWORK



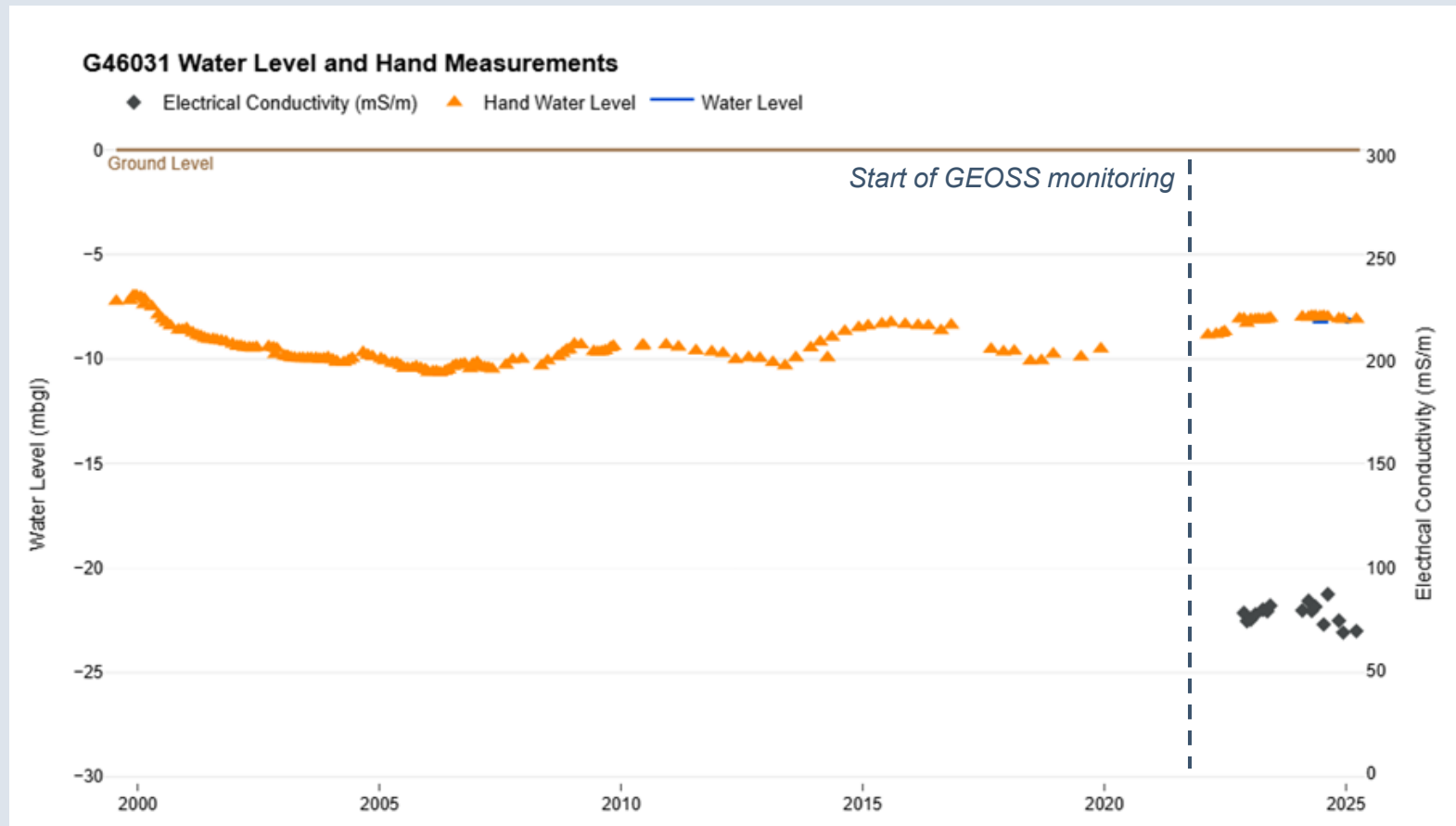
GROUNDWATER MONITORING NETWORK

- 19 Municipal wellfield boreholes (Langebaan Road and Hopefield Wellfields)
- 30 Dewatering boreholes and 20 injection boreholes at the Kropz Elandsfontein Mine
- A total of 61 dedicated monitoring boreholes are situated up- and down-gradient of these groundwater abstraction points, and 5 monitoring boreholes are located at Geelbek within the West Coast National Park.
- The monitoring boreholes were strategically located around the wellfields, mine and along the "paleochannel" leading toward the Langebaan Lagoon.
- Due to the sensitive nature of the system, the boreholes are monitored on a monthly basis and sampled quarterly.



GROUNDWATER MONITORING

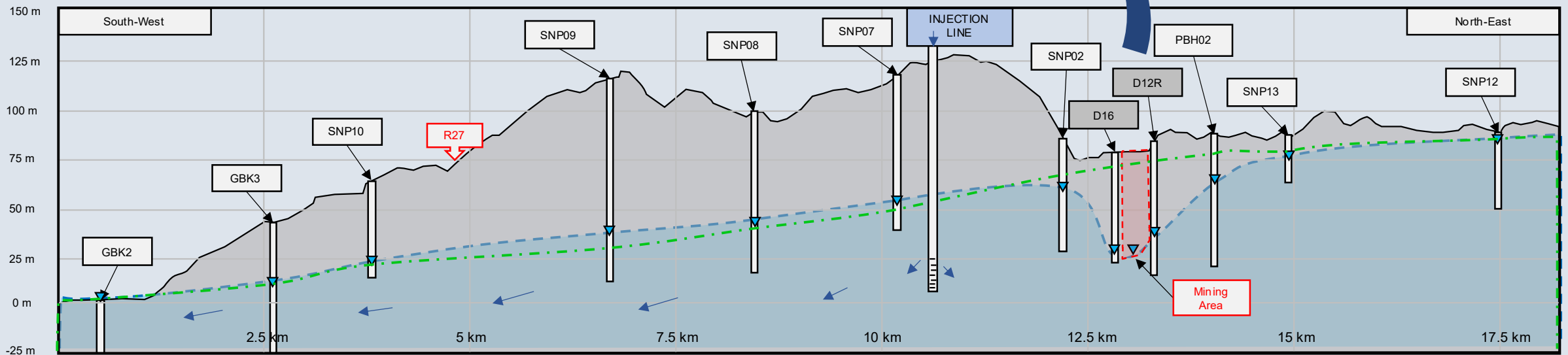
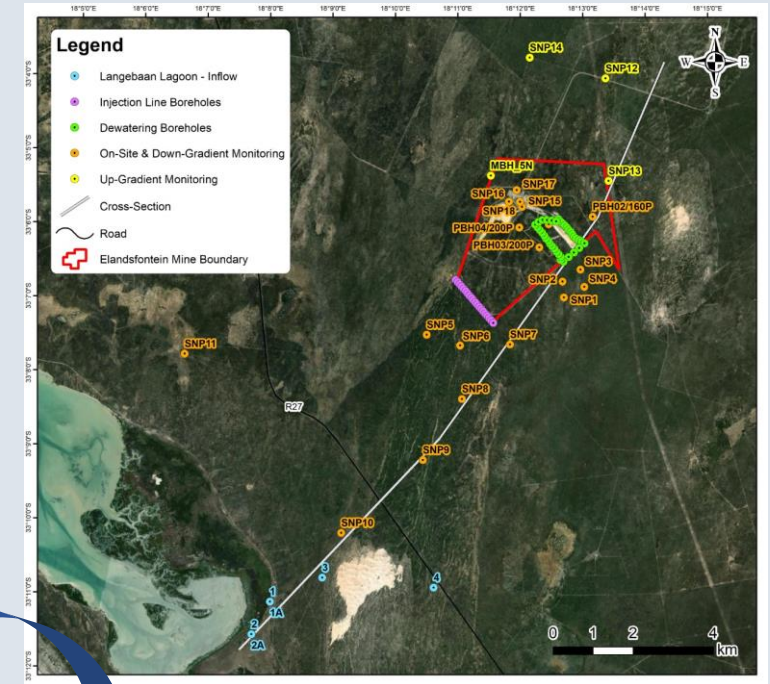
- Typically, automated water level loggers are installed at the abstraction boreholes.
- Manual hand readings are recorded at the monitoring boreholes monthly.
- With the manual water level readings, electrical conductivity (a measure of salinity) readings are taken monthly.



GROUNDWATER MONITORING – 2D CROSS SECTION AT MINE

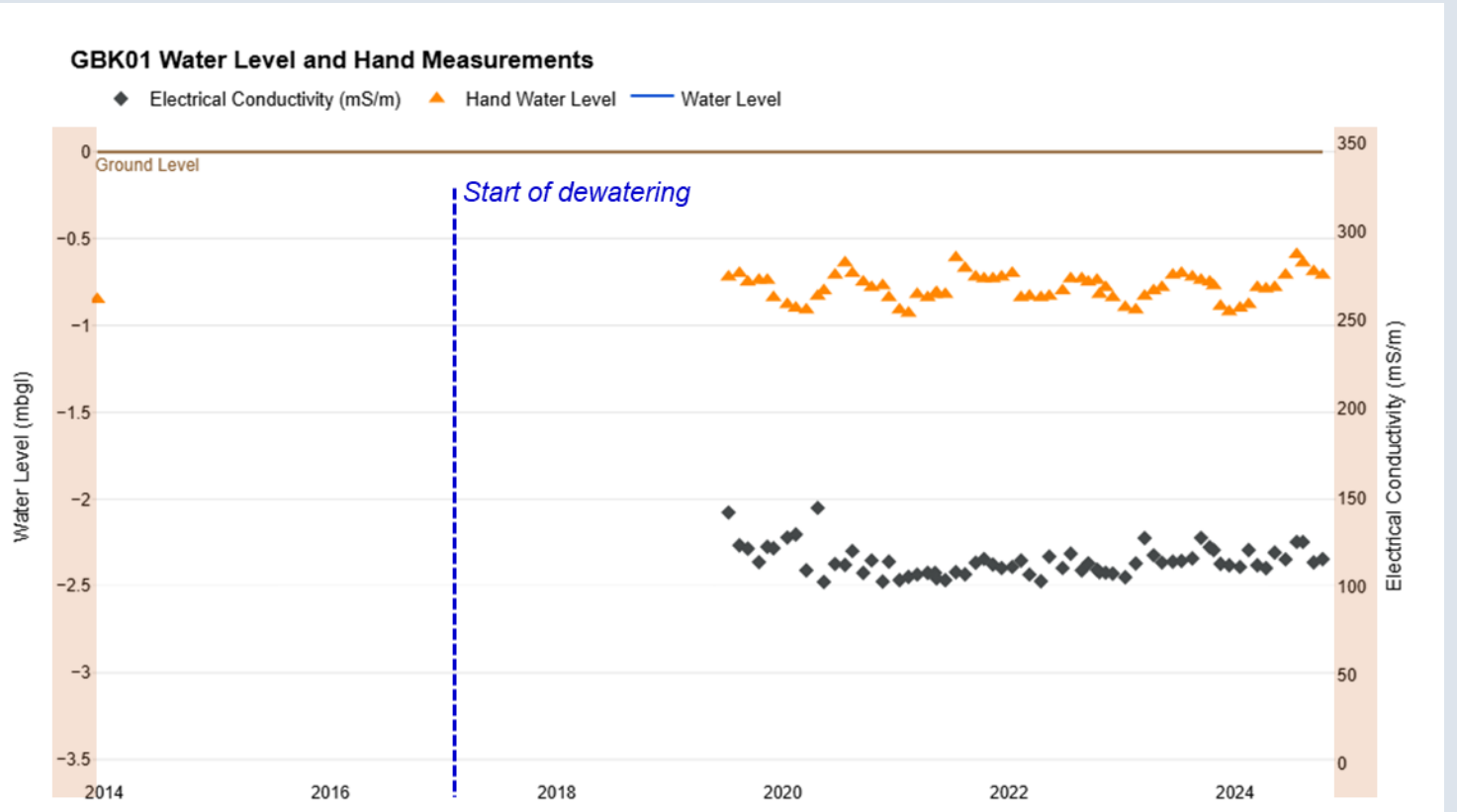
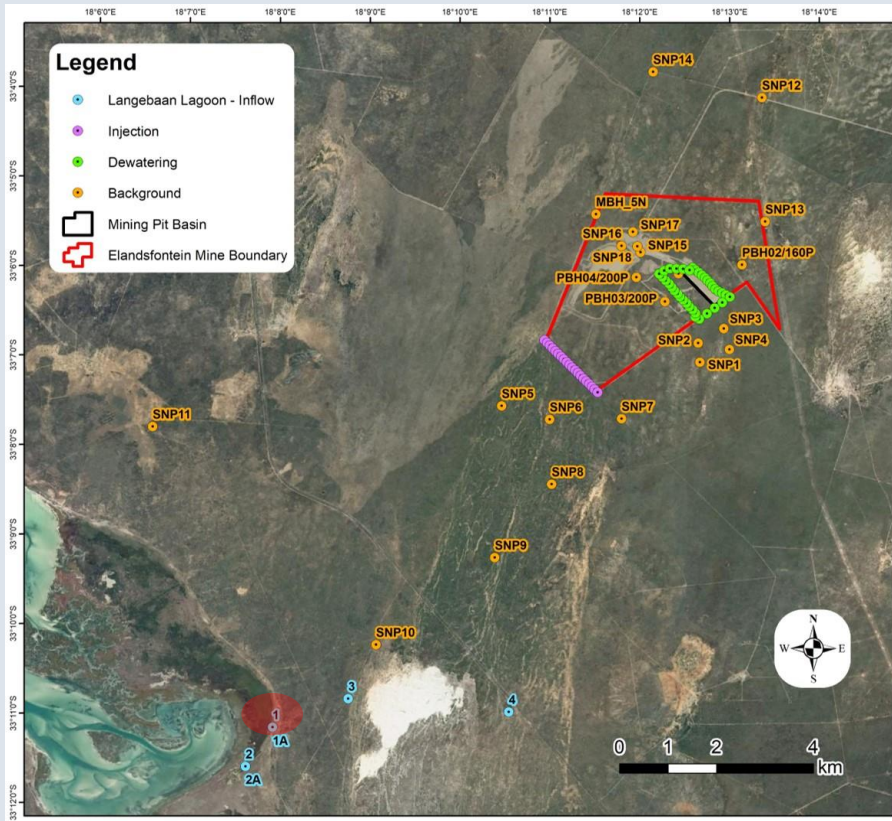
—●— Pre-mining water table
- - - Current water table

- **Upgradient** water levels remain the same since before mining commenced
- Localised dewatering (decrease in water levels) in the **vicinity of the mine**, as expected.
- **Downgradient** water levels have marginally risen due to the artificial recharge
- Groundwater levels at **Geelbek** remain stable



GROUNDWATER MONITORING – GEELBEK

GBK01 – 11.3 km southwest of the pit



SUMMARY

- The West Coast hosts vital aquifers to support the ecology, industry and humans within the area.
- Despite municipal abstraction and dewatering at the mine (amongst other groundwater users in the area), regional water levels are relatively stable with no long-term concerning trends detected.
- Groundwater EC's show evidence of seasonal and natural variation.
- Overall, based on chemical and water level analyses, both the mine and municipal wellfields have had no negative impact on the lagoon and surrounding aquifer system.





