Why monitor water?

- Key indicator of rehab effectiveness
- Quantitative data for assessment of above
- Monitor and mitigate – avoid surprises
- Revegetation planning and management
- Compliance
- Current and future stakeholders
Why monitor water in rehab?
Why are we measuring ?

- **Key** indicator for rehab methods:
  - Others – veg composition, erosion, plant cover etc.
- Water holding capacity (WHC) in capping soil ✓
- Infiltration – volumes & quality – to where ? ✓
- Mobilisation (e.g. metals/metalloids) ❌
- Deep drainage / groundwater ❌
- Surface runoff volumes & quality – optimal ✓
Essential to calculate water balances

- Good quality automatic rain gauge and/or irrigation monitoring equipment
  - Logging and data storage capacity
  - Precipitation
  - Intensity and duration
- Manual rain gauges across the area if rehab area is large.
- Located near rehab – not 20km away!
Water Holding Capacity

- Soil moisture and WHC - primary determinant in vegetation growth and persistence
  - Rainfall / irrigation
  - Soil – types, drying tests to determine moisture
  - Soil probes
    - Manual, neutron, capacitance, tensiometer, gypsum blocks
  - Boots in the field and auger / spade / hands.
Infiltration rates

• Is water being held in capping topsoil and utilised efficiently for rehab vegetation?
• How much into lower zones or drainage through sides or toes of slopes.
  ▪ Lysimeter
  ▪ Multi stage piezometer cluster
  ▪ Measurement of drainage e.g. interception trenches
  ▪ Observation
Is there ‘leakage’ of contaminants to groundwater?

How do we measure?

- Water balance
- Lysimeters / piezo clusters
- Surrounding piezo network
- Leachate pumping and sampling
- Tracers and modelling
- Mobilised metals, sulphur, pH
Evaporation

- Co-disposal, waste, dewatering storages
  - Bathymetric surveys, depth monitoring
• Seepage
  - Electromagnetic surveys (e.g. EM38)
  - Magnetometric resistivity surveys
  - Dedicated monitoring piezo network
  - Specialised pumping and sampling
  - Monitor surrounding bores and springs
Surface water

• Suspension / transport
  ▪ Surface runoff, erosion, sediment mobilisation
  ▪ Soil types. Sodic soils around Moranbah are dispersive, Al and Fe levels may be elevated.
  ▪ Sample and analyse to determine load and physiochem properties
pH and acidity problems

• AMD, acidification or alkalisation
  ▪ Mine and spoil dumping plans and management
  ▪ Sulphur minerals
  ▪ Acid or alkaline waste waters

• Monitoring
  ▪ PAF, NAG and ARD monitoring where sulphitic material
  ▪ Sample and measure pH, alkalinity, PAF, NAG.
  ▪ Observation of other monitoring sites – streams, GW
What are we monitoring?

- Basic physiochem, TSS, pH alkalinity
- Metals/metalloids – exacerbated if acidification and increased vertical drainage
- Salts
- Organic contaminants
- Site specific contaminants e.g. cyanide
- Bio-health – aquatic ecosystems as part of whole environment.
• Other – What has been chucked into your co-disposal site or spoil ??
  ▪ PCB from faulty electrical transformer
  ▪ Waste – e.g. oils and lubricants
  ▪ Chemicals – triazines, cleaning, drilling fluids

  ▪ Or………SURPRISE !!
For discussion ....

- Prescriptive monitoring
- Site specific programs
- ANZECC methodology
- ‘Flat lining’

- Variable intensity of monitoring
Water monitoring objectives

• Compliance – Government
• Meeting stakeholder expectations – landholders, communities.
• Building good science
• Sharing knowledge – EIANZ
• Minimising environmental impacts
• Modelling of contaminants - movement / plumes

• That’s what WE see as objectives
Just tick a box at the lowest cost!!
A light moment 😊
Stakeholders

Life of mine
After the party is over .......
“It’s not my problem – I’ll be outta here in three years!”

• Good science should prevail
• $$ are important but should not dictate the program

• As scientists we have a responsibility to gather reliable information that all stakeholders (apart from the wombat) can utilise to make informed decisions, and minimise the voodoo.
Thought for today

If you can’t explain it **simply**, you don’t understand it well enough.

– Albert Einstein