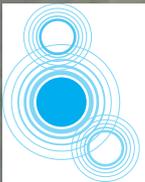


# Water Stewardship in the South African Mining Sector

Dr. Anthony Turton  
WISA Conference  
7 November 2012

<http://www.wscsa.org>



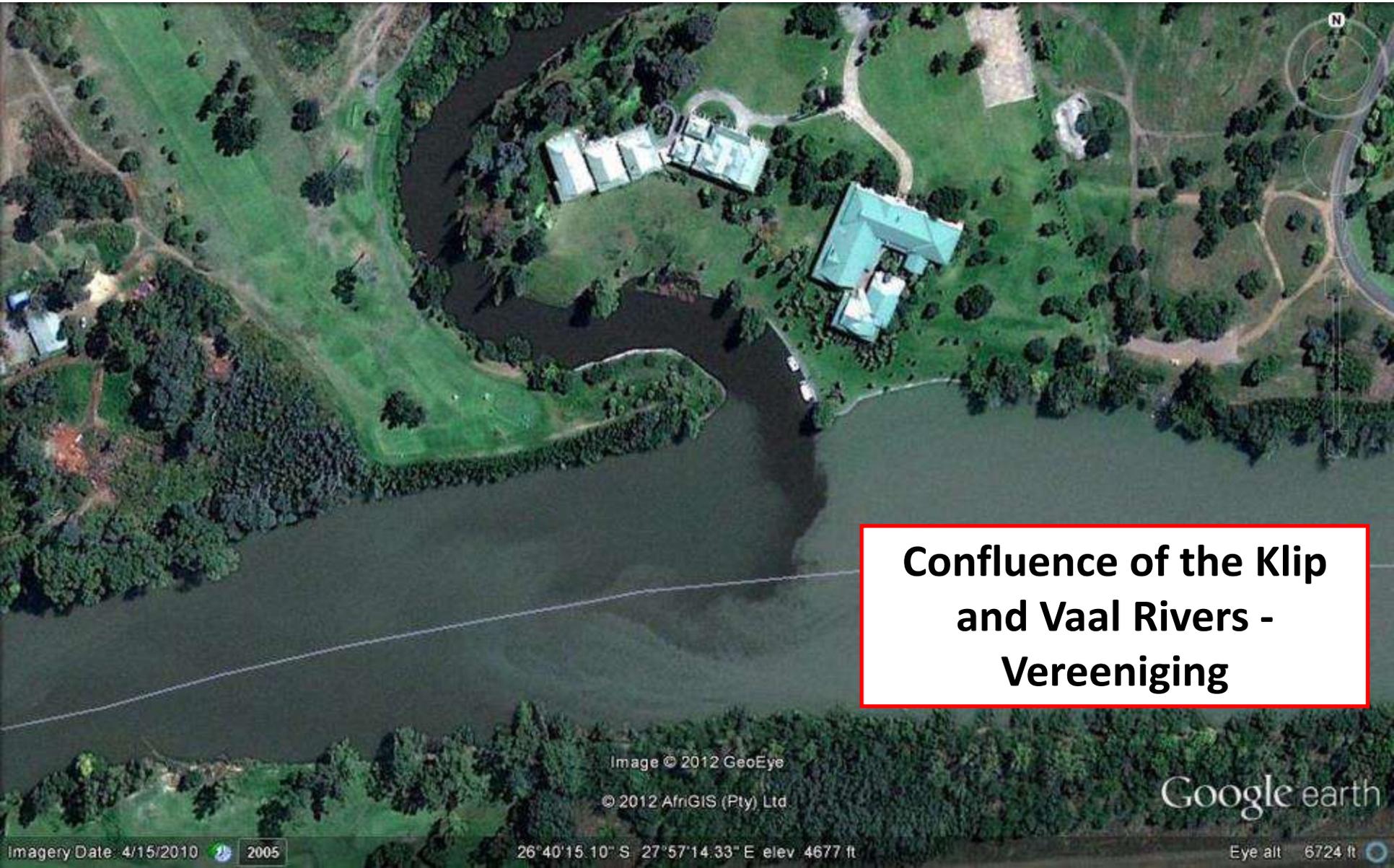
**SAWater**  
stewardship council trust

Image: © Anthony Turton 2012

# Understanding the Problem

**It is all about balancing  
three sets of numbers  
while growing jobs in a  
young democracy**

$\pm 48$  billion  $\text{m}^3/\text{yr}$  (BCM) – Total of all the water in all South African rivers



**Confluence of the Klip  
and Vaal Rivers -  
Vereeniging**

Image © 2012 GeoEye

© 2012 AfriGIS (Pty) Ltd

Google earth

Imagery Date: 4/15/2010 2005

26°40'15.10" S 27°57'14.33" E elev 4677 ft

Eye alt 6724 ft

± 38 (BCM) – Total of all the water in all  
dams – Hydraulic Foundation of our  
Economy



**Wagendrif Dam on the  
Bushman's River in KZN**

**± 63 (BCM) – Total of all water needed to create full employment by 2030**

**RSA will have a shortfall of ± 25 BCM by 2030 if we want full employment and social stability. This is the case for Stewardship.**

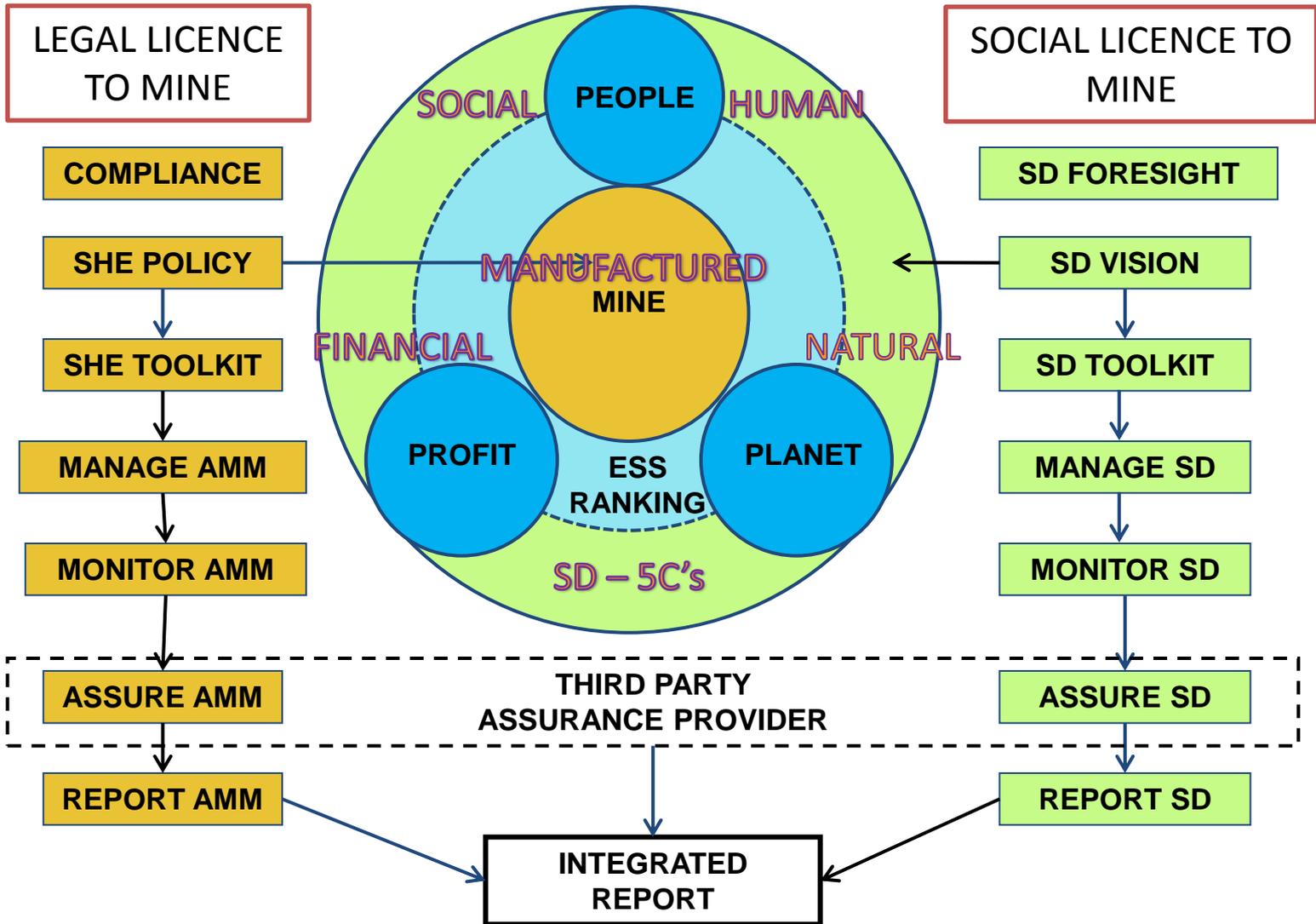
**Grey water recovery and groundwater recharge – Perth West Australia**