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WEST COAST GROUNDWATER: THE HIDDEN BUT VITAL RESOURCE

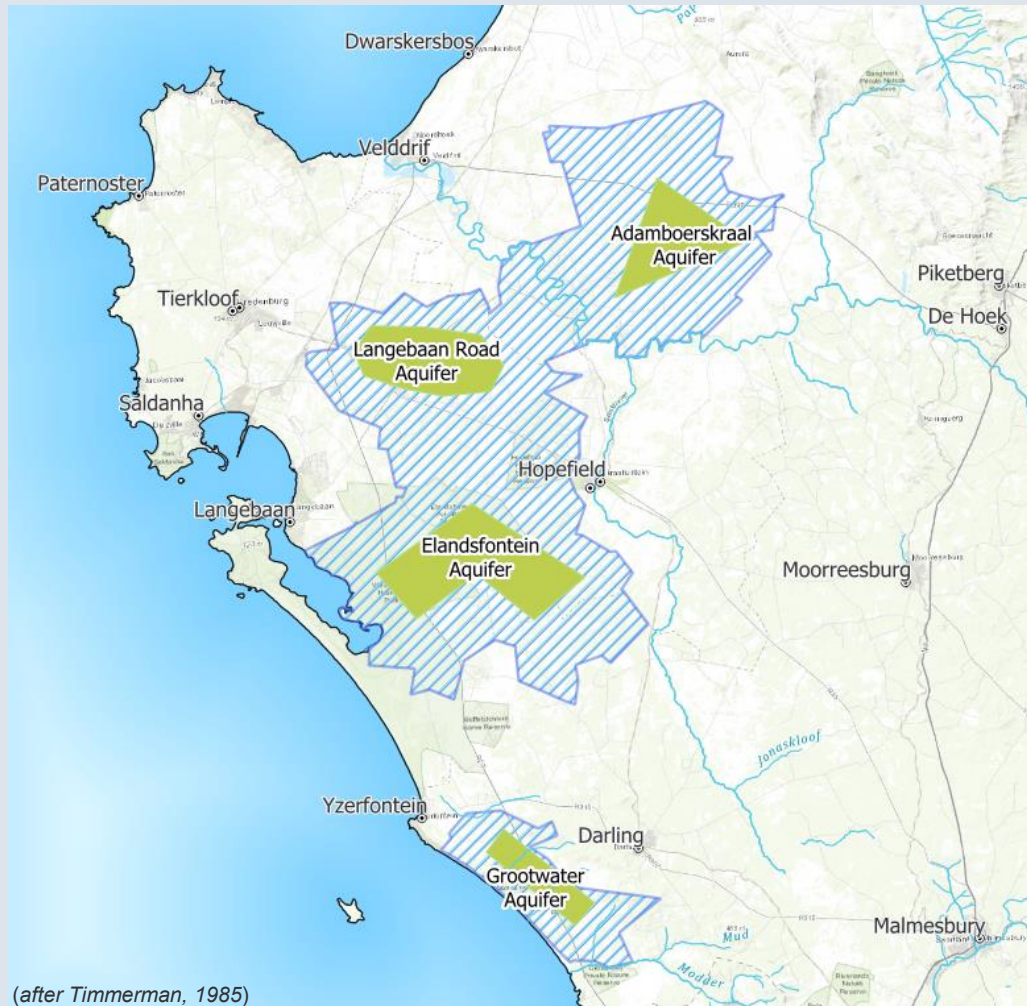
*Conceptual and Numerical Model of the Municipal Wellfield Abstraction:
Regional Groundwater Flow Model*

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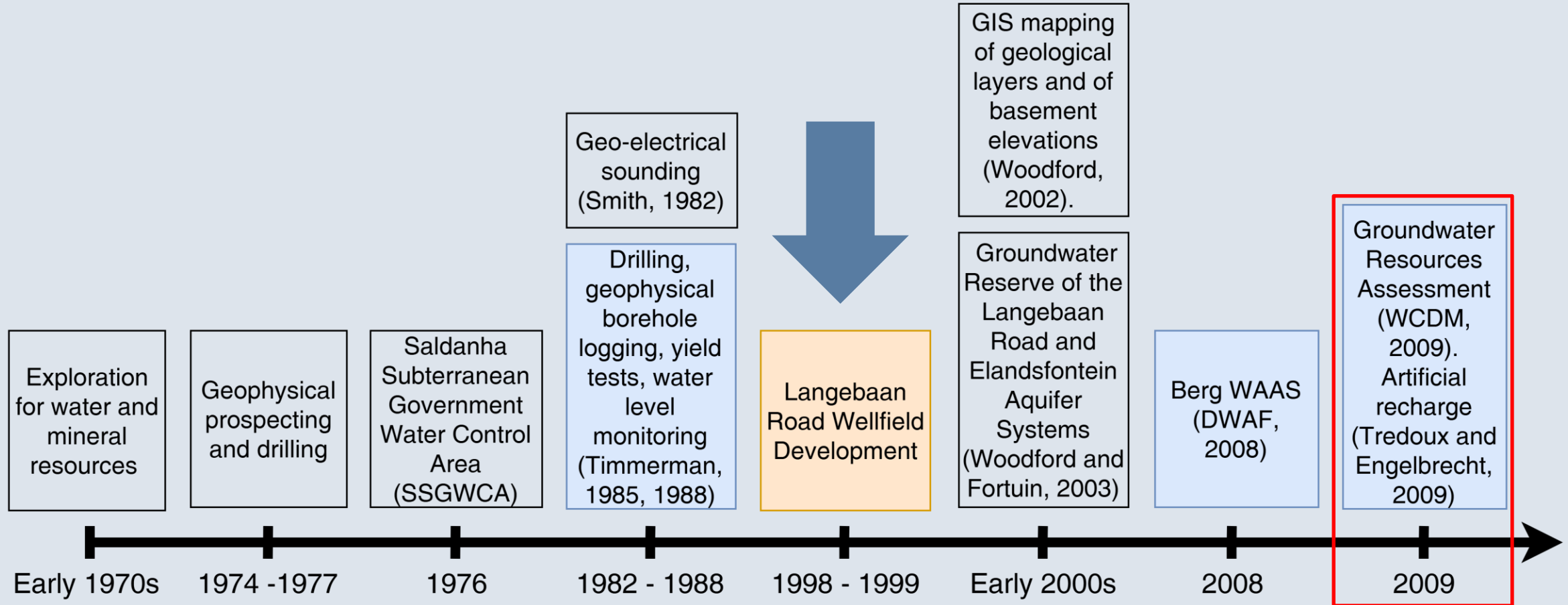
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LEGACY OF GROUNDWATER RESEARCH IN THE SALDANHA BAY REGION

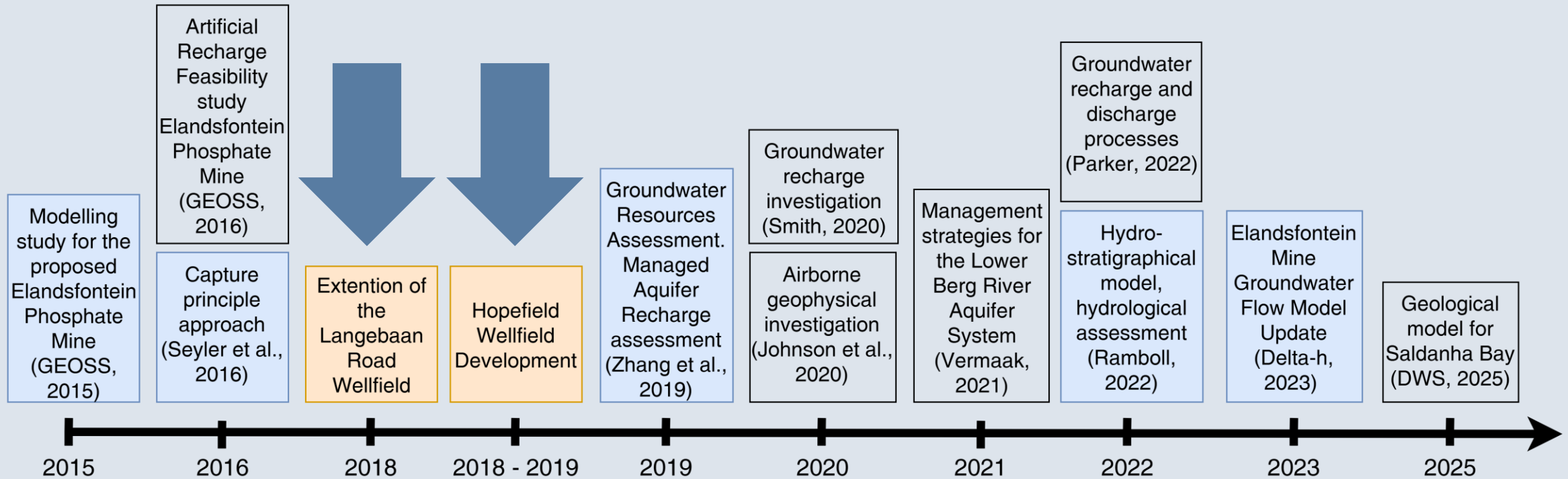


- Key aquifer units within the Saldanha Bay region have formed the basis of decades of hydrogeological research, monitoring and modelling.
 - Adamboerskraal Aquifer
 - Langebaan Road Aquifer
 - Elandsfontein Aquifer
 - Grootwater Aquifer
- } Lower Berg River Aquifer System

LEGACY OF GROUNDWATER RESEARCH IN THE SALDANHA BAY REGION



LEGACY OF GROUNDWATER RESEARCH IN THE SALDANHA BAY REGION

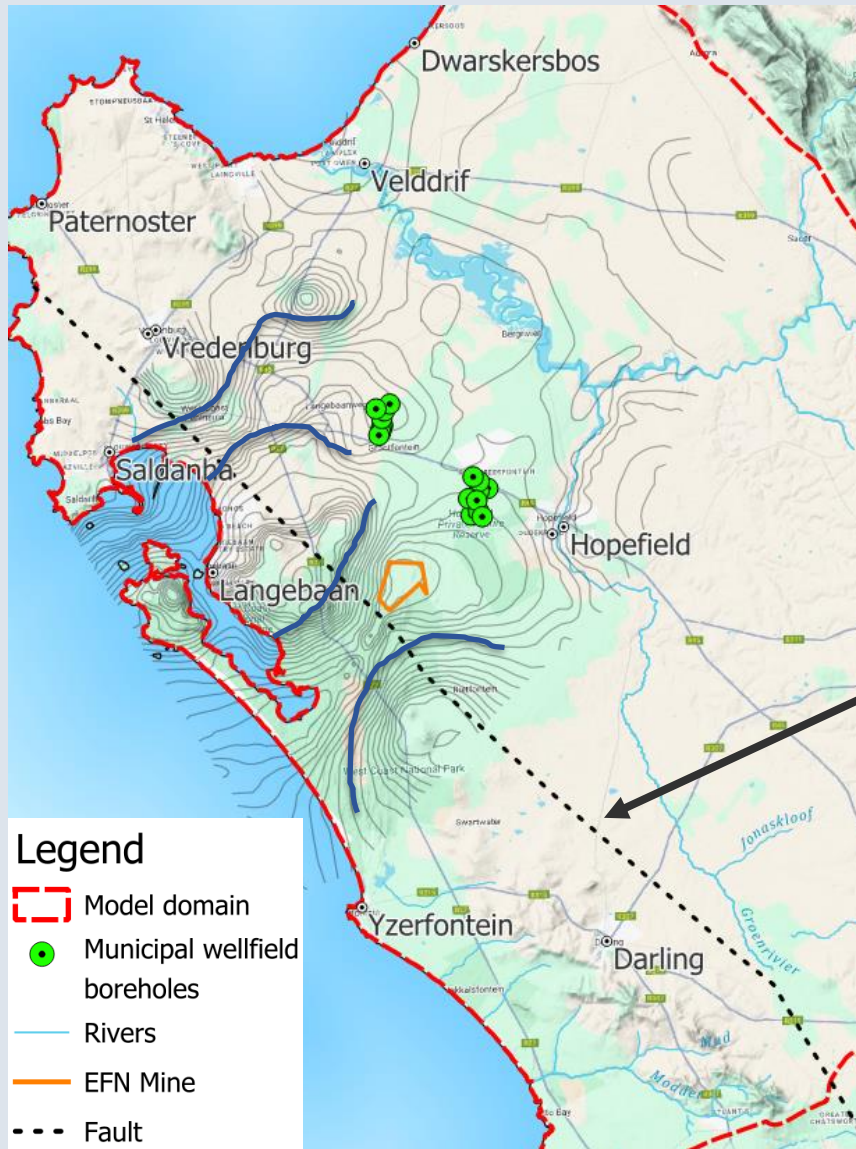


MODEL DOMAIN

- Based on regional understanding of the Berg River catchment area.
- Lower Berg River Aquifer System – treated as a complex integrated aquifer system.
- Aquifer system seen in context of the bedrock aquifers.
- Covers 5 287 km².
- Model boundaries:
 - Northwest and southwest: coastline.
 - Southeast: quaternary catchment divide separating G21A and G10L (within the model) from G21B, G21C and G21D and G10J.
 - East/Northeast: diverts from catchment divides and follows the topographic high east of Moorreesburg, connecting to a mapped fault to the north.
 - Northeast: either surface water courses or the geological contact with the TMG.

