5. GEOLOGY

5.1 INTRODUCTION

Geological information has been taken from the Department of Mineral Resources maps and explanatory notes for Dubbo and Narromine. Geological mapping for the Dubbo 1: 250,000 sheet was revised in May 1999 and the Second Edition map (71) and new Explanatory notes (72) released. Major changes have been made to the earlier edition, including in the area covered by the Little River Catchment, and a number of subgroups have been recognised that may help explain the hydrogeology and chemistry of the landscape. Dating of formations has been revised also. Mapping for the catchment is considered reliable at 1:50,000, and has been aided by radiometrics and magnetic surveys. Mapping for the Narromine 1:250 000 sheet (75) was revised in March 1996 and the map and explanatory notes (76) were released shortly afterwards. The Dubbo Sheet is more detailed, particularly with regard to structural features, due to the availability of radiometrics and aeromagnetics.

5.2 GEOLOGICAL HISTORY OF THE REGION

Landform and geology in the Central Tablelands of NSW has been influenced by a series of volcanic and sedimentary periods followed by folding and faulting. This has resulted in four distinct regions: from east to west - Capertee High (Rylstone to Coolah), Hill End Trough (from Dunedoo / Gulgong in the east to Stuart Town and almost to Wellington in the west), the Molong High (Cumnock to Ponto) and the Cowra Trough to the Hervey Syncline. These are distinct areas of volcanic and sedimentary rocks within the depositional regions. The Little River Catchment is located on the Cowra Trough and the Molong High, and also includes the Hervey Group from the Late Devonian period, which forms the western catchment boundary.

The Cowra Trough is found in the west of the district. The Cowra Trough is formed of deformed Silurian and Devonian rocks, including the Cabonne, Cudal, Goonigal and Toongi Groups. Shale, tuff and cherts are common in this area. The Silurian rocks are typically rhyolitic or dacitic volcanics and limestone. These formations were intruded by the Yeoval Batholith and the Dulladerry and Gregra Volcanics. Faulting in the batholith is generally in an east-west direction. This may have a significant effect on groundwater systems as the faulting runs at right angles to the natural drainage, and may be responsible for impeding water flow along the hydraulic gradient.

The Molong High is found between the Manildra Fault and the Curra Creek fault (which generally forms the eastern catchment boundary). It is comprised of the Mumbil, Gregra and Catombal Groups and faulting runs north -south. The Molong High was formed from the upheaval of strata at around the same time as the Hill End Trough to the east subsided. This north - south ridge system was a chain of active volcanoes that poured lava and ash onto the ridge. Volcanic debris then formed parent material for the shallow deposits of sandstone, limestone and conglomerate along the ridge and parent materials for the deepwater rocks to the east and west.

The Hill End Trough is a deep trough into which deepwater marine shales, greywackes, volcanic lavas and ash were deposited. The area underwent upheavals and folding at the end of the Devonian Period and was elevated above sea level following the intrusion of the granites. This produced the tight north-south trending folds in the strata. Rocks were converted to slate, schists and quartzite by the accompanying heat. This area was gradually eroded to a level plain, which was bisected by rivers draining to the east.

5.3 GEOLOGY UNITS

A description of the individual geological units that occur on the Dubbo and Narromine 1:250 000 geology map sheets can be found in Appendix 4.

5.4 SALINITY POTENTIAL

Rob Muller (73), Hydrologist with DLWC, Cowra built on work initiated by the Australian Geological Survey Organisation (AGSO), who had simplified the geological units to the lithostratigraphic units shown in Table 6. He has suggested some generalised classifications of potential risk of various lithologies to predispose to salinity, based on the following criteria.

The risks for Salt Potential and Complexity are indicated for each lithological category in Table 6. It is important to note that geology is only one in a large number of factors that can lead to salinisation, and the information obtained in Table 6 should be used with caution, and definitely in conjunction with other information. In assigning risk ratings, consideration of the above criteria and other anecdotal evidence of the salinity relationship to each were made.

The source potential risk indicates the capacity of the rock to produce and/or concentrate salts contributing to salinisation processes. This potential relates to a number of rock properties, including:

- whether the sediments were layed down in marine or freshwater conditions
- the rock porosity
- the degree of metamorphism
- the grainsize of igneous rocks
- the geochemistry of the rock types.

In general, weathering of coarse grained or porphyritic igneous rocks with a granitic composition has a higher potential of releasing salt forming ions into the groundwater than finer grained igneous rocks. Metamorphism leads to the formation of new minerals that also weather releasing salt forming ions.

Coarse-grained sediments are generally quite porous and permeable and hence any salt they contain is relatively easily leached out. If these are old rocks, there is little potential salinity contribution, as salt would have been leached out of them long before any anthropogenic influences were placed on the land. Fine-grained sediments, especially those having a marine origin, are much less permeable and can store salts for very long periods of time. These rocks have been given a high potential risk rating. Alluvial/colluvial unconsolidated sediments were assigned a moderate potential risk rating due to their location in lower parts of the landscape where most natural discharge occurs.

The degree of complexity is an indication of the amount of rock fracturing. More intense fracturing facilitates greater and faster groundwater flow within the rock. For this classification, any rocks older than ~320 million years (Early Carboniferous) were assigned a high degree of complexity, simply because these rocks would have been affected by tectonic activity associated with Lachlan Fold Belt development.