# Coal of Africa (Ltd)



Image: © Anthony Turton 2011

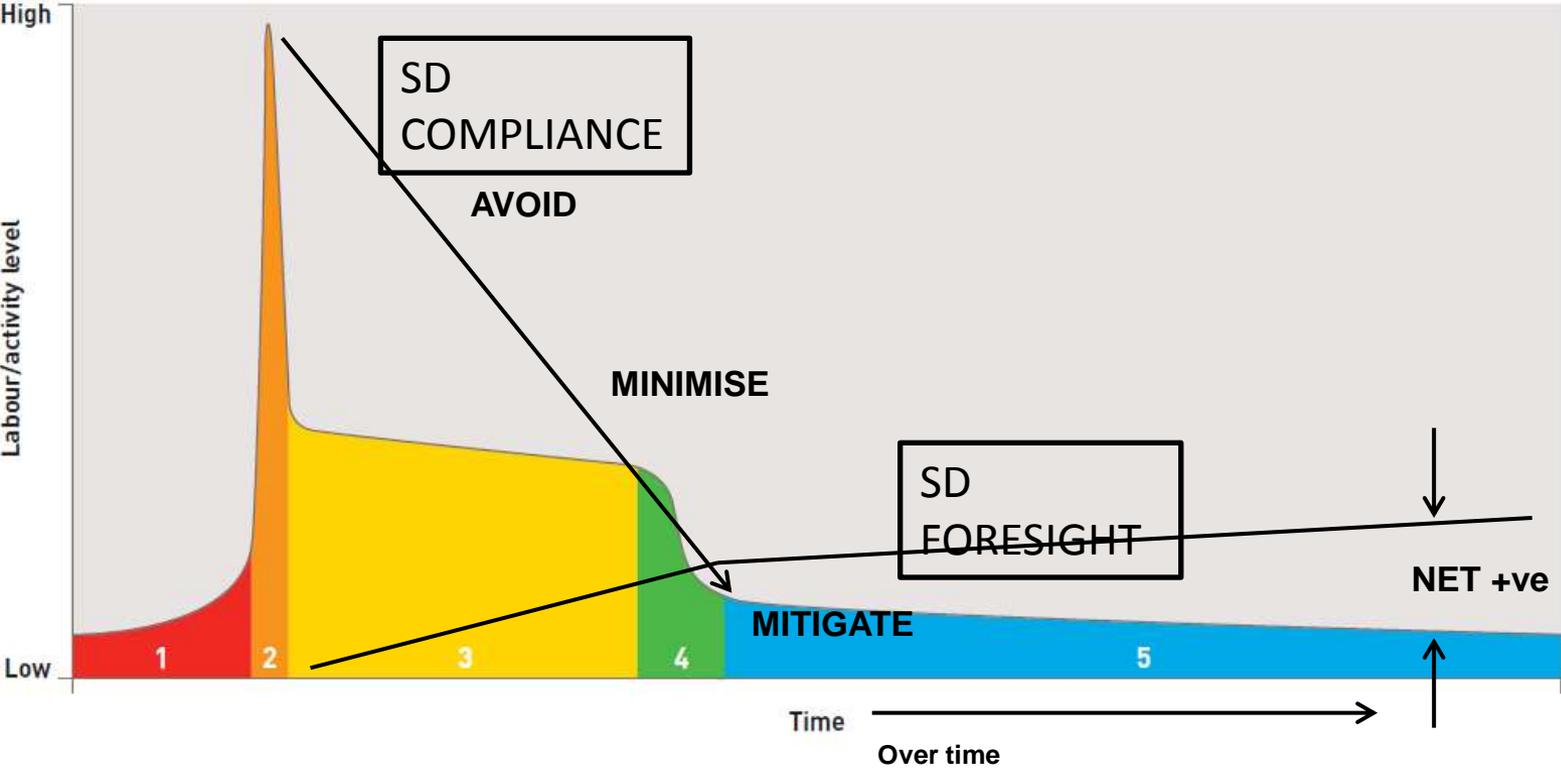
# CoAL's Emerging Thinking on SD



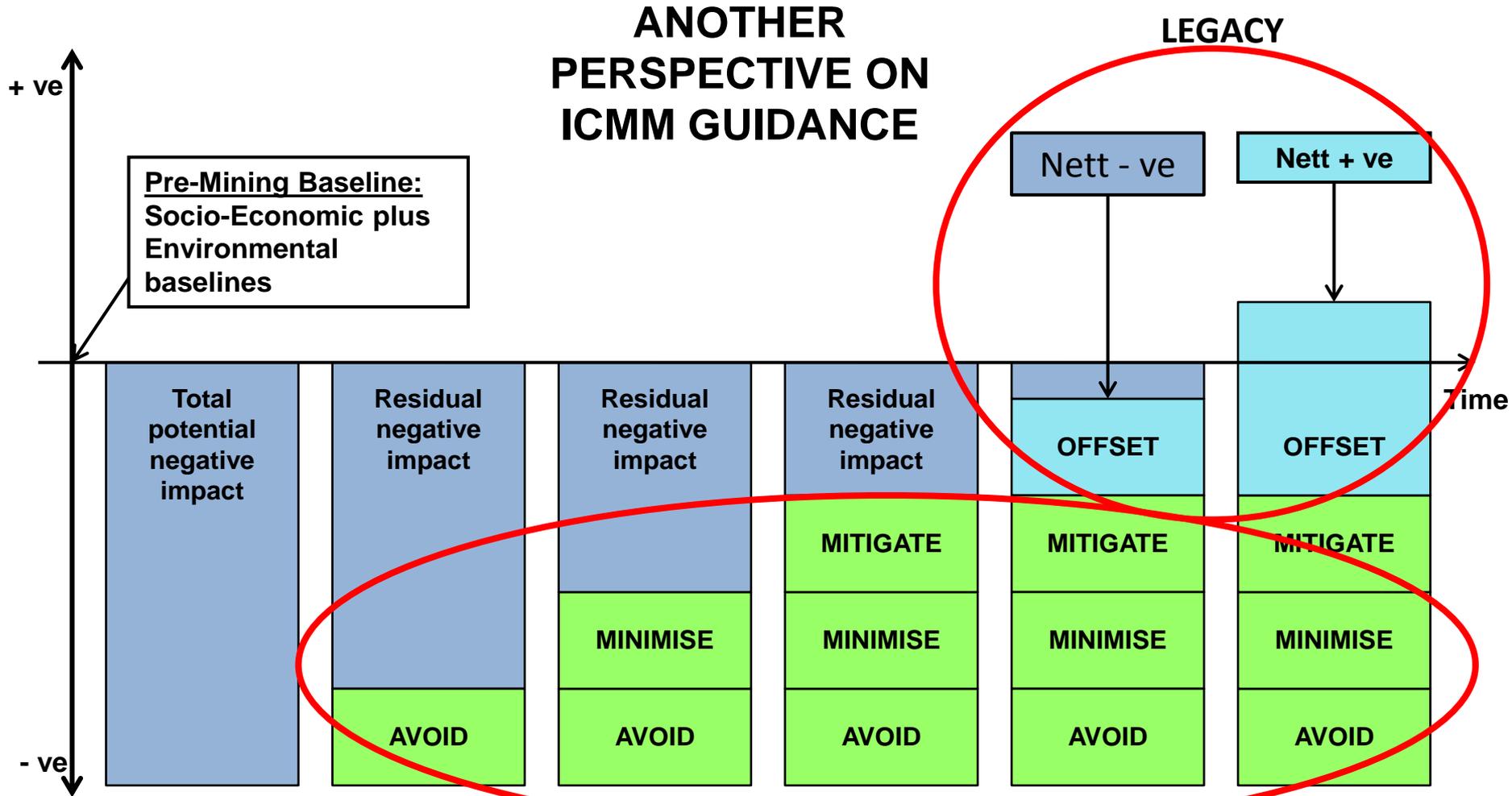
# CoAL's Emerging Thinking on SD

Figure 1: The mine project life cycle

- 1** Exploration  
1-10 years  
or more
- 2** Site design and  
construction  
1-5 years
- 3** Operation  
2-100 years
- 4** Final closure and  
decommissioning  
1-5 years
- 5** Post-closure  
A decade to perpetuity

