Saldanha Bay Water Quality Forum Trust

25 Oct 2019

Club Mykonos

Langebaan Road and Elandsfontein Aquifer Assessments

Dr Jaco Nel

Kezia Smith

Aqeela Parker

Ashleigh Tomlinson

Angelo Johnson

Involvement in Saldanha West Coast

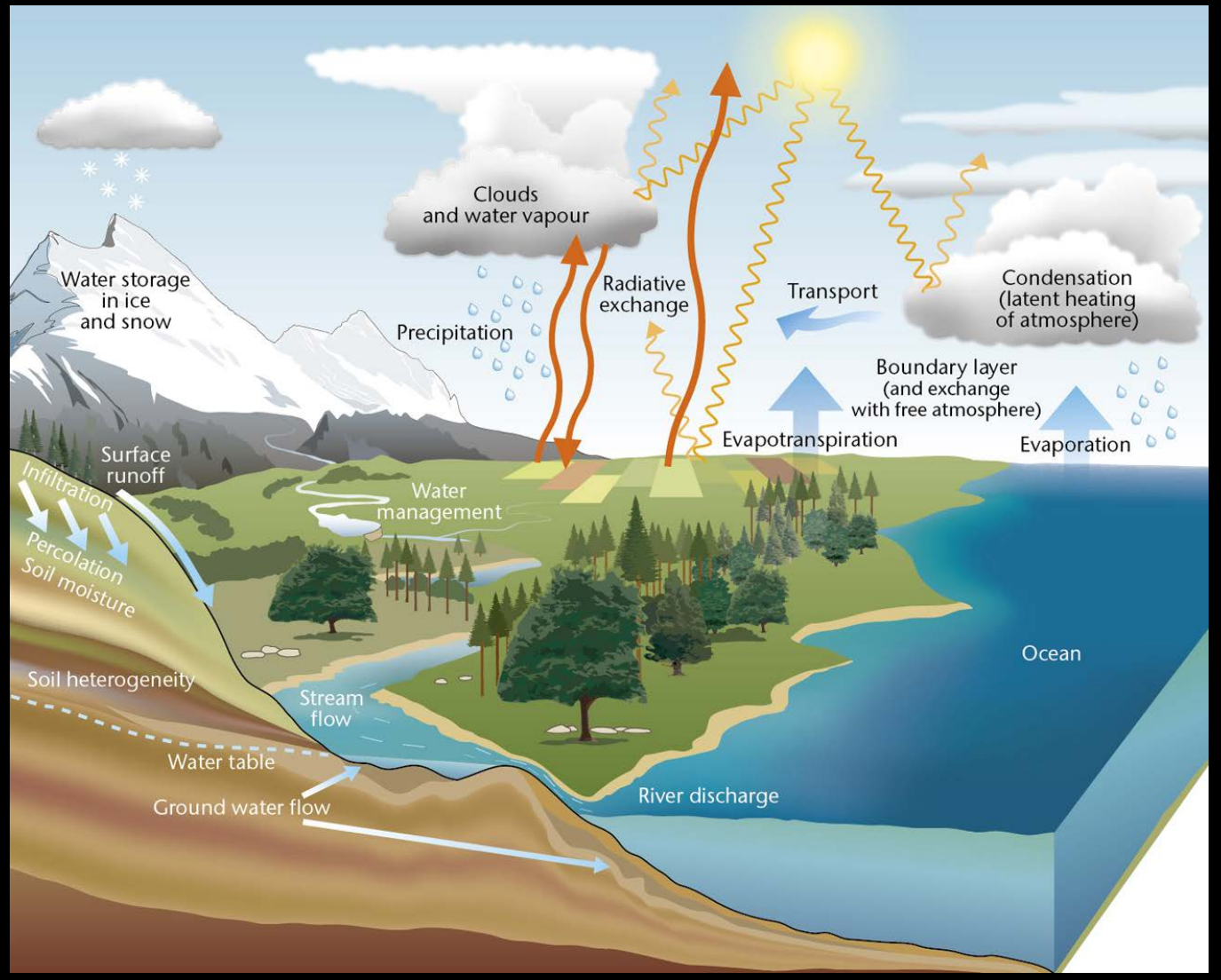
- 2015-2016 reviewer for SANParks to ensure no negative impacts from Elandsfontein Mine on WCNP or Langebaan Lagoon from a groundwater perspective.
- 2017 – Numerical model for water supply for SBM
- 2018-2019 – Numerical Models for Kropz using monitoring data to predict forward and improve management
- 2018 Langebaan Road Wellfield Expansion
- 2019 Hopefield wellfield development
- Currently
  - part of Elandsfontein and regional monitoring committees
  - Research and monitoring for SBM on wellfields and improved management.
  - Supervising a SANParks Junior Scientist doing a PhD on Sustainable Mine Closure – using Elandsfontein as one of case studies
  - Supervising 3 MSc students working on different aspects of the aquifer management
  - Continuous model updates for Kropz and SBM – integrated model.

Show do we solve the Water Balance ?

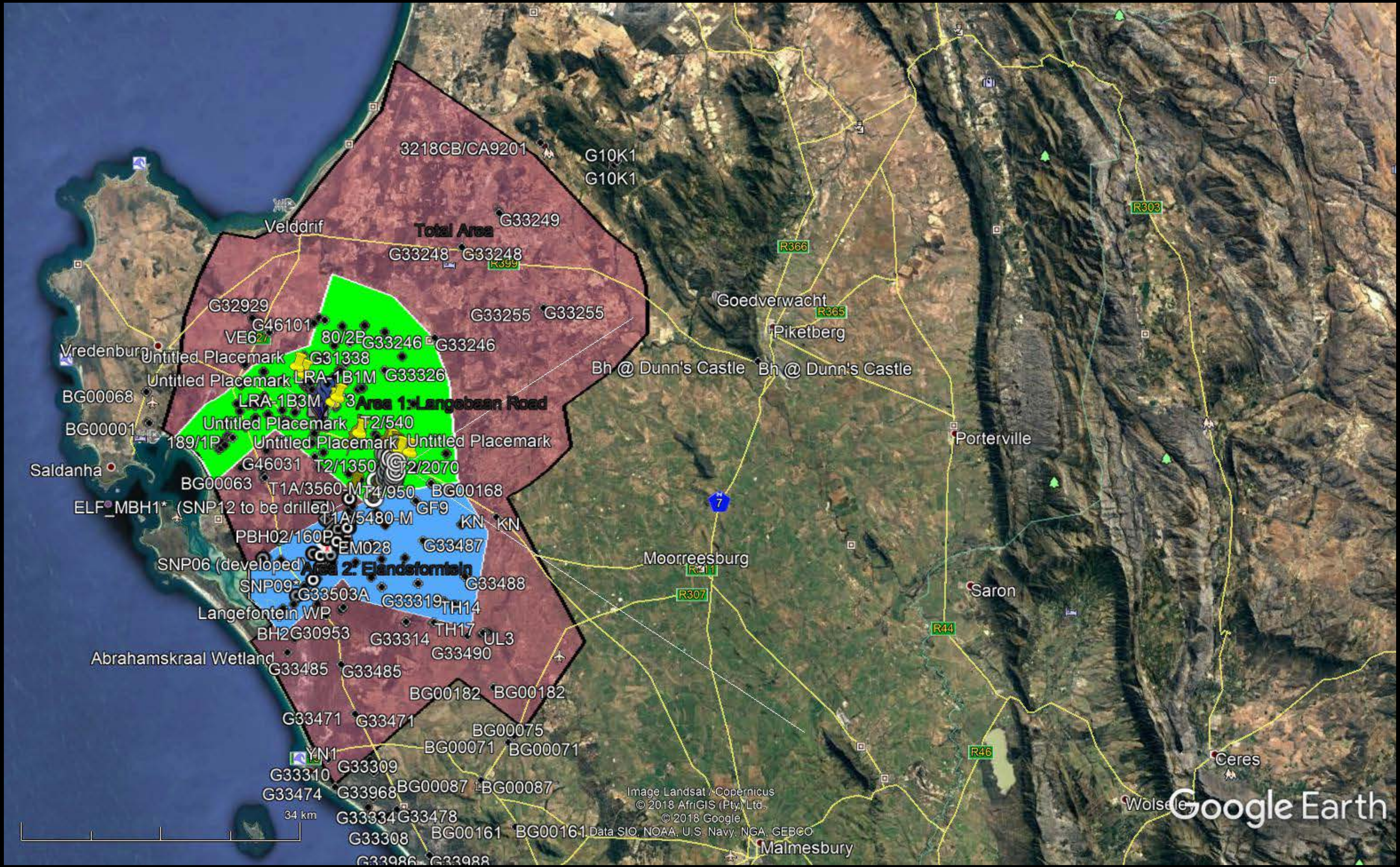
How much Recharge? – What flow path? – How many users? – What volumes? – discharge to lagoon, springs, ….

What real data do we have?

Where do each piece of the puzzle fit?



