Sitting on the Horns of a Dilemma: SA and its Strategic Water Supply

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Layout of Presentation

- What is the current status of water in South Africa?
  - The **Thunder Graph**
- What we need to do about it to ensure stable economic growth in future?
  - Water as a **Stock** vs **Flux** debate.
- The resultant **Horns of a Dilemma.**
- Conclusion

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South Africa's Resource Constraints to Development are ...

- **Energy** ...
- **Water** ...
- Our energy constraint is defined by water.
- The **sulphur cycle** is of particular importance.
- In a future scenario where we burn more coal, but possibly with less precipitation, what will happen to **acid rain**?
- **Water quality** is a national problem ...

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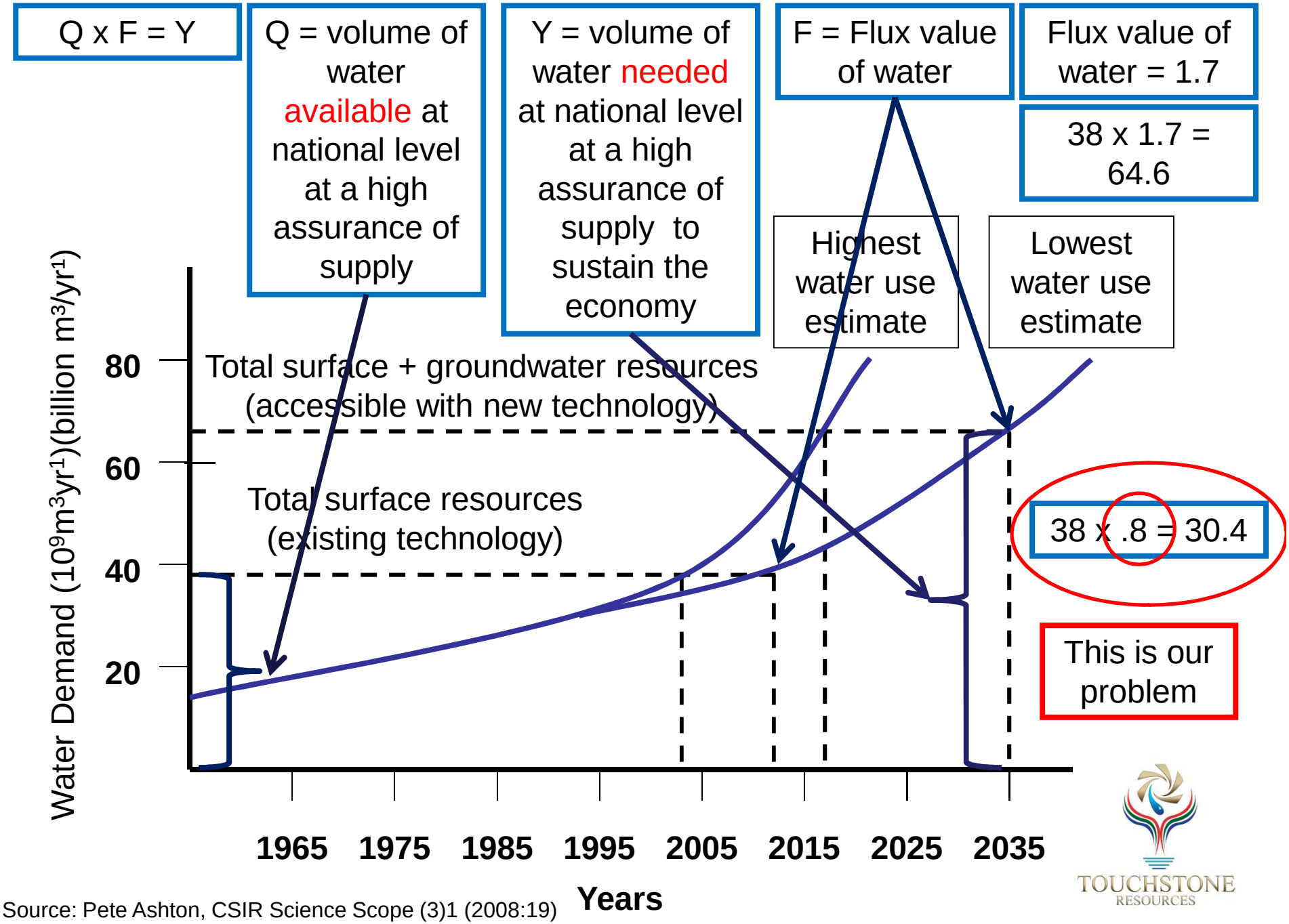
What is the Current Status of Water in South Africa?

- 1966 **Commission of Enquiry into Water Matters** made some startling predictions.
- This Commission elevated the management of water to a **national strategic level**.
- This was mostly ignored when the **National Water Act** was promulgated.
- Today we face significant water constraints to our national economic growth.
- DWAF & DEAT are both being **restructured** but indications are that this might be beneficial.
- Restructuring often has unintended consequences.



Source: Pete Ashton, CSIR Science Scope (3)1 (2008:19)

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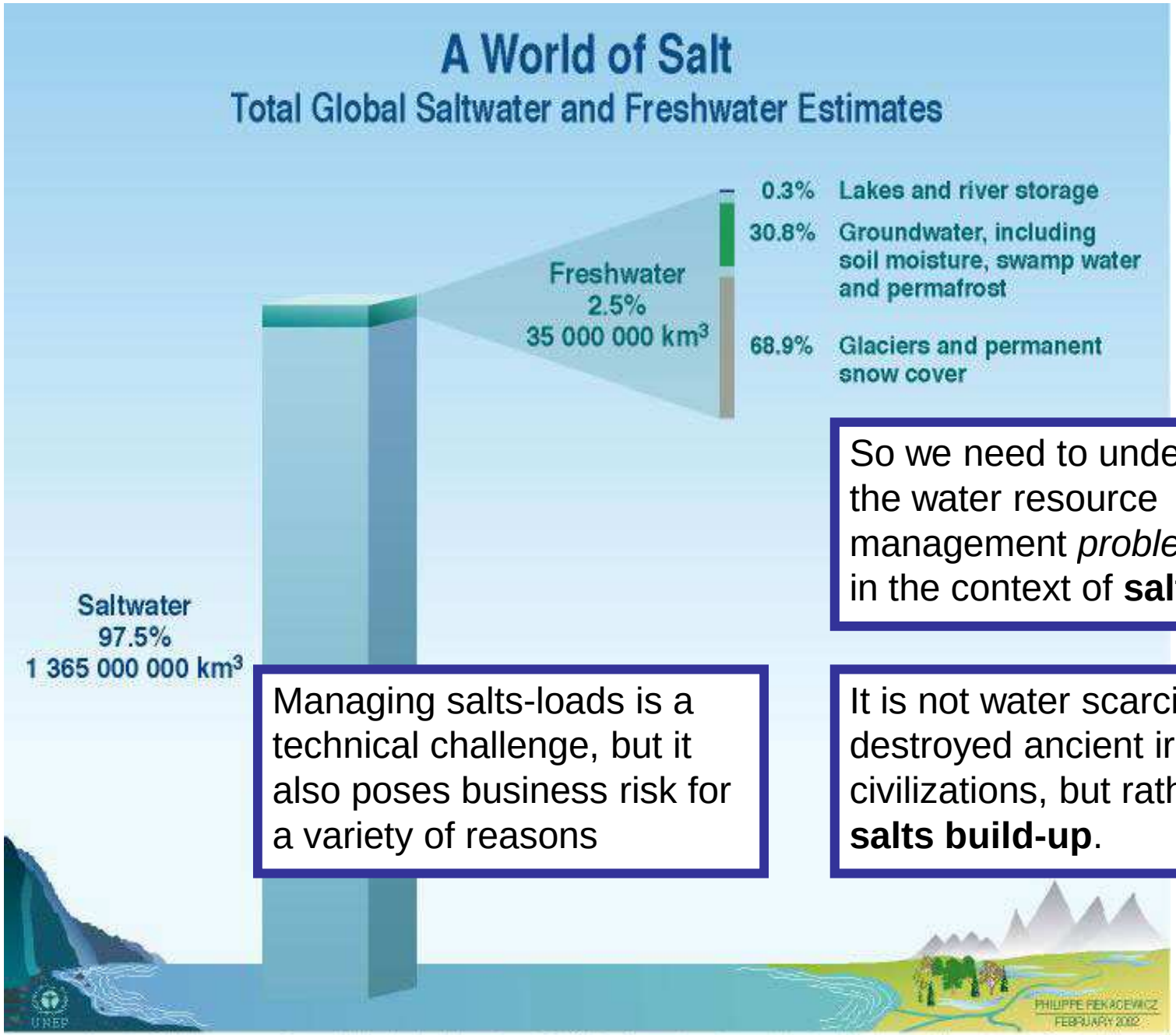

