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NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

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Groundwater Monitoring Summary
North East Salinity Strategy – Year 2000

Saline discharge site at Everton Upper

This brochure presents a summary of groundwater trends across the salinity priority areas of the North East Catchment Management Authority (NECMA) Region. These trends were determined from the groundwater monitoring bore network program.

The main objectives of groundwater monitoring for salinity are:

- to understand groundwater and salinity processes,
- to determine changes in groundwater levels and salinity risk across catchments,
- to monitor the impact of salinity control measures (e.g. trees, pasture and pumping).

The groundwater monitoring program commenced in the NECMA Region in the mid 1980s. Many of these early monitoring bore networks were installed in response to reports from landholders of saline discharge outbreaks in areas such as Springhurst, Bobinawarrah, Indigo Valley and Everton. Since the early 1990s, in recognition of the seriousness of the salinity problem, a large number of additional monitoring bores have been installed across the north-western part of the region (e.g. Ovens Riverine Plain). This has substantially improved the monitoring network which now totals 370 bores.

This monitoring program is co-ordinated by the Department of Natural Resources and Environment (DNRE) Wangaratta, Centre for Land Protection Research (CLPR) Bendigo, and Sinclair Knight Merz (SKM) in association with the local Landcare community. The program is a component of the North East Salinity Strategy (NESS) whose work directly benefits the environmental program of the NECMA.

Tree plantation in a recharge area at Indigo Valley.

DNRE staff measuring groundwater level.

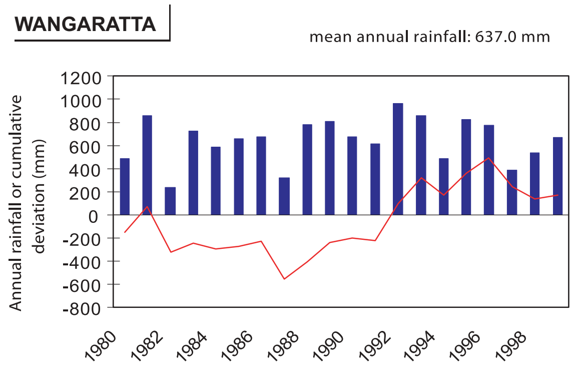
SELECTED HYDROGRAPHS FROM KEY SALINITY BORES IN THE NECMA REGION
Groundwater trend update

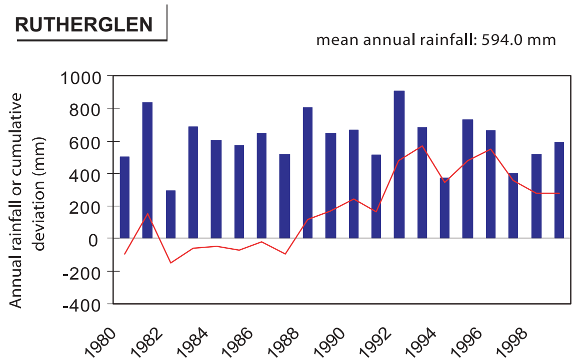
RAINFALL CHARTS

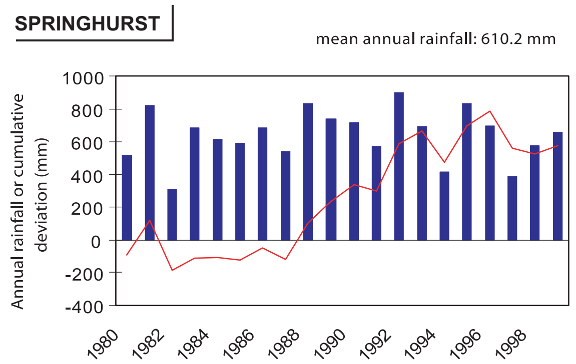
Longterm rainfall records indicate that the NECMA Region had a significant shift from drier to wetter than average conditions during the late 1940s, and then several key climatic extremes in the past 20 years. The rainfall charts below indicate annual rainfall for the selected stations from 1980 to 1999. The accompanying line graphs indicate the cumulative deviation (cumulative variation from the mean rainfall over time). The charts show low rainfall in 1982, 1994 and 1997, and there were consecutive wet years in the late 1980s and early 1990s. The rainfall charts also display a relatively drier period during the late 1990s. The variation of rainfall across the region also can be seen in the rainfall charts.