Study Area



Total Area
Area 1: Langebaan Road
Area 2: Elandsfontein
3218CB/CA9201
G10K1
G10K1
Velddrif
G33249
G33248
G33248
G32929
G46101
VE6
80/2P
G33246
G33246
G33255
G33255
Vredenburg
Untitled Placemark
G31338
Untitled Placemark
LRA-1B1M
G33326
BG00068
LRA-1B3M
Untitled Placemark
T2/540
BG00001
189/1P
Untitled Placemark
Untitled Placemark
G46031
T2/1350
T2/2070
Saldanha
BG00063
T1A/3560-M
T4/950
BG00168
ELF_MBH1*
(SNP12 to be drilled)
GF9
T1A/5480-M
KN
KN
PBH02/160P
EM028
G33487
SNP06 (developed)
SNP09*
G33503A
G33488
G33319
TH14
Langefontein WP
BH2
G30953
TH17
G33314
UL3
G33490
Abrahamskraal Wetland
G33485
G33485
BG00182
BG00182
G33471
G33471
BG00075
BG00071
BG00071
YN1
G33309
G33310
BG00087
BG00087
G33474
G33968
G33334
G33478
G33308
BG00161
BG00161
Goedverwacht
Piketberg
Bh @ Dunn's Castle
Bh @ Dunn's Castle
Porterville
Moorreesburg
Saron
Ceres
Wolseley
Malmesbury
R303
R366
R365
R399
R311
R307
R44
R46
7
34 km
Image Landsat / Copernicus
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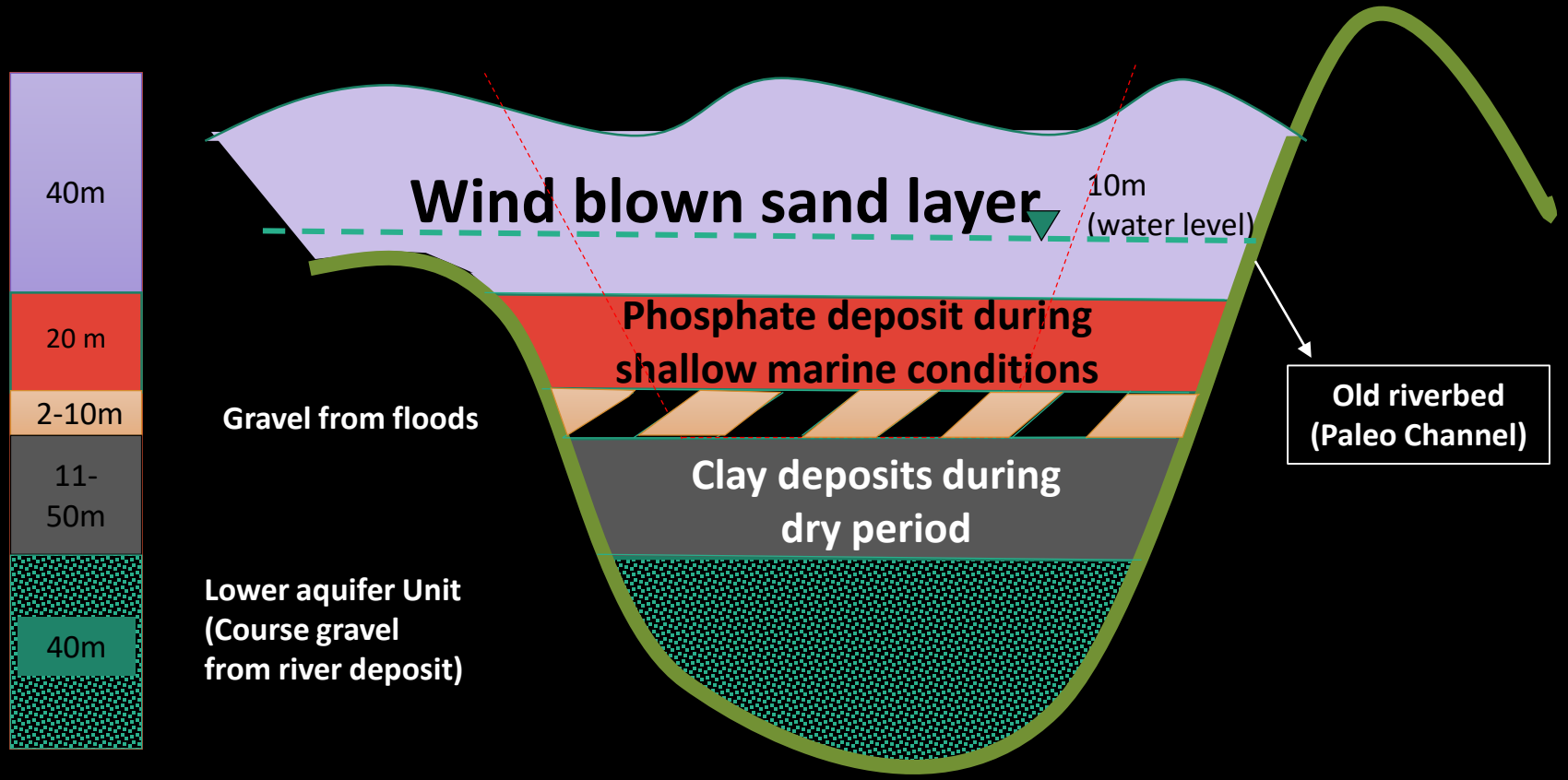
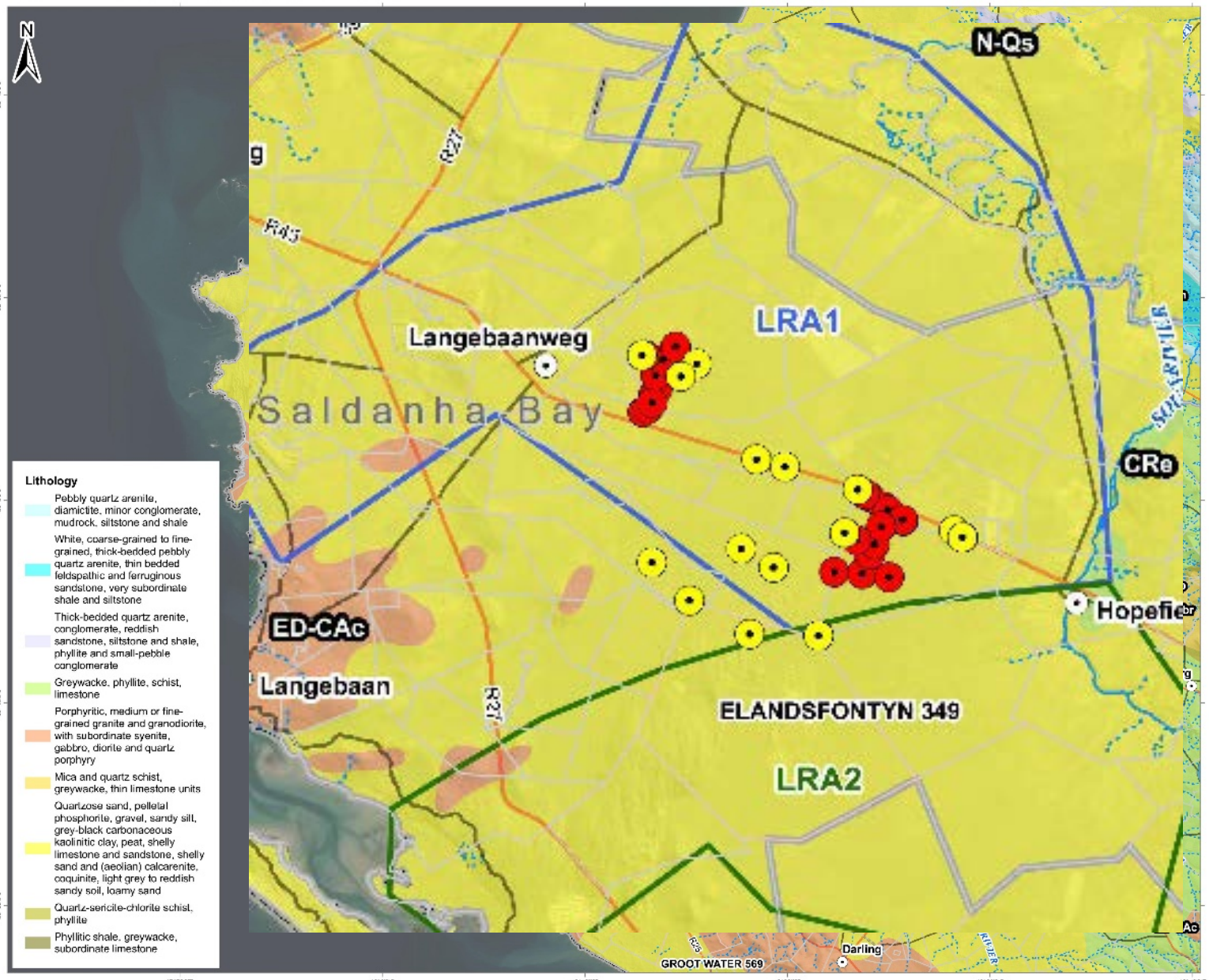
© 2018 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth