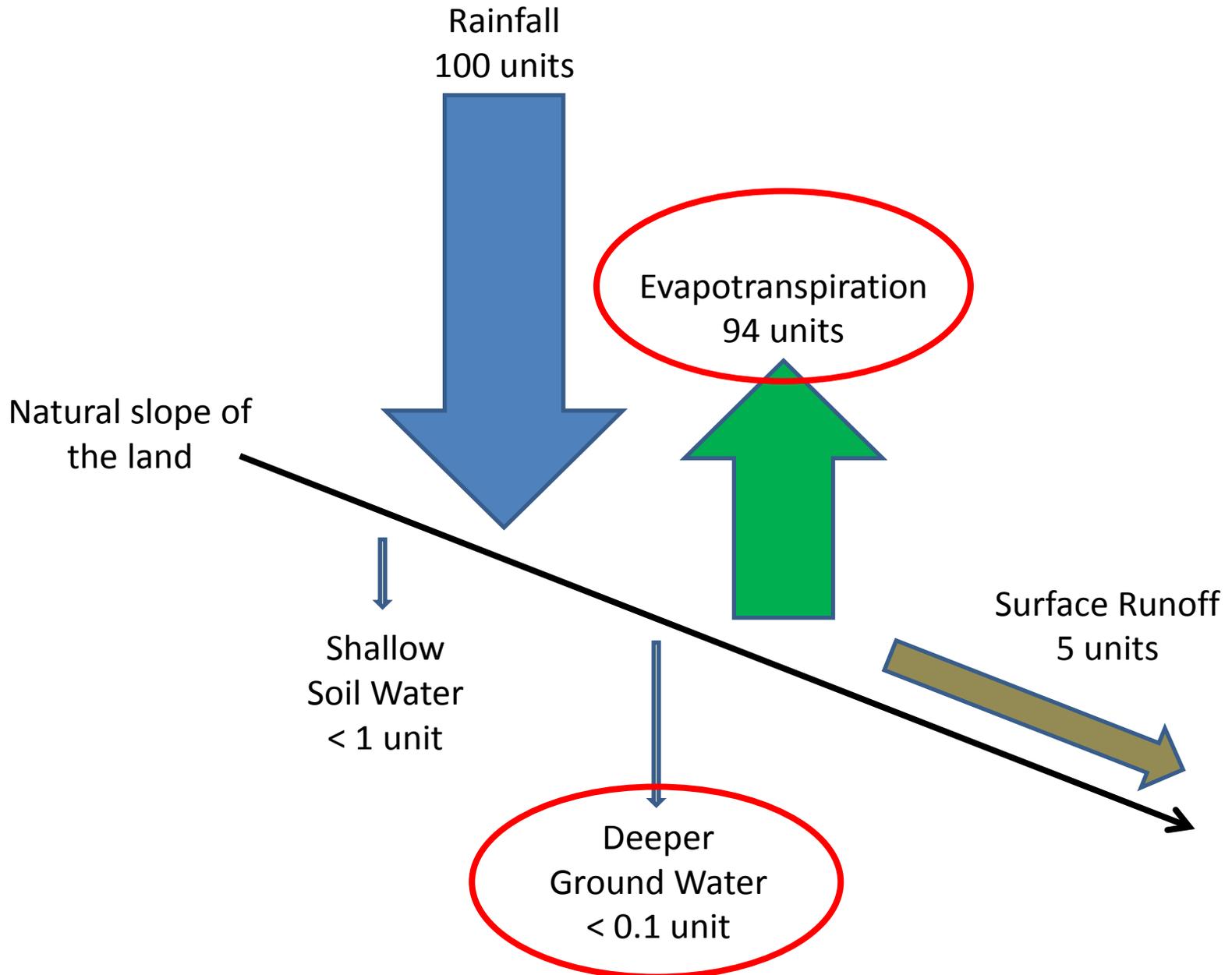


# CoAL's Emerging Thinking on SD

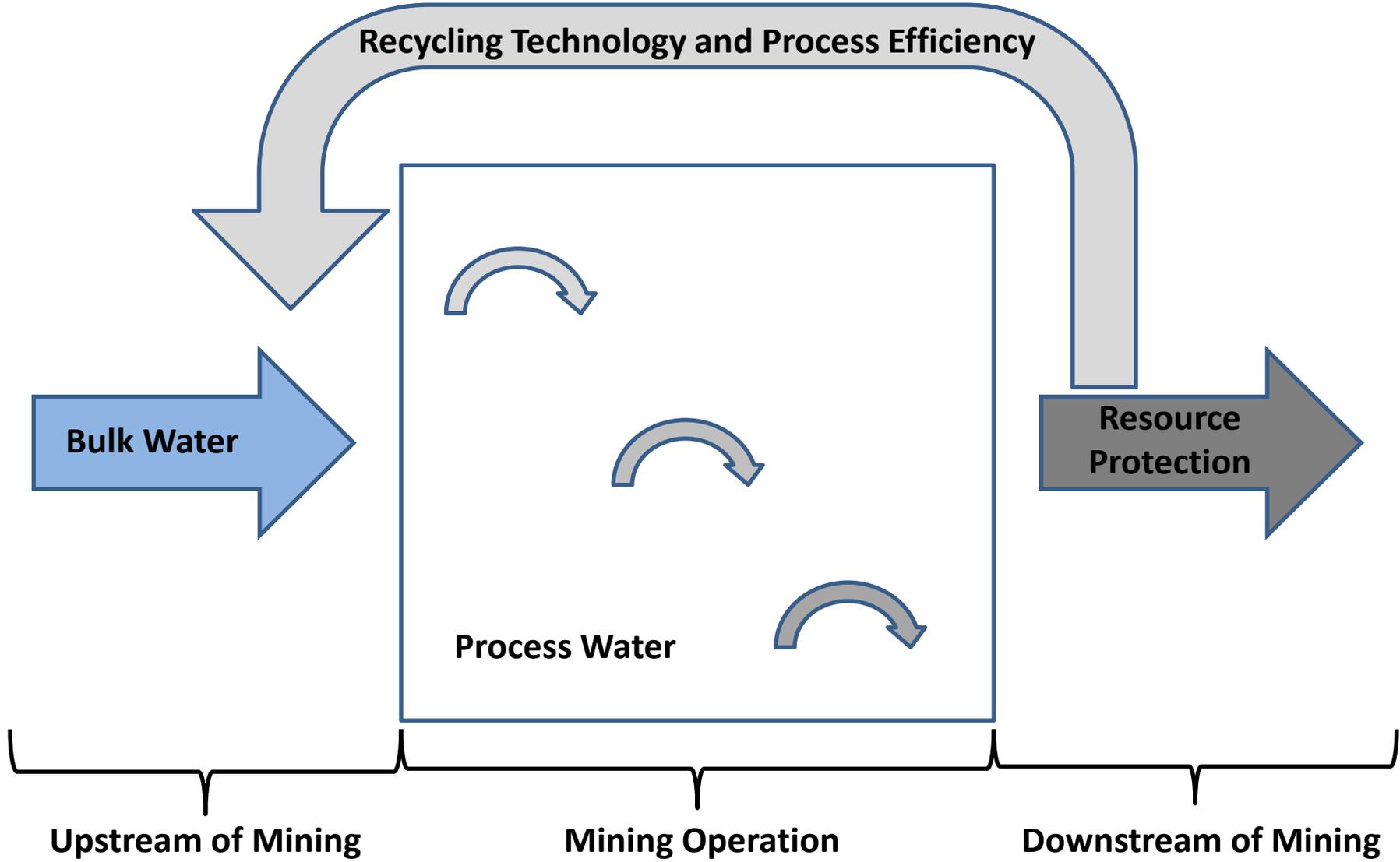


Source: SD Outcomes

# The Hydrological Problem in which CoAL is Embedded



# CoAL's Water Management Philosophy

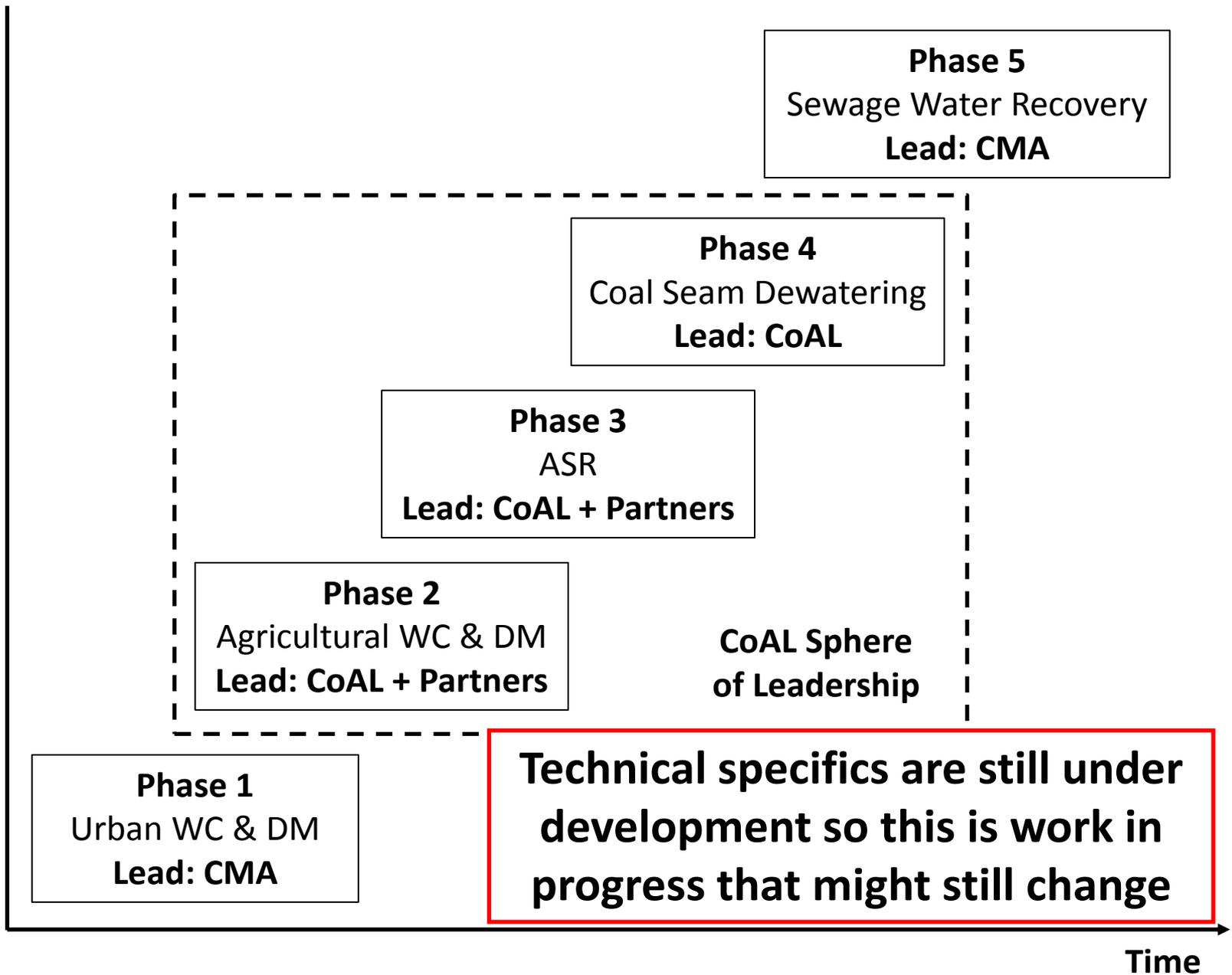


# The CoAL R<sup>3</sup>ES<sup>2</sup>P<sup>2</sup>ECT for Water Policy

- **R<sup>3</sup> - Recovery, Reuse & Recharge.**
  - Process Water & Resource Protection.
- **E – Evapotranspiration.**
  - Bulk Water Supply.
- **S<sup>2</sup> - Separation & Storage.**
  - Process Water, Bulk Water & Resource Protection.
- **P<sup>2</sup> - Partnership & Protection.**
  - Bulk Water Supply & Resource Protection.
- **E – Evaluation.**
  - Process Water, Bulk Water & Resource Protection.
- **C – Catchment Management Agency (CMA).**
  - Bulk Water Supply & Resource Protection.
- **T –Technology.**
  - Bulk Water Supply, Process Water & Resource Protection.