So we need to understand the water resource management *problematique* in the context of **salt loads**.

Managing salts-loads is a technical challenge, but it also poses business risk for a variety of reasons

It is not water scarcity that destroyed ancient irrigation civilizations, but rather a **salts build-up**.

Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999.

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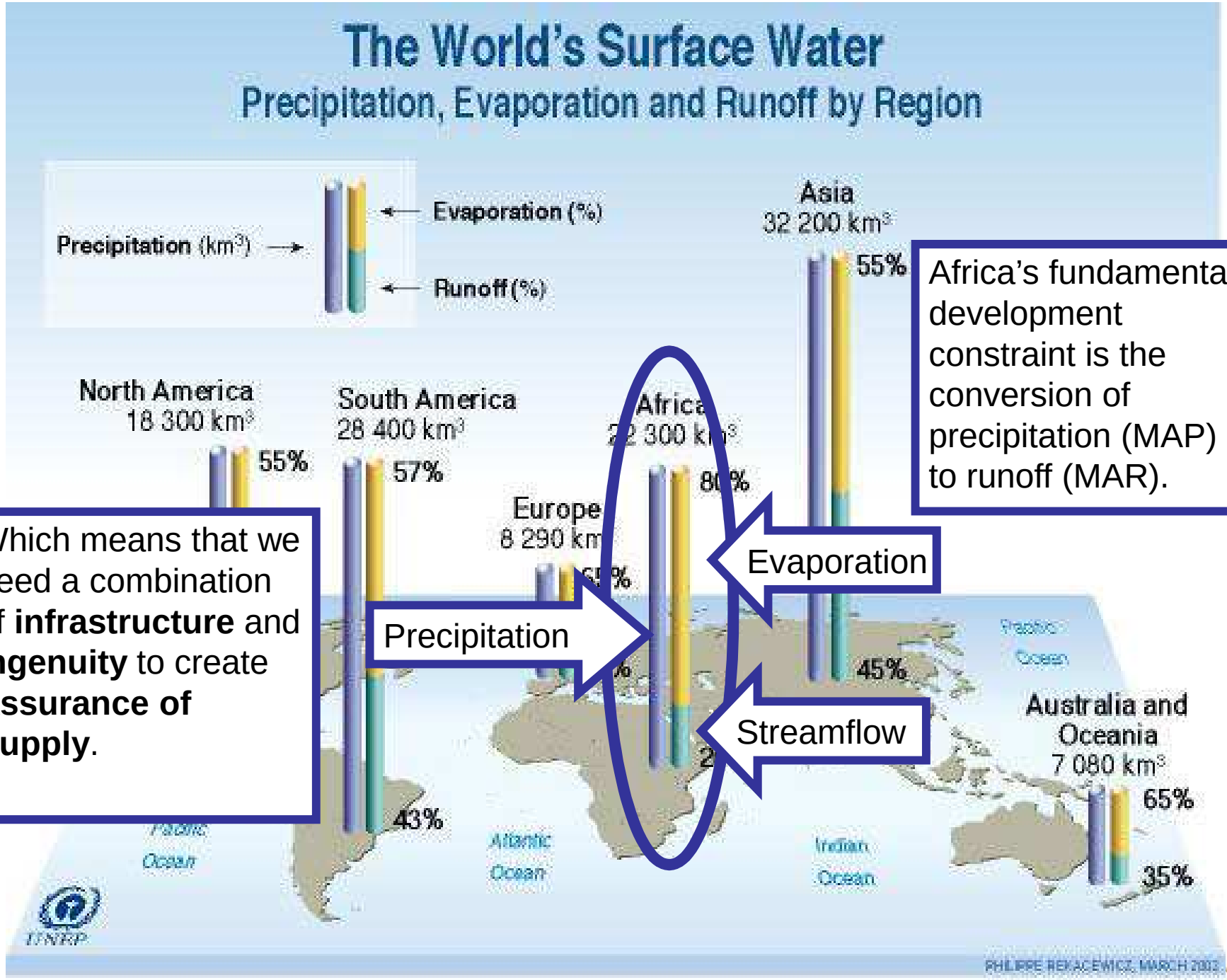


Africa's fundamental development constraint is the conversion of precipitation (MAP) to runoff (MAR).

Which means that we need a combination of **infrastructure** and **ingenuity** to create **Assurance of Supply**.