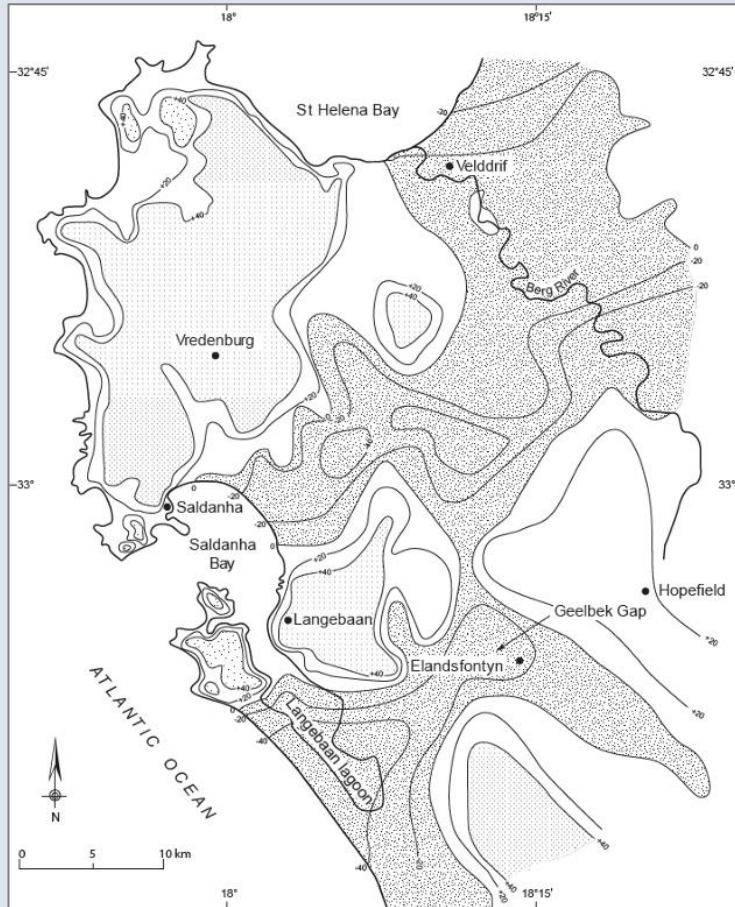


MACRO-SCALE GEOLOGICAL FEATURES

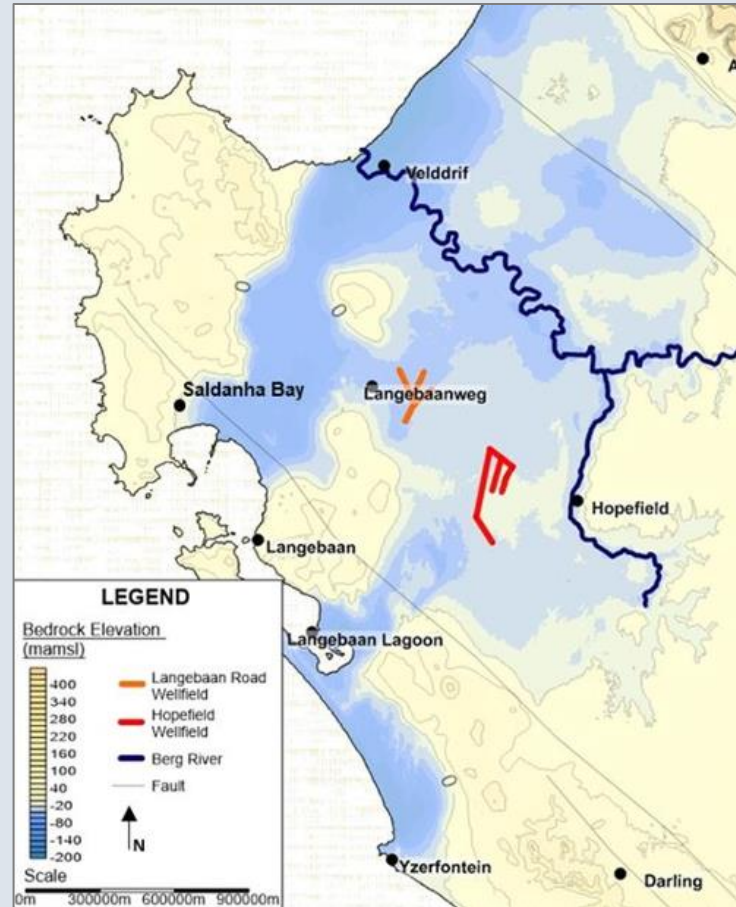


- Palaeochannels – deeply incised channels in the bedrock that were filled with layers of different sandy deposits.
- Fault systems – Colenso Fault.

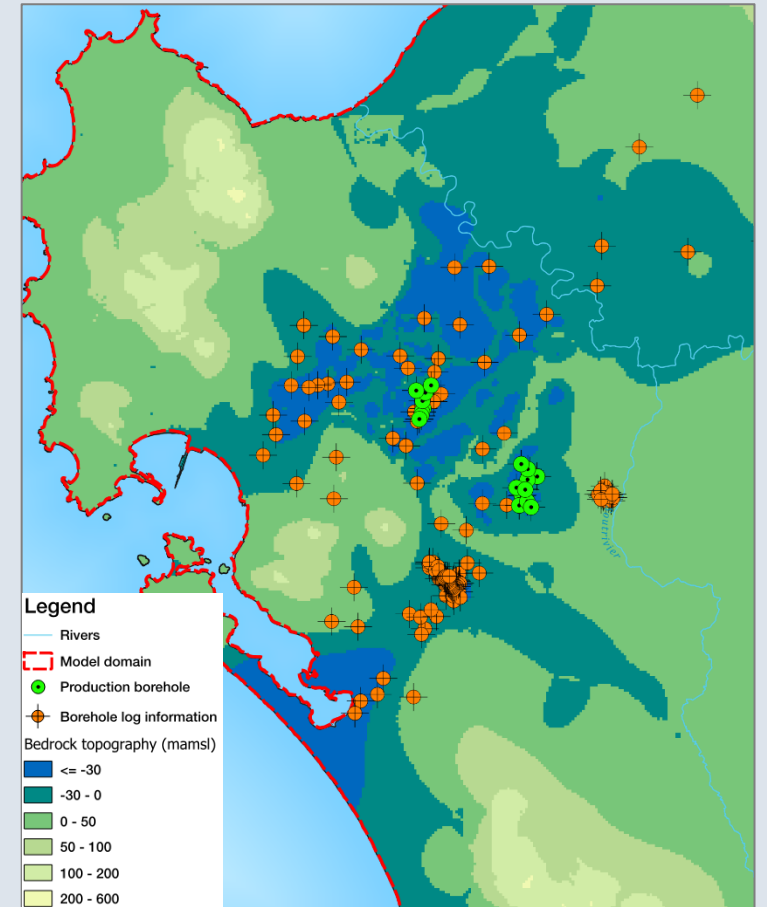
PALAEOCHANNELS – BEDROCK TOPOGRAPHY



(Roberts and Siegfried, 2014)



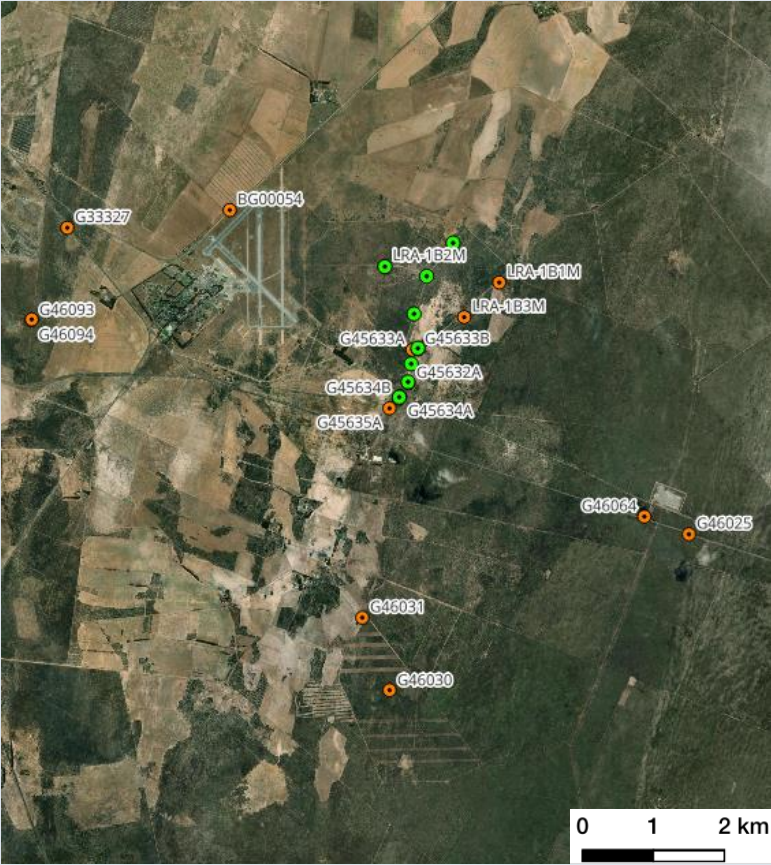
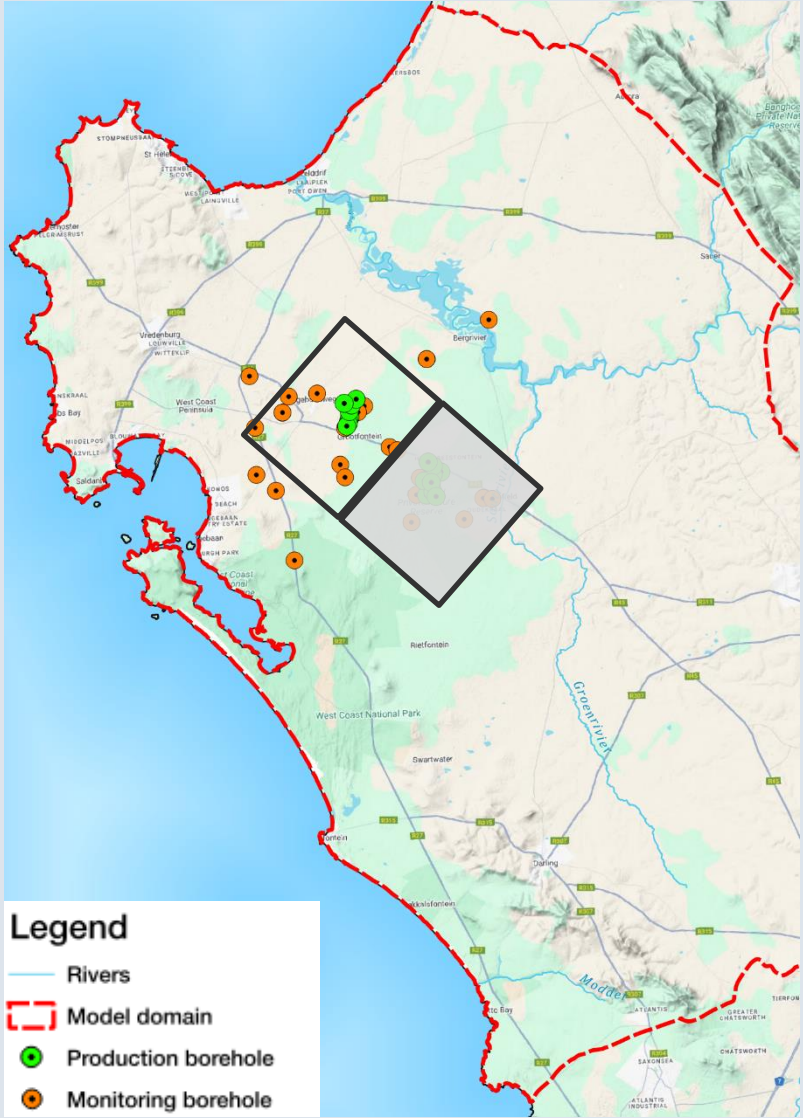
(Parker, 2022)



