

Rehabilitation & Water quality

EIANZ

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4T CONSULTANTS



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 

Input measurement



- 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



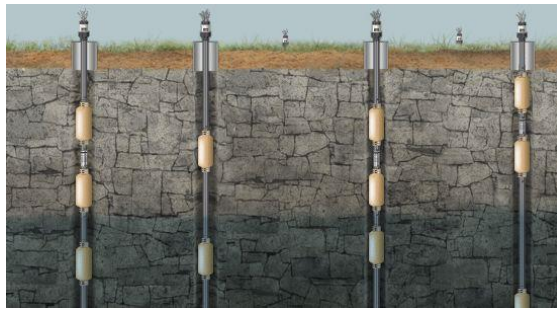
- Is water being held in capping topsoil and utilised efficiently for rehab vegetation ?
- How much into lower zones or drainage through sides or toes of slopes.
 - Lysimeter
 - Multi stage piezometer cluster
 - Measurement of drainage e.g. interception trenches
 - Observation

Deep drainage



- 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

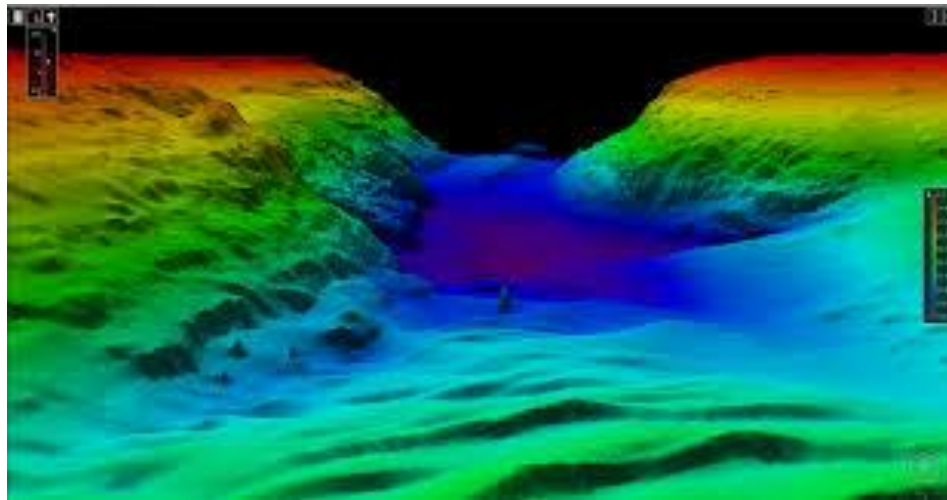
Equipment



Evaporation



- Co-disposal, waste, dewatering storages
 - Bathymetric surveys, depth monitoring

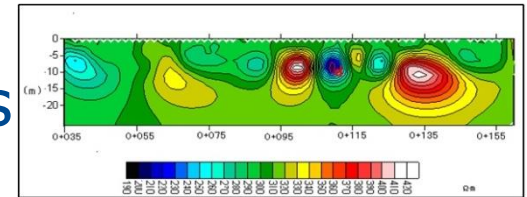
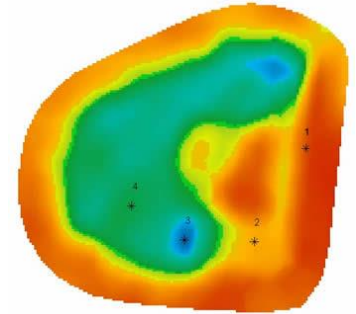


Seepage from storages



- 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.

What are we monitoring ?



- 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

Monitoring considerations



Accountant



Engineer



Procurement



Anonymous
remote person

Just tick a box at the lowest cost !!

A light moment 😊



Stakeholders



Life of mine

Other Stakeholders



After the party is over



Finally



“It’s not my problem – I’ll be outta here in three years !”

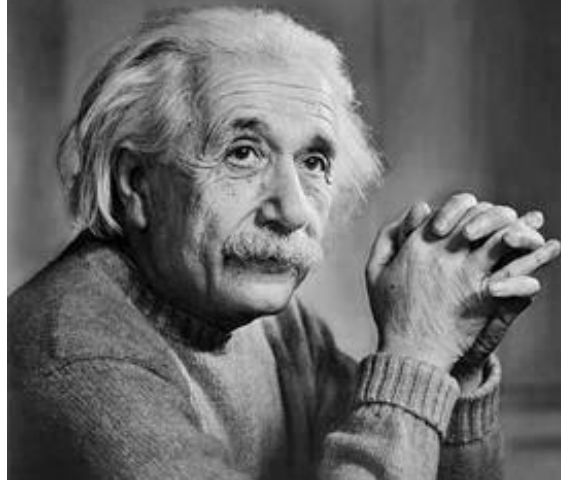
- Good science should prevail
- \$\$ are important but should not dictate the program
- As scientists we have a responsibility to gather reliable information that all stakeholders (apart from the wombat) can utilise to make informed decisions, and minimise the voodoo.

Thought for today



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

– Albert Einstein





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