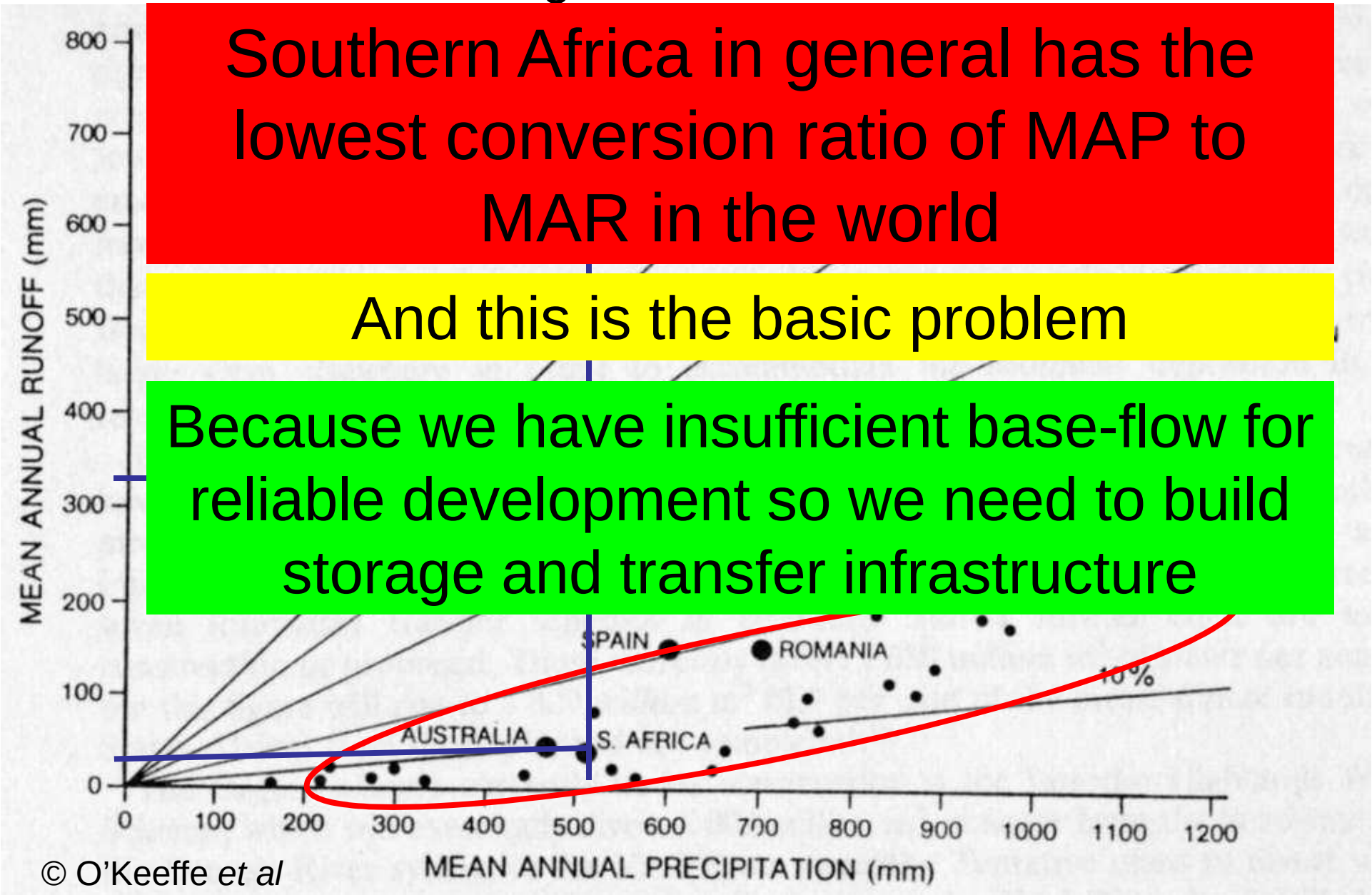
Evaporation

Precipitation

Streamflow

Source: Peter H. Gleick, *Water in Crisis*, New York Oxford University Press, 1993.

What is Southern Africa's Fundamental Water Resource Management Problem?

