



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

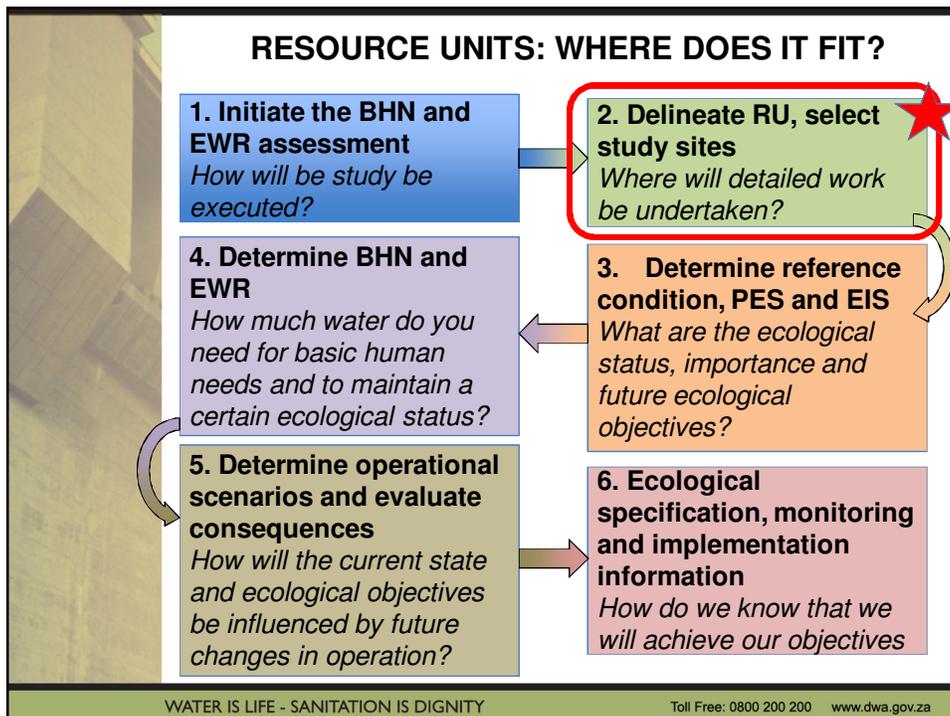
Determination of Ecological Water Requirements for Surface Water (Rivers, Estuaries and Wetlands) and Groundwater in the Lower Orange WMA: WP10974

23 June 2016

GROUNDWATER RESOURCE UNITS

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GROUNDWATER RESOURCE UNITS (GRUs)

Groundwater Regions: Based on groundwater occurrence, lithostratigraphy, physiography and climate (not hydrological units)

GRUs: Coincide with hydrological units, categorisation by homogenous geohydrological properties that can be managed as a unit due to similar properties and impacting on same resource