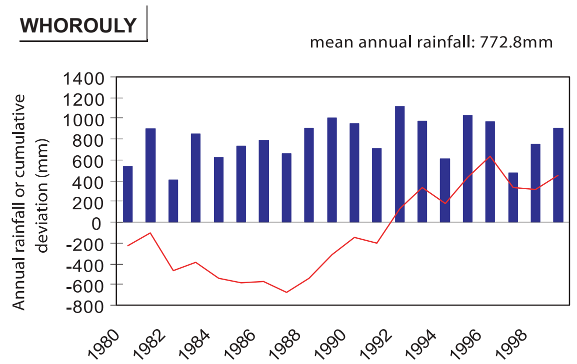
Rainfall trends since 1980

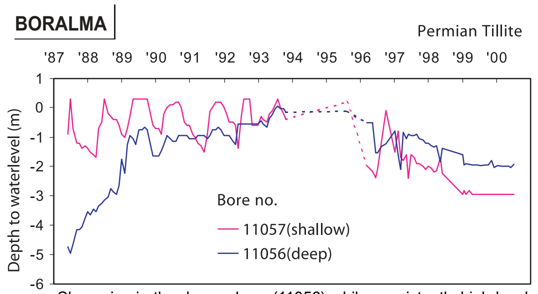
Annual rainfall (mm) — Cumulative deviation (mm)



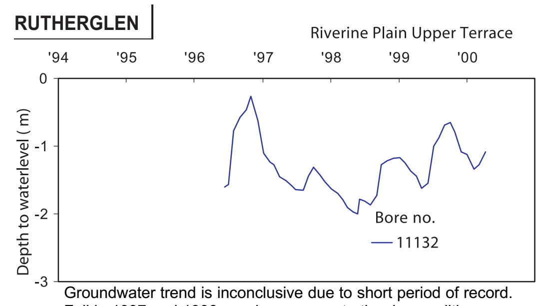




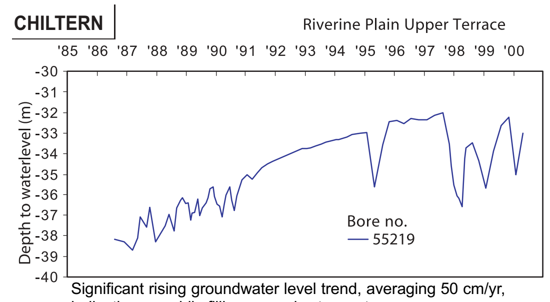




Sharp rise in the deeper bore (11056) while consistently high level in the shallower one in late 1980s. Fall in both bores in late 1990s. Record was discontinuous between 1994 and 1996.



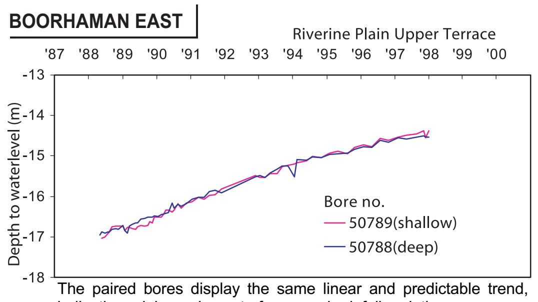
Groundwater trend is inconclusive due to short period of record. Fall in 1997 and 1998 was in response to the dry conditions.



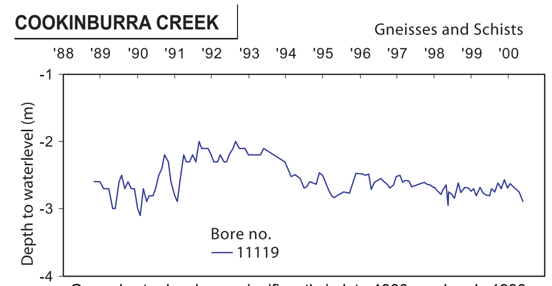
Significant rising groundwater level trend, averaging 50 cm/yr, indicating a rapidly filling groundwater system.