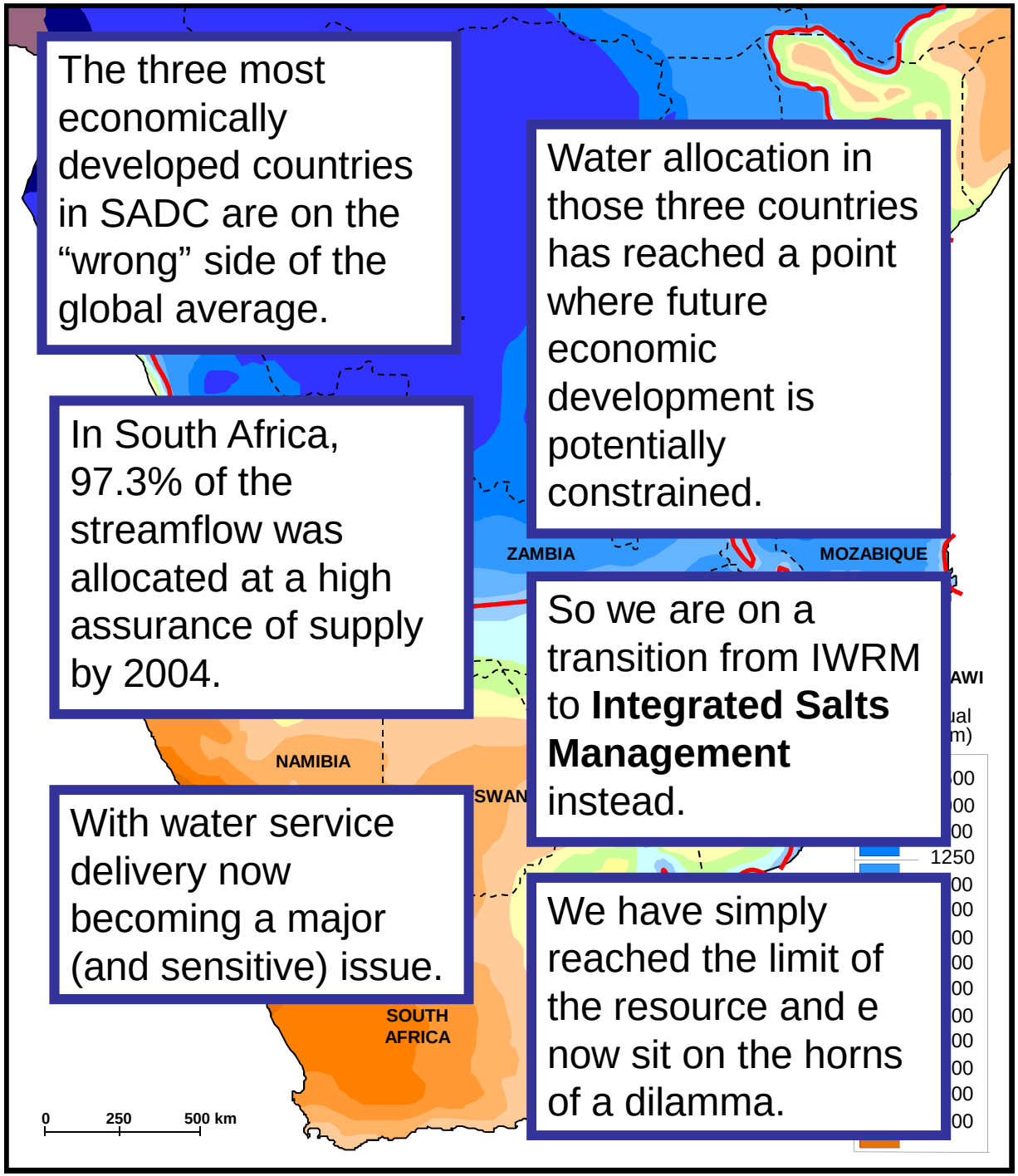


MEAN ANNUAL RAINFALL

= 860 mm isohyet

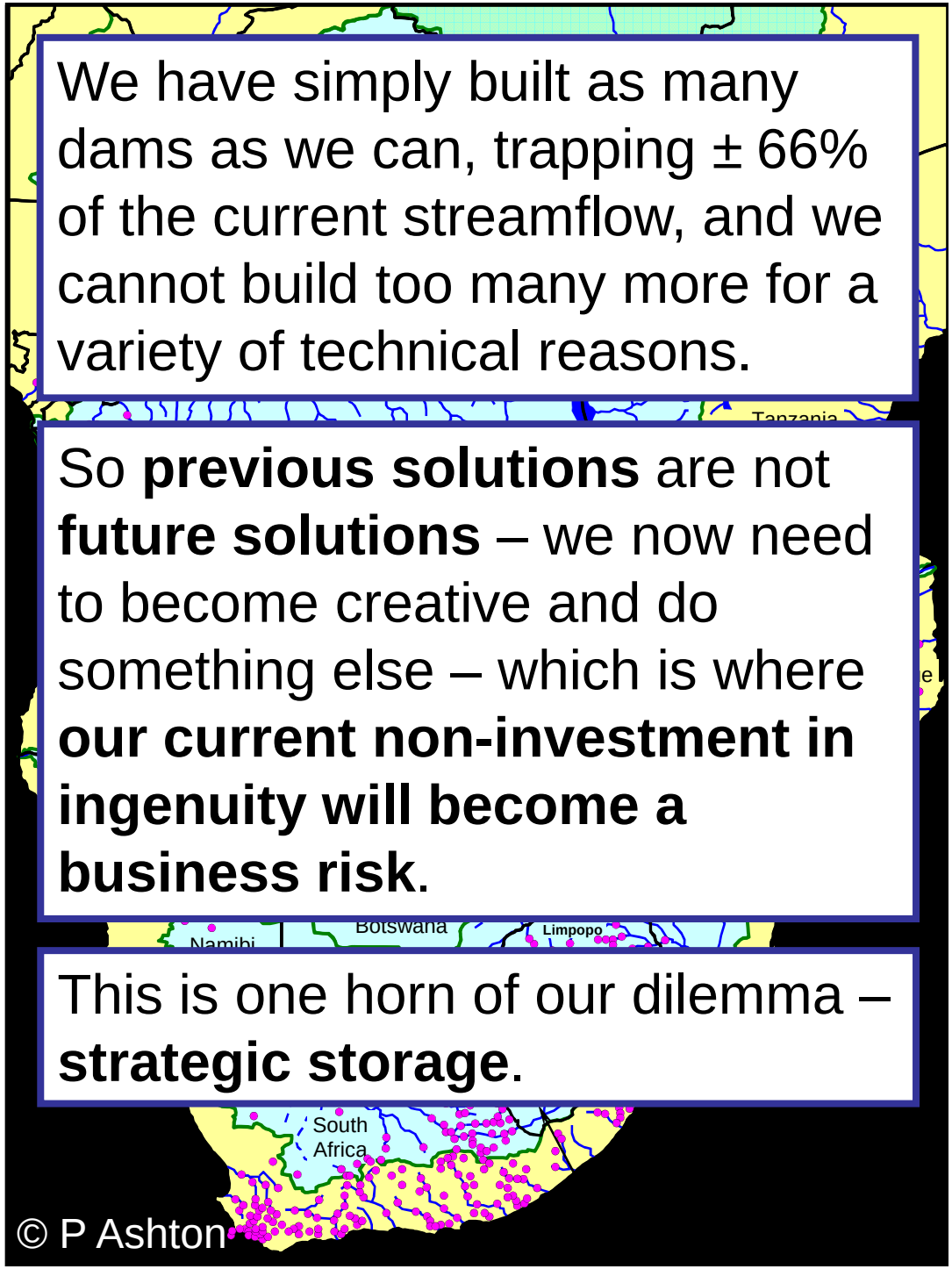
= World average rainfall

SADC Average Annual Rainfall = 948 mm



Dams and hydraulic inf'structure in Southern Africa

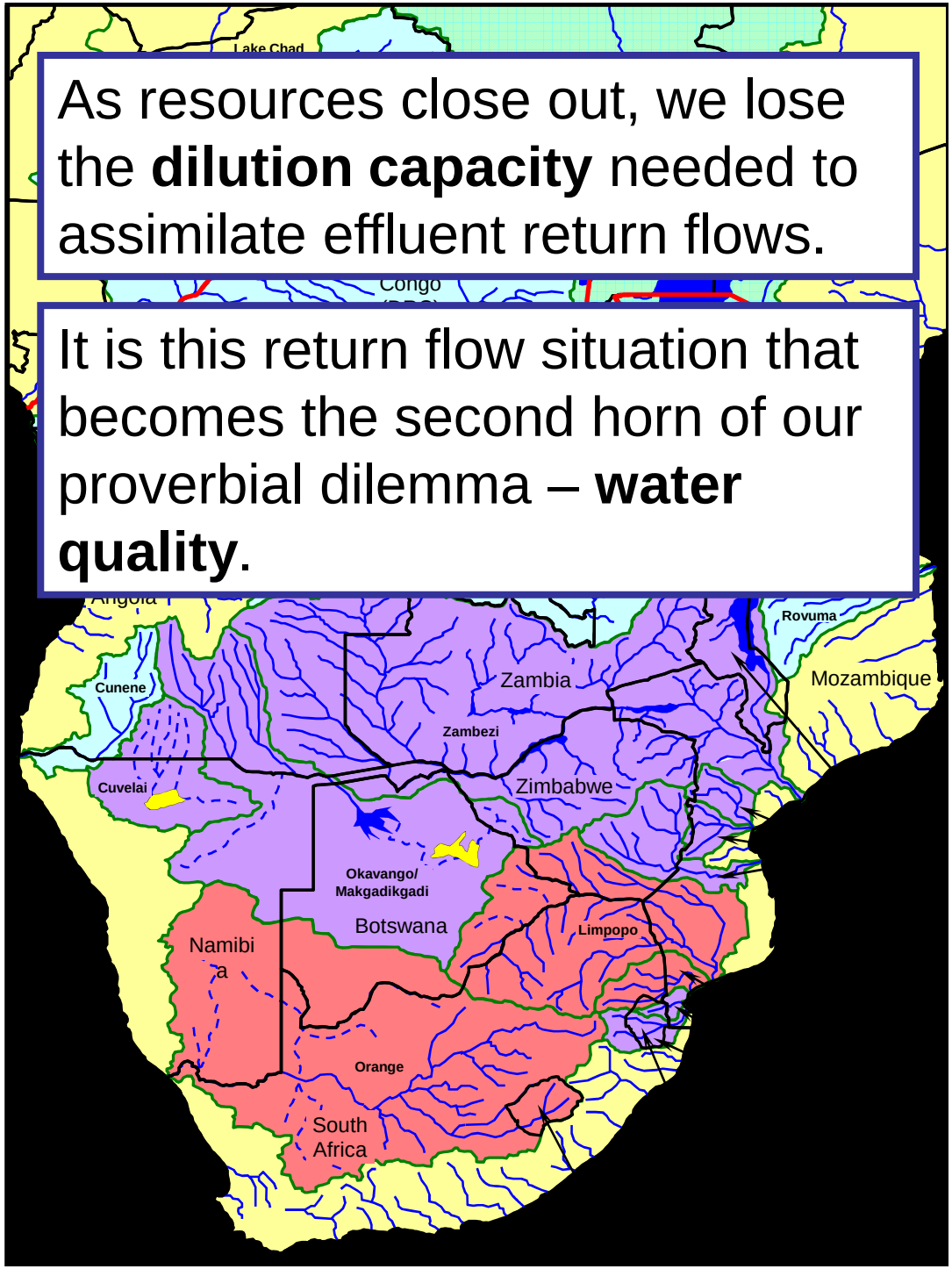
South Africa and Zimbabwe are listed amongst the top twenty countries in the world in terms of the numbers of dams built (WCD 2000)



Heavily Utilized Water Resources in Southern Africa

As resources close out, we lose the **dilution capacity** needed to assimilate effluent return flows.