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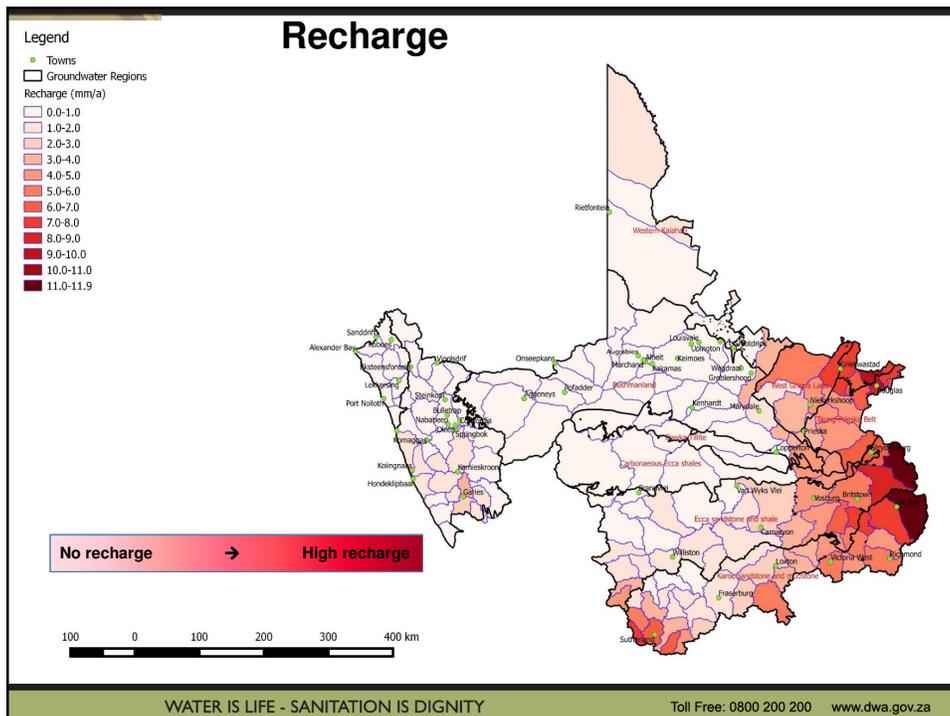
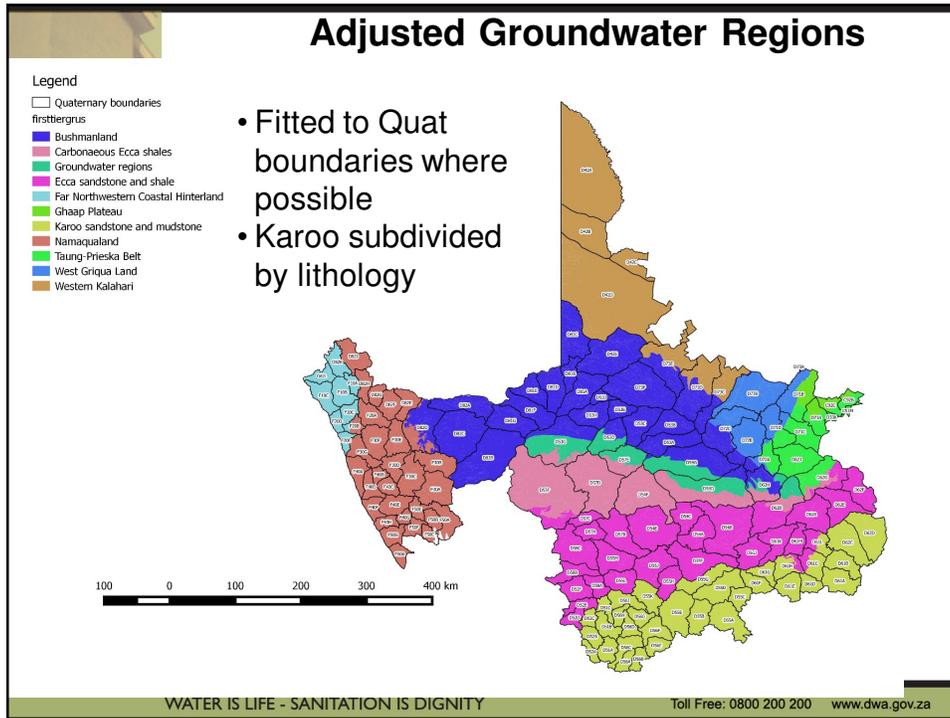
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