GROUNDWATER HYDROGRAPHS

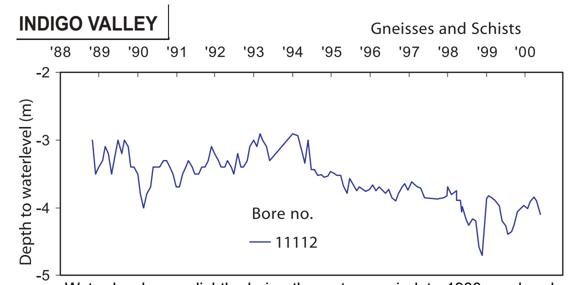
A graph of water levels against time is usually referred to as a hydrograph. The pattern of groundwater level variation in a hydrograph is dependent upon the nature of the groundwater system and climatic conditions. Hydrographs are a useful tool to indicate long term trends as well as seasonal fluctuation. A peak is commonly observed in winter/spring as a result of recharge during this period. Where there is minimal seasonal fluctuation, only minor local recharge to the watertable is suggested, though soil waterlogging or excess runoff may then be significant issues.



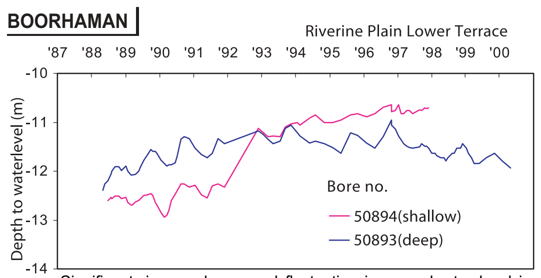
The paired bores display the same linear and predictable trend, indicating minimum impact of seasonal rainfall variation.



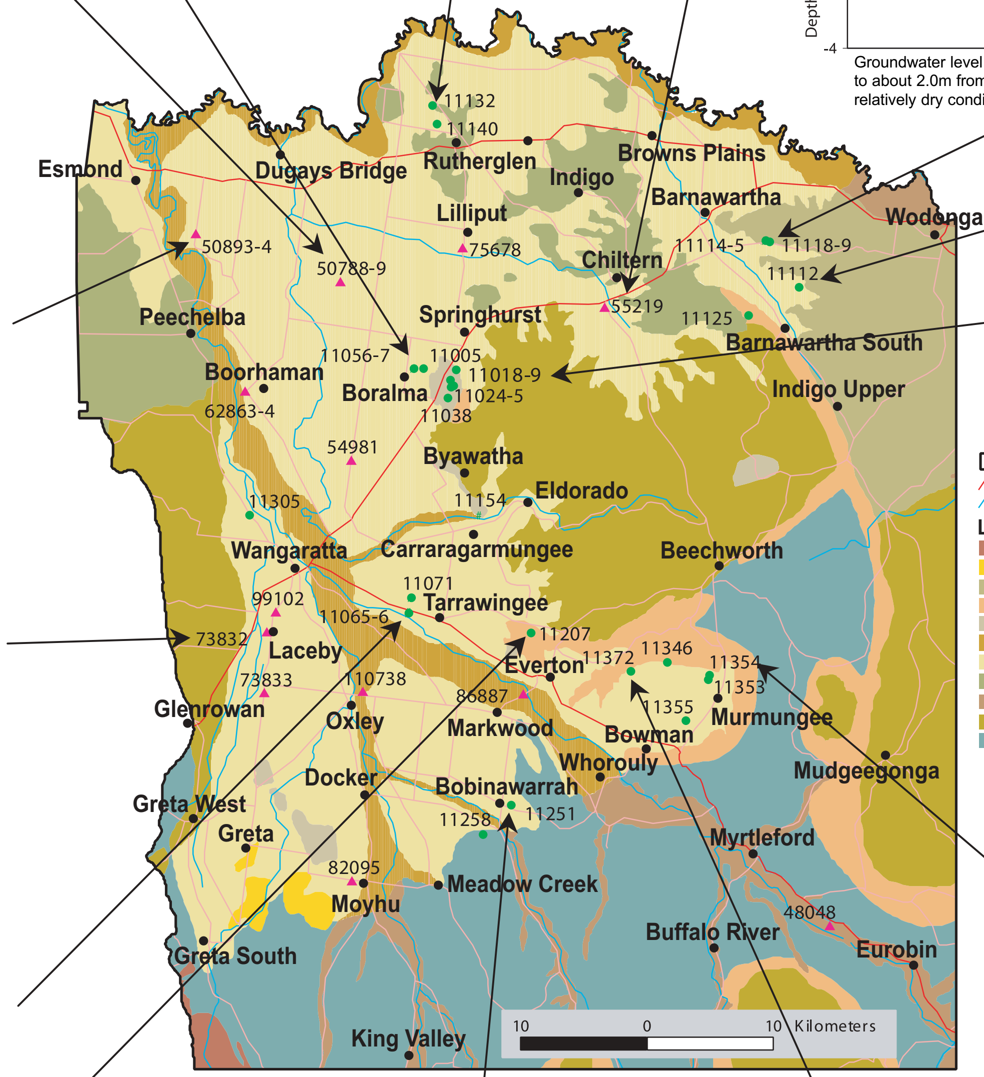
Groundwater level rose significantly in late 1980s and early 1990s to about 2.0m from ground surface. Gradual fall since 1994 due to relatively dry conditions.