Igneous rocks younger than 320 million years where assigned an intermediate complexity value as some fracturing and jointing is expected due to cooling of the molten rock. Any younger sedimentary deposits were assigned a low degree of complexity, as it would be expected that they would have undergone little deformation other than diagenesis.

Figure 5: Geological Provinces

Due to errors in the electronic files held by DLWC, Central West Region Resource Information Unit, this map has not been included.

References:

(3) Soil Conservation Service (1982) *Wellington Tech Manual*

(24) Soil Conservation Service (1978) *Orange Tech Manual*

(71) E. Morgan et al (1999) *Dubbo 1:250 000 Geological Sheet SI/55-4 Second Edition*

(72) N.S. Meakin and E.J. Morgan (1999) *Dubbo 1:250 000 Geological Sheet Explanatory Notes*

(73) R. Muller (1999) *Salinity Potential of the Geology of the Central West Region*

(75) L. Sherwin et al (1996) *Narromine 1:250 000 Geological Sheet SI/55-3 First Edition*

(76) L. Sherwin (1996) *Narromine 1:250 000 Geological Sheet SI/55-3 Explanatory Notes*

Table 6: Geological Timeline, Correlation with Lithostratigraphic Classes & Potential for Release of Minerals that may predispose to salinity.

ERA	PERIOD	GEOLOGY GROUPS	GEOLOGY UNITS	SYMBOL (symbols in italics are on the Narromine sheet)	LITHOSTRATIGRAPHIC CLASS	POTENTIAL SALT SOURCE*	DEGREE COMPL-EXITY *
Cainozoic	Quaternary	Alluvials Colluvials		Qa *Cza* Qc *Qt,Qr*	Cainozoic alluvial/colluvial sediments	Medium	Low
	Tertiary						
Mesozoic	Jurassic	Surat Basin Sandstones		Js	Jurassic coarse-grained sediments	Low	Low
	Mesozoic	Mesozoic Igneous Rocks	Googodery Trachyte	Mg Mtu Mtk Mts Mtx	Jurassic volcanics	Medium	Low
	Triassic	Gunnedah basin	Boulderwood Formation	Rb	Triassic coarse-grained sediments	Low	Low
			Napperby Formation	Rp	Triassic fine-grained sediments	Low	Low
Palaeozoic	Permian						
	Carboniferous						
	Devonian (mid-late)	Hervey Group	Burrill Formation Caloma Sandstone Mandagery Sandstone Pipe Formation	*Dhb* *Dhl* *Dhm* *Dhp*	Late Devonian coarse-grained sediments	Low	Medium
		Catombal Group	Black Rock Subgroup	Dtb	Late Devonian coarse-grained sediments	Low	Medium
			Kurrool Formation	Dtck	Late Devonian fine-grained sediments	Medium	Medium
		Dulladerry Volcanics	Yahoo Peaks composite / Curumbenya Ignimbrite / Warraberry / unnamed	Ddy Ddi Ddw / Dd/ *Ddr/ Dds /* *Ddp*	Devonian Volcanics	High	Medium

Table 6: Geological Timeline, Correlation with Lithostratigraphic Classes & Potential for Release of Minerals that may predispose to salinity (cont).

ERA	PERIOD	GEOLOGY GROUPS	GEOLOGY UNITS	SYMBOL (symbols in italics are on the Narromine sheet)	LITHOSTRATIGRAPHIC CLASS	POTENTIAL SALT SOURCE*	DEGREE COMPL-EXITY *
Palaeozoic	Devonian (early)	Yeoval Batholith	Mudgingar, Kyuna, Yennora, Glenrowe, Sorronto *Yeoval Complex* *Nallawa Complex*	Dbg Dkg Dog Dwg, Dsg Dyg, Dyq, Dyx, Dym Dig Dign,Digd	Silurian - Devonian Granitoids	Medium	Medium
		Gregra	Garra Formation Cuga Burga Volcanics Berkley Formation	Dgg Dgc Dge	Limestones Silurian-Devonian Basic rocks Silurian-Dev Coarsegrained sediment	High Medium Low	Medium Medium Medium
		Toongi Group		*S-Dt*	Silurian-Dev Coarsegrained sediment	Low	Medium
	Silurian	Goonigal	Wansey Burgoon Jews Creek Volcanics	Sgw Sgb Sgj	Silurian-Dev Coarsegrained sediment Silurian-Dev Finegrained sediments Silurian -Dev basic rocks	Low Low Medium	Medium Medium Medium
		Cudal	Hanover, Cary, unnamed unit Canowindra Volcanics	Sce, Scc, Scet Scv	Silurian- Dev. Finegrained sediments Silurian Volcanics	Low High	Medium Medium
			Burrawang Limestones	Scu	Limestones	High	Medium
		Mumbil	Barnby Hills Shale	Smb	Silurian-Dev. fine-grained sediments	Low	Medium
	Ordovician	Cabonne	Kabadah, Sourges Shale Oakdale	θck, θcu θco	Cambrian -ordovician metasediments Cambrian -ordovician volcanics	High High	Medium Medium

N.B. * This is preliminary data and should be used with caution