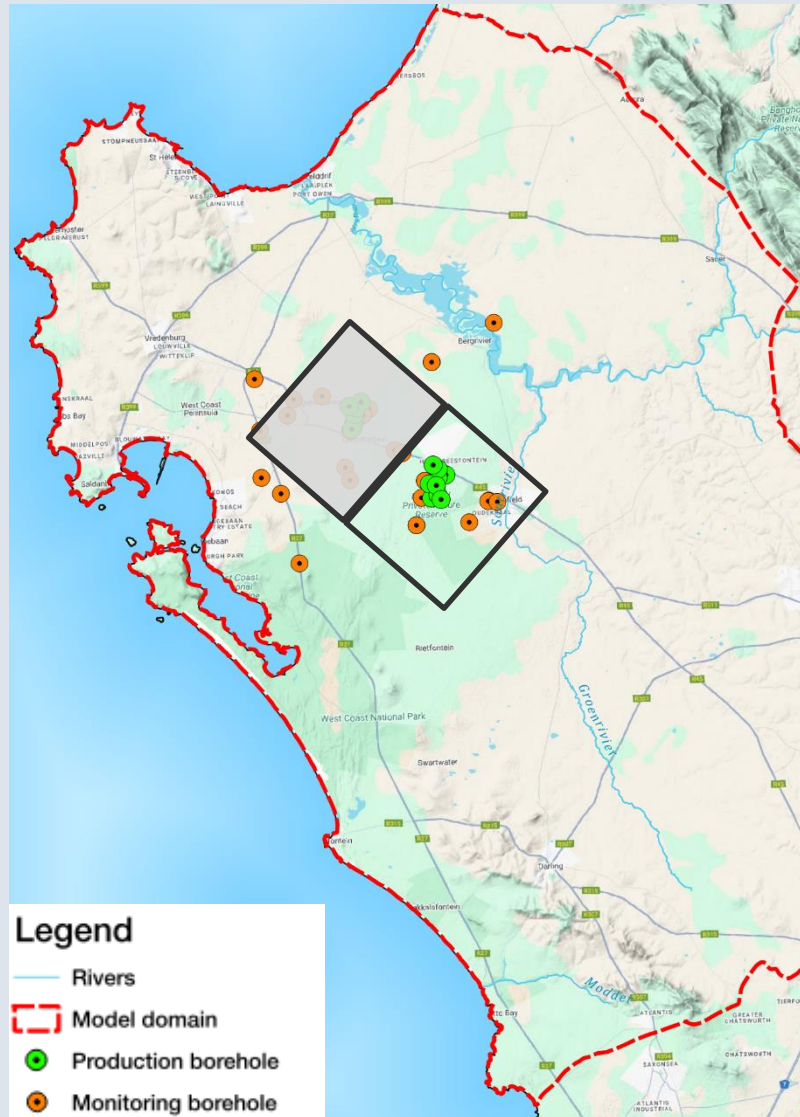
(Ramboll, 2022)

MUNICIPAL WELLFIELDS MONITORING NETWORK

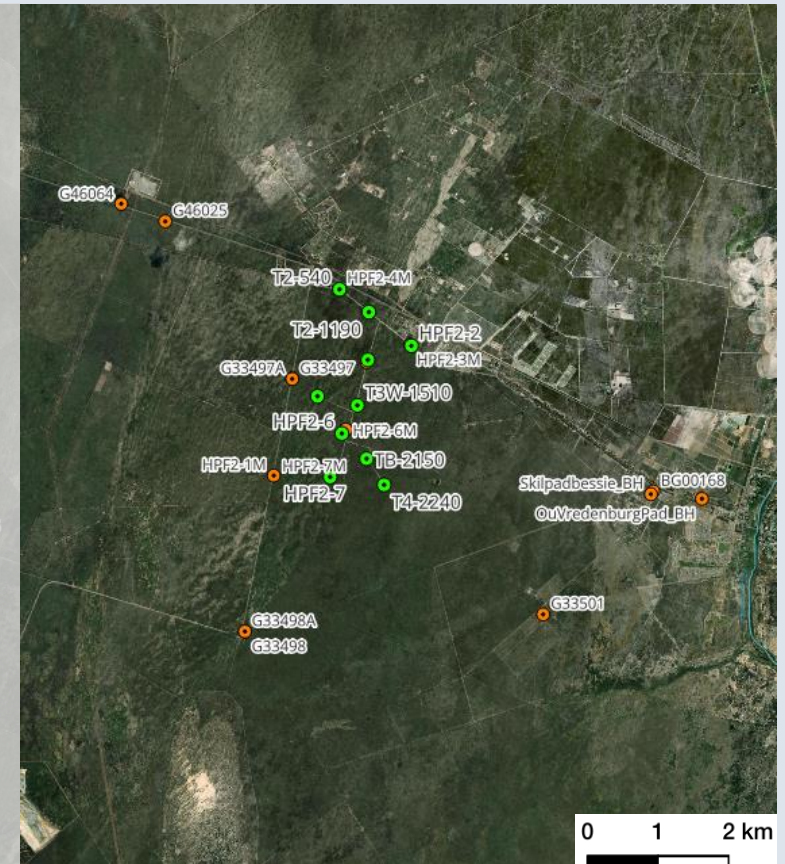
LRA Wellfield



MUNICIPAL WELLFIELDS MONITORING NETWORK

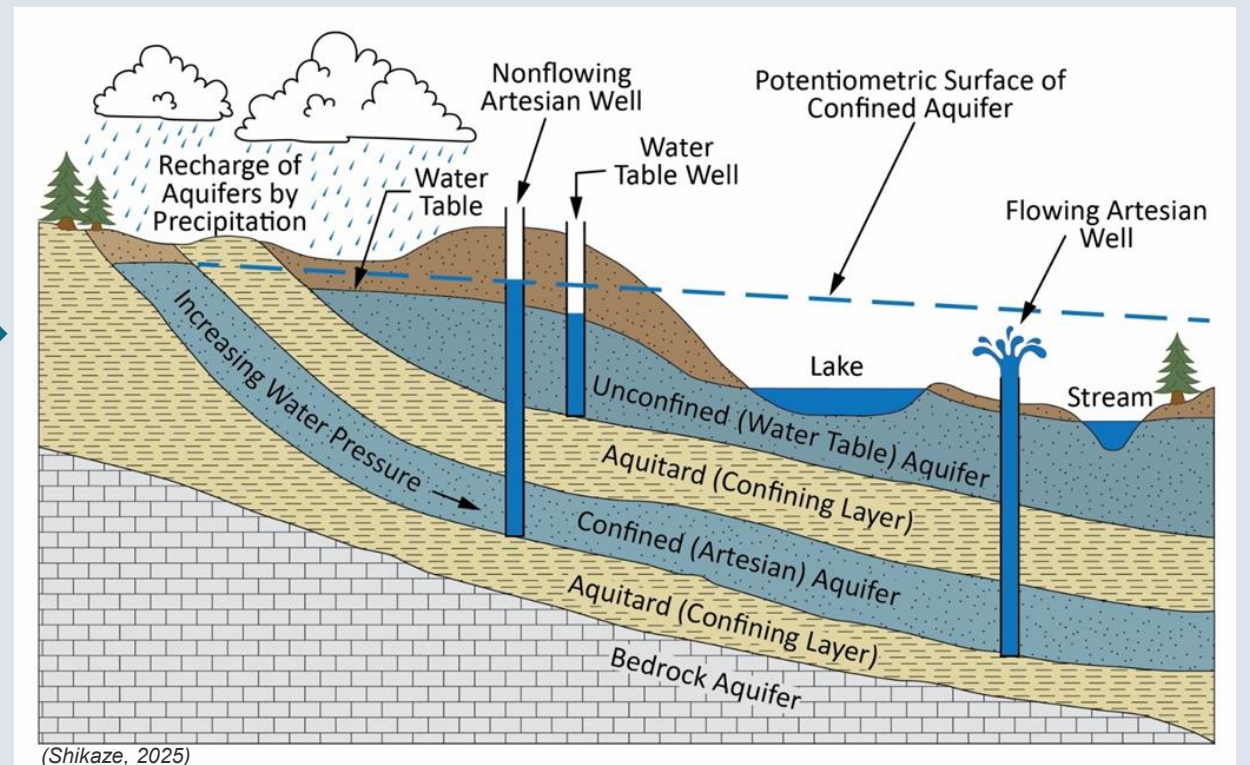
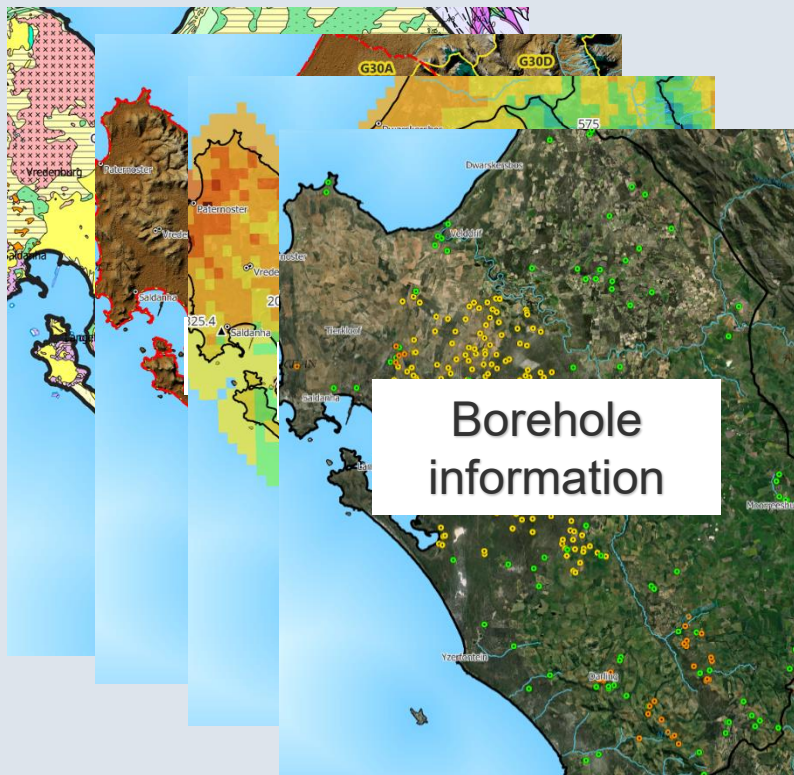