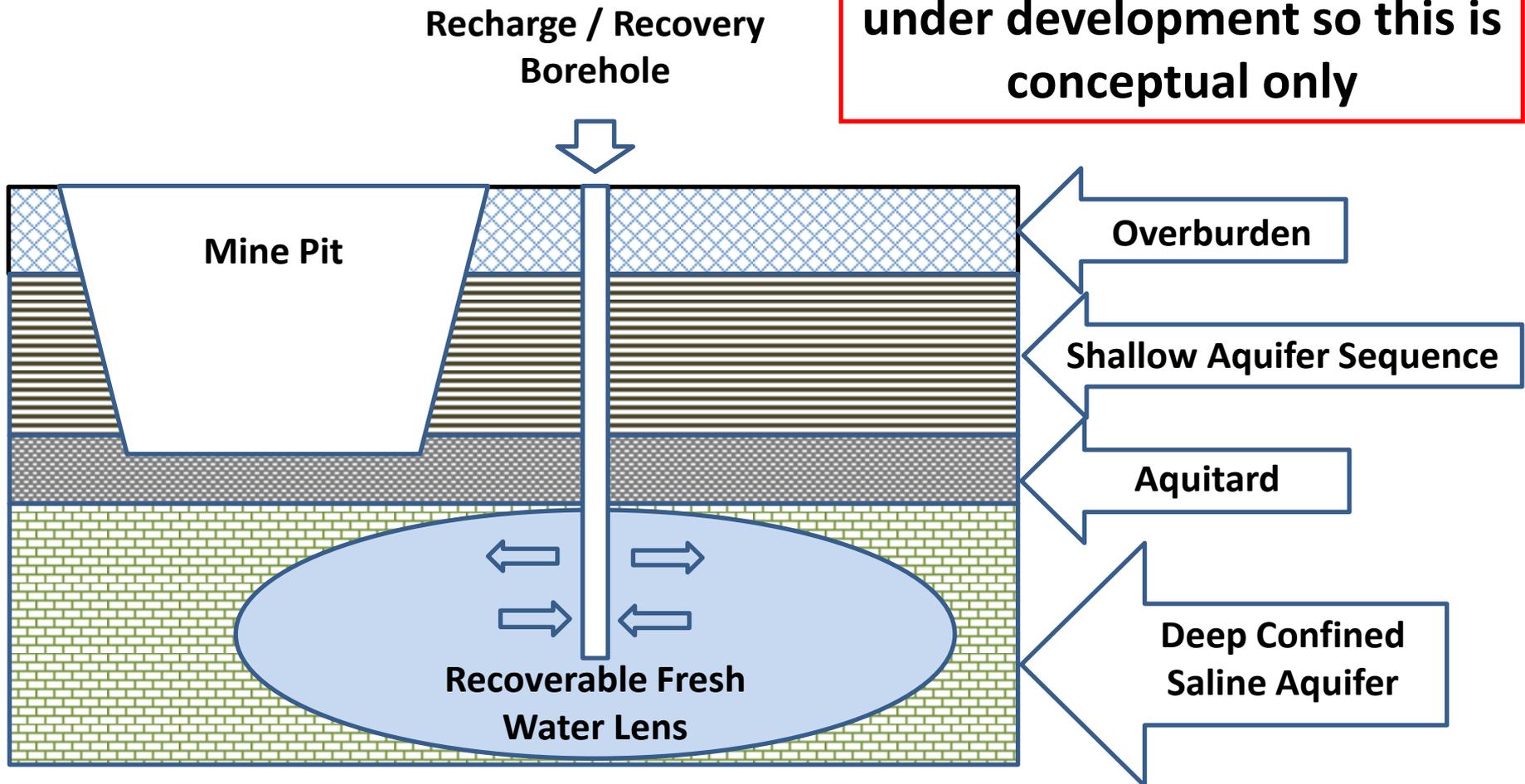
# CoAL's Emerging Stewardship Strategy

Complexity



# ASR as an Element of CoAL's Water Stewardship Strategy

Technical specifics are still under development so this is conceptual only



# Closure with PRIDE

## P – People-centred approach

Everything we do is about people and for people both inside and outside the company. We are **temporary occupants** of a site

## R – Respect for all I&AP's

Because people matter we respect them all, including those directly affected and **shareholders**. Respect **permanent residents** around the site

## I – Investment leveraging for livelihood flows

The money we invest on-site also has implications off-site, so wherever we can we leverage what is best for **our LEGACY** such as **sustained livelihood flows post-closure**

## D – Development alignment

Wherever we can we will align our own investment with the developmental aspirations of the broader community to build **our LEGACY**

## E – Environment both on and off-site

Because we believe in people we also respect the environment as a life-support system for all biological life. This is part of **our LEGACY** arising from our **Core Values**

# CoAL's LEGACY Program

**L – Leveraging** to sustain **Livelihoods**

**E – Economic Development** needs **Alignment**

**G – Gains** must always exceed **losses** at all levels

**A – Accountability** *via* **Sustainability Reporting**

**C – Communication** that is **Honest and Transparent**

**Y – Yearning** to become **Best of Breed**

# Mintails (Mogale Gold)

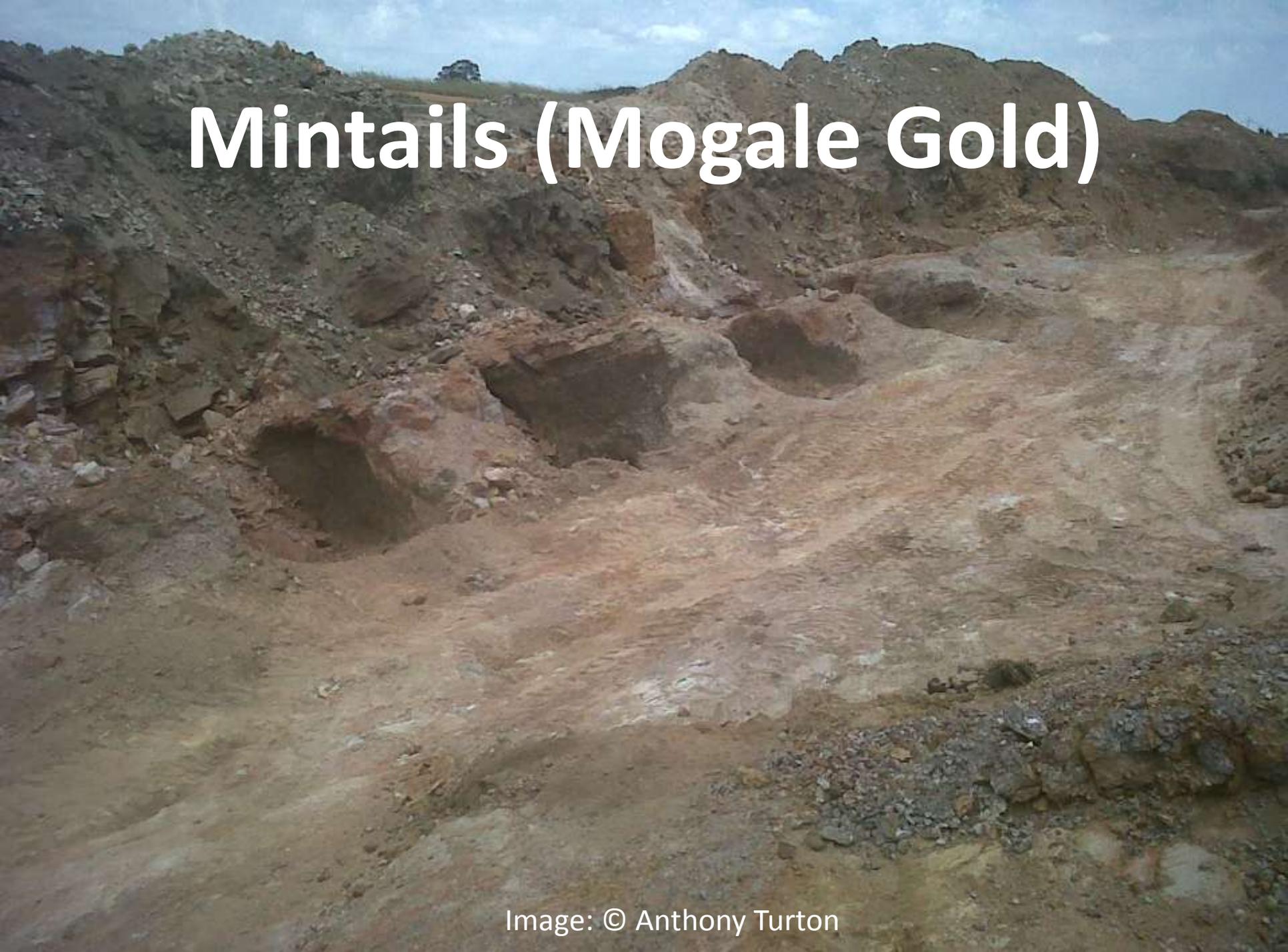
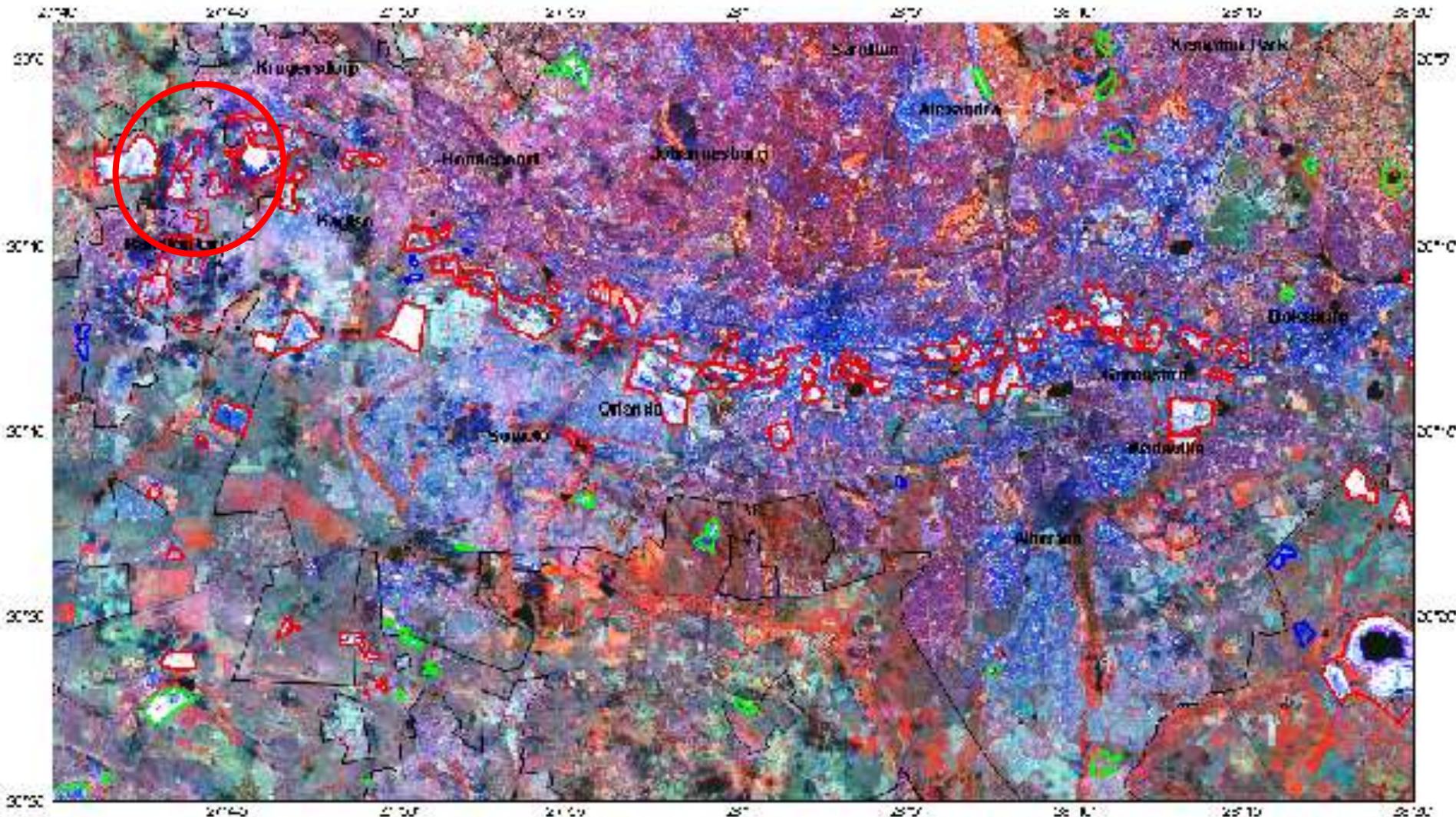