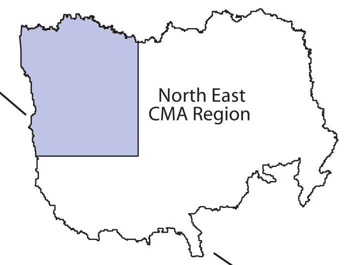


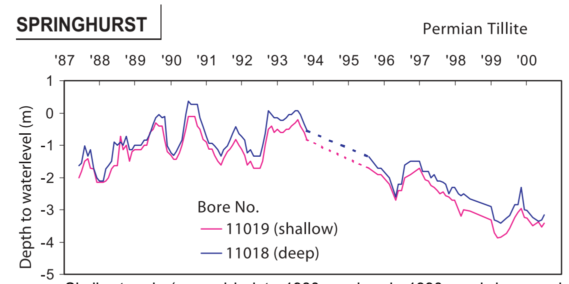
Water level rose slightly during the wet years in late 1980s and early 1990s. Significant fall since 1994. This trend is typical of the shallow groundwater system in the Indigo Valley.



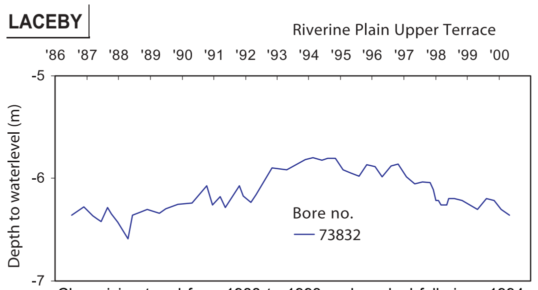
Significant rises and seasonal fluctuation in groundwater level in both of the paired bores, but the high rainfall in 1992 had a more significant impact on the shallower bore (50894).







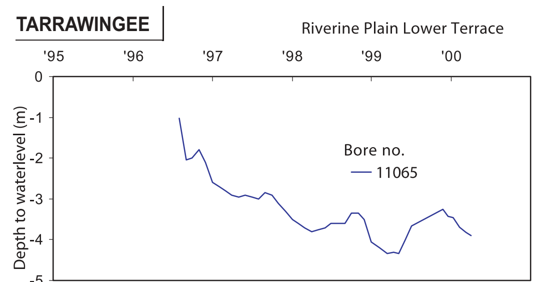
Similar trends (upward in late 1980s and early 1990s and downward since 1994) in the paired bores. Higher pressure in the deeper bore (11018) indicate discharge occurring. Record was discontinuous between 1994 and 1995.