Hopefield Wellfield

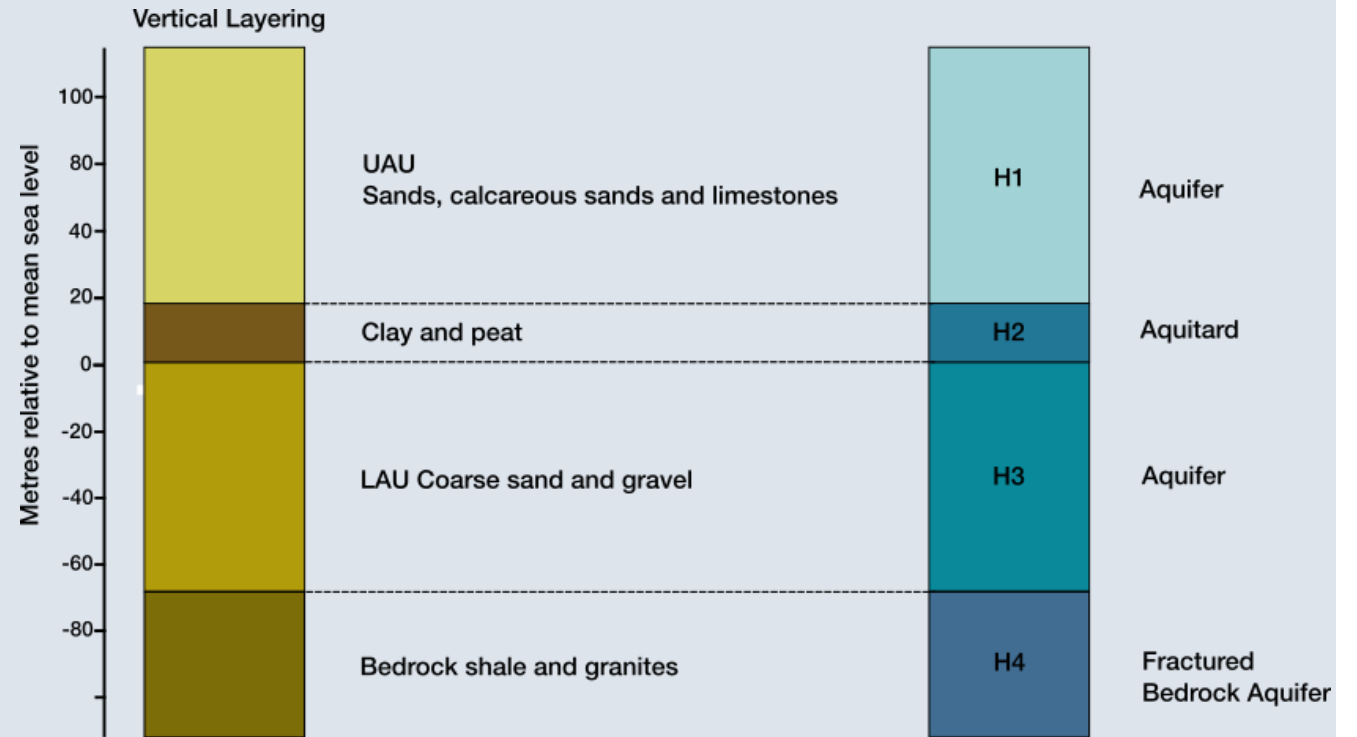
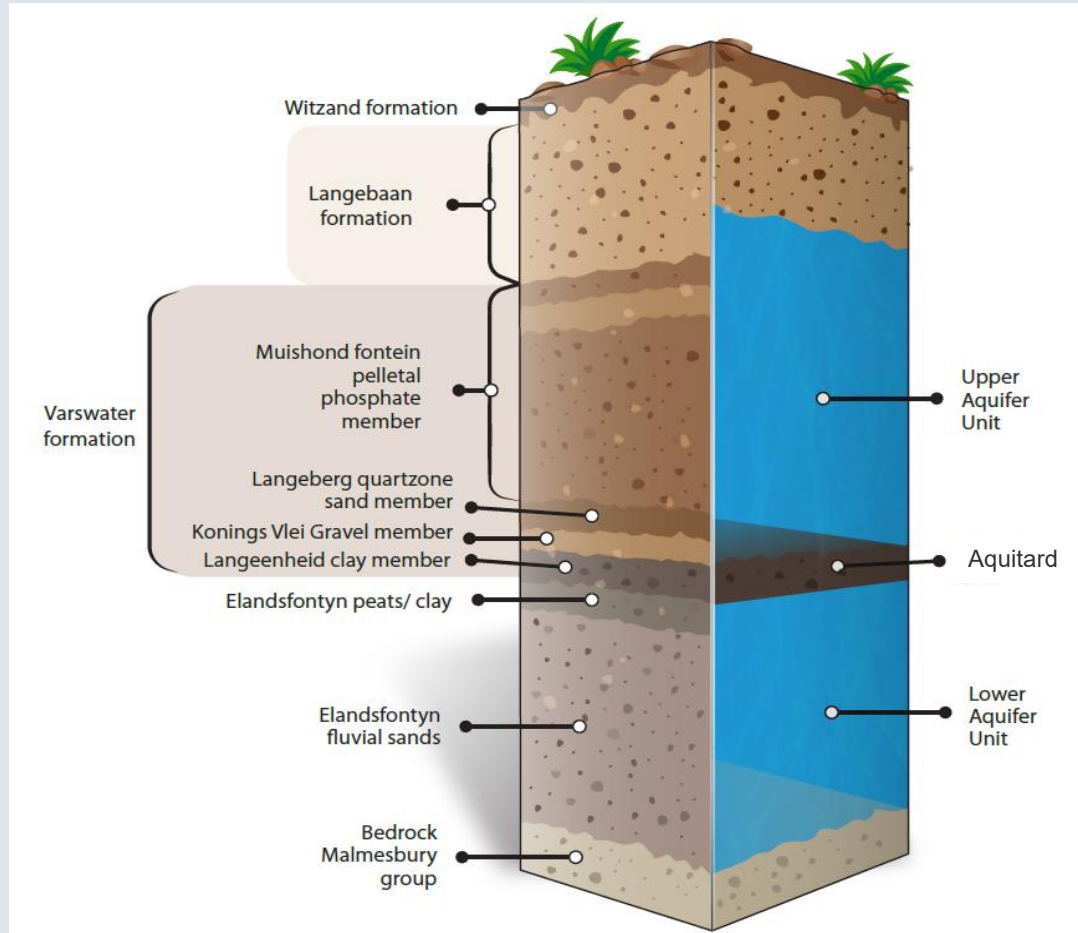


OUR CONCEPTUAL UNDERSTANDING OF THE GROUNDWATER SYSTEM

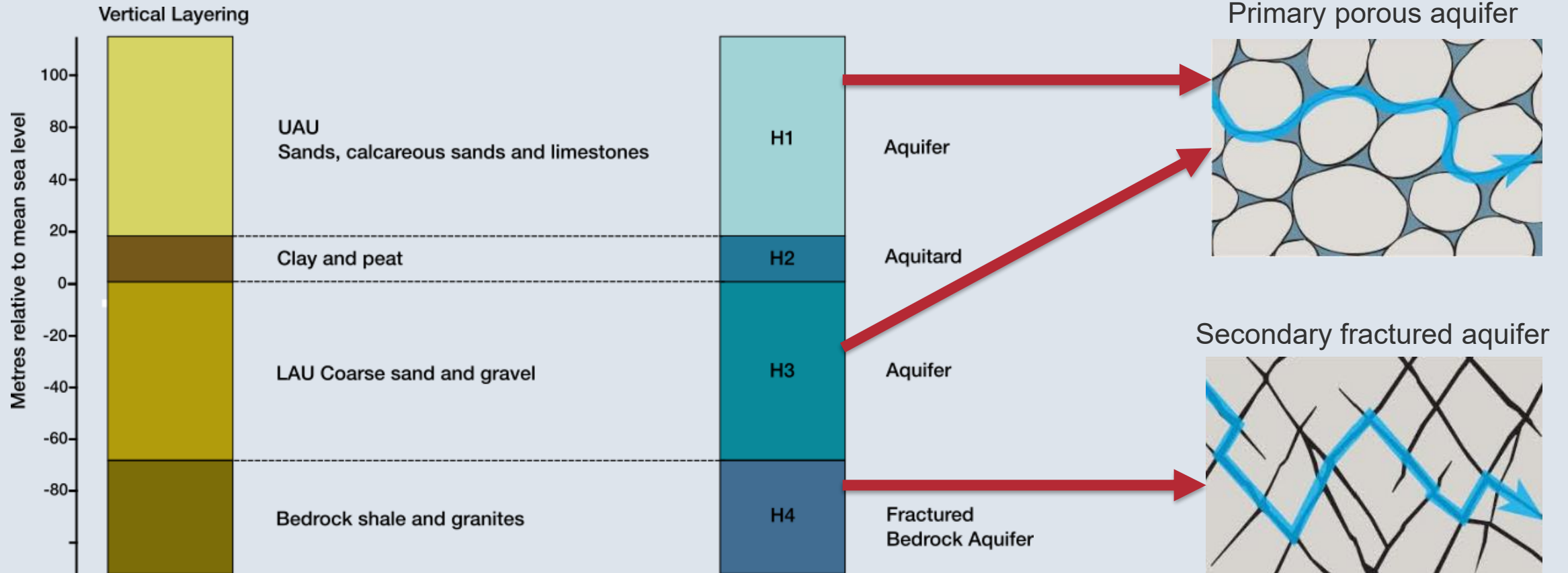
- “Data! Data! Data! I cannot make bricks without clay.” – Sherlock Holmes (The Adventure of the Copper Beeches, 1892)



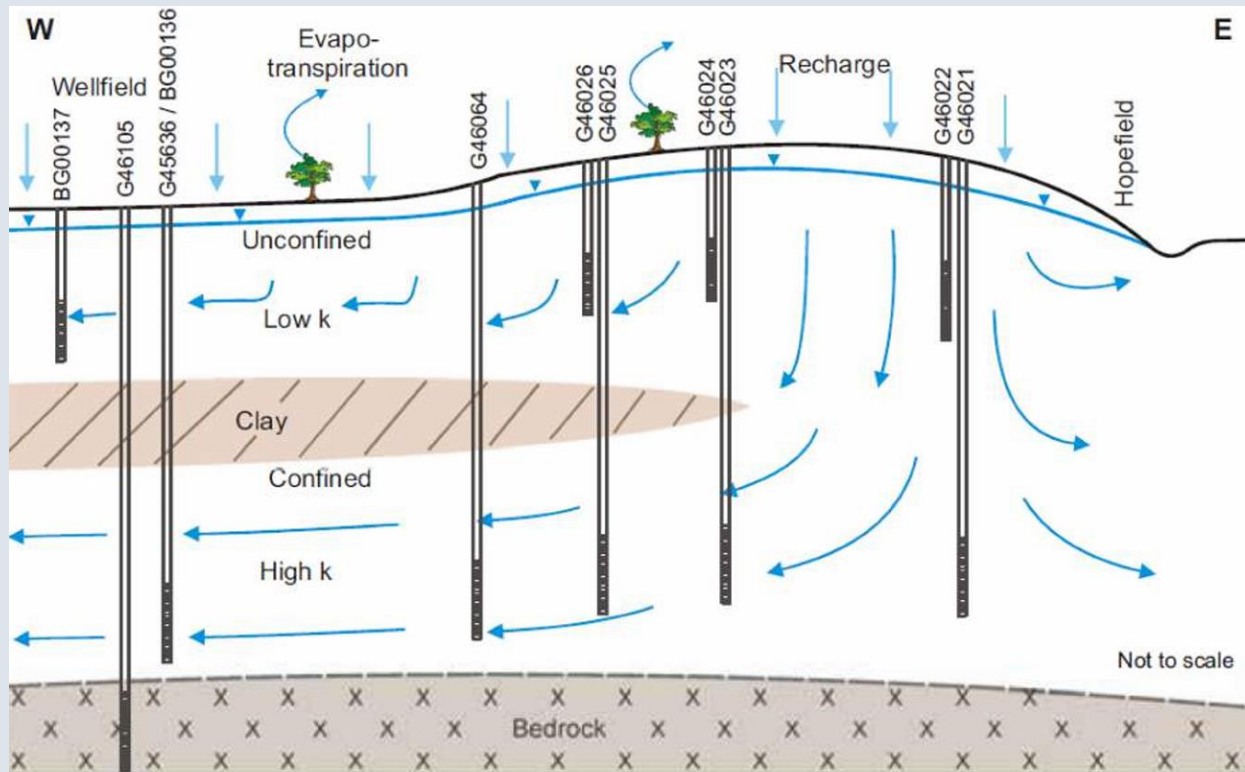
GENERALISED GEOLOGY AND HYDROSTRATIGRAPHIC UNITS