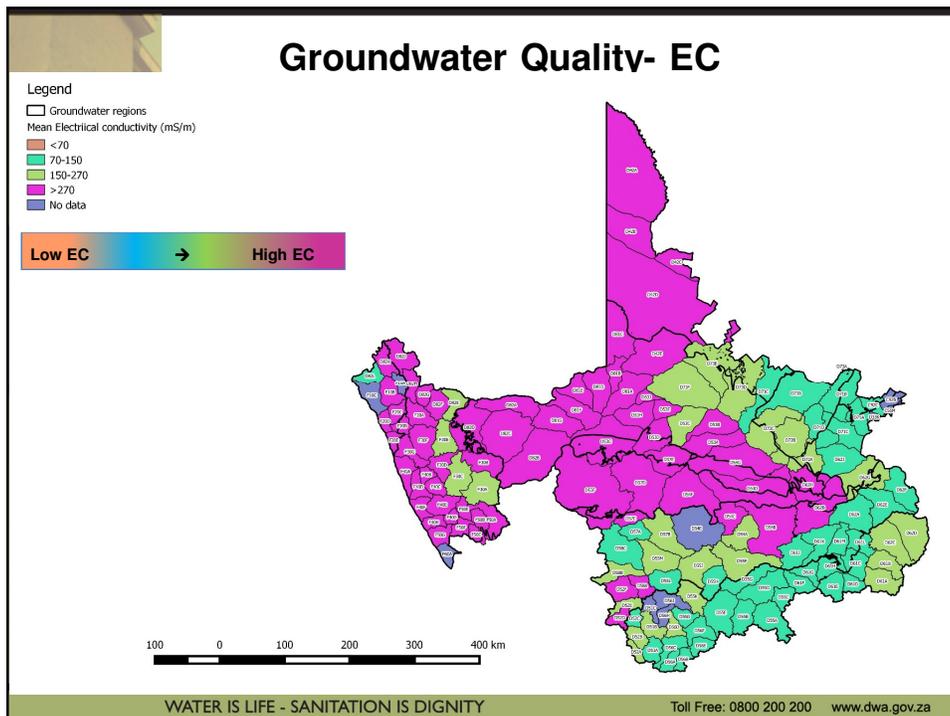
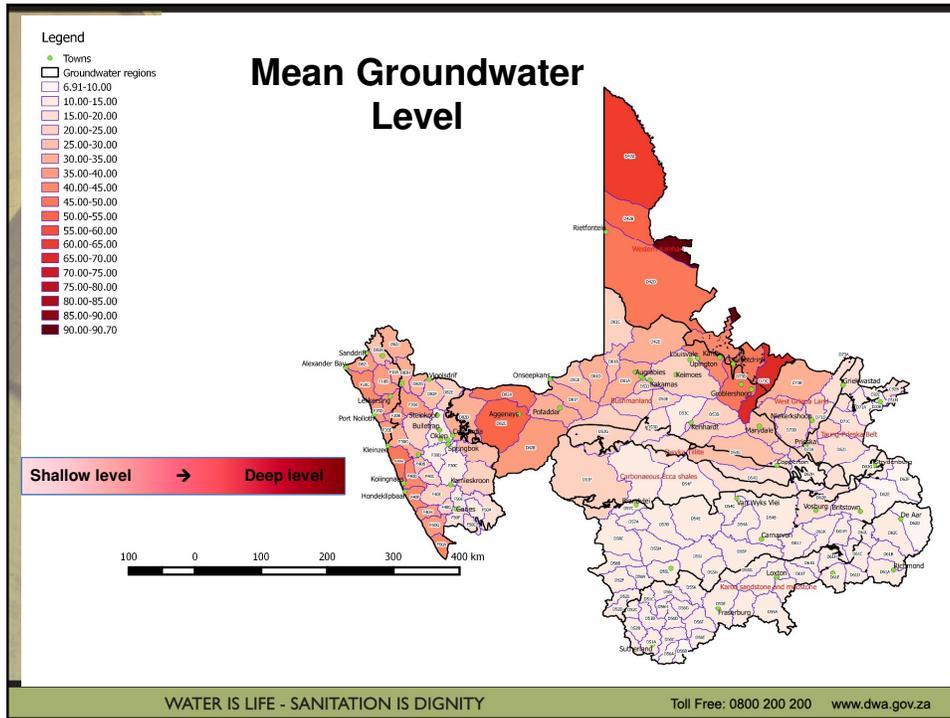
Approach for Delineation of GRUs – Factors considered