Clear rising trend from 1988 to 1993 and gradual fall since 1994, typical of groundwater level trend in the western part of the Lower Ovens Valley.

KEY BORES

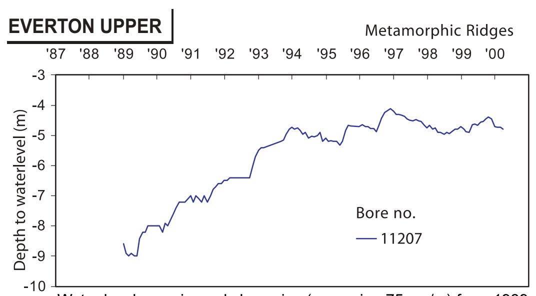
Forty-six key bores have been selected across priority areas of the NECMA Region to assist in the analysis and reporting of groundwater trends. These have been selected on the basis of representative trends within a monitoring network, geographic distribution, quality and length of monitoring record. The 14 bores presented in this summary have been selected from these key bores.



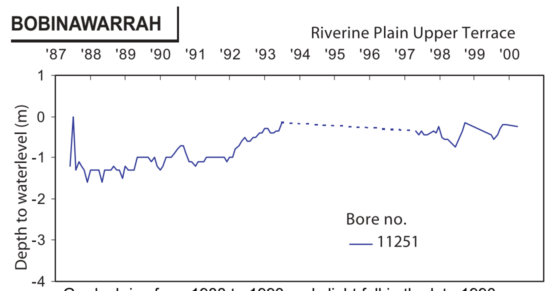
Significant fall in groundwater level since 1996, probably mainly due to dry conditions in this period. However groundwater trend is inconclusive due to short period of record.

LAND MANAGEMENT UNITS

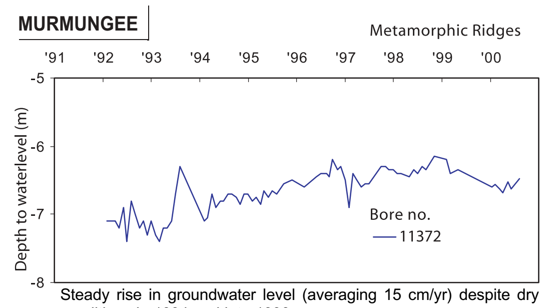
The key bores shown are located within specific Land Management Units (LMUs). A LMU is a zone of similar geology, soils, landscape type and climate. By definition, a particular LMU would be expected to respond in a consistent manner with respect to salinity treatment.



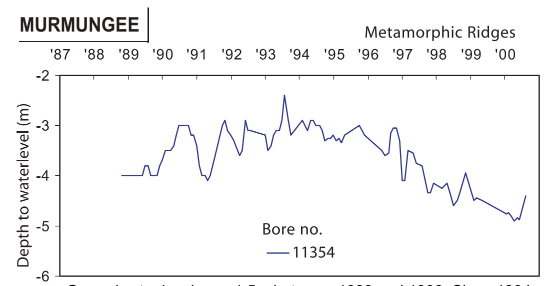
Water level experienced sharp rise (averaging 75 cm/yr) from 1989 to 1993 and substantial rise in 1995-6. Slight fall during the dry periods in 1994 and late 1990s. High salinity risk in this area.



Gradual rise from 1988 to 1993 and slight fall in the late 1990s. Record was discontinuous between 1994 and 1997.



Steady rise in groundwater level (averaging 15 cm/yr) despite dry conditions in 1994 and late 1990s.



Groundwater level rose 1.5m between 1989 and 1993. Since 1994 a clear downward trend can be seen.