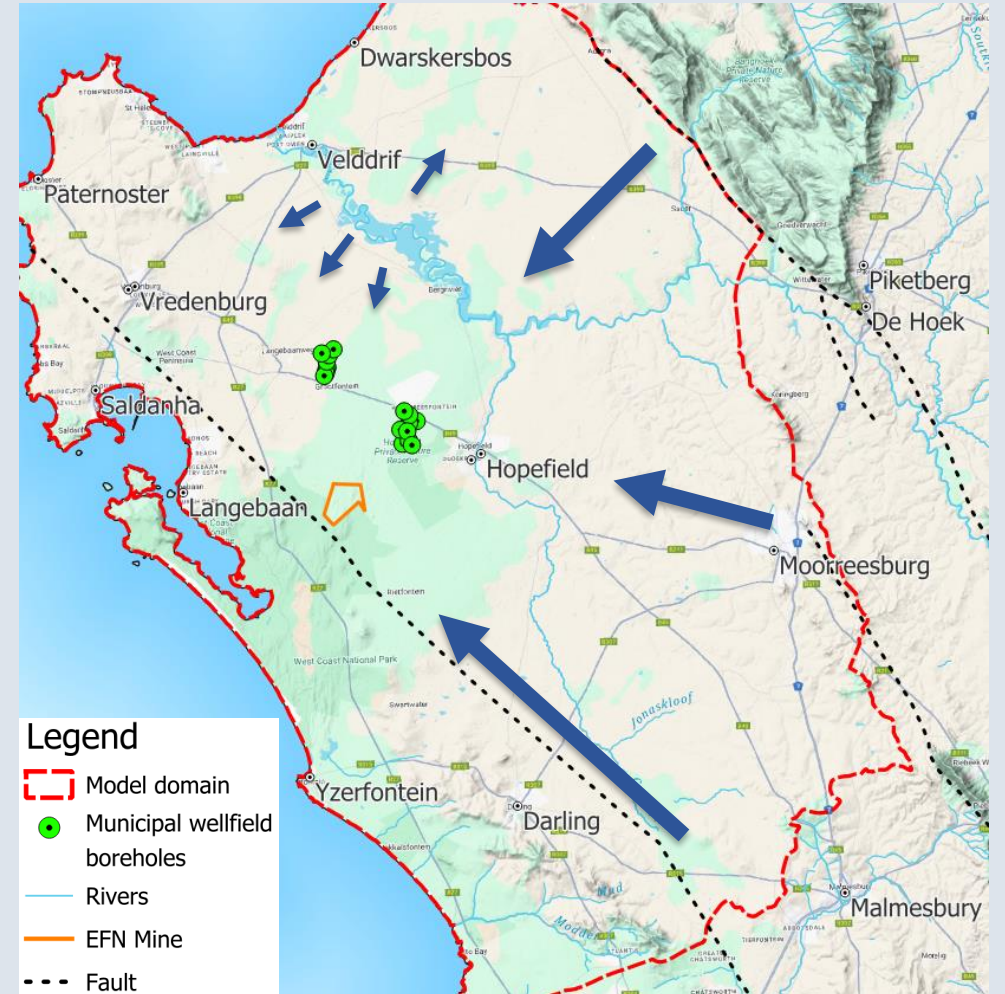
AQUIFER TYPES



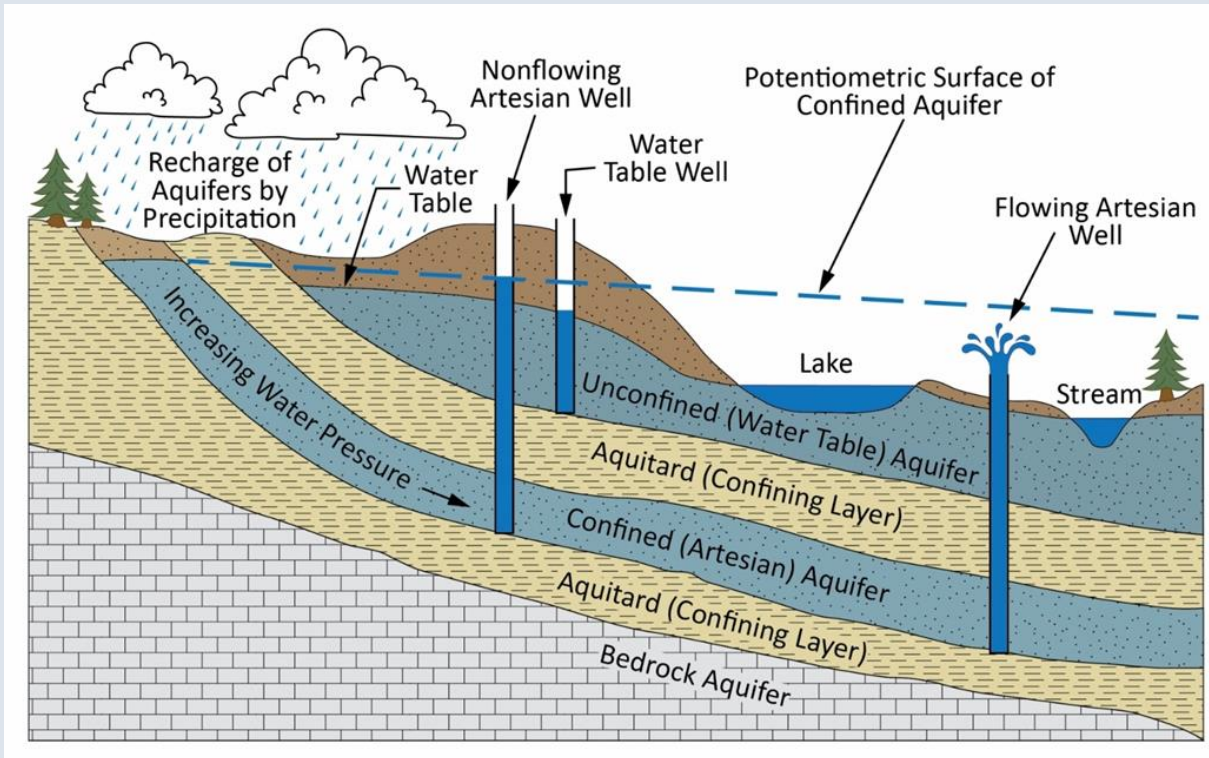
HOW IS GROUNDWATER RECHARGED?



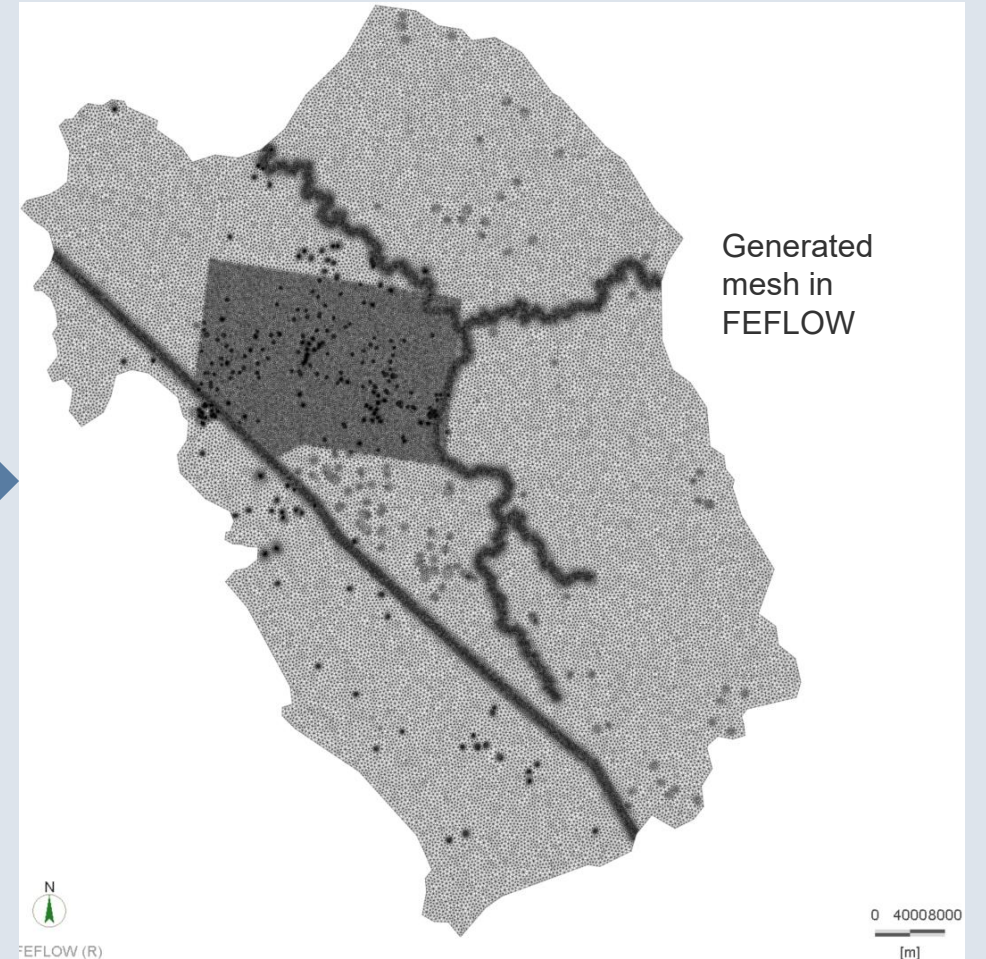
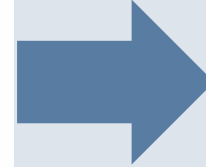
(DWA, 2010)



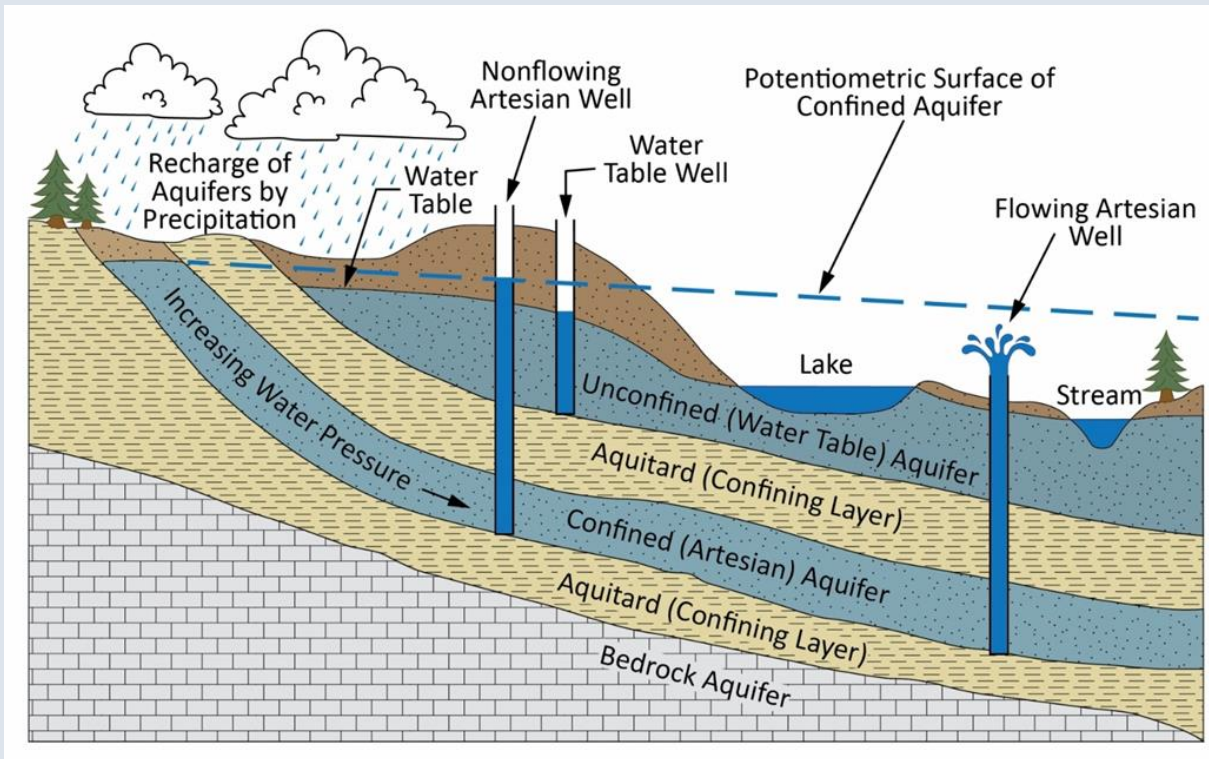
FROM A CONCEPTUAL MODEL TO A NUMERICAL MODEL



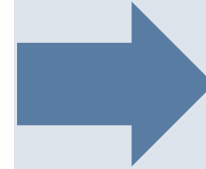
(Shikaze, 2025)



FROM A CONCEPTUAL MODEL TO A NUMERICAL MODEL

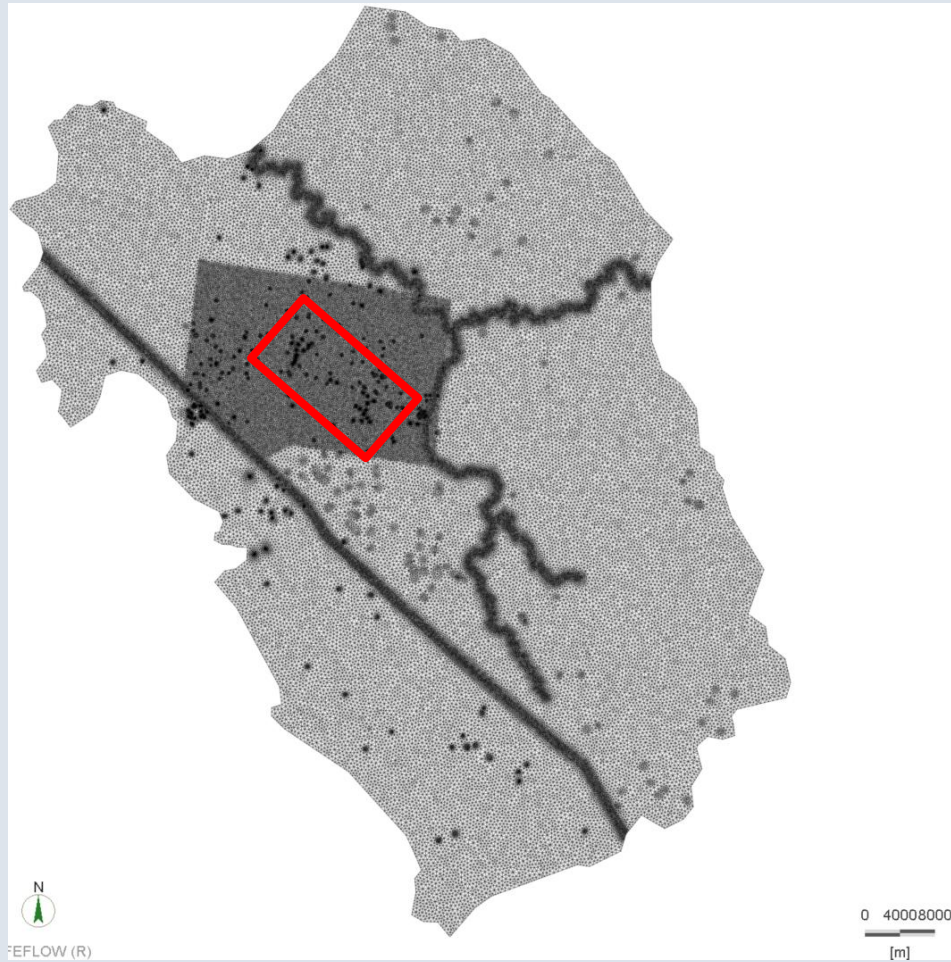


(Shikaze, 2025)

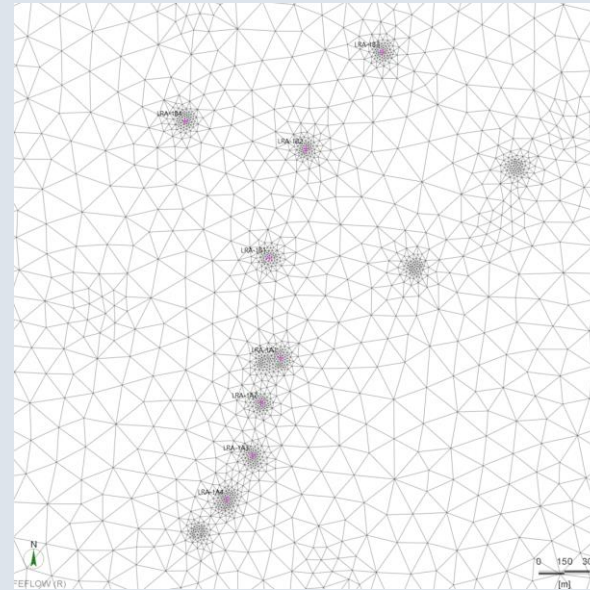


(Delta-h, 2023)