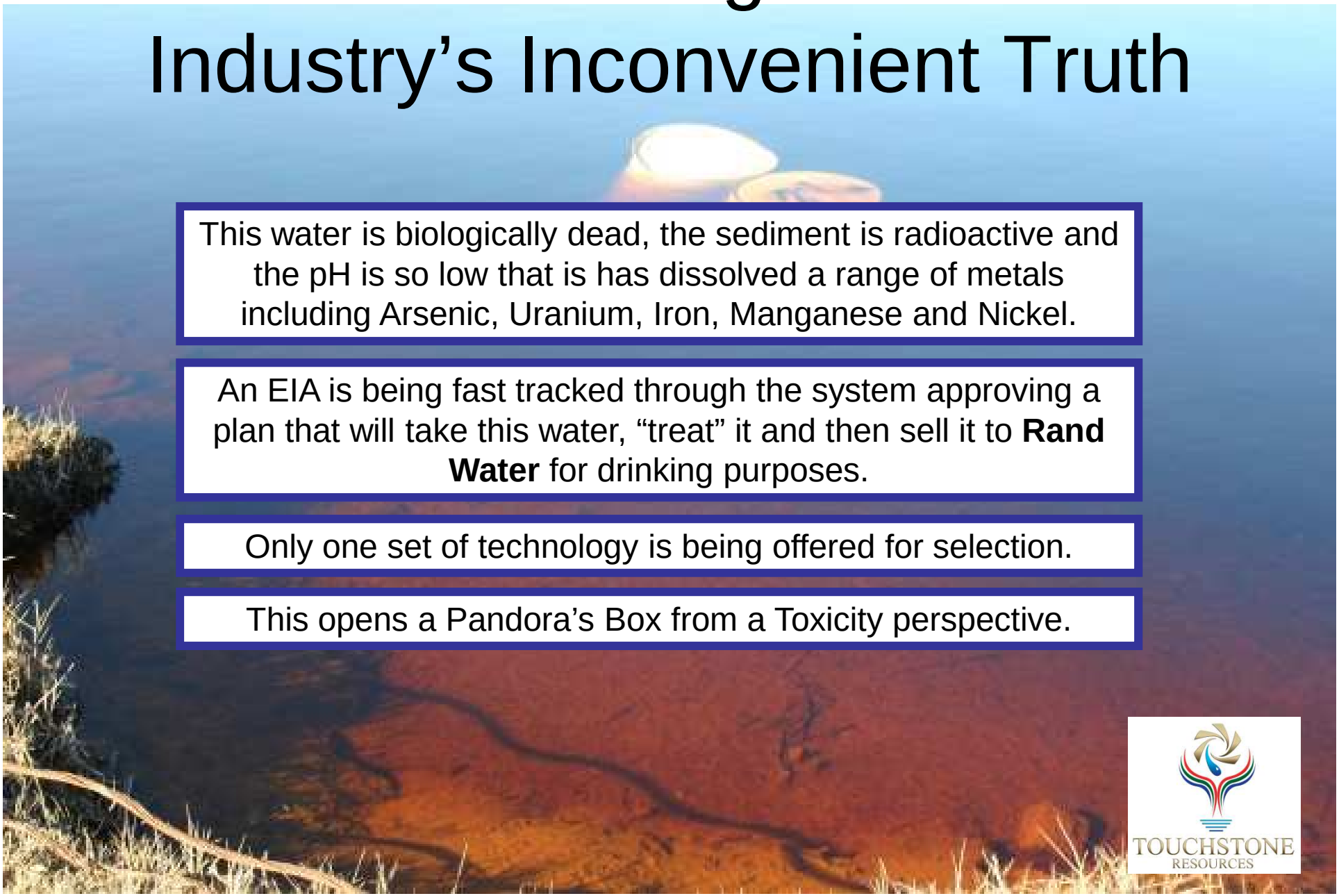
It is this return flow situation that becomes the second horn of our proverbial dilemma – **water quality**.



Water resources approaching "closure" – very little left to allocate for off-channel uses

Water resources under increased pressure – need to ensure closer co-operation with neighbouring states

Acid Mine Drainage – The Gold Industry's Inconvenient Truth



This water is biologically dead, the sediment is radioactive and the pH is so low that is has dissolved a range of metals including Arsenic, Uranium, Iron, Manganese and Nickel.

An EIA is being fast tracked through the system approving a plan that will take this water, "treat" it and then sell it to **Rand Water** for drinking purposes.

Only one set of technology is being offered for selection.

This opens a Pandora's Box from a Toxicity perspective.

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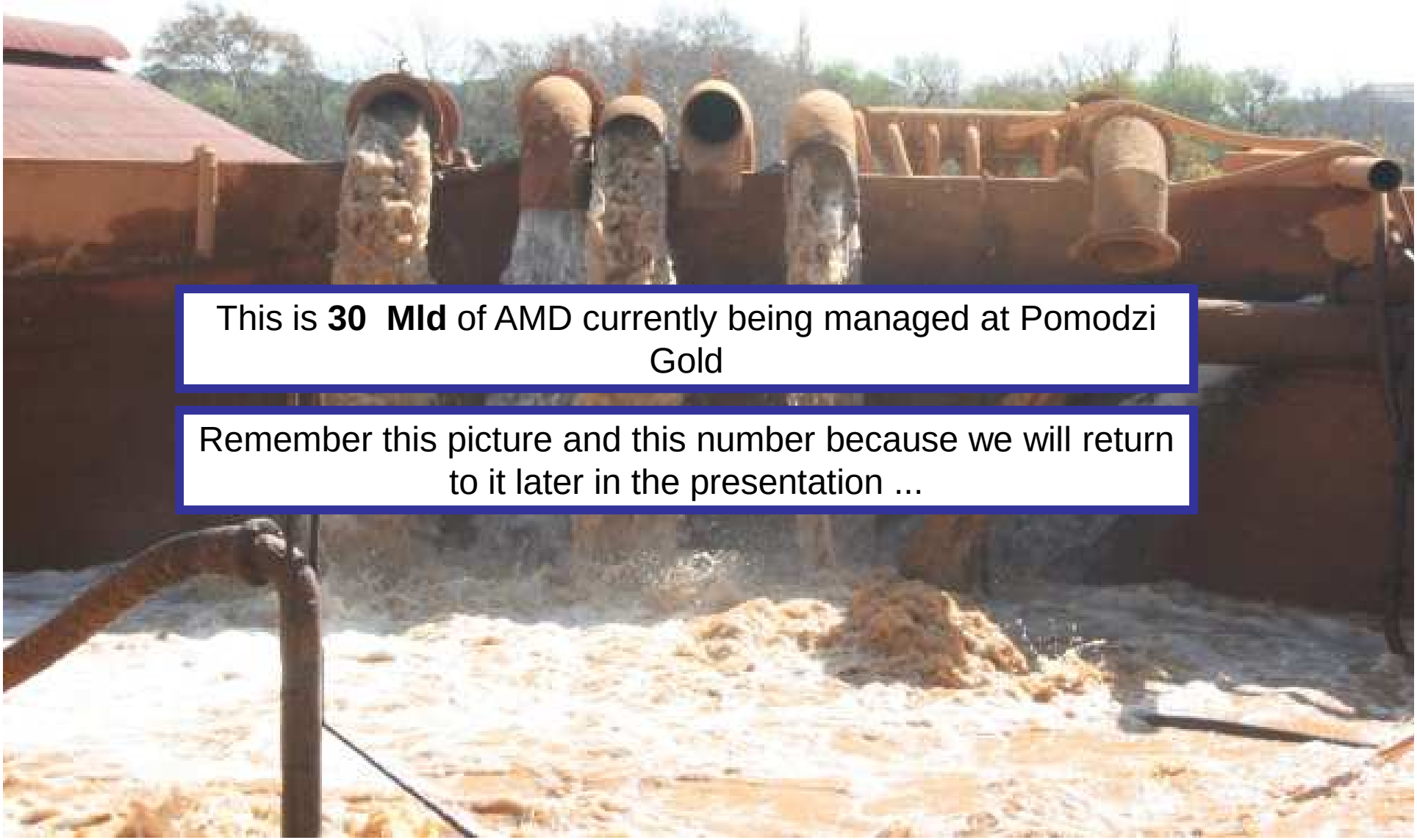
Is AMD Management Sustainable?