Conceptual Cross Section



GEOLOGY: SBM RECHARGE STUDY



LEGEND

- Towns
- Monitoring BHs
- Wellfield BHs

Road Network

- National Route
- Main Road
- Secondary Road

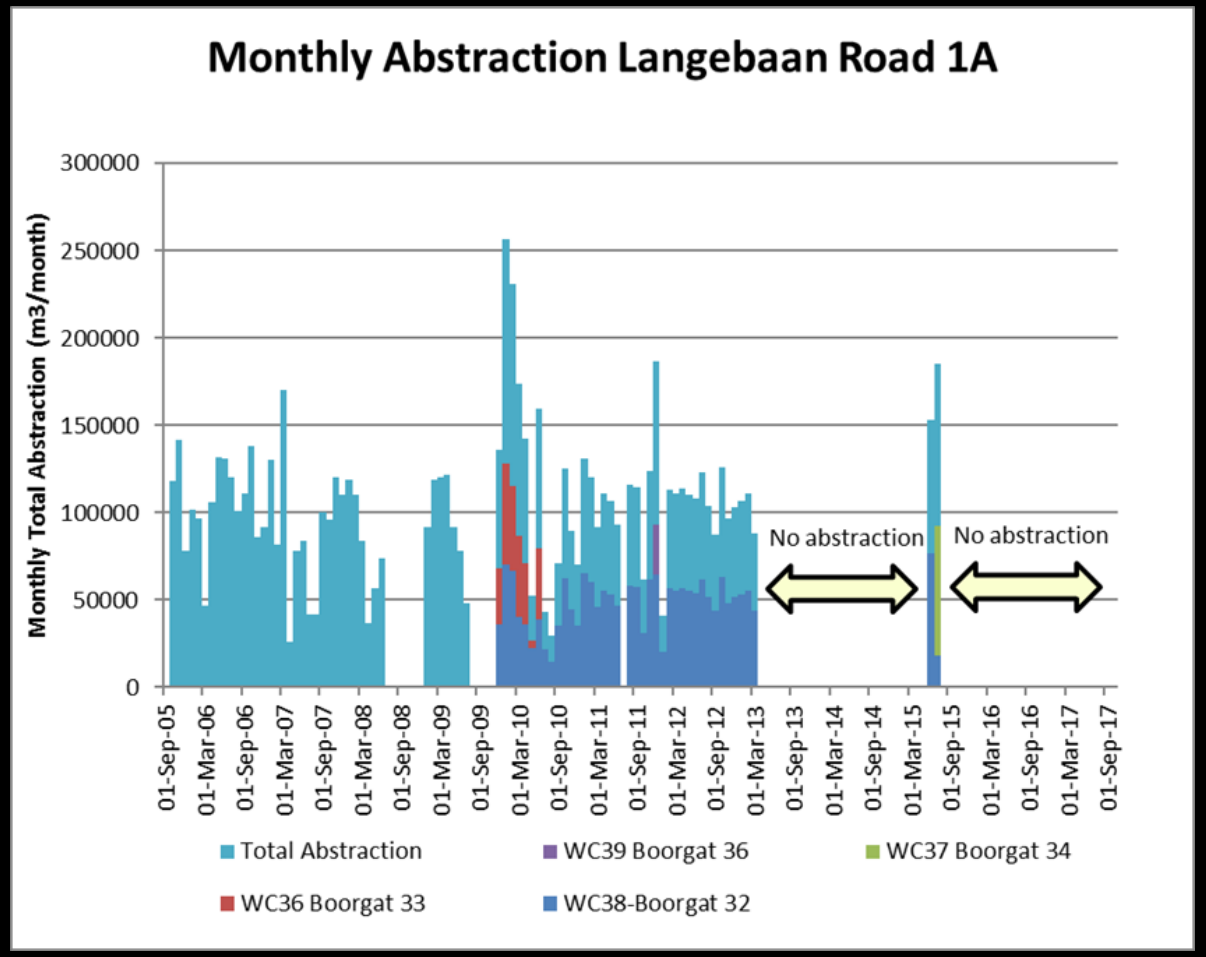
Rivers and Streams

- Non-Perennial
- Perennial
- LRA1
- LRA2
- Parent Farms
- Local Municipalities

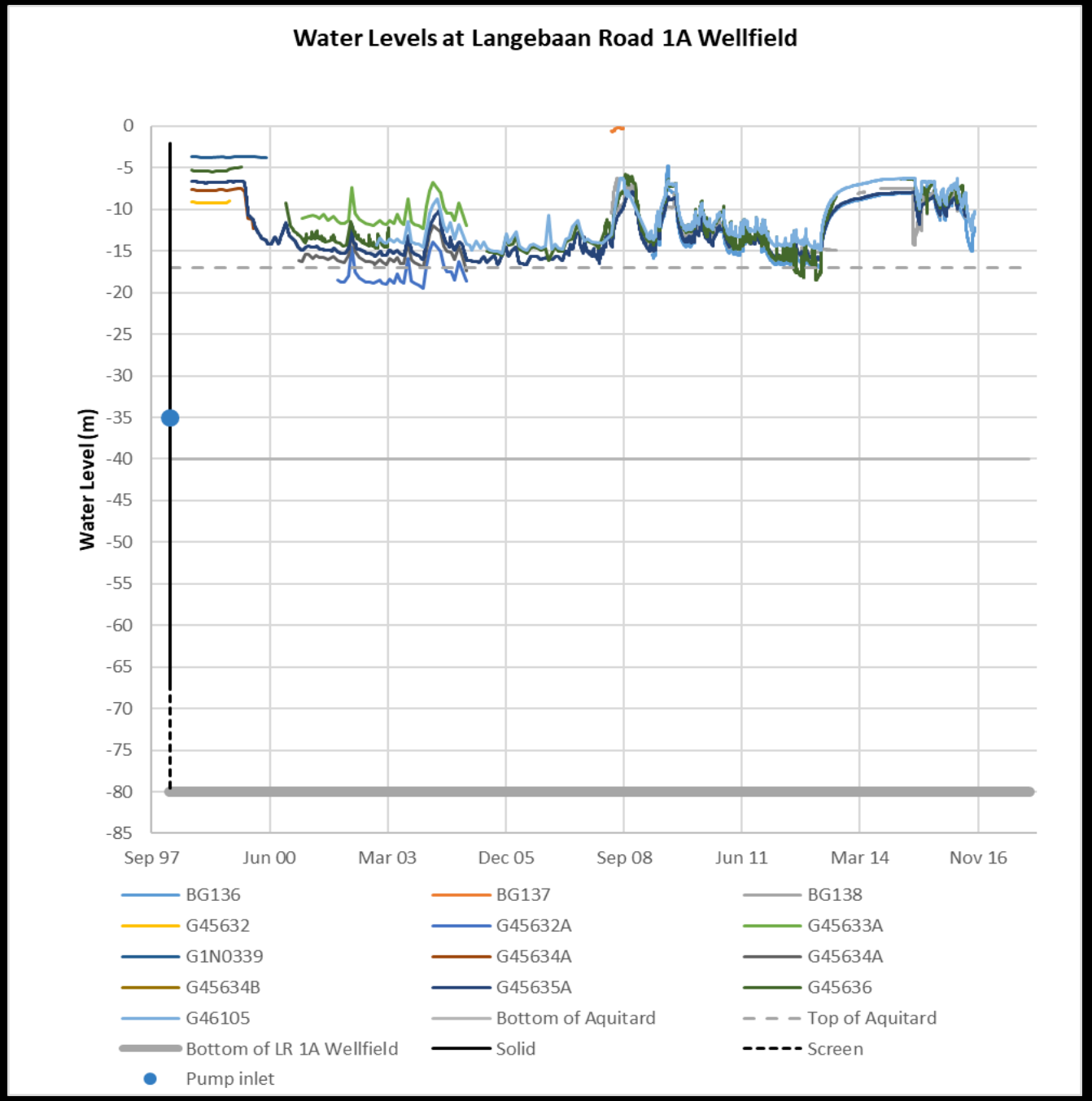
Langebaan

Wellfields

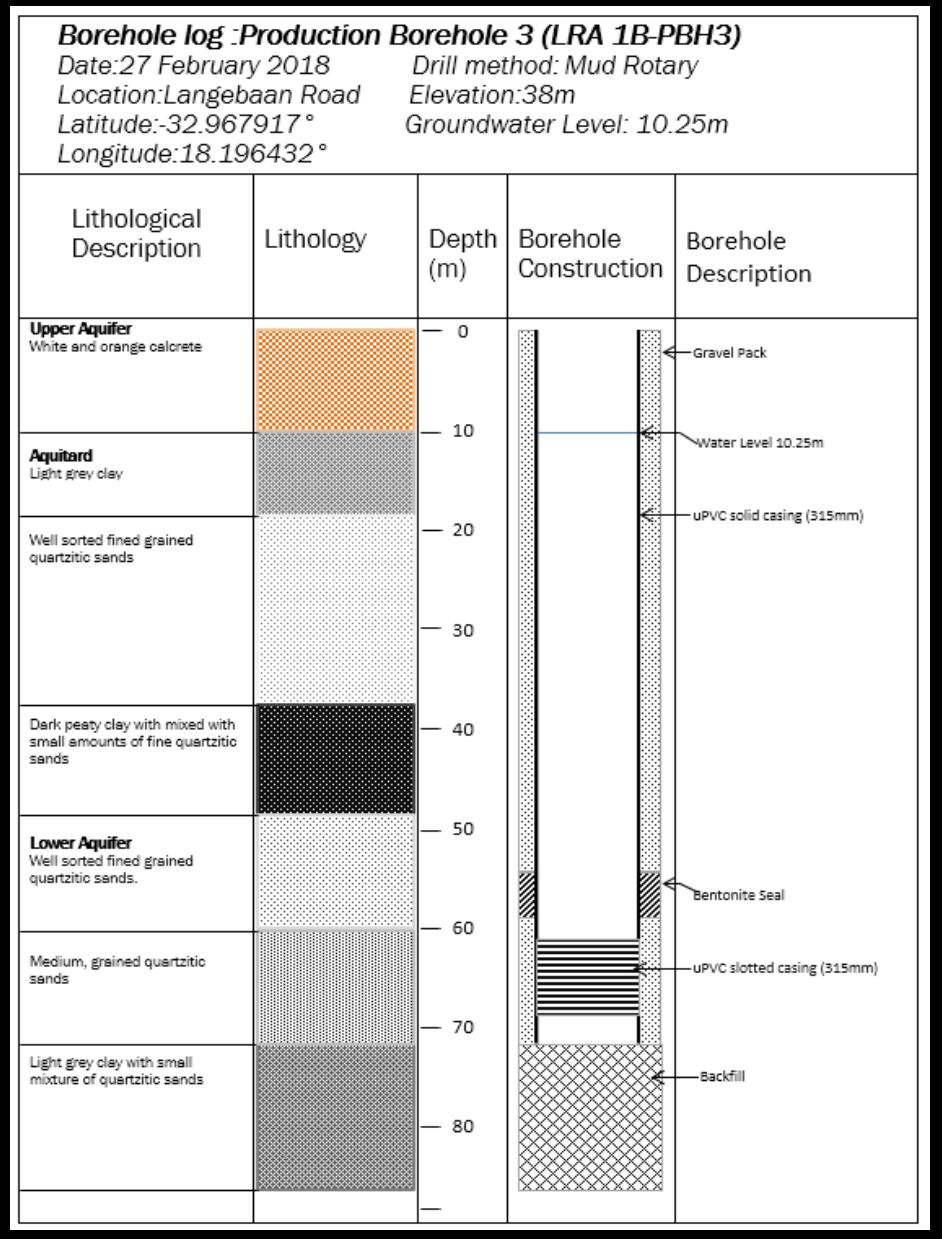
- Langebaan Road 1A – 4 Production Wells
- Langebaan Phase 2 – 4 Additional Wells in lower aquifer
- Hopefield – 10 Additional Wells in upper aquifer