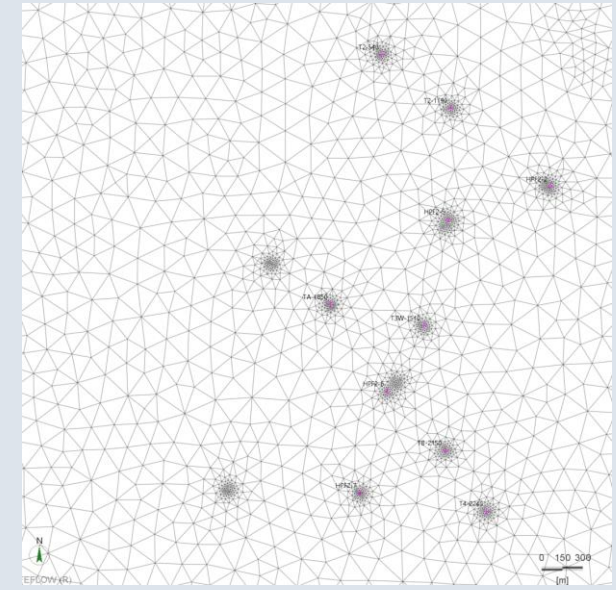
NUMERICAL MODEL MESH



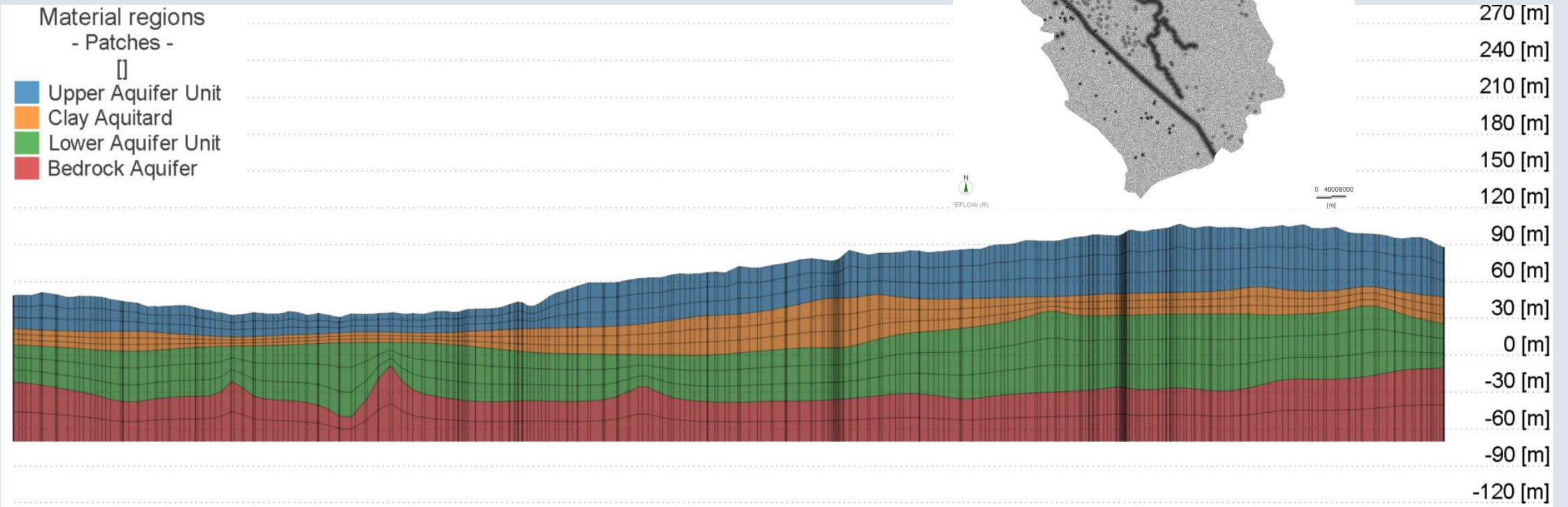
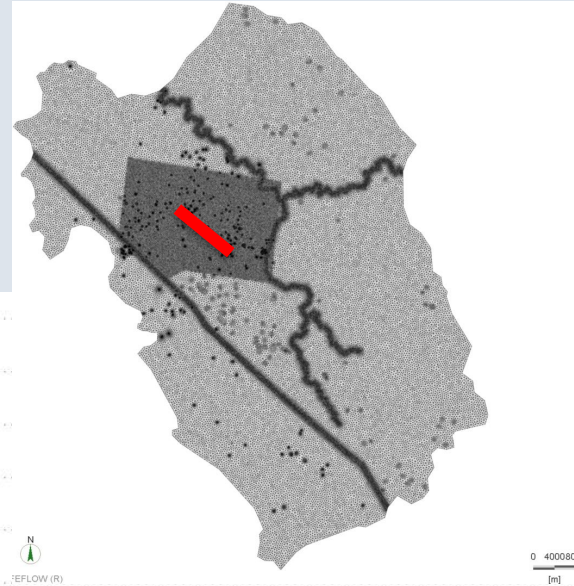
LRA Wellfield



Hopefield Wellfield

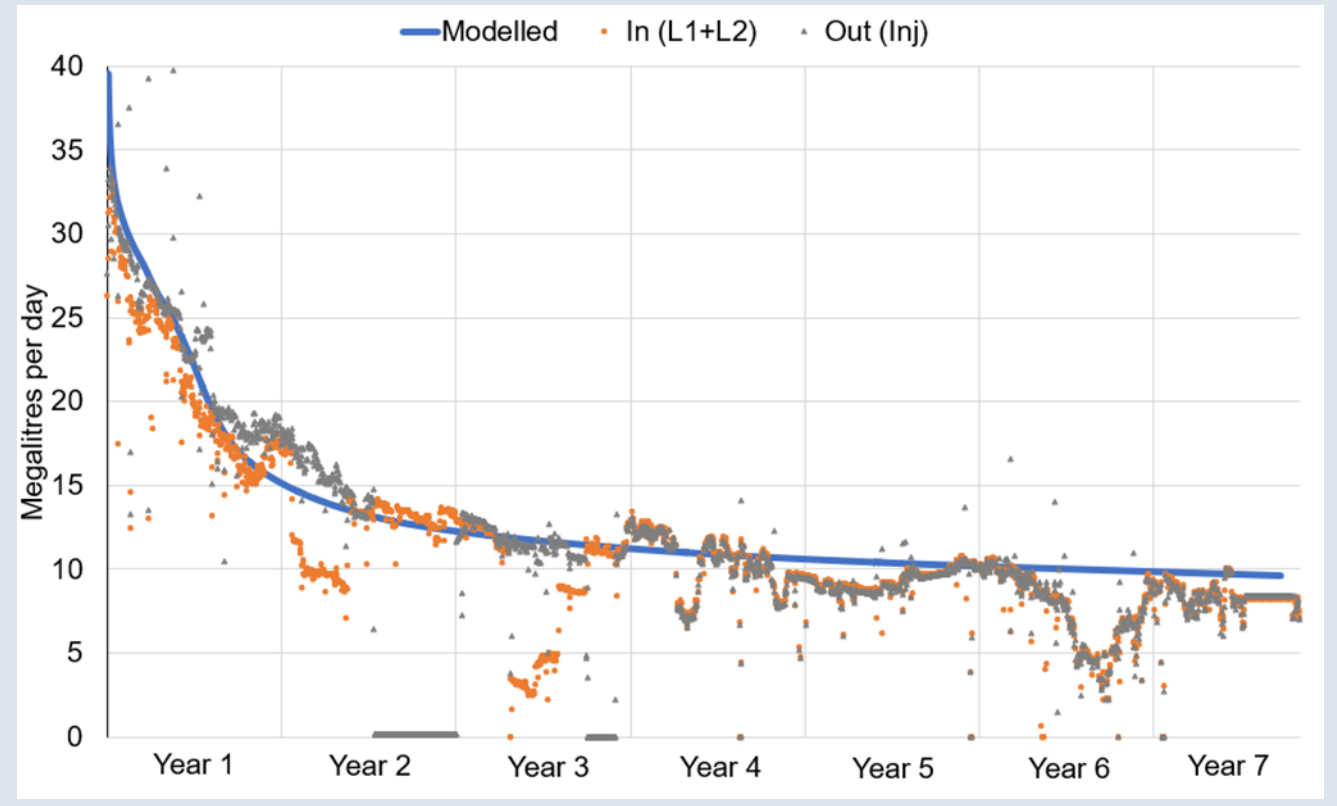
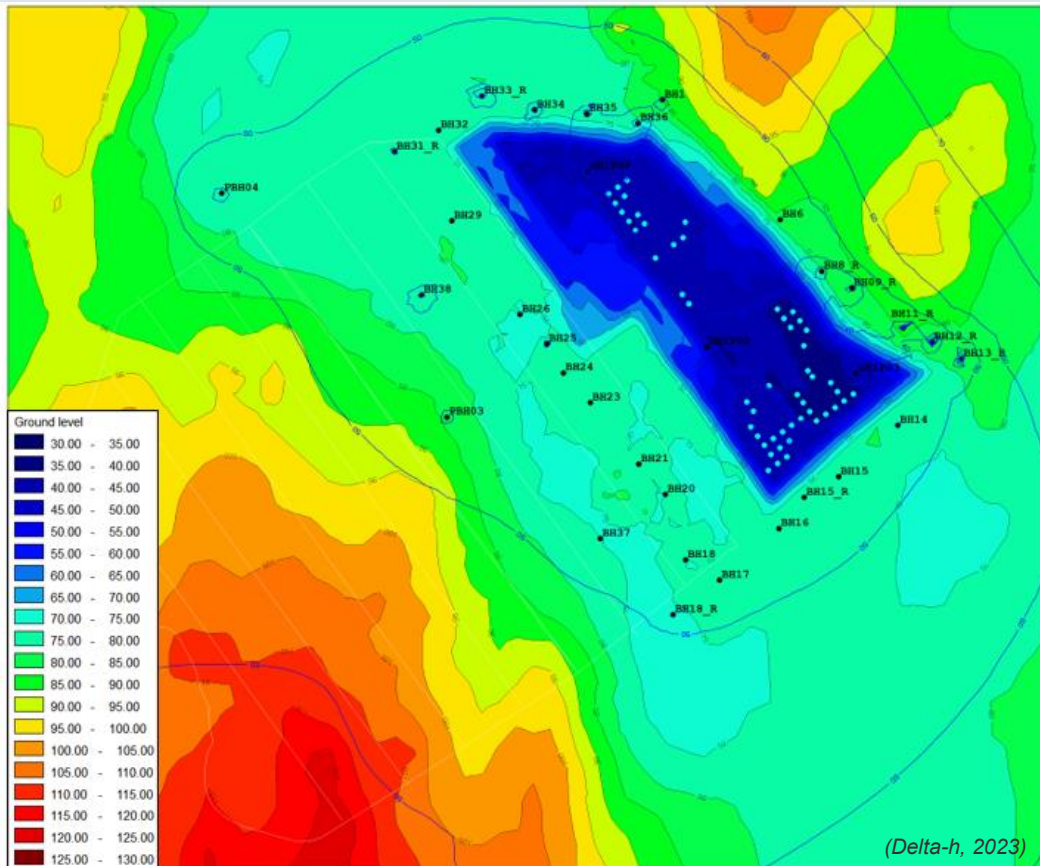


NUMERICAL MODEL VERTICAL LAYERING



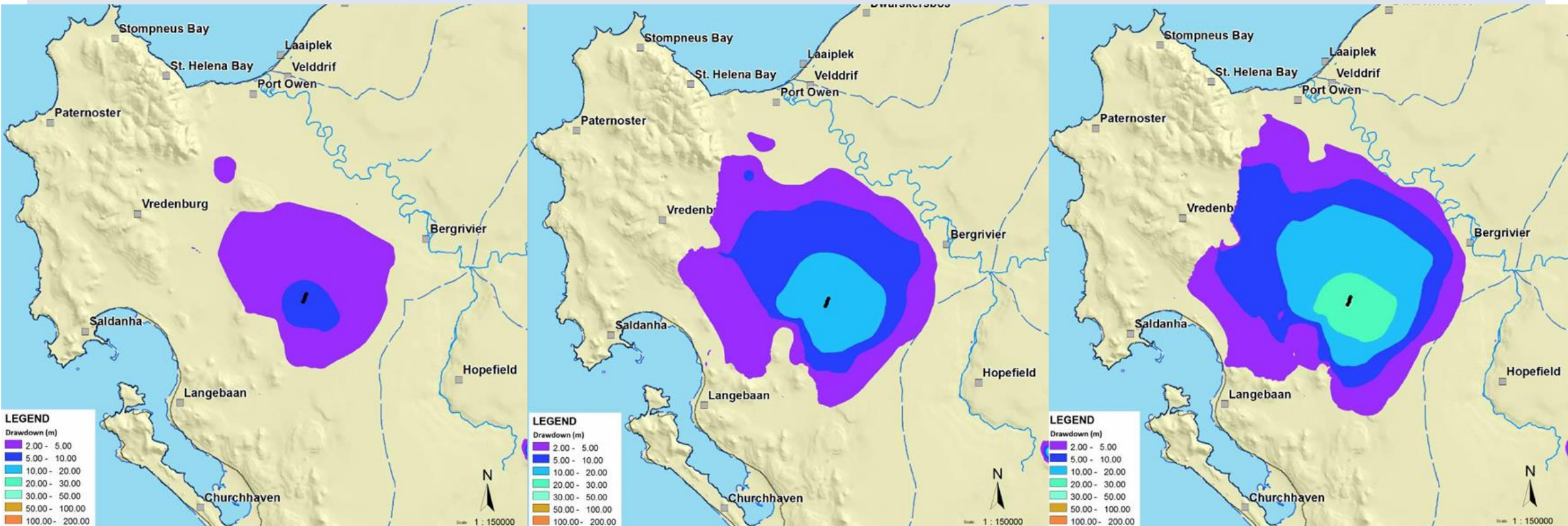
NUMERICAL MODELLING AS A TOOL FOR GROUNDWATER RESOURCE MANAGEMENT

- Effectiveness of the dewatering scheme at EFN Mine (**Actuals vs modelled**)



NUMERICAL MODELLING AS A TOOL FOR GROUNDWATER RESOURCE MANAGEMENT

- Aquifer potential and impact of wellfield abstraction under different stress scenarios



(Seyler et al., 2016)

NUMERICAL MODELLING AS A TOOL FOR GROUNDWATER RESOURCE MANAGEMENT

- We cannot predict the future, but we can run scenarios based on our current knowledge of the system and anticipated changes over time.
- Keep in mind that models are built on our current understanding of geology and groundwater flow processes. They rely on input data, “in-field” observations and assumptions about key mechanisms, and as such, they have inherent limitations.
- Numerical modelling is a powerful tool to inform decision making.
- Ongoing monitoring is critical to validate numerical model outputs and to update and recalibrate the model periodically.