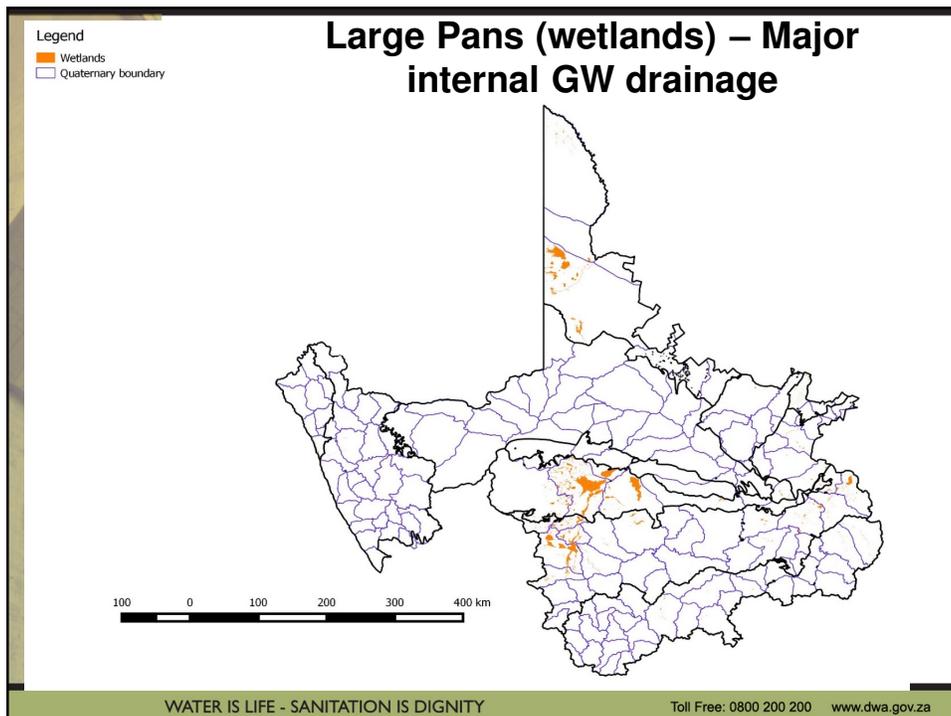
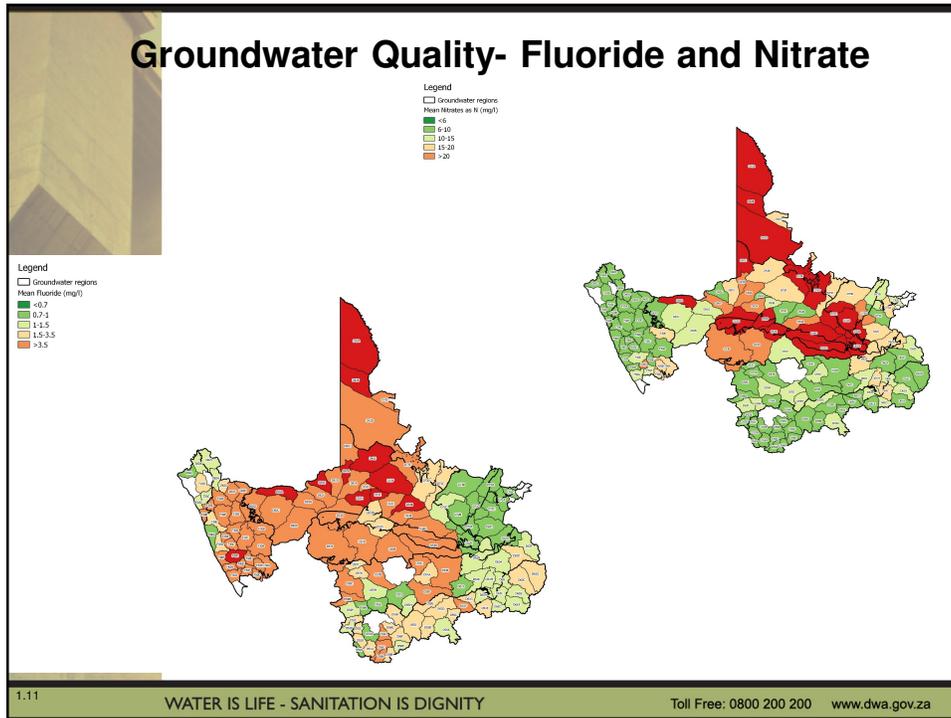
- TOPOGRAPHY: primary delineation by quaternary catchment boundary
- AQUIFER TYPE: Geological age, structure and lithology and groundwater regions
- INTERACTIONS: Identification of catchments with baseflow to surface water bodies (pans and baseflow)
- RECHARGE AND RESOURCES: Climate, recharge, and Harvest Potential
- ACCESSIBILITY: Groundwater levels
- FITNESS FOR USE: Groundwater quality
- INTERACTIONS: Groundwater dependent ecosystems and or wetlands
- DEPENDENCE: Groundwater use and stress