Image: © Anthony Turton

# Radioactive Mine Residue Areas Western and Central Wits Basins



# Radioactivity Levels of Uraniferous Tailings along the Witwatersrand



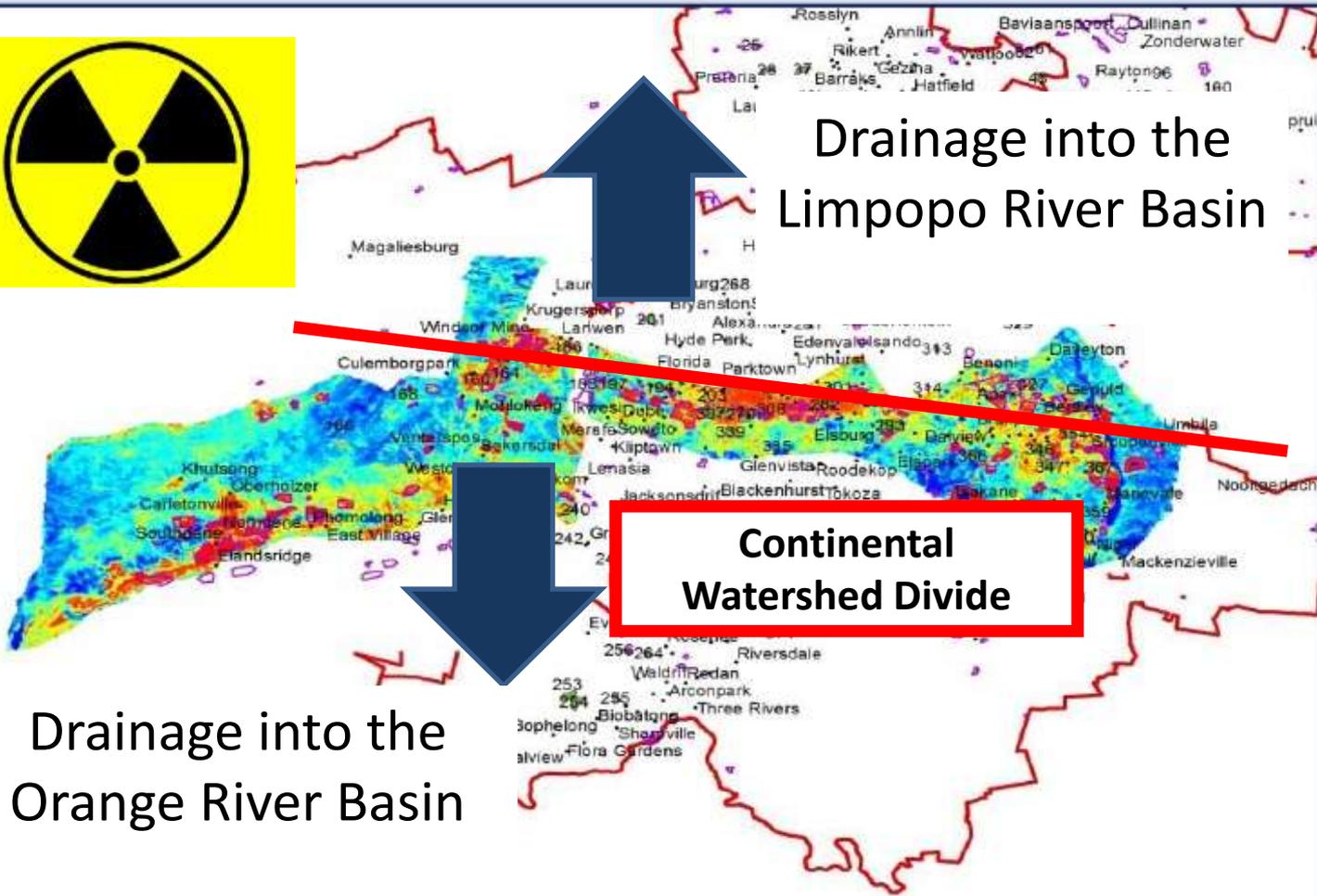
Drainage into the Limpopo River Basin



Drainage into the Orange River Basin



Continental Watershed Divide



Feasibility study on Reclamation of Mine dumps for Development purposes

Map 7 Mine Residues and radio activity

September 2009

### Legend

- Towns
- Qualified for development
- Mine Residues
- Radio activity**
- RGB**
- Red: High
- Yellow: Medium
- Blue: Low
- District Municipalities

0 7 Kilometers  
Geographic: WGS84



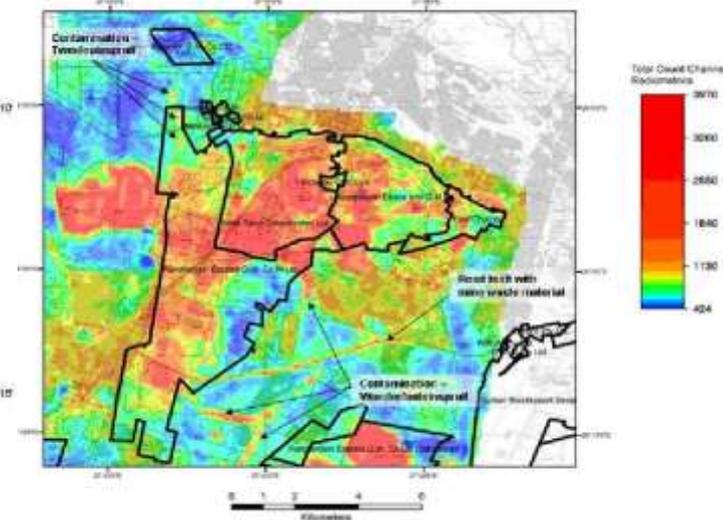
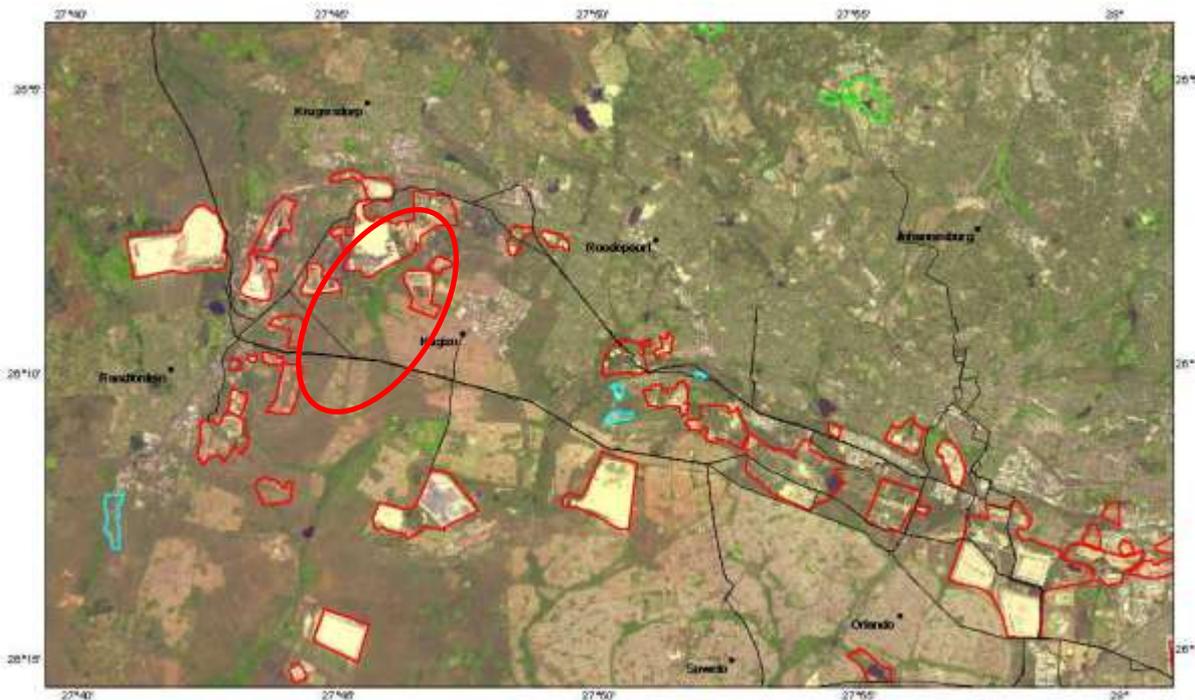
Contact details:  
NWUniversity (Prof v Deventer)  
Cell: 0829554532  
Patchedroom Map created by A Hattings

DISCLAIMER: All possible care has been taken in the production of this map. NWU cannot take any liability for provided inaccuracies or misrepresentation of the information shown on this map.

