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Australians live with a highly variable rainfall

Australians live with a highly variable rainfall

THEREFORE

Interpreting Climate Change against this background of Very High Rainfall Variability is very important

Australia has 13 major components of climate system variability

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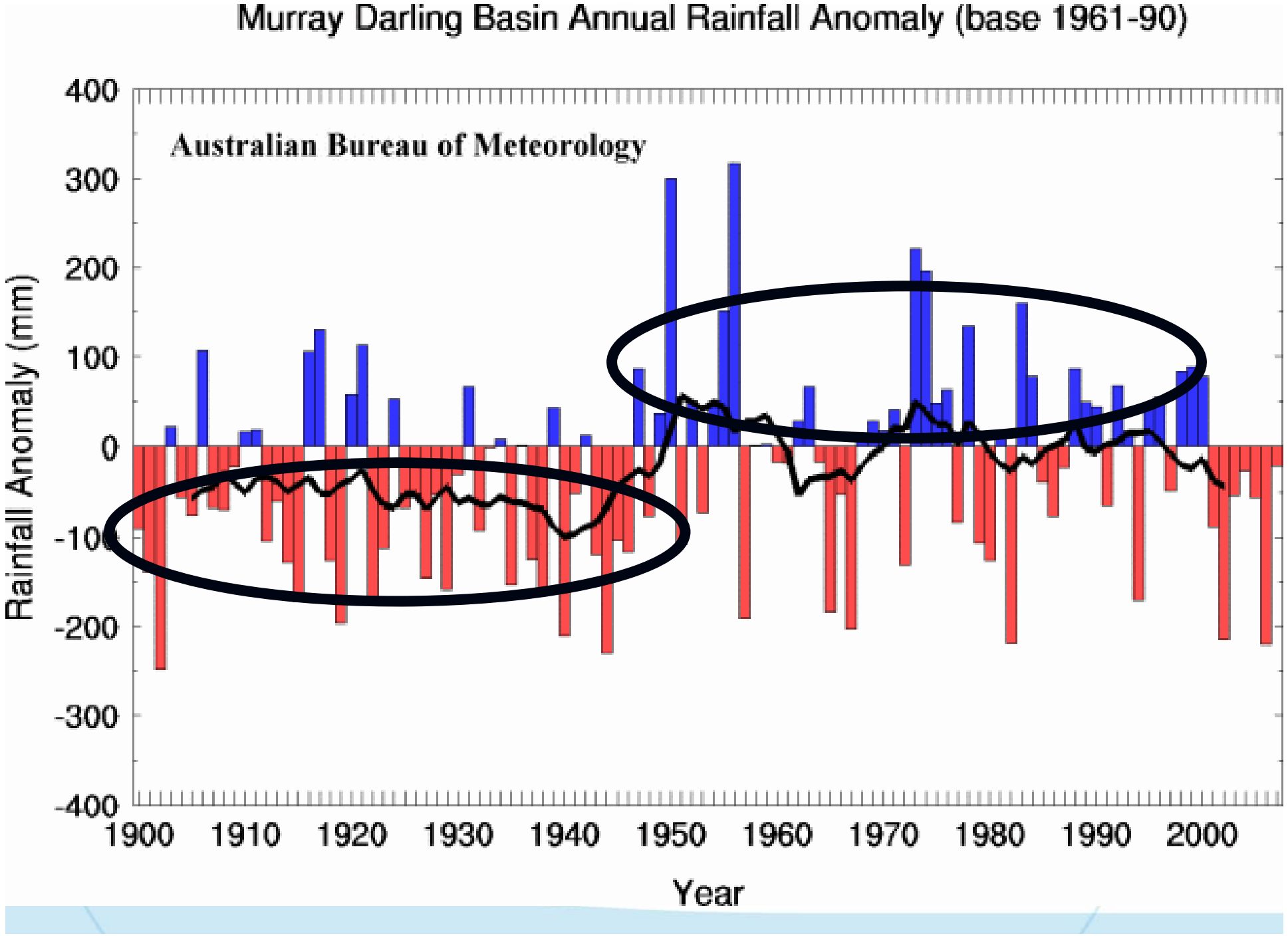
Major components of the climate system variability

