



Santos

# Scone CCC Groundwater Study

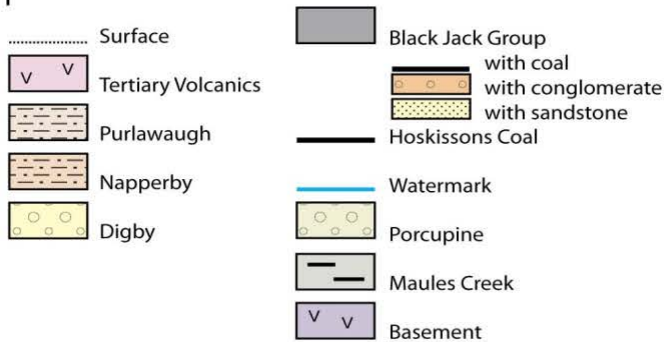
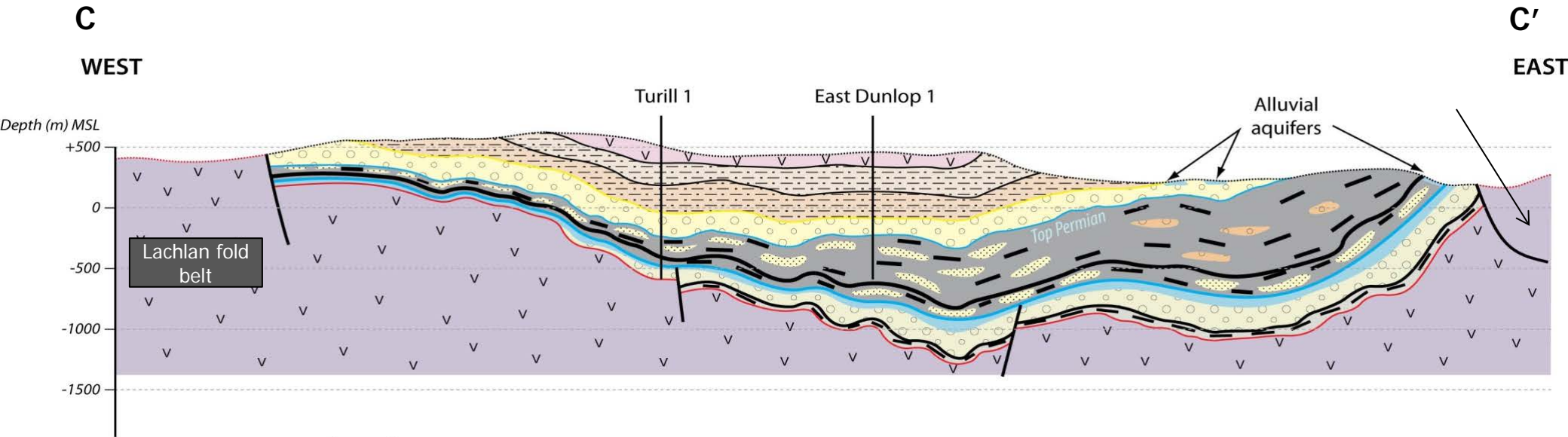
10 December 2012

# Agenda

## Groundwater Study

- Understanding the hydrogeological regime of the area
  - Aquifer Interference activities
  - Existing users of groundwater; Agriculture, Mining + others
  - Existing monitoring datasets – NOW, Farm Bores
- Groundwater Abstraction – What are the likely volumes
- Groundwater Monitoring – How, when, why
  - Installation of Aquifer Monitoring Bore in geologically controlled locations

# Gunnedah Basin – Murrurundi Trough



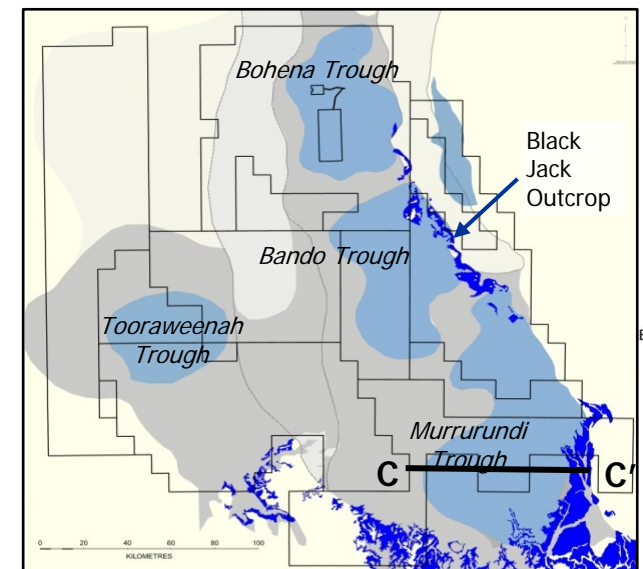
## Mapping Hydrostratigraphic Units

Primary seam target: Hoskissons Seam

Depth: 200 – 1200 m (outcrops at surface)