Source: Van Deventer, 2009

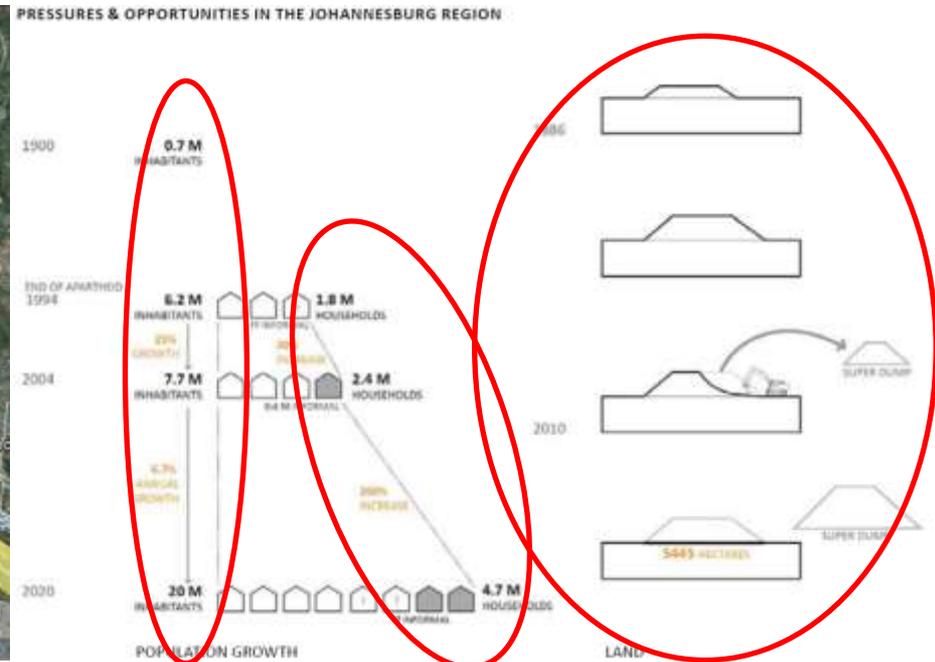
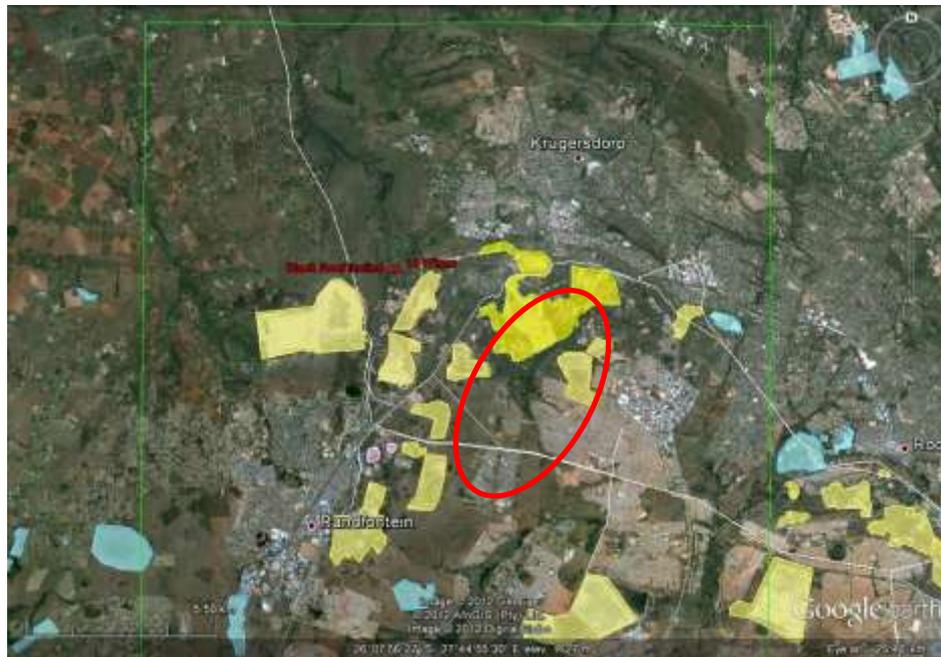
# Game Changer for Gold Sector

- Growing awareness of Uranium in all MRA's
- 430,000 Tonnes U<sub>3</sub>O<sub>8</sub> – GDARD Report
- Tudor Shaft case – Radioactivity scare

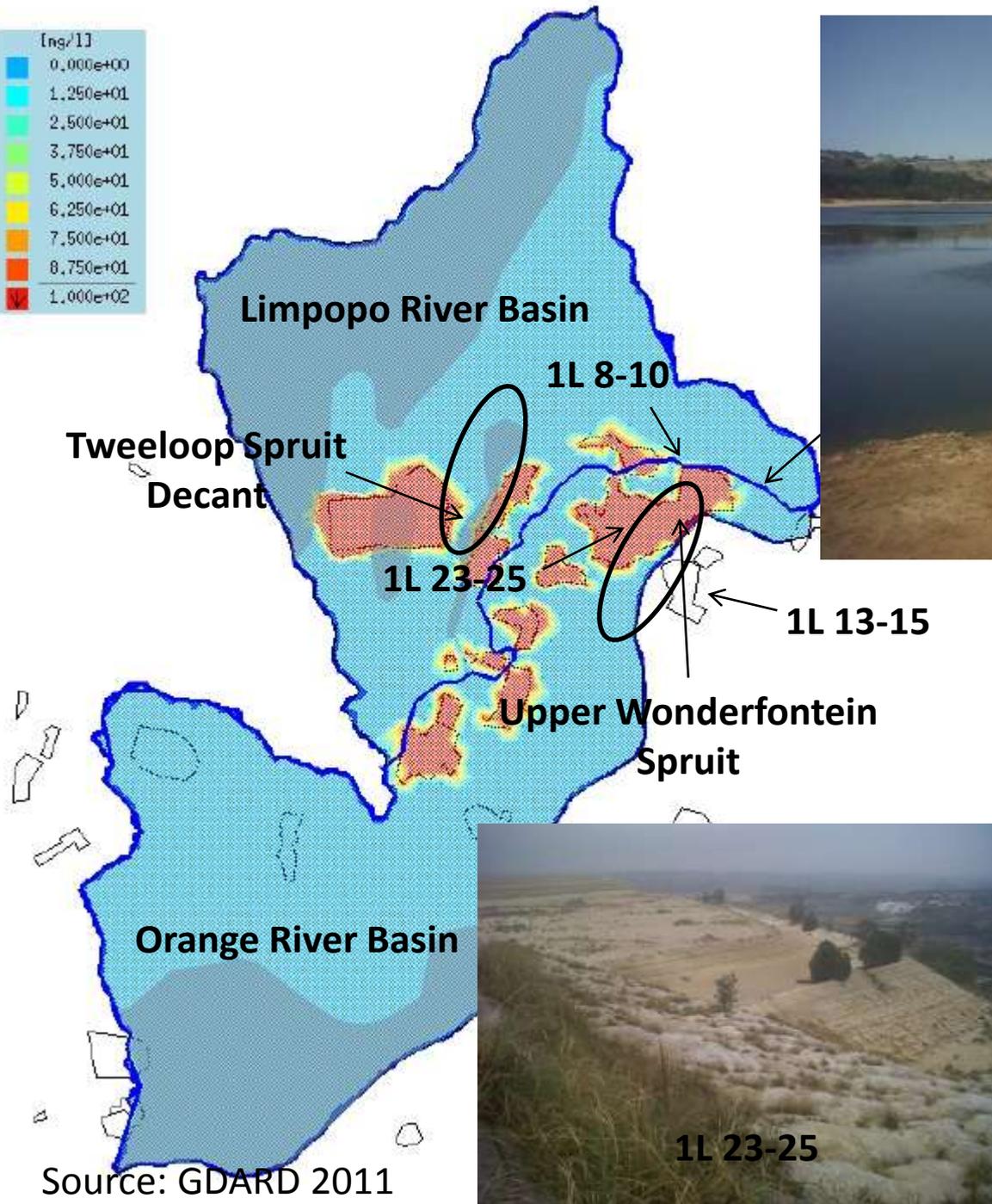
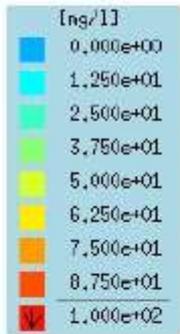


# Emerging Thinking on Mine Closure at Mintails

- GDARD report – concept of consolidating smaller TDF's into Mega Dumps engineered to 21<sup>st</sup> Century standards.
- Wonderfontein Spruit as a logical focal point



Source: Tang & Watkins (2012)