This is **30 Mld** of AMD currently being managed at Pomodzi Gold

Remember this picture and this number because we will return to it later in the presentation ...

Image courtesy of Elise Tempelhoff of Beeld

This is where it started – at Harmony GM in Krugersdorp from an old ventilation shaft

This is about **20 Mld** of uncontrolled decant

This is what stood between the uncontrolled decant and the **Cradle of Humankind**

Gold-based AMD – some Facts

- The current **Western Basin** decant is ± **30 Mld**.
- This has a pH of ± 3 and a salts load of ± 2,000 mg/l, some of which is **radioactive**.
- This is equivalent to 140 tons of salt or the weight of 70 medium-sized cars.
- The total decant potential of the Witwatersrand Goldfields is ± **350 Mld**.
- **140 Mld** is expected to decant in the next 2 yrs.
- The **Central Basin void** is filling at **60 Mld**.
- This is an **Inconvenient Truth**.

Gold-based AMD – More Facts

- Let us look a bit deeper...
- The current water demand for the entire **Rand Water** (RW) area of supply is ± **3,500 Mld**.
- The current water consumption for **Johannesburg Water** (JW) is ± **1,500 Mld**.
- The total **Wits decant** potential is ± **350 Mld**.
- This is **10%** of the total current consumption of **Rand Water** (which sustains **25% of the South African population** and ± **10%** of the economic output of Africa), or **¼ of Johannesburg's use**.
- Reflect on what this means ...

Coal-based AMD – More Facts

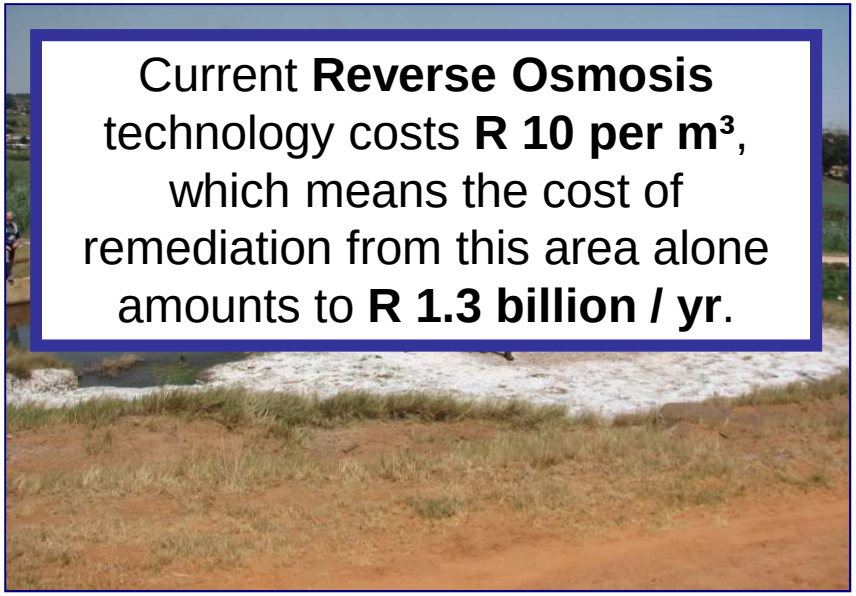
- Is much **larger than Gold-based AMD** ...
- We do not have an accurate number yet because it is so sensitive, but we know it is larger for a number of reasons.
- The **Olifants Basin** alone has **R 28 Bn** currently at risk from lost exports to the EU.
- This jeopardizes thousands of jobs.
- Tourism is being affected in KNP.
- This is cascading down to Mozambique where human health risks are not quantified.
- Cost of remediation is about **R 1.3 Billion / yr**.

This is the coal mining industry's **Inconvenient Truth** – salts loading from **Acid Mine Drainage** – in this case into the **Olifants River Basin**.

The unintended consequence of the **Sulphur Cycle**.

This is a part of the **true cost** of our "cheap" energy.

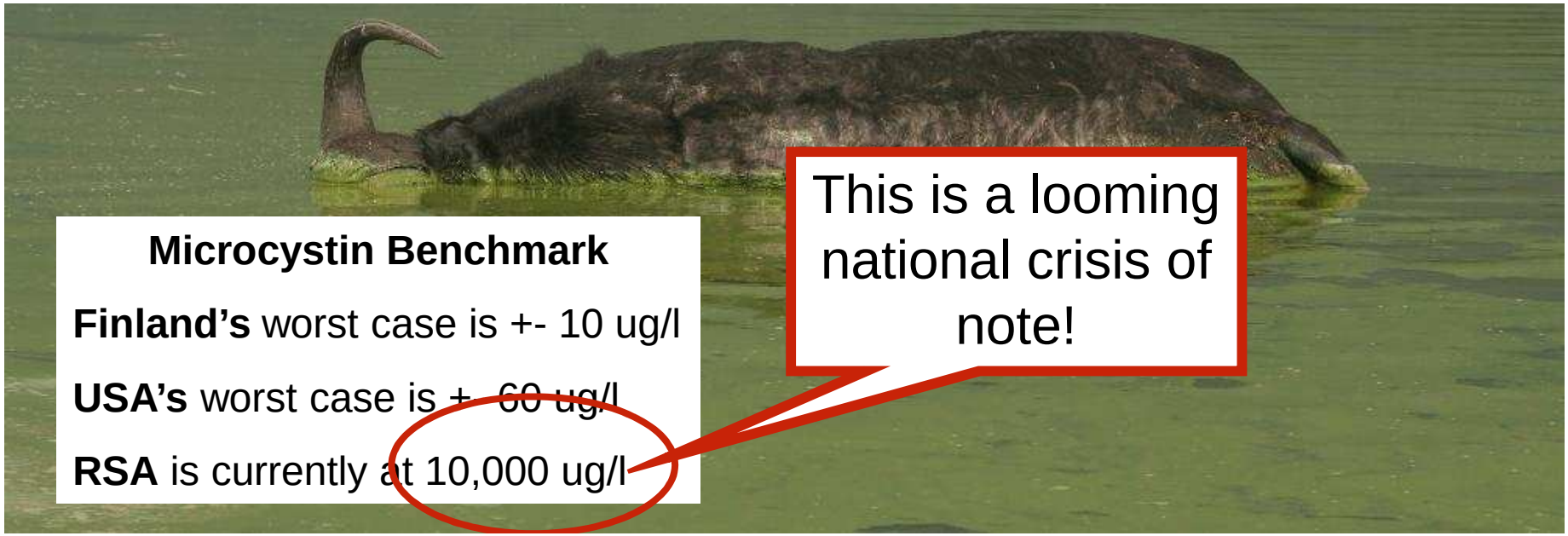
Current **Reverse Osmosis** technology costs **R 10 per m³**, which means the cost of remediation from this area alone amounts to **R 1.3 billion / yr**.