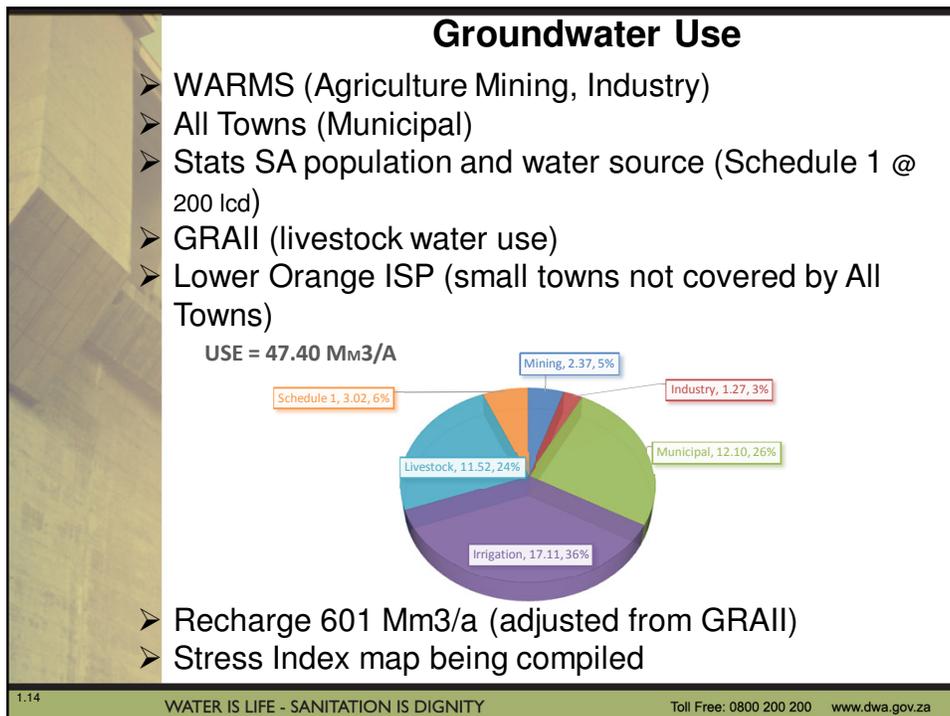
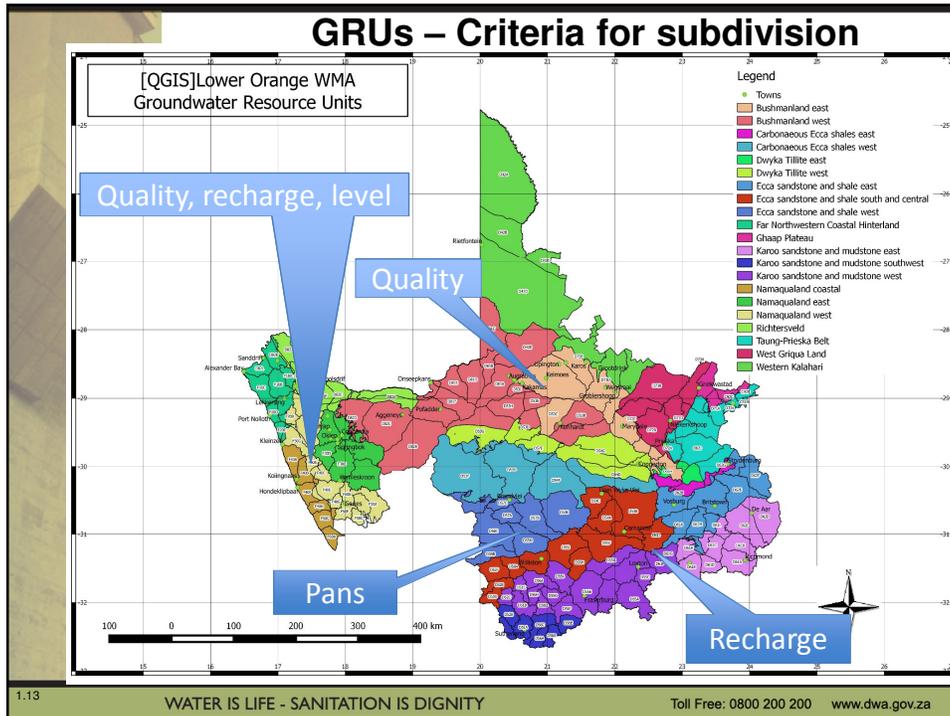
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Data Problems