1L 8-10 /  
Lancaster Dam



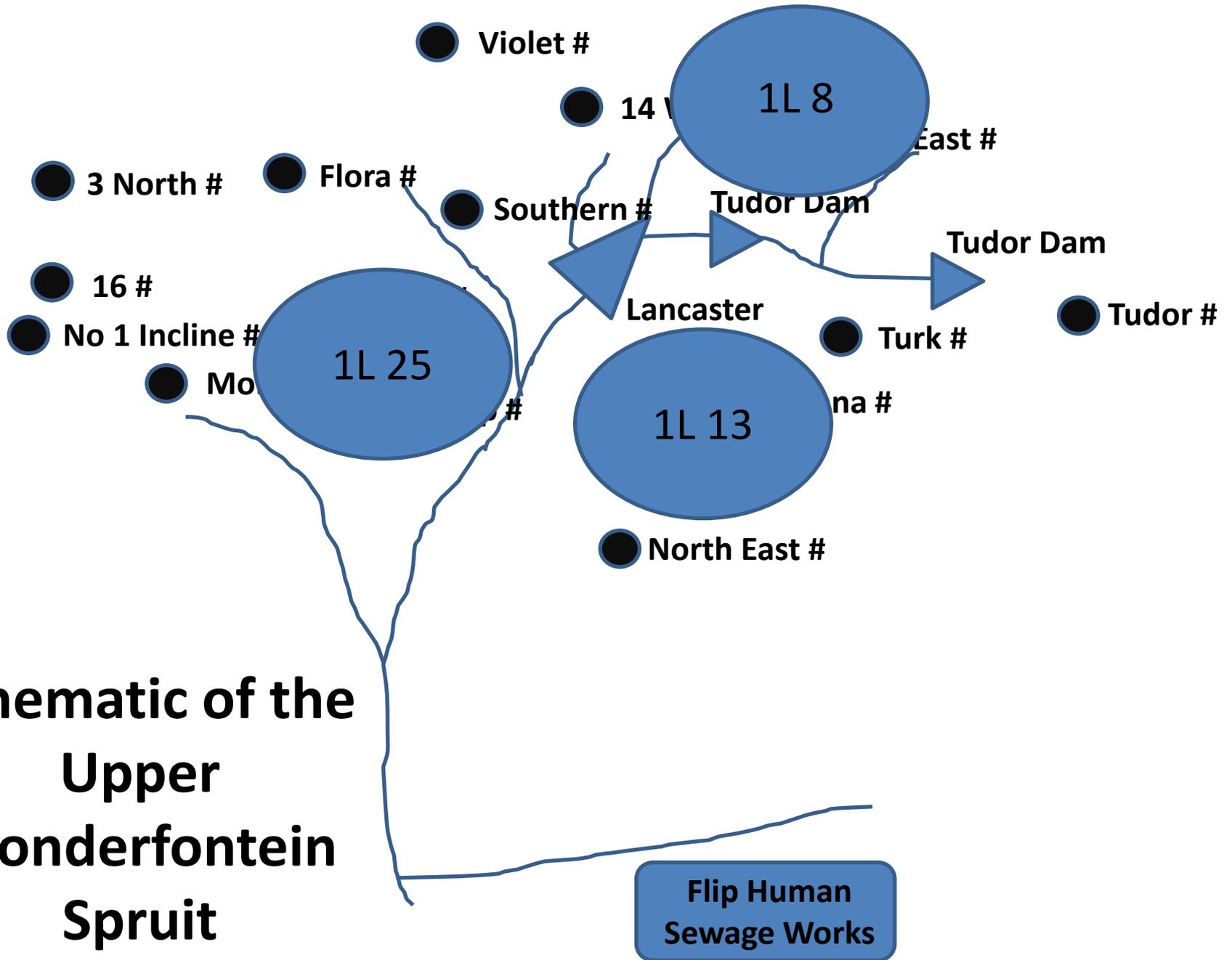
1L 13 - 15  
Housing Encroachment



1L 23-25

Source: GDARD 2011

# Schematic of the Upper Wonderfontein Spruit



# Tailings Pump Station at 1L 25

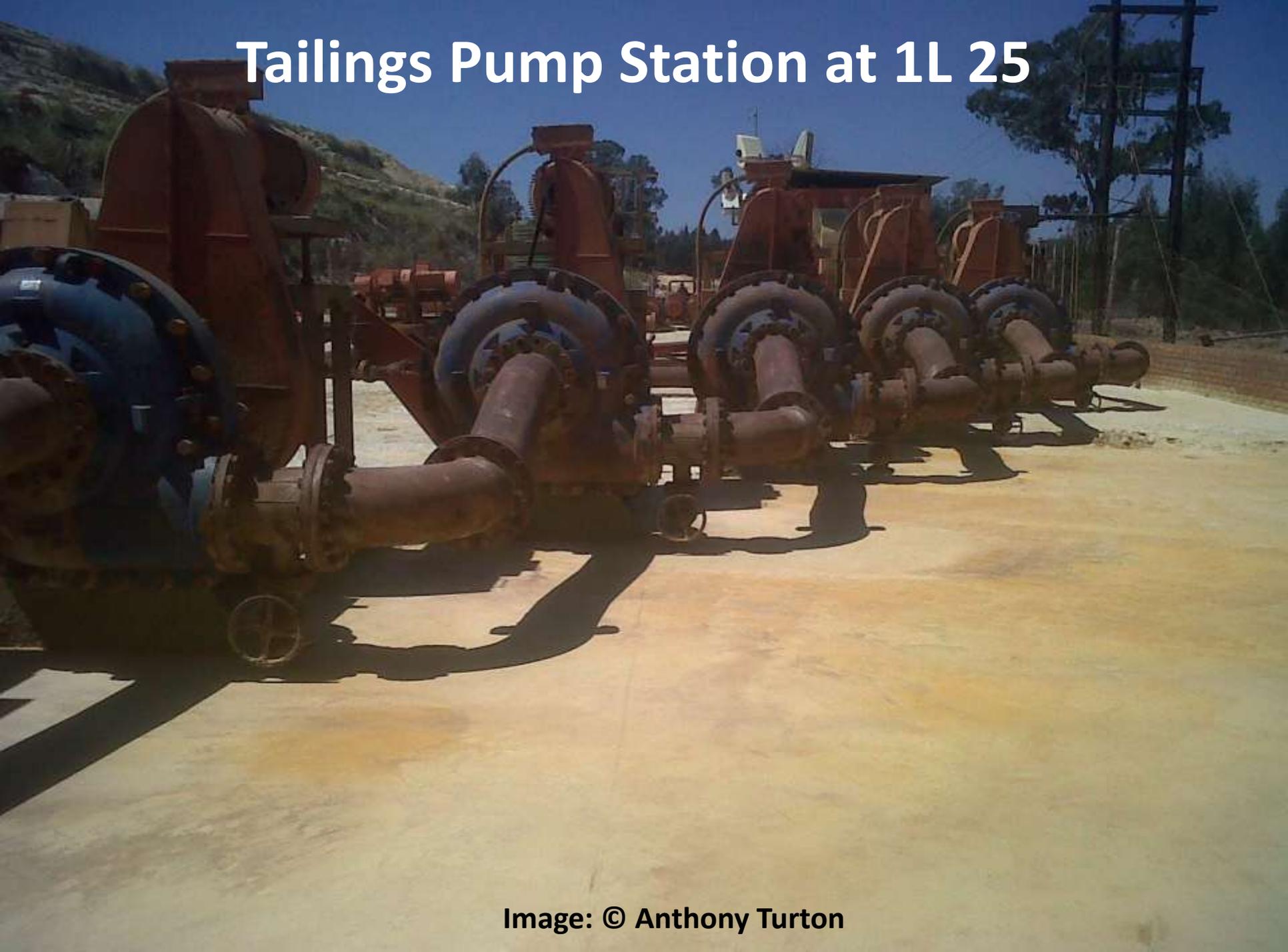
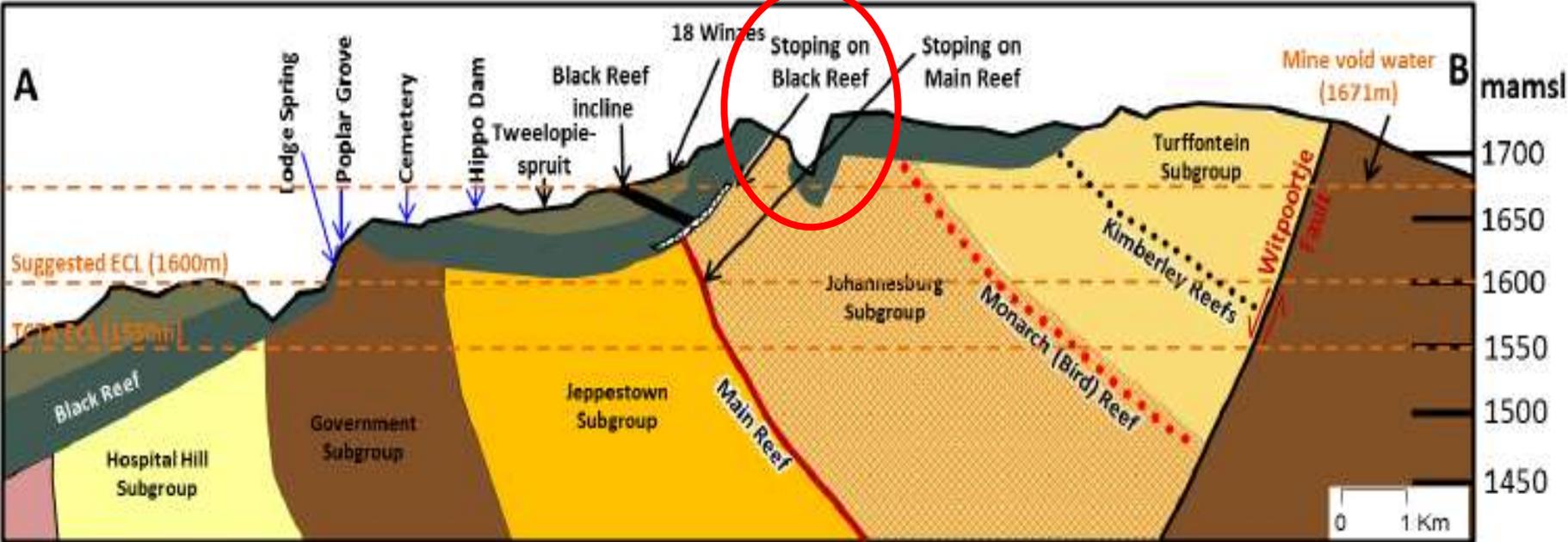