GROUNDWATER TRENDS

Key similarities in many upland areas of the NECMA Region are the upward groundwater trends in the late 1980s and early 1990s, and downward trends since 1994 (e.g. Bores 11018 at Springhurst, 11056 at Boralma, 11112 at Indigo Valley, 11119 at Cookinburra Creek and 11354 at Murmungee). Groundwater levels in these areas generally show strong seasonal fluctuations which indicate high seasonal groundwater recharge that potentially leads to increases in groundwater storage and discharge at break of slope and lower landscape areas.

It is interesting to note that the shallow weathered formations of the Metamorphic Ridges LMU at Everton Upper (Bore 11207) and Murmungee (Bore 11372) have experienced substantial rises in groundwater level despite dry conditions in the late 1990s. In these areas, groundwater movement occurs through the shallow weathered formations and converges from the hills towards the centre of what are almost closed sub-catchments. Lateral groundwater accumulation occurs due to the combination of the gradual reduction in permeability in the weathered materials, and restrictions of groundwater and surface flow out of the areas.

On the riverine plain, groundwater levels in the lower terrace and immediately adjacent areas (e.g. Bores 50893 and 50894 at Boorhaman) are highly fluctuating whilst those in the upper terrace are quite subdued (e.g. Bores 50788 and 50789 at Boorhaman East). The difference in groundwater behaviour between the lower and upper terraces suggest that substantial recharge to the lower terrace occurs during high stream flows or floods. The groundwater levels in the lower terraces have generally shown a rising trend from the late 1980s to early 1990s and a gradual fall since 1994. In contrast, some bores in the upper terrace (e.g. Bore 50788 and 50789 at Boorhaman East) display a linear and predictable rising trend which may result from lateral groundwater accumulation. The relatively short period of monitoring records for the groundwater bores at Tarrawingee (e.g. Bore 11065) display significant falls in groundwater level. This trend is mainly due to the dry conditions in the late 1990s.


Salinity treatment at Everton Upper

IMPACT OF CLIMATIC VARIATION ON TRENDS

Climate is an important factor that influences the pattern of groundwater level variation. In the interpretation of long term groundwater trends, climatic variation must be taken into account. Since 1980, despite low rainfall in 1982, 1994 and the late 1990s, the cumulative rainfall is currently 200-500 mm above average across the region. The consecutive wet years from the late 1980s to early 1990s contributed to this excessive cumulative rainfall. Also, rainfall across the region has strong seasonal variations with dry summers and wet winter/springs. In most areas, both seasonal (e.g. winter/spring rainfall) and annual rainfall (e.g. 1992 wet year and 1994 dry year) variations are reflected in groundwater hydrographs.

However, the rainfall pattern cannot explain the steady rises in groundwater level in some areas (e.g. Bores 50788 and 50789 at Boorhaman East, Bore 11207 at Everton Upper). The magnitudes of the rising trends in these areas suggest that hydrogeological characteristics and land use also have an important influence on groundwater trends.

IMPORTANT LIMITATIONS IN THE DATA

This groundwater monitoring summary is limited by a number of constraints in the groundwater data. For instance, the relative youth and patchy distribution of the regional groundwater monitoring network restrict the current selection of representative bores. In addition, there are very few bores located in areas with adequate and appropriate salinity management treatments such as perennial pastures and trees. Therefore, the impacts of these treatments on groundwater levels in the region are inconclusive at this stage.

SALINITY MANAGEMENT TREATMENTS

At the catchment scale, currently the total area of appropriate salinity management treatments is still only small. Much wider adoption of these management practices is necessary to significantly reduce recharge and subsequent saline discharge and ultimately improve water quality. Local and intermediate scale groundwater systems are common in the uplands, so that localised treatment (e.g. recharge control in the upper landscape) should realistically lead to effective salinity management. However, on the plains, where regional groundwater systems are more dominant, more innovative solutions (e.g. groundwater pumping) may be necessary.

The recently developed NESS aims to identify and promote best management practices for salinity control in the NECMA Region.

FURTHER INFORMATION

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Information can also be viewed on the NRE web site:
http://www.nre.vic.gov.au/catchmnt/salinity/dryland
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