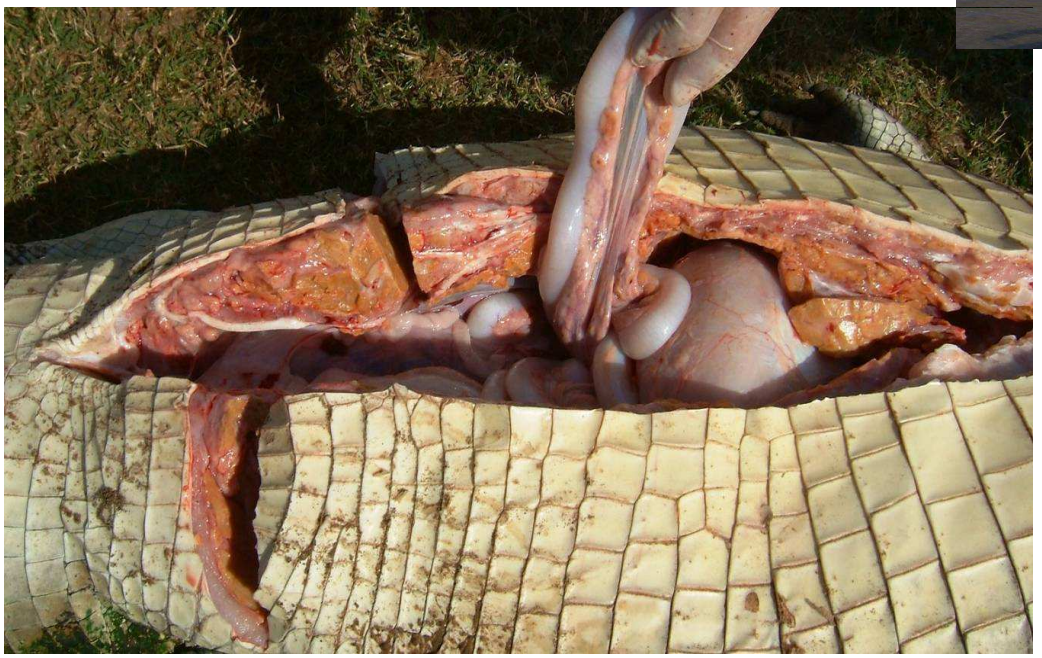
All images courtesy of Dr. Jan Myburgh of Pretoria University

Microcystin Contamination

The biochemistry of Microcystin was described by the CSIR in 1984 – it is chemically similar to Rinkhals venom – but no significant new research is being done on mitigation

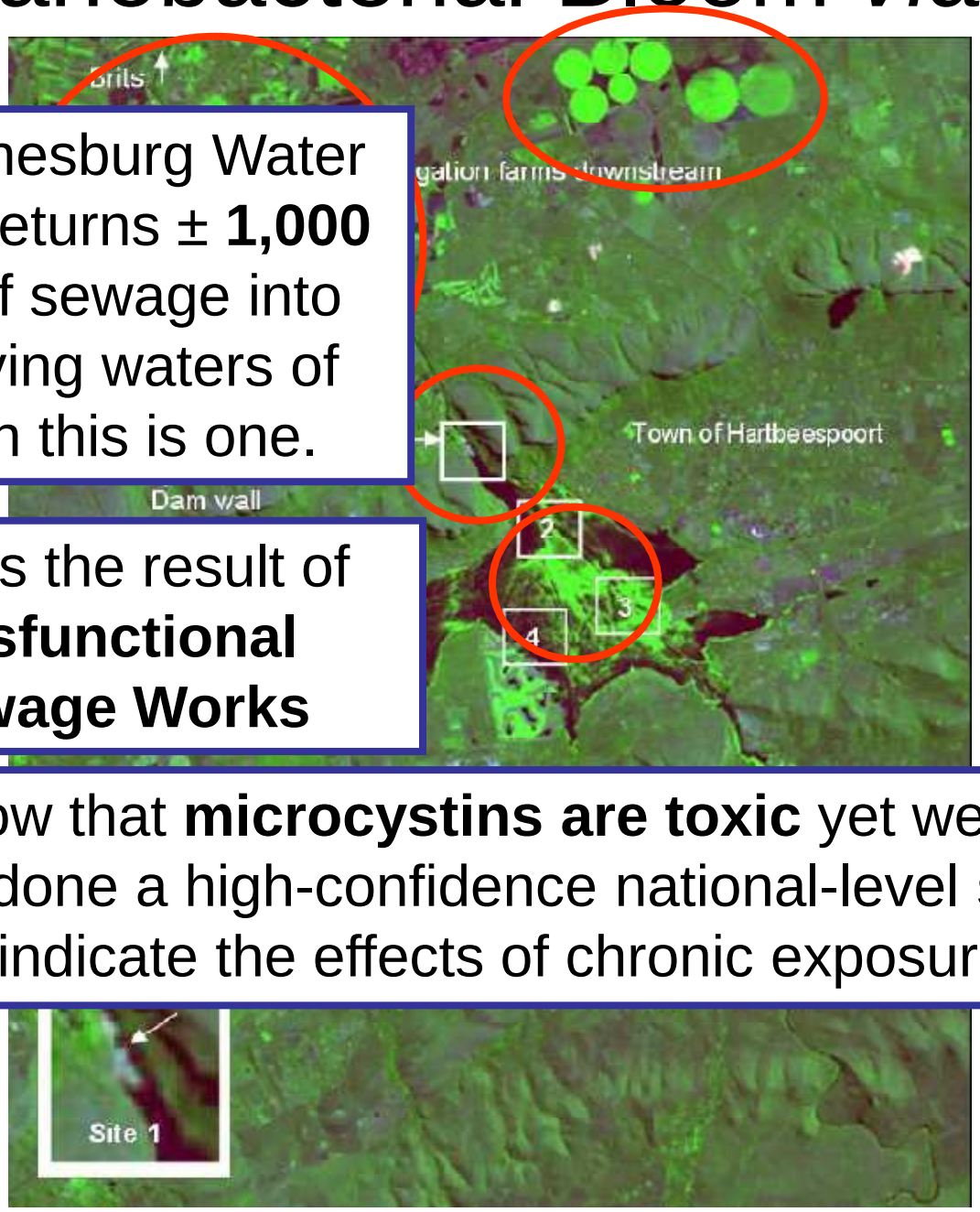


Pansteatitis – an Unfortunate Truth



All images courtesy of Dr. Jan Myburgh of Pretoria University

Cyanobacterial Bloom *via* Satellite



Johannesburg Water alone returns ± **1,000 Mld** of sewage into receiving waters of which this is one.