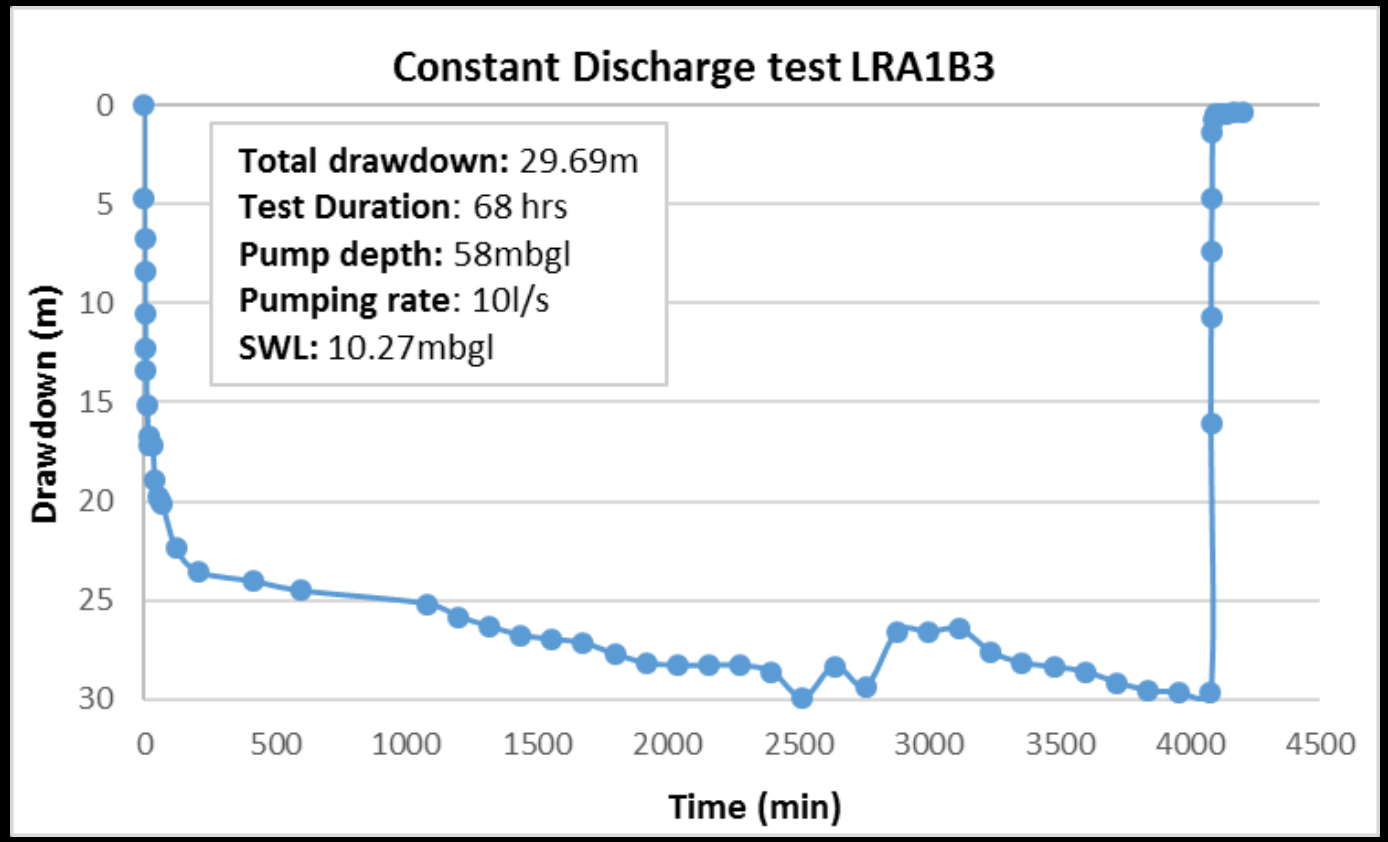


Old Water Levels

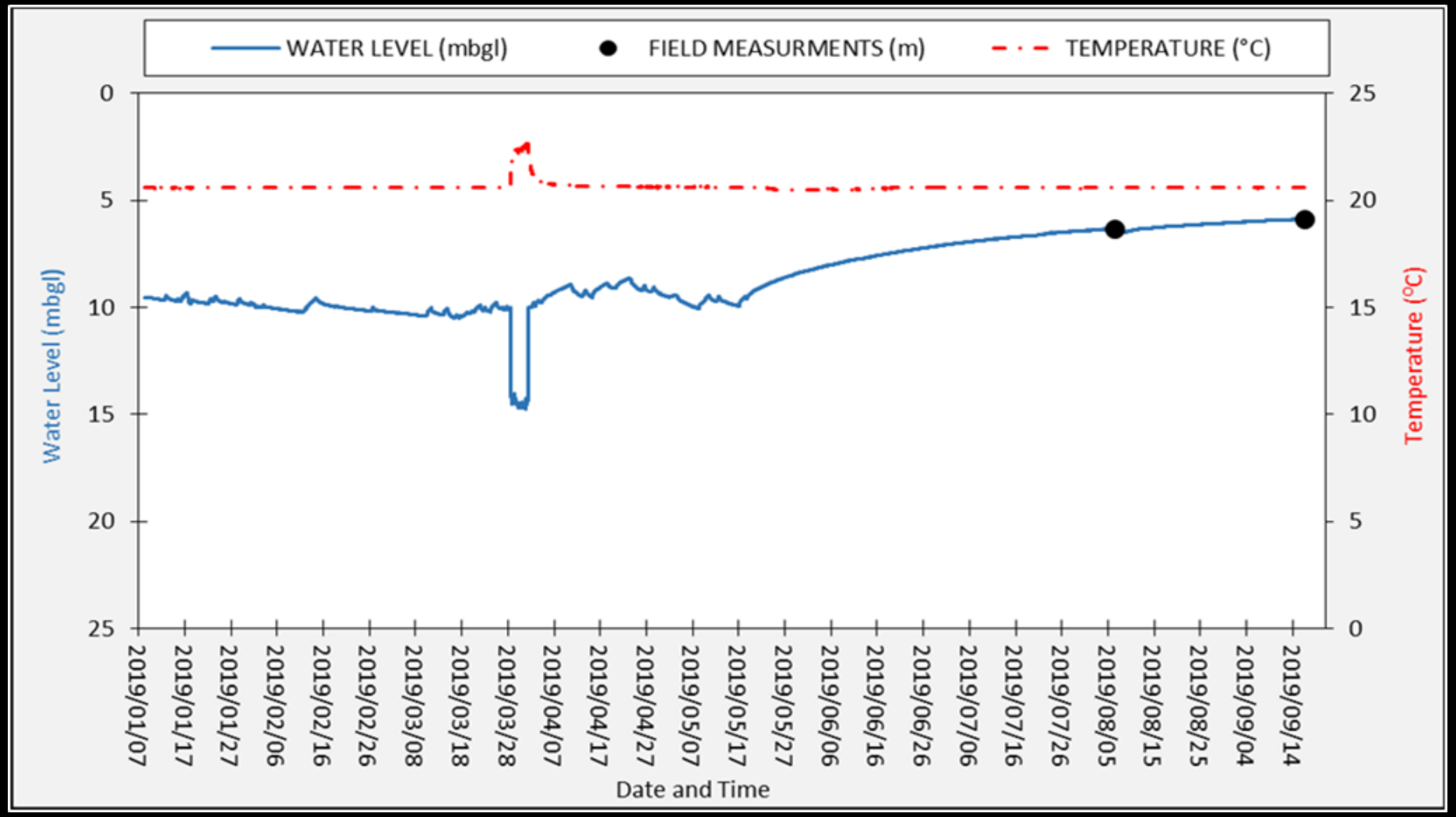


New Boreholes and testing

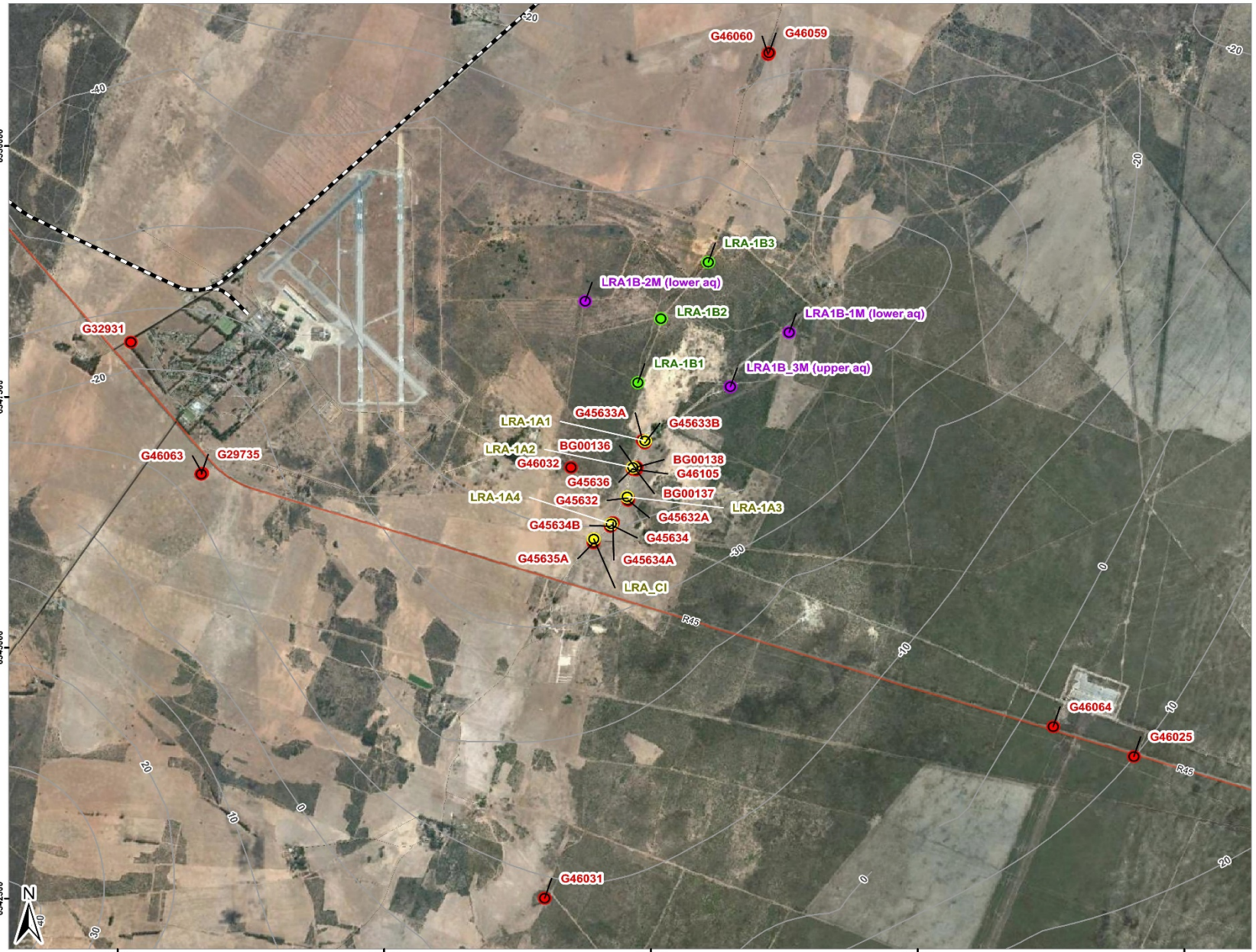




Langebaan Road Monitoring – New Borehole LRA1B1



LANGEBAAN ROAD WELLFIELD 1B: MONITORING BOREHOLES



LEGEND

- Existing Production Boreholes
- Proposed Production Boreholes
- Proposed New Monitoring Boreholes
- Existing DWS Monitoring Boreholes

Road Network

- National Route
- Main Road
- Secondary Road
- Street
- Railway Line

Rivers and Streams

- Non-Perennial
- Perennial
- 10m Contours

Data Sources:
Google Earth™ mapping service: 2018
Imagery Date: 19/05/2017

SCALE: 1:35 000

FIGURE NO.:	-	MAP NUMBER:	17-0966-25-V2
DRAWN BY:	AMT MKHWNANAZI GIS INTERN	REVIEWED BY:	P CHETTY GIS SPECIALIST
DATUM: PROJECTION:	WGS84 UTM34S	DATE:	12 FEBRUARY 2018
PROJECT:	GCS CARTOGRAPHY SERVICES		
CLIENT:	JACO NEL		

INSTITUTE FOR WATER studies
University of the Western Cape
Robert Sobukwe Road,
Bellville, 7535,
Republic of South Africa
Tel: +27 (0) 27 959 2911
E-mail: info@uwc.ac.za
www.uwc.ac.za

Hopefield

Cenozoic Strata Thickness

(Roberts and Siegfried 2014)

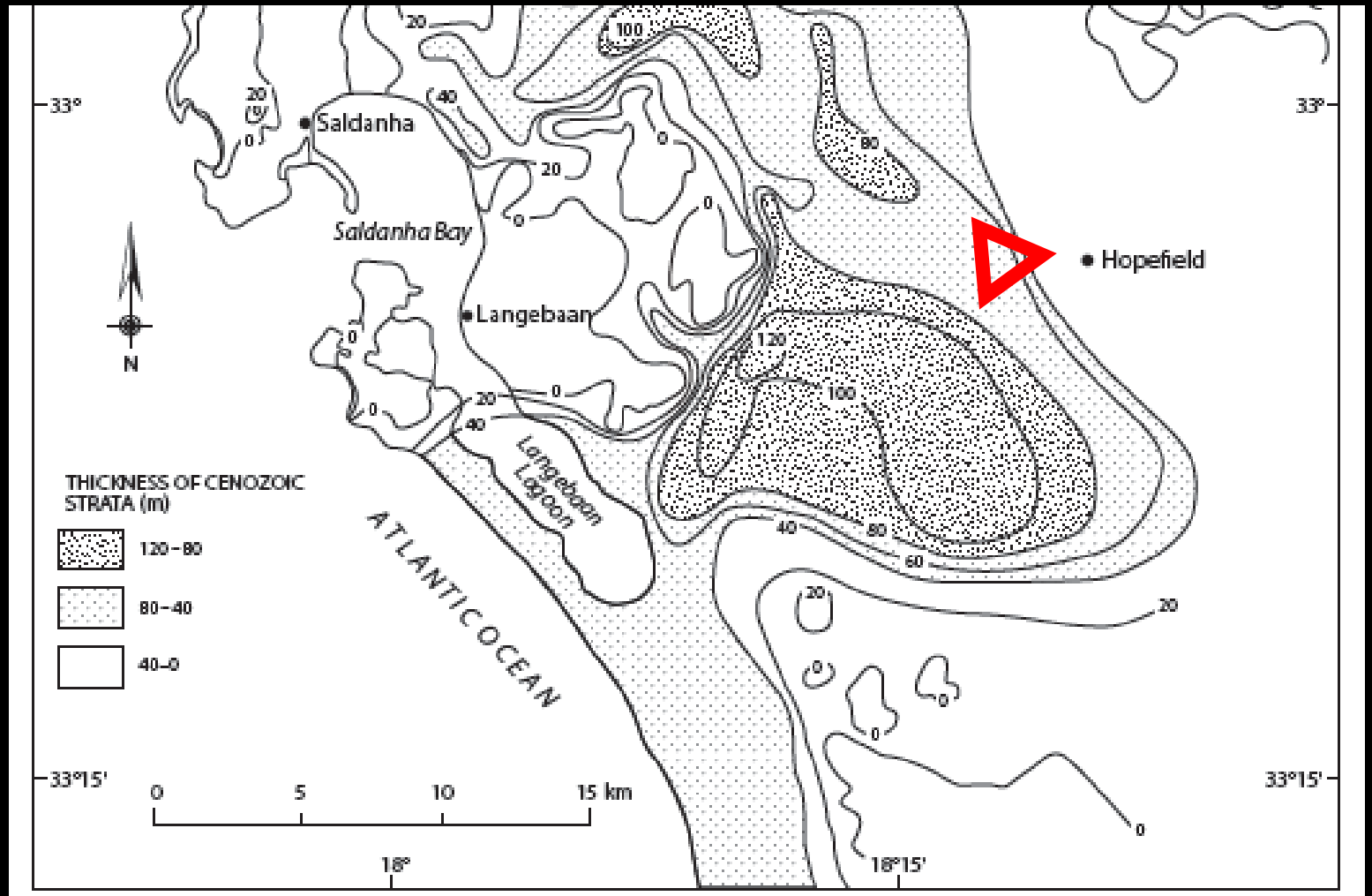
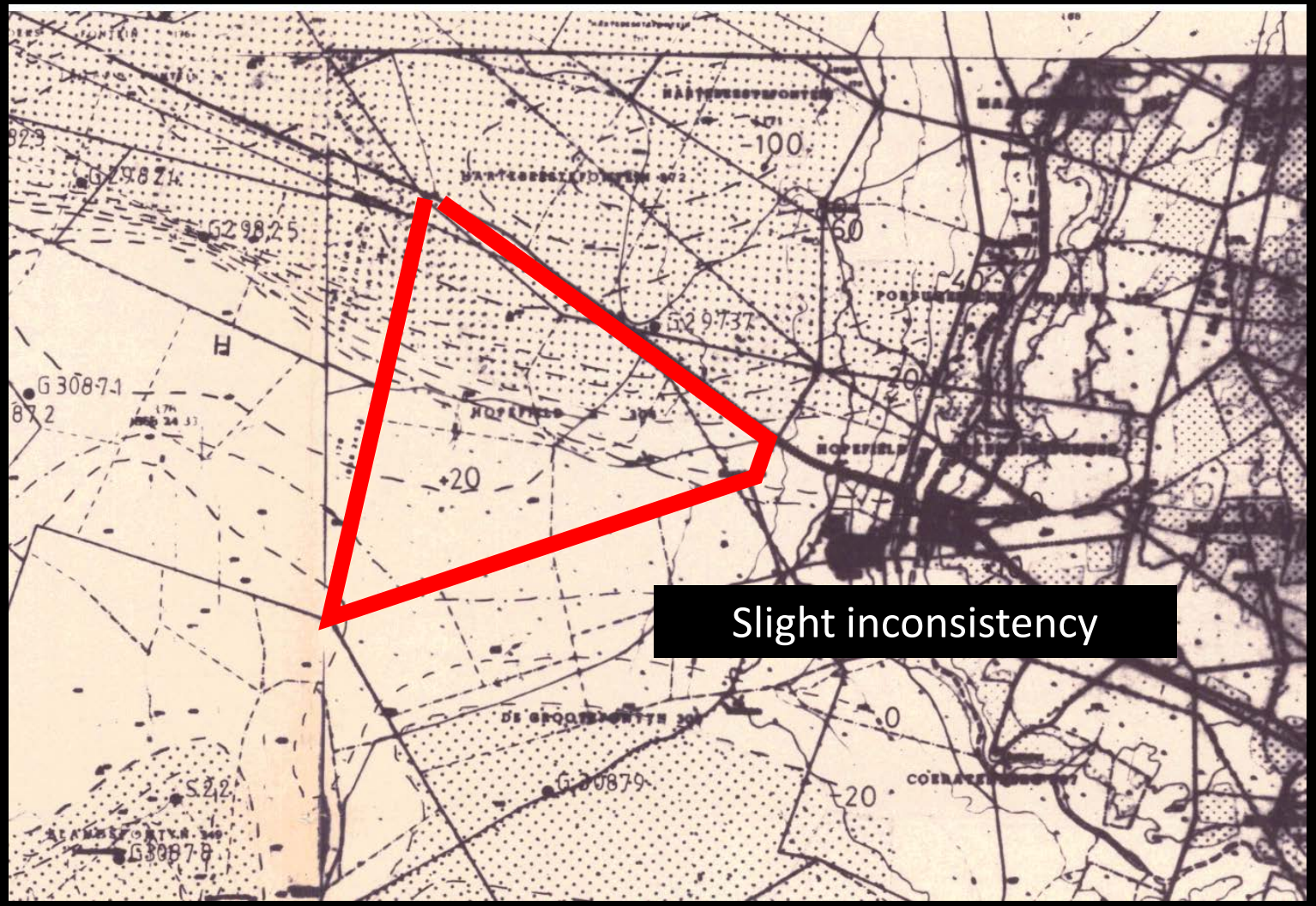
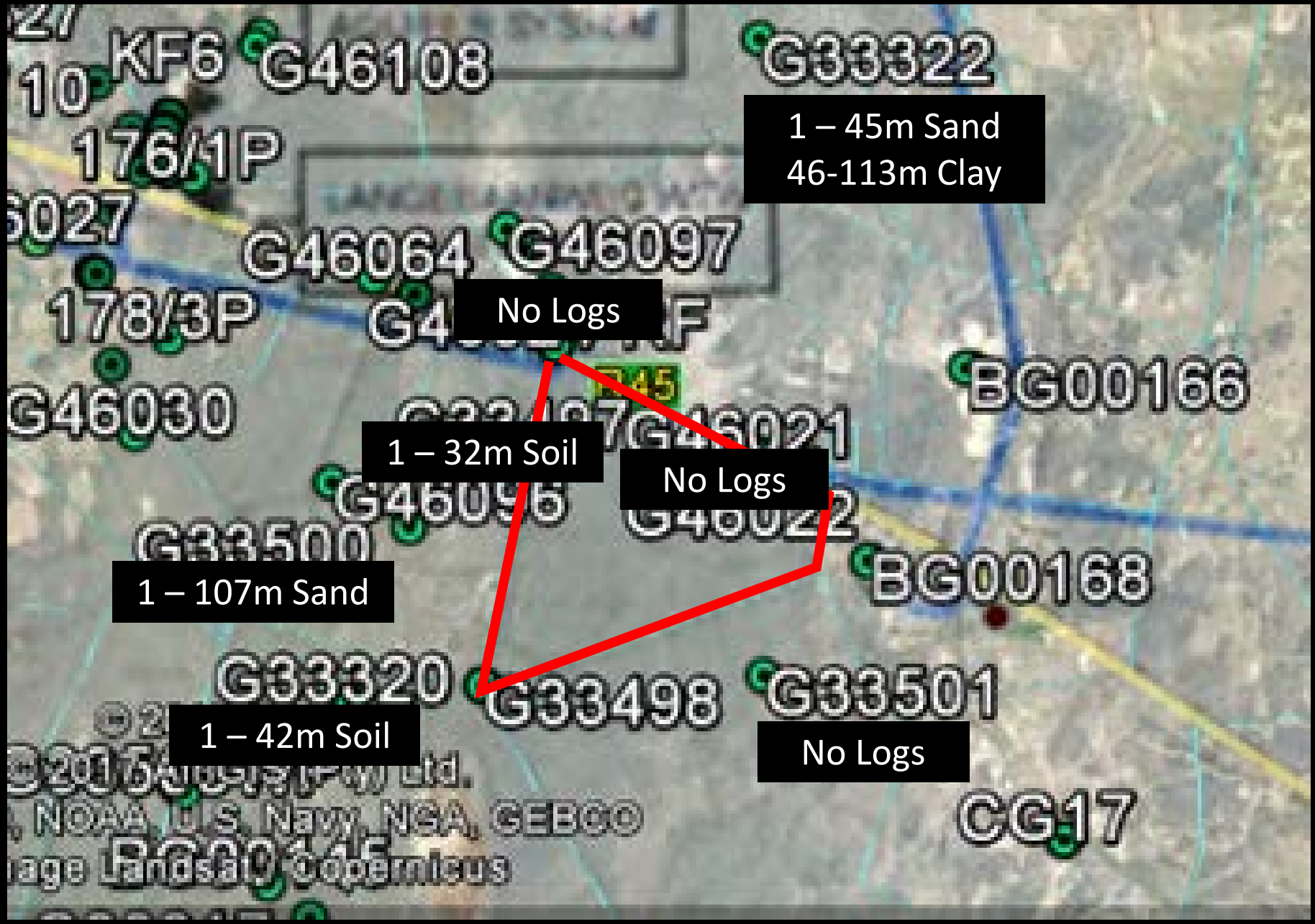