- Resolution of use from WARMS, ISP and All Towns
SOLUTION: use All Towns, and where there are gaps use ISP and WARMS only for irrigation, industry and mining
- GRAII Recharge data has zero values & wide scatter, especially in Bushmanland. Recharge is critical for the GW component of the Reserve and the stress index

Bushmanland

Far northwest coastal

SOLUTION: Remove zeros, establish correlation by GW region. If recharge < 1 mm/a use correlation. Calibrate with sparse point data eg. Adams et al.

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Main GW dependent towns and fracking

Legend

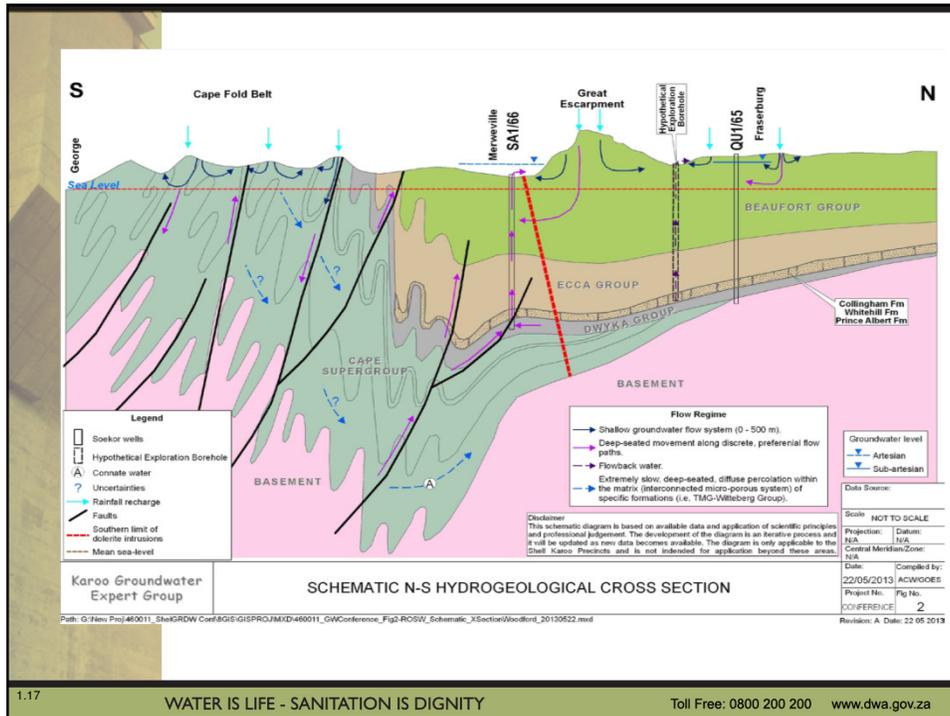
Groundwater dependent Communities Use (Mn3/a):

- 0.016 - 0.055
- 0.055 - 0.150
- 0.150 - 0.248
- 0.248 - 0.349
- 0.349 - 0.445
- 0.445 - 0.500
- 0.500 - 0.722
- 0.722 - 2.798

GRU

- Bushmanland east
- Bushmanland west
- Carbonaceous Ecca shales east
- Carbonaceous Ecca shales west
- Dwyka Tillite east
- Dwyka Tillite west
- Ecca sandstone and shale east
- Ecca sandstone and shale south and central
- Ecca sandstone and shale west
- Far Northwestern Coastal Hinterland
- Ghaap Plateau
- Karoo sandstone and mudstone east
- Karoo sandstone and mudstone southwest
- Karoo sandstone and mudstone west
- Namaqualand coastal
- Namaqualand east
- Namaqualand west
- Richtersveld
- Taung-Prieska Belt
- West Griqua Land
- Western Kalahari

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Fracking

- **TARGET AREA:** Eccca shale where it dips under the Karoo M+S (Karoo GRUs) (1500-6000 m below ground). Presence of dolerite may limit viability
- Eccca shale is over-pressurised. At depth there is an upward gradient
- Over pressure and hydraulic gradients show the rock between the shallow and deep aquifer is an aquiclude
- Most likely pathways are structures, dolerite intrusions and upward flow in wells and where artesian to sub-artesian conditions exist.
- Higher recharge yet higher TDS of groundwater in De Aar - Richmond area may be evidence of upwelling saline groundwater

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Fracking and Reserve

- Availability of groundwater, licencing of further groundwater use
- Potential localised impact on water quality of the Reserve
- Potential expansion of towns dependent on additional groundwater which may not be available
- Potential viability of utilising poor quality groundwater (although these are areas of low recharge)
- The Reserve and RQOs may be a legal tool that will impact on fracking by limiting use of groundwater or setting quality RQOs.

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GROUNDWATER COMPONENT: WAY FORWARD TO NEXT MEETING

- 1. Initiate the BHN and EWR assessment**
How will the study be executed?
- 2. Delineate RU, select study sites**
Where will detailed work be undertaken?
- 3. Determine reference condition, PES and EIS**
What are the ecological status, importance and future ecological objectives?
- 4. Determine BHN and EWR**
How much water do you need for basic human needs and to maintain a certain ecological status?
- 5. Determine operational scenarios and evaluate consequences**
How will the current state and ecological objectives be influenced by future changes in operation?
- 6. Ecological specification, monitoring and implementation information**
How do we know that we will achieve our objectives

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QUESTIONS FOR CLARIFICATION

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