This is the result of **Dysfunctional Sewage Works**

Hartebeespoort Dam is highly **eutrophic**

Microcystins accumulate at take-off points

To irrigate crops

We know that **microcystins are toxic** yet we have never done a high-confidence national-level study to indicate the effects of chronic exposure

Source:
Oberholster *et al.*, 2008

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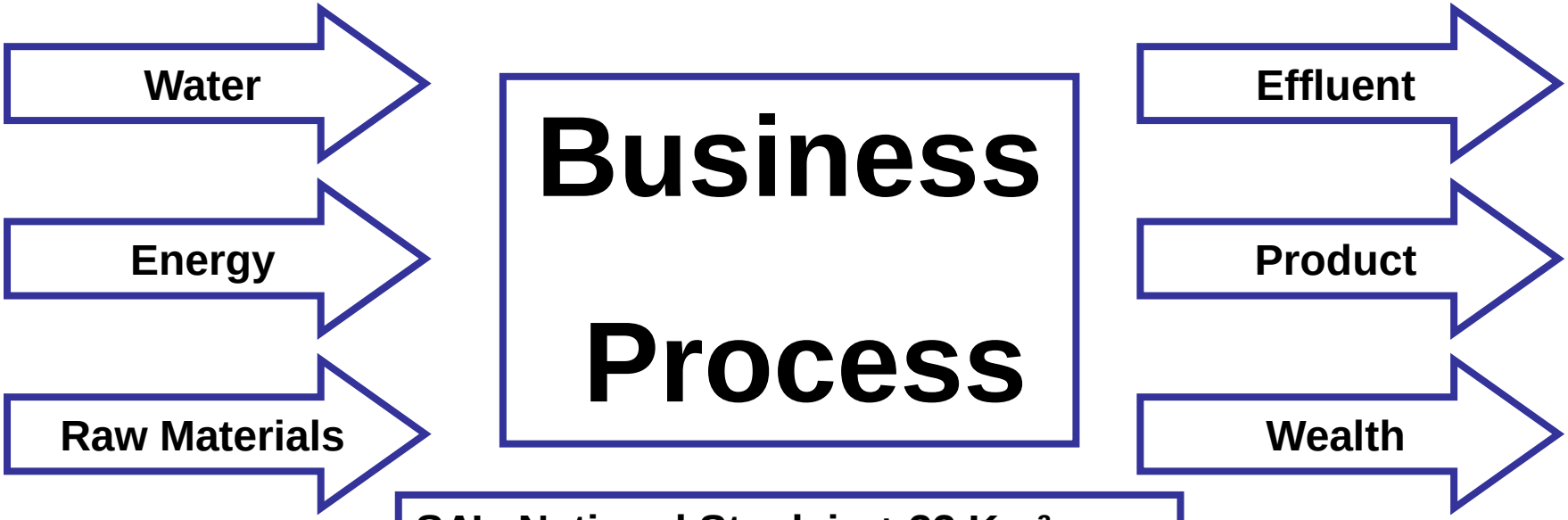
Water as a Stock

So water as a stock is the product of **linear thinking** in which the **finite resource** is used and then discarded.



SA's National Stock is ± 33 Km³, which is 66% of the MAR (50 Km³).

In this model water is subjected to a **linear process** degrading in utility as it passes through the "black box".

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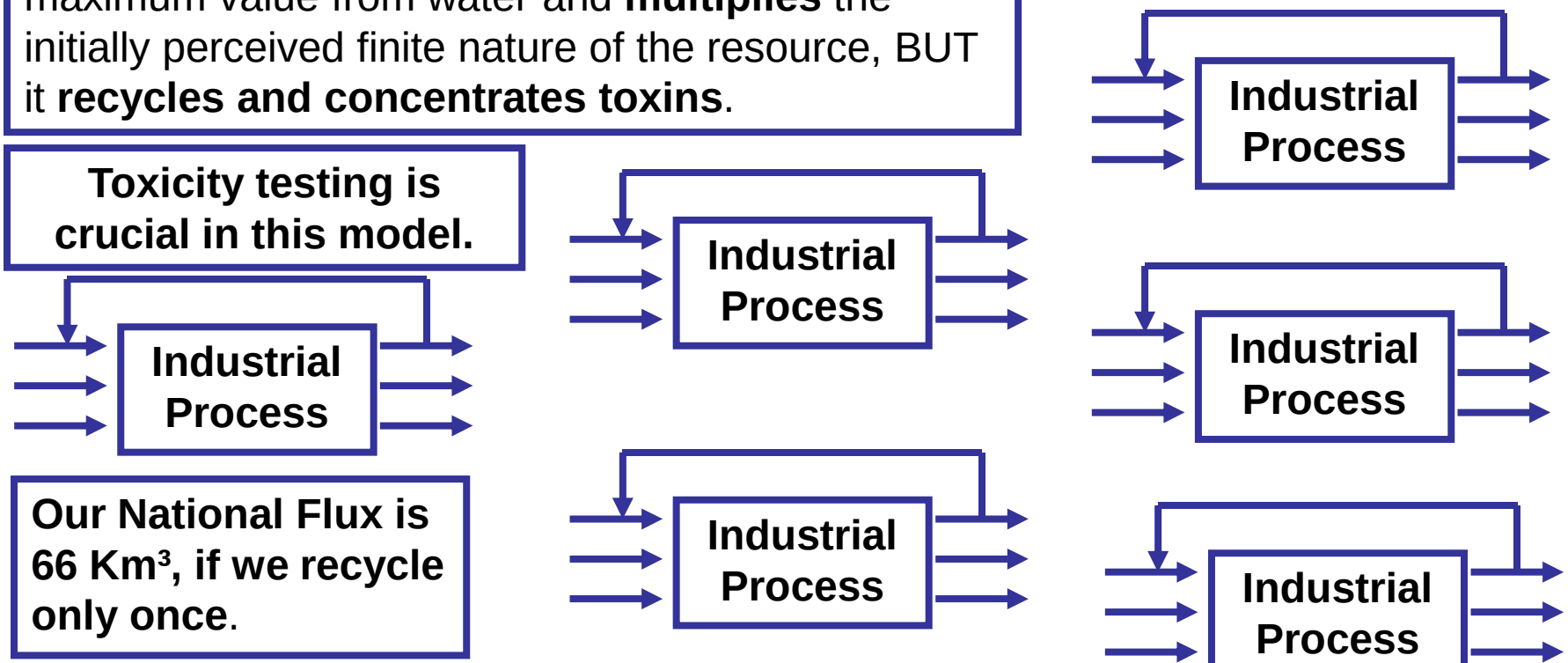
Water as a Flux

In this model a **network of processes** unlocks the maximum value from water and **multiplies** the initially perceived finite nature of the resource, BUT it **recycles and concentrates toxins**.

Toxicity testing is crucial in this model.

Our National Flux is 66 Km³, if we recycle only once.



So the **water as a flux paradigm** is the product of network thinking in which it is **cascaded** around the economy with the number of new process cycles limited only by our **ingenuity** and **technological capacity** as a nation.

Key Water Issues

- **The South African economy is fundamentally water constrained**.
- We have reached a new threshold and are now moving into an unknown era.
- This dilemma has two horns:
  - **Quantity** (strategic storage)
  - **Quality** (AMD, EDC's and Eutrophication)
- We need new **partnerships** between **Government**, **Organized Business, Universities** and the **National Science Councils** to develop and resource a fresh **Strategic Vision.**

Conclusion

- **Water resource management** will need a **new strategic paradigm** if we are to grow our economy.
- **National Water Quality Science, Technology and Policy Support Program**
  - National Council of Provinces has already accepted this.
- **Q x F = Y (38 x 2 = 76)**
- Become part of the **Solution**.
- Yes we can!

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Yes, We Can!
Q x F = Y
F = 1.7 by 2035
WAR PRODUCTION
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Thank You