Fig. 4.2 – Isopachs of Cenozoic strata in the Saldanha, Vredenburg and Velddrif environs. The depocentres record the locations of ancient channels of the Berg River and possibly the Groen River in the east.

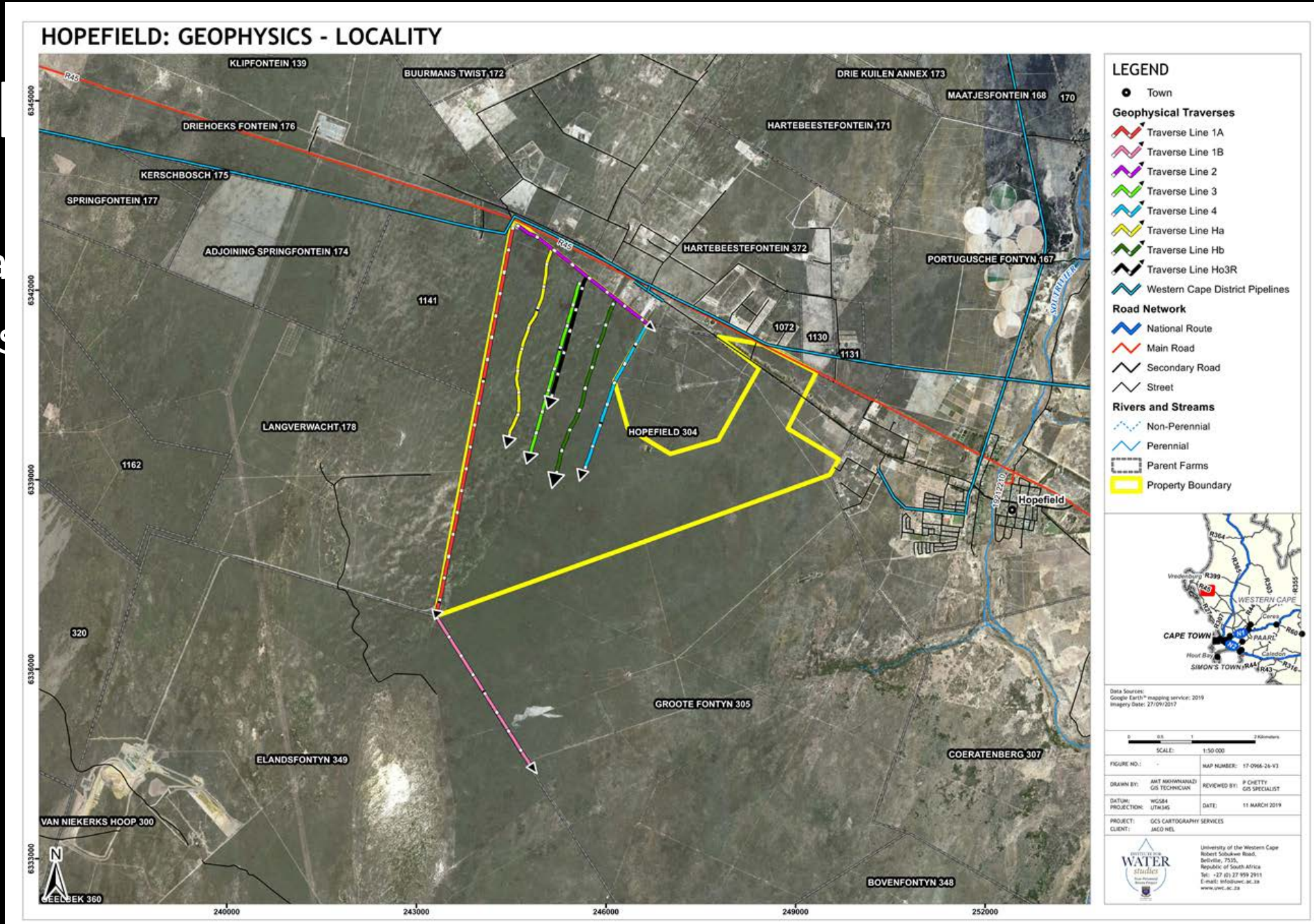
Geo-Electric Basement (Smith 1982)

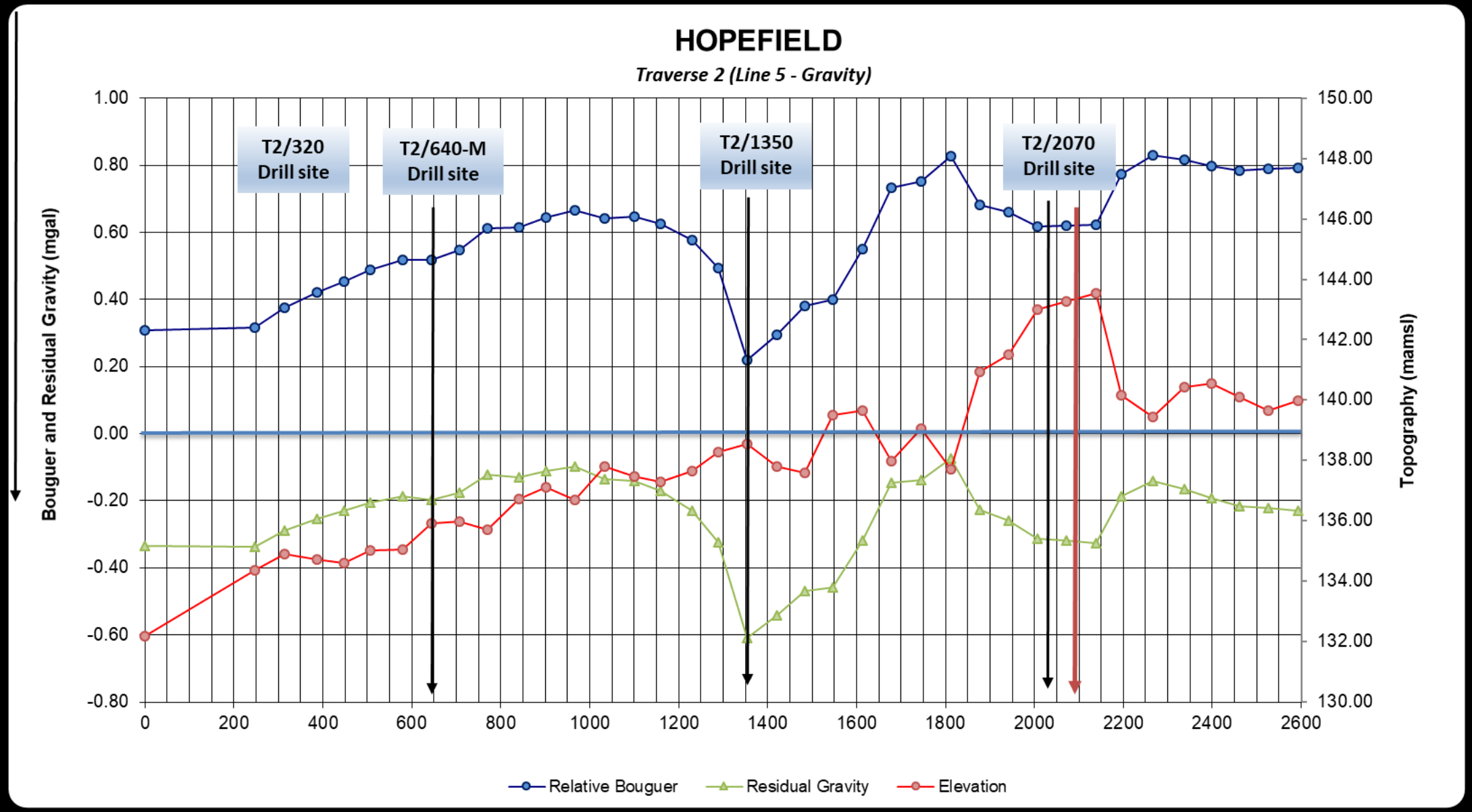



KF6
G46108
G33322
1 – 45m Sand
46-113m Clay
176/1P
G46064
G46097
No Logs
178/3P
BG00166
G46030
1 – 32m Soil
No Logs
G46021
G33500
BG00168
1 – 107m Sand
G33320
G33498
G33501
1 – 42m Soil
No Logs
CG17