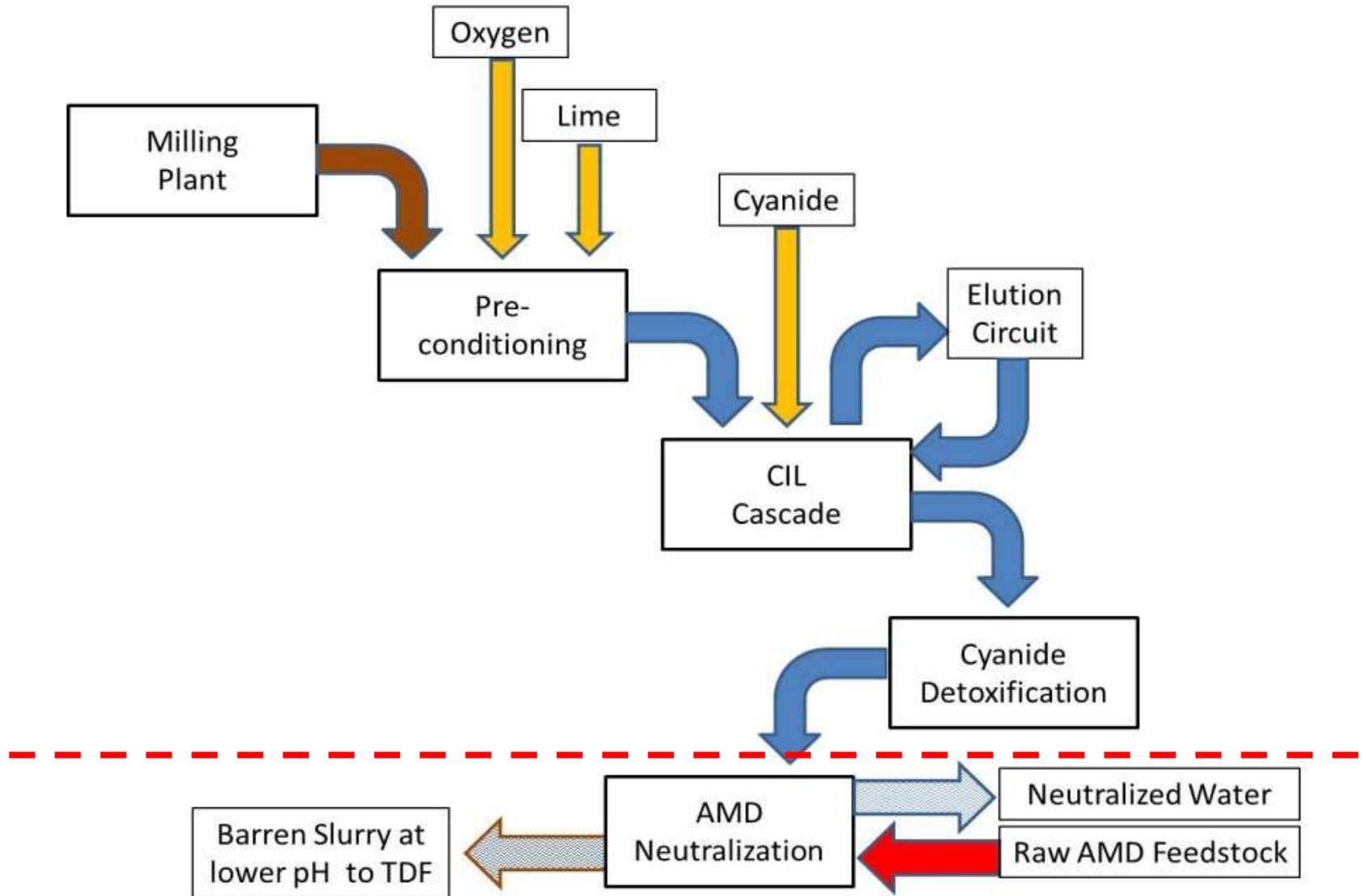
Image: © Anthony Turton

# Geology at Mogale Gold



- |                 |                        |                     |                       |                           |                      |
|-----------------|------------------------|---------------------|-----------------------|---------------------------|----------------------|
| Basement        | Diabase                | Government Subgroup | Johannesburg Subgroup | Ventersdorp Supergroup    | Black Reef Formation |
| Quartz Felsites | Hospital Hill Subgroup | Jepestown Subgroup  | Turffontein Subgroup  | Dolomite and Allied Rocks | Pretoria Group       |

# Mintails AMD Solution



# Proposed West Wits Pit Rehabilitation

Precipitation falling onto the rehabilitated TDF arising from rainfall (100 Units)

Evapotranspiration off the rehabilitated TDF ( $\pm 94$  Units)

Surface runoff ( $\pm 5$  Units)

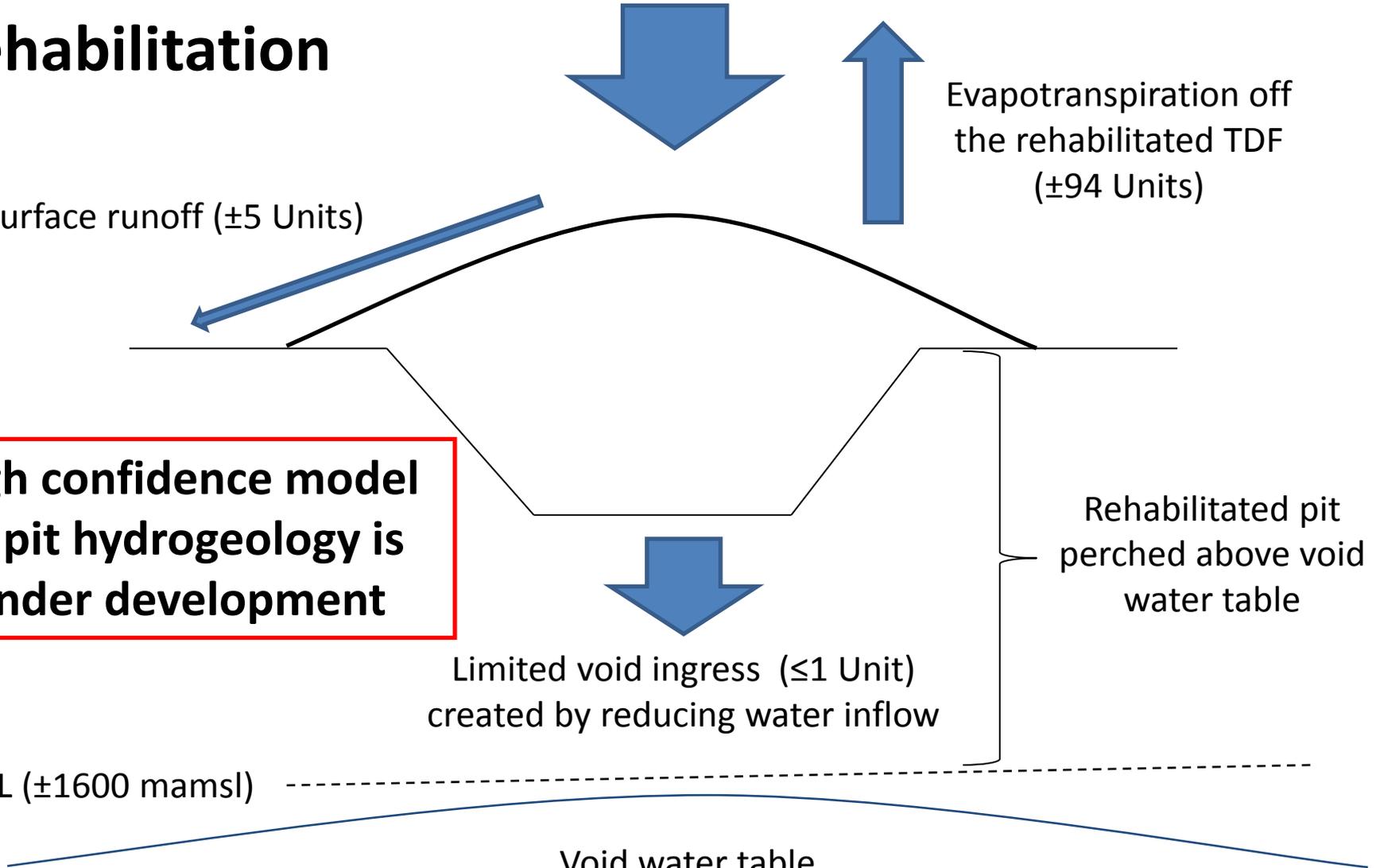
**High confidence model of pit hydrogeology is under development**

Rehabilitated pit perched above void water table

Limited void ingress ( $\leq 1$  Unit) created by reducing water inflow

ECL ( $\pm 1600$  mamsl)

Void water table

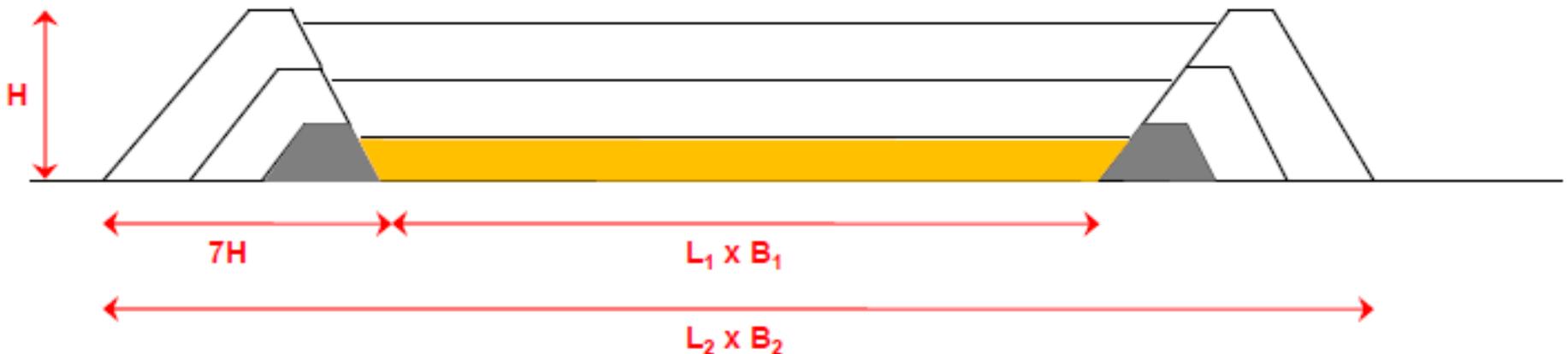


# TCTA Preferred AMD Solution

## HDS Sludge Storage Facilities (SSF<sub>s</sub>)

Basin	AMD (MI/d)	H (m)	L <sub>2</sub> (m)	B <sub>2</sub> (m)	NPV (R.mil)	URV (R/m <sup>3</sup> )
Western	23	22	735	590	959	7.27
Central	46	38	1030	630	1152	4.35
Eastern	80	32	1200	800	1946	4.24

*Size and NPV for 50 years*



# Mintails AMD Solution

Table 1  
Mintails AMD Treatment Offering

	Immediate (1 month)	Short-Term (3 months)	Mid-Term (6 months)
<b>Discharge Specifications</b>			
Volume (m <sup>3</sup> /month)	360,000	360,000	1,200,000
pH	8.0	7.5	7.5
Iron (mg/l)	<1.0	<1.0	<1.0
Sulphate (mg/l)	2,500	2,500	2,500
WAD Cyanide (mg/l)	0.0	<1.0	<1.0
Operational Cost (R/m <sup>3</sup> )	R 6.06	R 4.12	R 3.09
Capital Cost	R 0.00	R 1,000,000.00	R 15,000,000.00

# Ten Cardinal Values of Stewardship

- **Respect** – Even if we are “Masters and Owners”
- **Reduce** – Improve productive efficiency
- **Reuse** – Water is a flux (infinity)
- **Recycle** – Different quality at different cost
- **Renew** – Nature is our ally so assist it
- **Regenerate** – Where ecosystems have collapsed
- **Reinvigorate** – Where ecological functioning still exists
- **Restore** – Aquatic ecosystems provide useful services
- **Revitalize** – Water retains a memory
- **Repair** – Maintenance is a good thing



# Thank You

AMD mitigation and land reclamation are currently major drivers of water stewardship in the mining sector



Image of decanting AMD © Anthony Turton 2012