Major Aquifers: Alluvial/ Tertiary Volcanics (potentially others)

Major Aquitards: Purlawaugh/ Napperby (potentially others)





# Groundwater Monitoring – Considerations of where to sample



- Assessment of sensitive receptors (ecosystems, existing groundwater users)
- Groundwater flow directions – upgradient/down gradient
- Establishing an encompassing network of monitoring locations to understand lateral/horizontal variability

# Groundwater Monitoring – How we sample



Parameter	ALS Method/ Package Code	Technique/ Method Reference	Limit of Reporting (mg/L) (or as indicated)	Holding times	Bottle Type / label colour
Bromide	ED009X	APHA 4110	0.01	28 days	500ml plastic / green
pH	EA005P	APHA 4500-H* B	0.01 pH units	6 hours	
Conductivity	EA010P	APHA 2510 B	1 µS/cm	28 days	
Total Dissolved Solids	EA015H	APHA 2540 C	10	7 days	
Alkalinity	NT-2A	APHA 2320 B	1	14 days	
Total Alkalinity as CaCO <sub>3</sub> , Bicarbonate as CaCO <sub>3</sub> , Carbonate as CaCO <sub>3</sub> , Hydroxide as CaCO <sub>3</sub> , Sulphate -turbidimetric as SO <sub>4</sub>		APHA 4500 SO4-E	1	28 days	
Chloride		APHA 4500-Cl -B	1	28 days	
Fluoride		APHA 4500 F -C	0.1	7 days	
Silica	EC052	APHA 4500-SiO2	0.1	28 days	
Residual Alkali (calc)	EA161	In House	0.01	-	
Ionic Balance	EN055-DA	APHA	-	-	
Major Cations - Ca, Mg, Na, K	NT-1B	APHA 3120 Ca, Mg, Na -A	1	28 days	
Total Hardness (calc)	EA065	APHA 2340 B	1	7 days	
Reactive Phosphorus		APHA 4500 P - C	0.01	2 days	
Nitrite		APHA 4500-NO <sub>2</sub> -I	0.01	2 days	
Nitrate	NT-8A	APHA 4500-NO <sub>3</sub> -I	0.01	2 days	
Ammonia as N		APHA 4500 NH <sub>4</sub> <sup>+</sup> -H	0.01	28 days	
Total Nitrogen (inc TKN/NO <sub>x</sub> )		APHA 4500 Norg/NO <sub>3</sub>	0.1	28 days	
Total Phosphorus as P		APHA 4500 P - H	0.01	28 days	
Total Organic Carbon	EP005		1	28 days	40ml vial/purple
Dissolved Organic Carbon	EP002	APHA 5310B	1	28 days	40ml vial/purple field filtered
Standard Plate Count (21°C & 36°C)	MW002	AS 4276.3.1	<1 cfu/mL	24 hours	600ml plastic / grey (sterile)
Sulfate reducing bacteria**	SR8-WAT	Subcon Baseline (NOT NATA ACCREDITED)	MPN/100mL	24 hours	600ml plastic / grey (sterile)
Dissolved Metals - As, Ba, Be, Cd, Cr, Co, Cu, Mn, Ni, Pb, V, Zn	W-3	USEPA 6020 ICP/MS	Cd-0.0001 Zn - 0.005 Others -0.001	180 days	60ml plastic / red field filtered
Hg		CV/FIMS	0.0001	28 days	
Additional Metals - Fe, Se, B, Sr, Al, Mo, Sn, U, Li	EG020F	USEPA 6020 ICP/MS	Fe, B - 0.05 Al, Se - 0.01 Others -0.001	180 days	60ml plastic / red
Total Metals (including digest) As, Ba, Be, Cd, Cr, Co, Cu, Mn, Ni, Pb, V, Zn	W-3T	USEPA 6020 ICP/MS	Cd-0.0001 Zn - 0.005 Others -0.001	180 days	
Hg		CV/FIMS	0.0001	28 days	
Additional Metals - Fe, Se, B, Sr, Al, Mo, Sn, U, Li	EG020T	USEPA 6020 ICP/MS	Fe, B - 0.05 Al, Se - 0.01 Others - 0.001	180 days	2 x 40ml vial/purple
Ethanol	EP117	In-House GC/MS	50 µg/L	14 days	
TPH(C6-C9) & TRH (C6-C10)/BTEX	W-7	GC/FID, P&T-CC/MS, CC/MS-SIM	TPH/TRH: 20 - 100 µg/L BTEX: 1-2µg/L PAH: 0.5-1µg/L	14 days	2 x 40ml vials/purple
TPH (C10-C36) & TRH (C10-C40)/PAH				7 days	100ml amber glass /orange