Flow pat

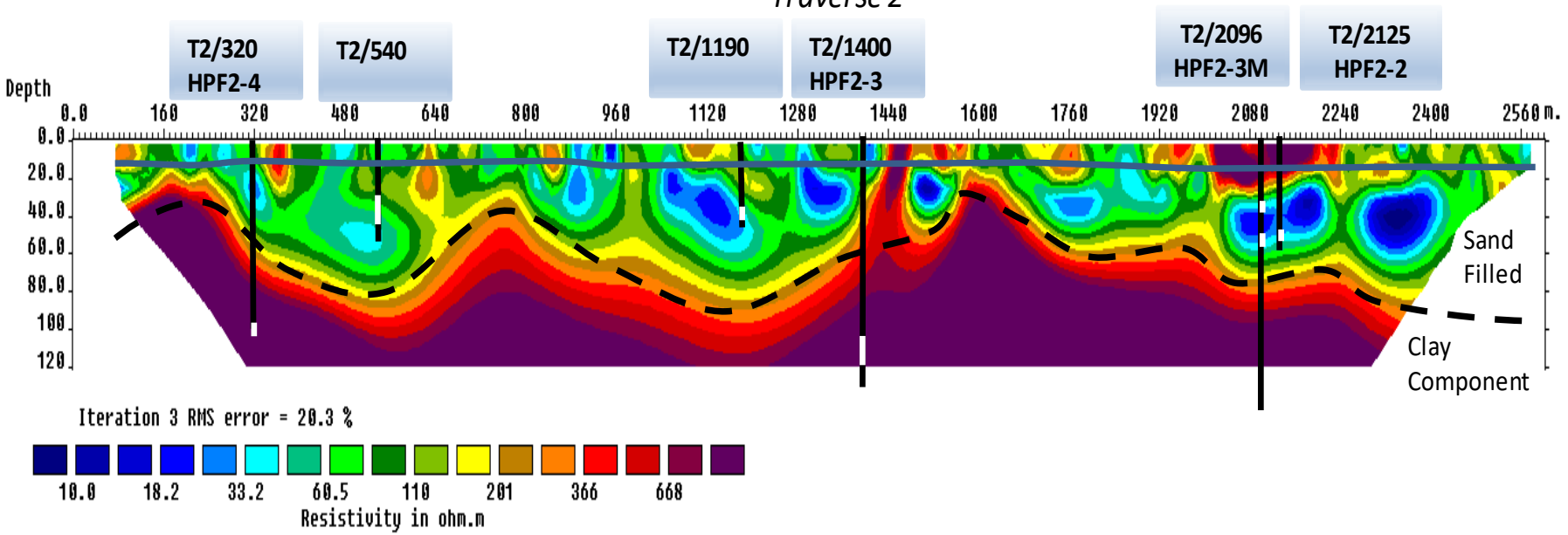
- Very much a
- Assumption



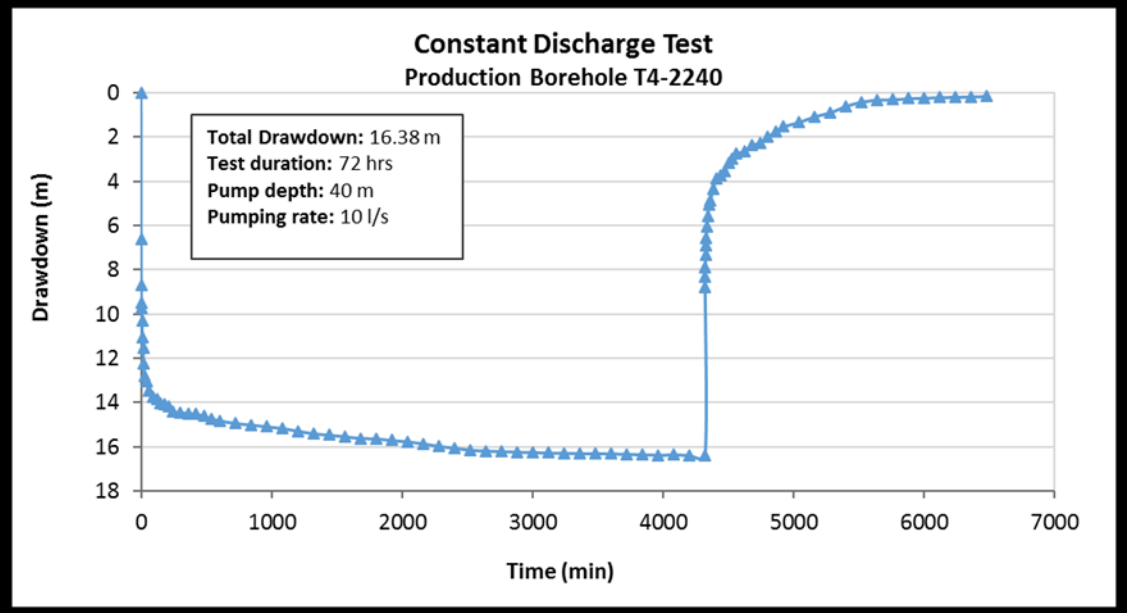

HOPEFIELD
Traverse 2 (Line 5 - Gravity)
T2/320 Drill site
T2/640-M Drill site
T2/1350 Drill site
T2/2070 Drill site
Bouguer and Residual Gravity (mgal)
Topography (mamsl)
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
150.00
148.00
146.00
144.00
142.00
140.00
138.00
136.00
134.00
132.00
130.00
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Relative Bouguer
Residual Gravity
Elevation

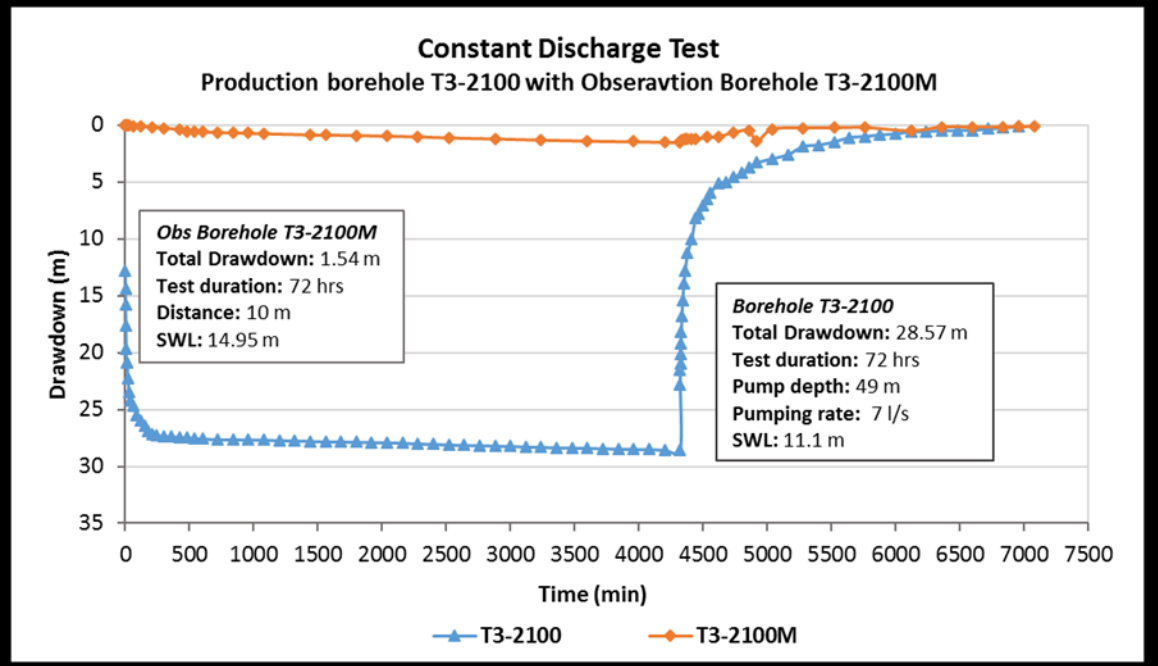
HOPEFIELD

Traverse 2



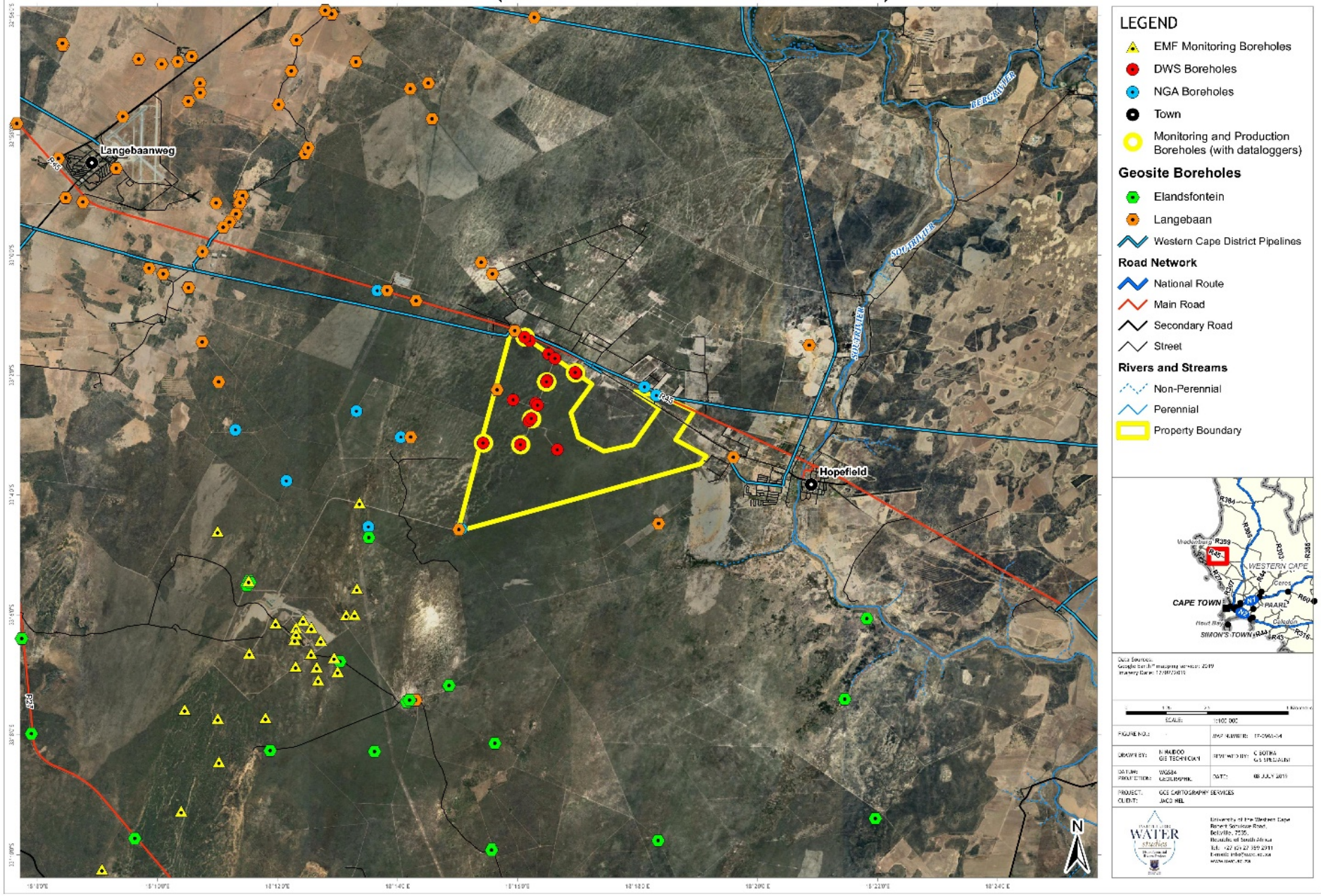
Hopefield
Aquifer tests conducted – no pumping yet