KROPZ ELANDSFONTEIN

INDEPENDENT AFRICAN PHOSPHATE ROCK PRODUCER

24 October 2025

Mark Maynard (stan@kropz.com)



WHY KROPZ?



Phosphate

- Essential to food production
- N **P** K
- 85% of rock used in fertilizer production
- Demand ↑
- Prices ↑



Sub-Saharan Africa

- Expanding population
- Improving diets
- Low fertilizer usage
- Food demand to triple by 2050
- Fertilizer is needed



Kropz Opportunity

- Elandsfontein ramping up
- Global supply shortage
- Low cadmium resource
- Geographical advantage
- 5-7% of traded rock market



OUR ROCK



- ~30% P₂O₅ quality
- Suitable for Phosphoric acid, DAP, MAP and SSP production



- Low cadmium – meets current and future EU standards
- Low radioactivity – gypsum meets EU standards

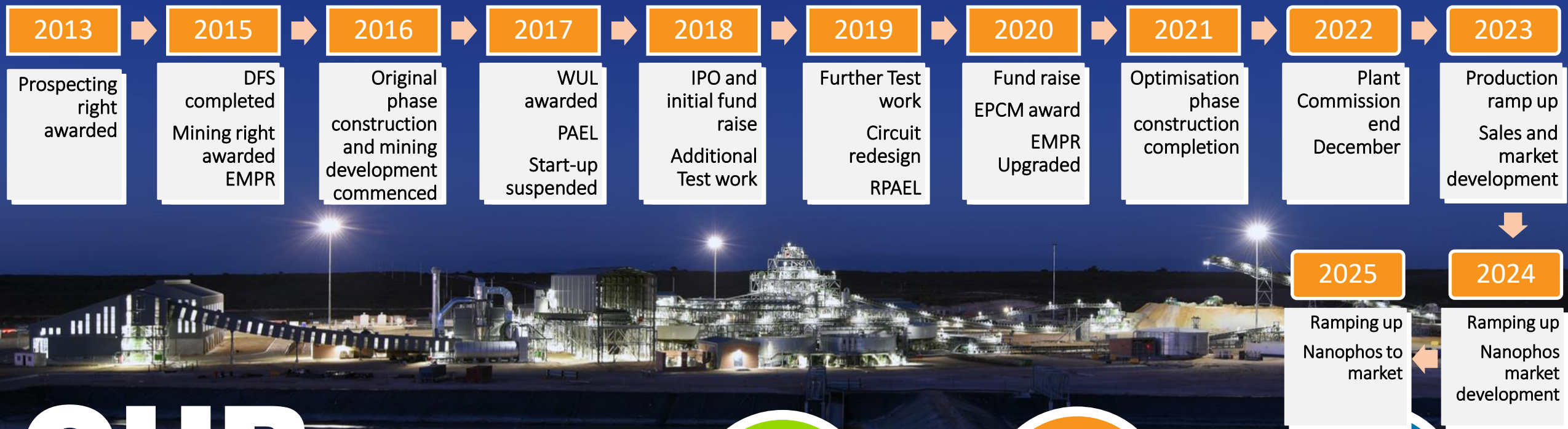


- Lower Sulphuric acid consumption in Phosphoric acid production
- Less gypsum produced

PHOSPHATE ROCK + SULPHURIC ACID = PHOSPHORIC ACID + NITROGEN (AMMONIA) = MAP/DAP + POTASSIUM (MOP/SOP) = NPK FERTILIZER

Where is the Elandsfontein mine?





OUR JOURNEY

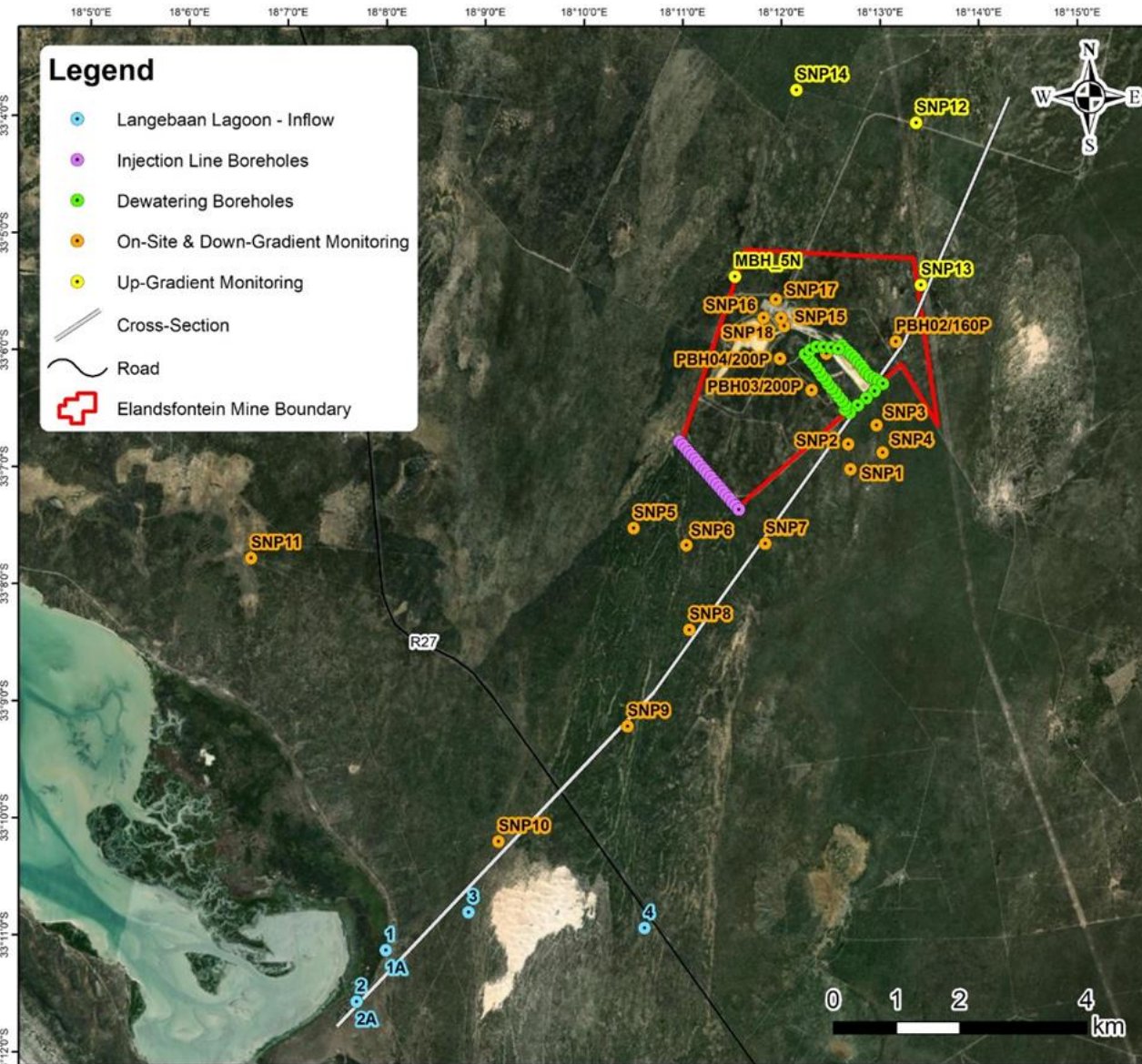


- Pit to Port 43km, serviced by surfaced mine road and national freight route
- Port capacity secured thru MPT - a busy terminal
- Power and water secured
- Mine fully permitted
- >90% RSA ownership
- Plant commissioned end Dec 2022.
- Ramp up 2023 thru 2025.
- ~539 Full time employees (93% from SBM, 44% from Hopefield, 22% WIM)

MANAGED AQUIFER RECHARGE (MAR)



Overview – Dewatering, Reinjection, GW monitoring



- Designed to prevent impact on aquifer, while dewatering the pit to mine safely.
- Confined to the upper aquifer.
- Dewatering borehole ring (●) – Initially 36 BH's around the pit recently reduced to 28 more efficient.
- Water pumped via closed injection line system, reinjected into same aquifer through 20 Reinjection BH's (●).
- Extensive groundwater monitoring network established (●●●).
- Monthly groundwater monitoring of 25 BH's including physical and chemical parameters.
- Successful biannual Water Monitoring committee (EWMC) established (15 meetings held to date). Represented by various external stakeholders, including government departments and NGOs as per WUL.
- Extensive data indicating impacts controlled and monitoring is effective.
- Routine and active on-site maintenance program.

Operations – Mining sequence and backfilling



Mining operations and water management



- Conventional open cast mining (ADT's, Excavators) – No blasting.
- Dewatering since 2017, with dewatering and injection volumes being comparable over the 8-year period.
- The dewatering boreholes designed individually to abstract volumes of either 5, 10 or 15 l/s.
- Total output of dewatering boreholes ~160 l/s [13.8 MI/day].
- The injection system currently running at 50% capacity, designed for ~400 l/s.
- Most of the groundwater is reinjected into the aquifer through direct method via buffer tank – gravity fed.
- Accumulated in-pit water utilized for processing within the plant as per WUL conditions.
- Dynamic system of decommissioning and reinstalling boreholes as mining pit advances.
- Water Conservation and Demand Management principles applied.

Maintenance challenges

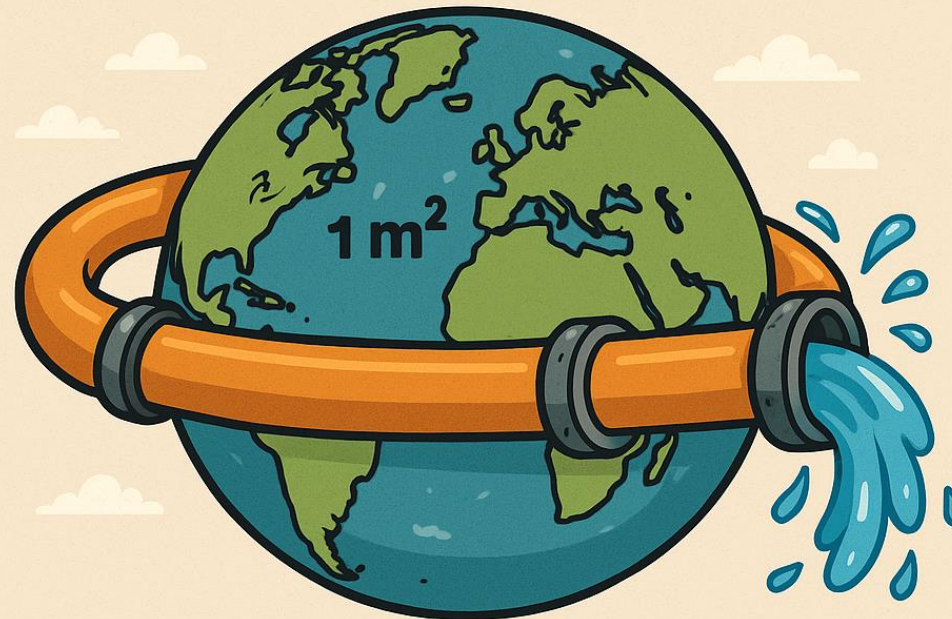


- Waterlogged pit in 2023 during **excessive rains**.
- Various dewatering boreholes were **drilled too shallow**, hindering the effective removal of upwelling water at clay layer contact, redrilling campaign initiated.
- Pump failures – **ultrafine sands infiltrating** the dewatering boreholes, leading to significant sand ingress and subsequent pump wear and malfunctions.
- Clogging – due to **iron-rich fine sediments** with clay-like properties infiltrating the borehole and bypassing the gravel pack.
- Continuous and rigorous **maintenance program** in place to mitigate these issues with full time site team.

Total water pumped and reinjected since 2017

27,979,255 m³

WATER PUMPED AROUND THE



LENGTH AROUND THE EARTH

40,075 km



THANK YOU

www.kropz.com