- Santos undertakes all direct contact with landholders/managers
- A water sampling expert from an external provider leads the sampling on site – (collects the sample)
- Samples are securely transported to a NATA Authorised laboratory for analysis
- Analysis is undertaken on a wide variety of analytes

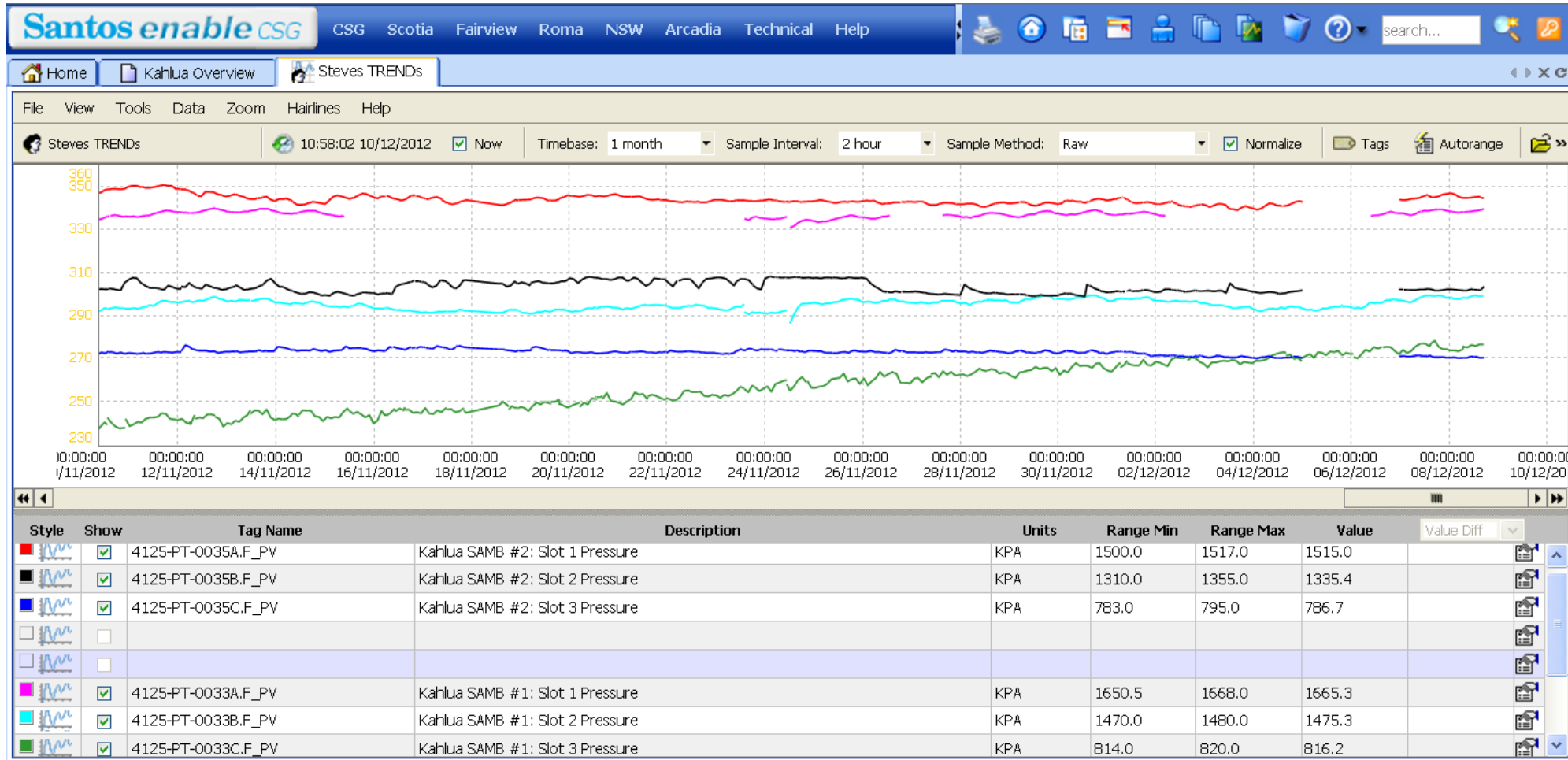


# Shallow Aquifer Monitoring Bores (SAMBs)



- Pressure gauges are used to monitor the water pressure of formations on top of the coals
- Data is 'real time' and relayed back to a central system.

# Enable data example



# Questions