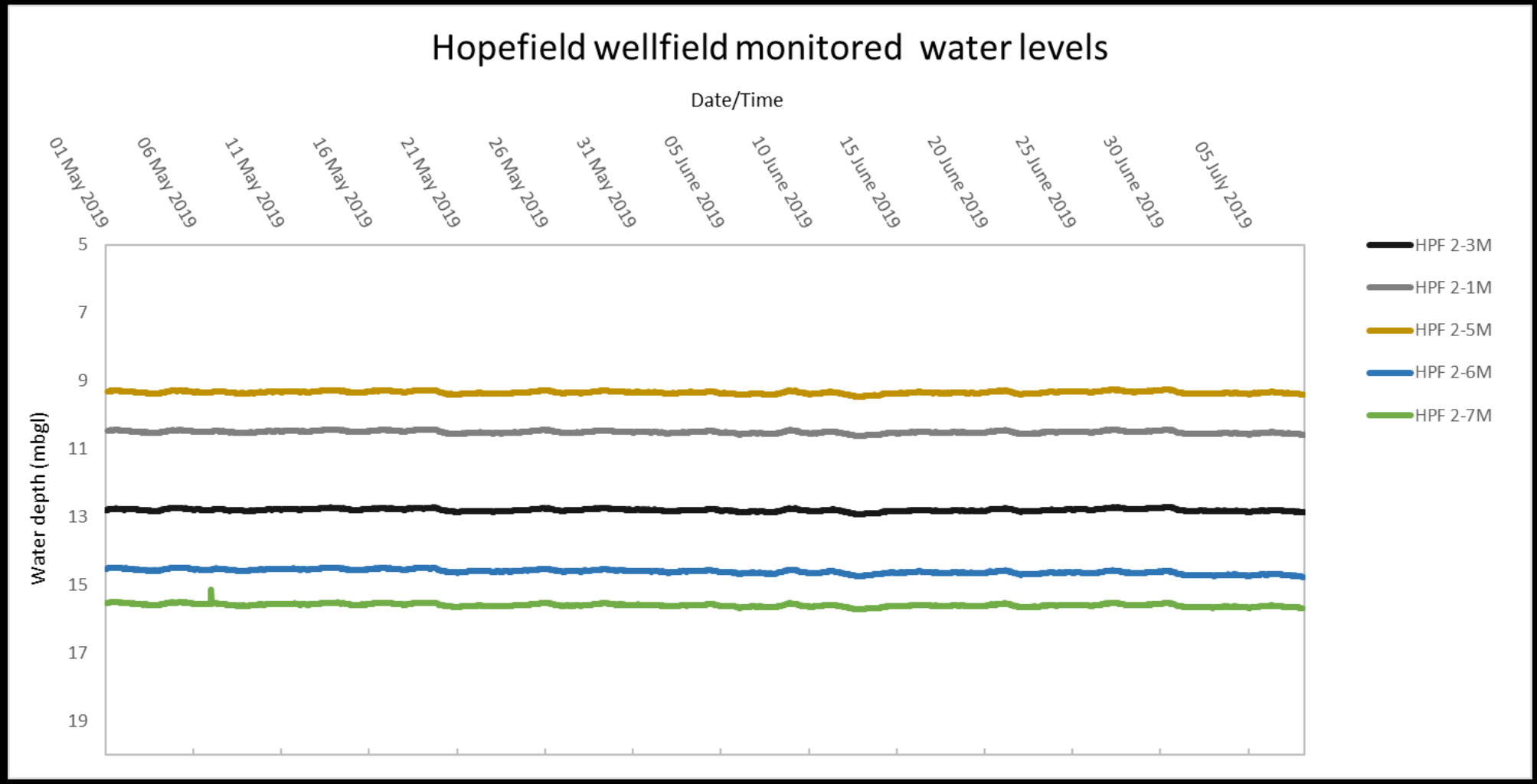


H

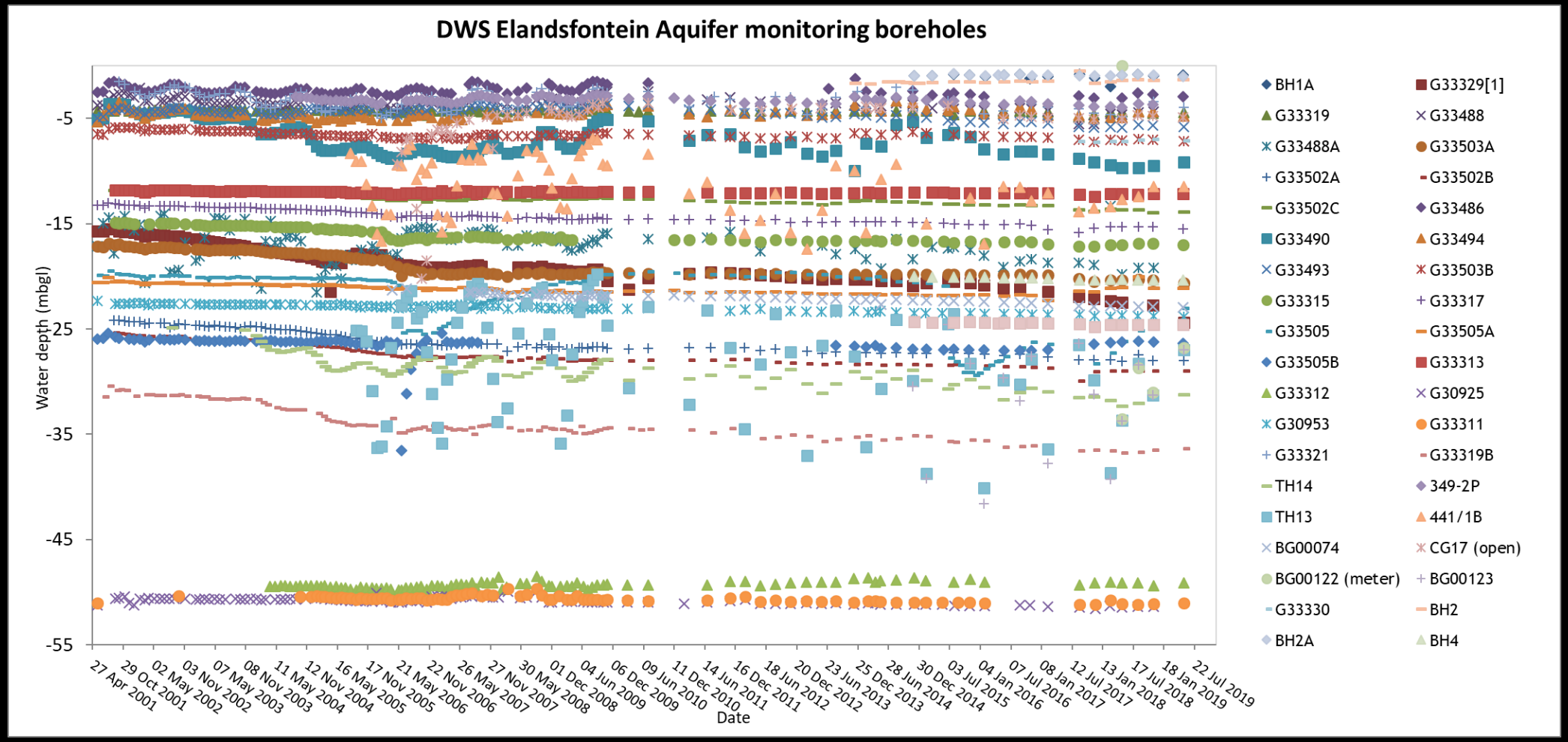
HOPEFIELD: GROUNDWATER MONITORING (ELANDSFONTEIN AND LANGEBAAN)



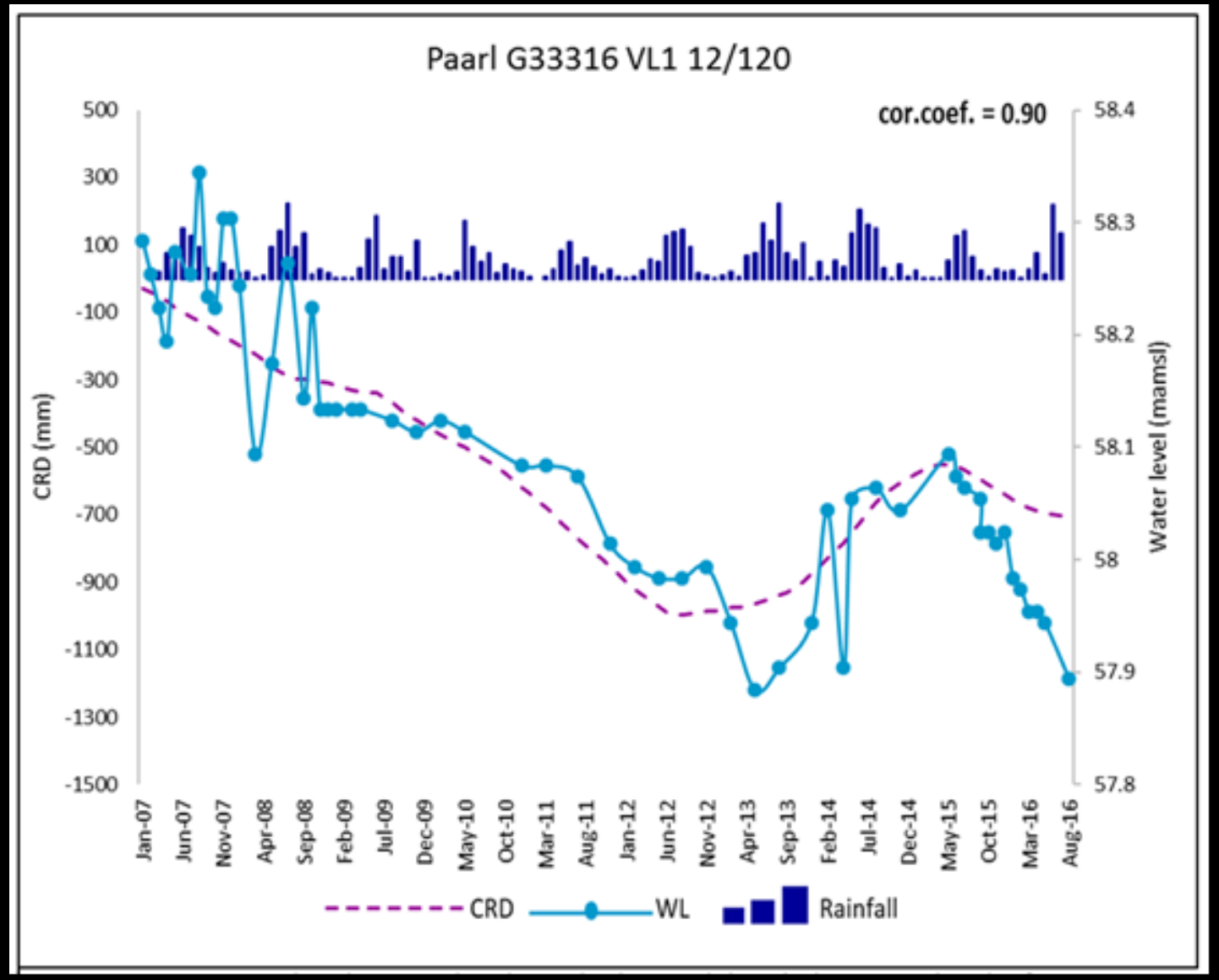
Hopefield Monitoring



DWS Monitoring frequency not optimal for wellfield management



Example From Kezia MSc



Discharge

- Reeds at Geelbek
- Volumes?
- Exactly what is the local discharge process

- Push in Soil probe - Temperature and EC profiles
- Hope to get a vertical profile of salinity and zones of discharge.
- Will also try resistivity geophysical profiles – not sure we can get usefull resolution with depth.

Numerical Models and Predictions

What do I use models for?

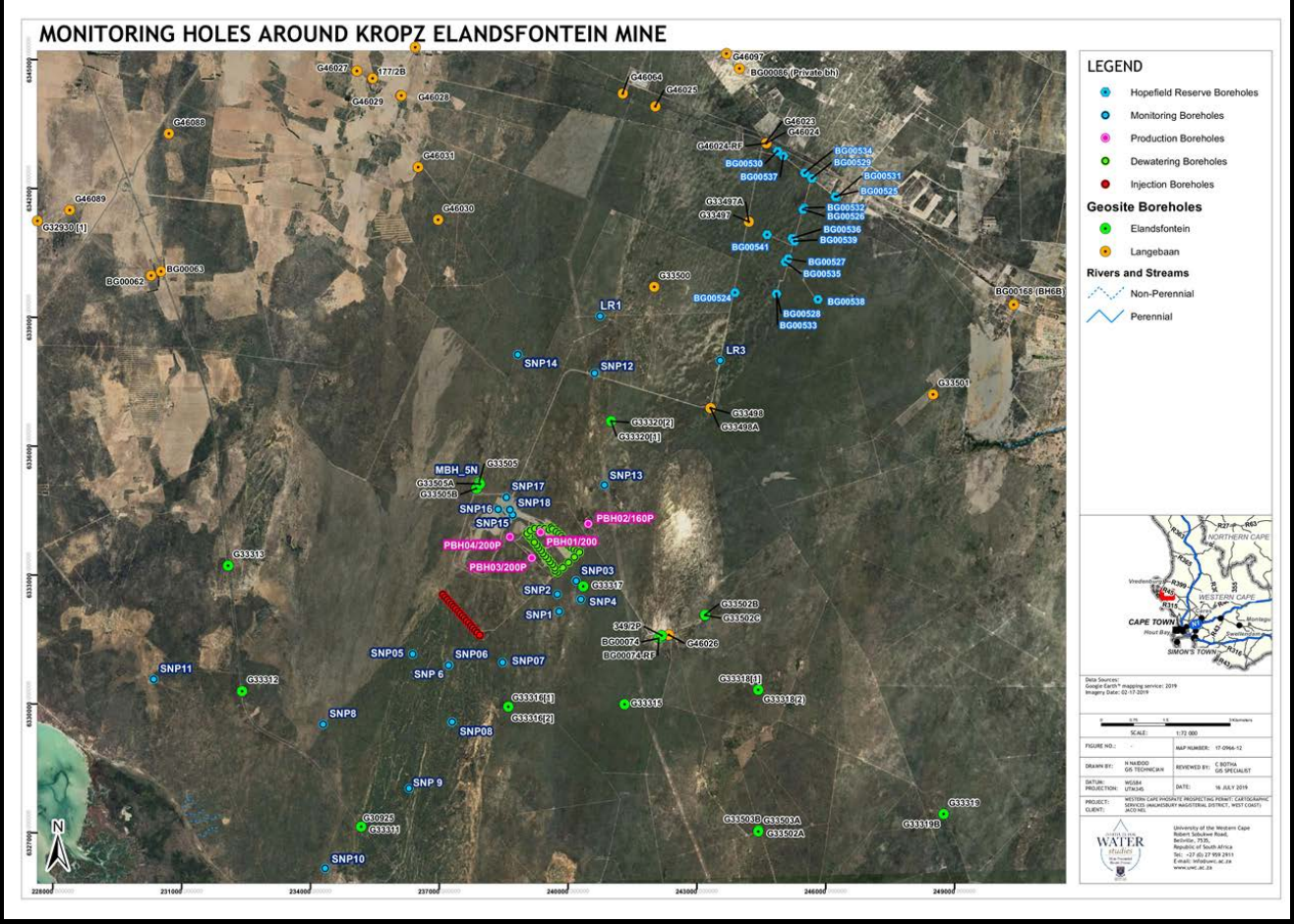
- Integrate all the kn

How far can I dri

- Evaluate the data I have – perhaps make some assumption – use the data in a suitable equation - predict forward
- Uncertainty ?

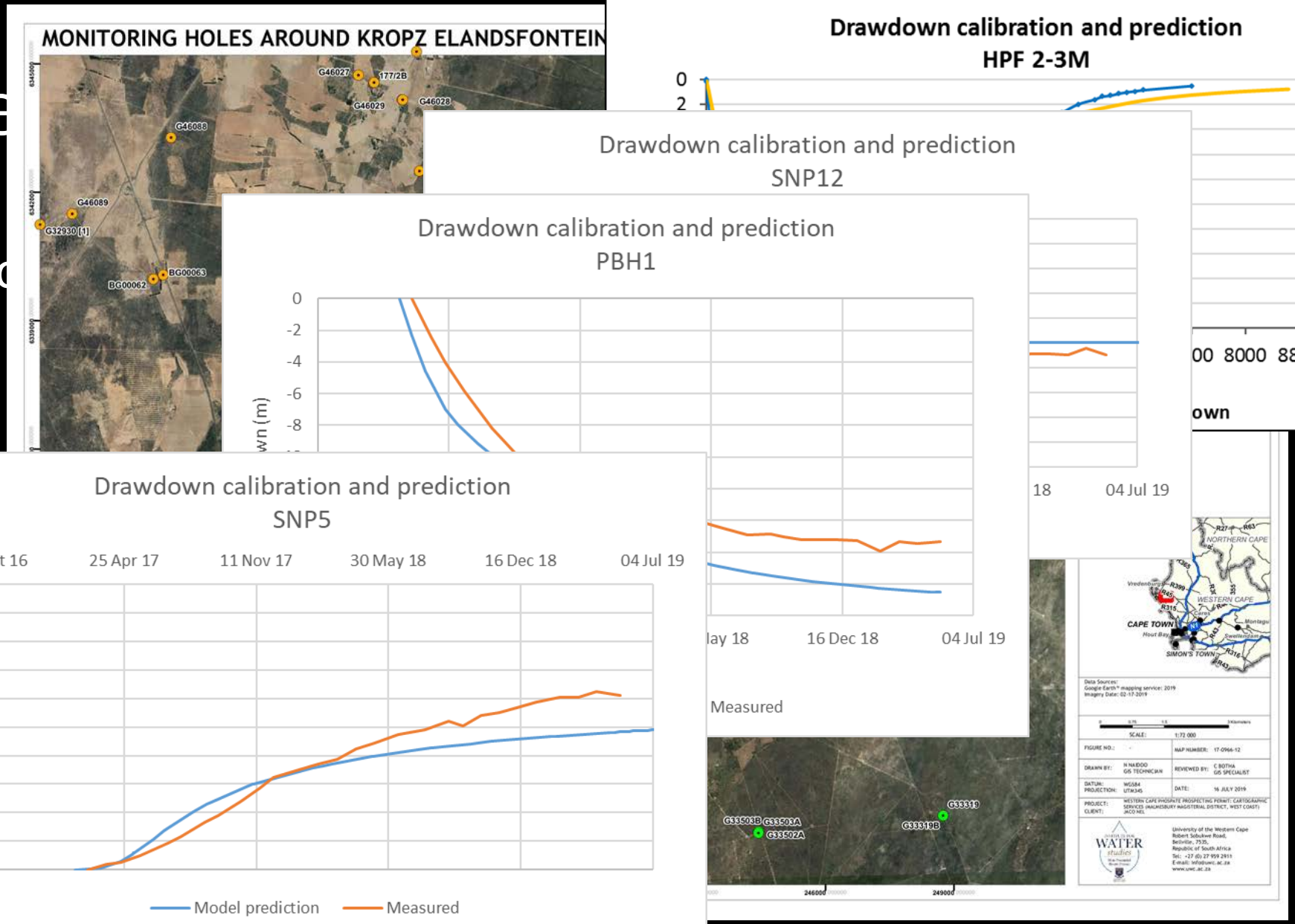
Numerical model

- One model partly funded by SBM and partly by Elandsfontein mine



Nume

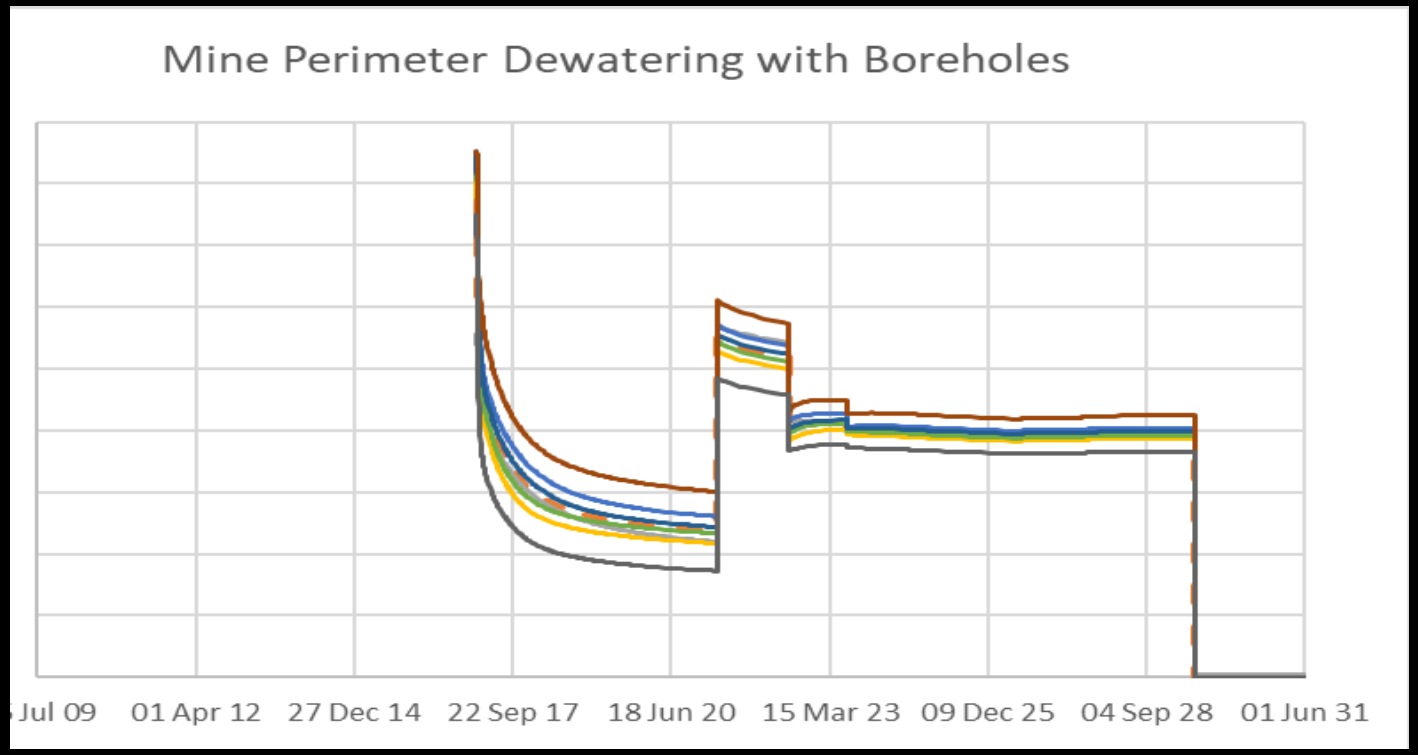
- One mo


MONITORING HOLES AROUND KROPZ ELANDSFONTEIN
G46027
177/2B
G46028
G46029
G46088
G46089
G32930 [1]
BG00062
BG00063
Drawdown calibration and prediction
HPF 2-3M
0
2
00 8000 8800 9600
own
Drawdown calibration and prediction
SNP12
18
04 Jul 19
Drawdown calibration and prediction
PBH1
0
-2
-4
-6
-8
wn (m)
ay 18
16 Dec 18
04 Jul 19
Measured
Drawdown calibration and prediction
SNP5
07 Oct 16
25 Apr 17
11 Nov 17
30 May 18
16 Dec 18
04 Jul 19
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Drawdown (m)
Model prediction
Measured
G33319
G33319B
G33503B
G33503A
G33502A
246000
249000
NORTHERN CAPE
WESTERN CAPE
CAPE TOWN
SIMON'S TOWN
WATER studies

Sensitivity Analysis and predictions

- Uncertainty in spatial distribution of sand layers, bedrock, rainfall
- Determine Effect of Uncertainty on Calibrated Model
- Lets Play – and see how the model behaves when we put it under stress

Predictions considering different management scenarios



Work currently being implemented

- Water balance and Cl balance

- Additional Rainfall samplers – Cl and Water isotopes
- Unsaturated zone Cl and Temperature – different plants will influence the Cl reaching the GW differently
- Saturated zone Cl and Temperature – identify different flow zones.

Thank You

JMNel@uwc.ac.za