Component of climate system variation	Time period
Madden-Julian Oscillation (MJO)	30 – 60 days (intra-seasonal)
Quasi-biennial Oscillation	2.5 years
El Nino-Southern Oscillation (ENSO)	2 – 7 years (inter-annual)
Southern Annual Mode (SAM)	Inter-annual and trends
Indian Ocean Dipole (IOD)	Inter-annual and decadal
Pacific-Decadal Oscillation (PDO)	Inter-decadal
Multi-decadal	30 – 100 years
Global warming and Greenhouse	Since late-1800's
Stratospheric Ozone Depletion	Since 1970's
Asian Aerosols	Since 1980's
Land Cover Change	Since mid-1800's
Very Long-term Oscillations (e.g. Milankovitch cycles or Ice Ages)	Thousands of years

Source: Stokes and Howden, 2010, Adapting Agriculture to Climate Change


Murray Darling Basin Annual Rainfall Anomaly (base 1961-90)
Australian Bureau of Meteorology
Rainfall Anomaly (mm)
400
300
200
100
0
-100
-200
-300
-400
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

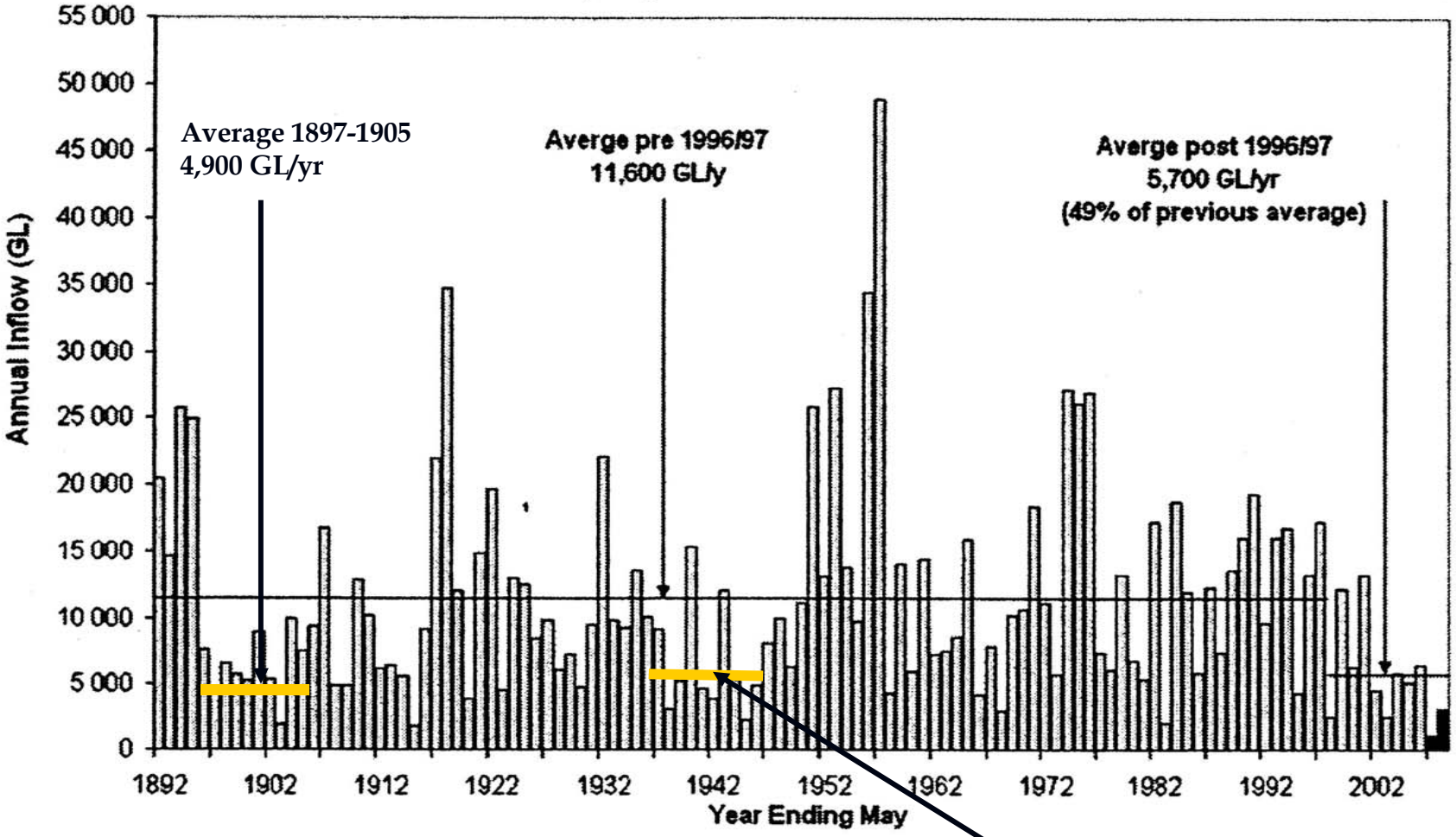
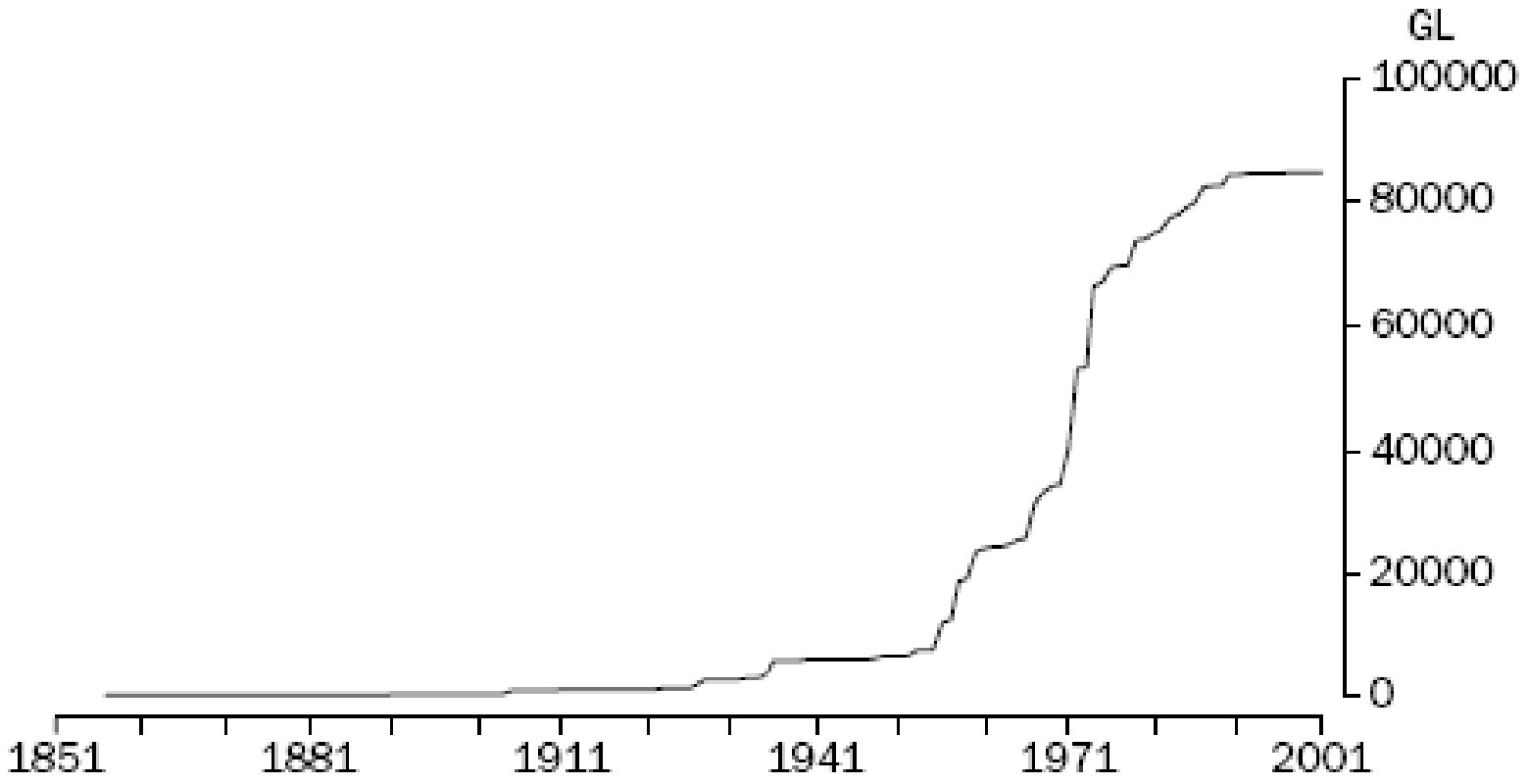
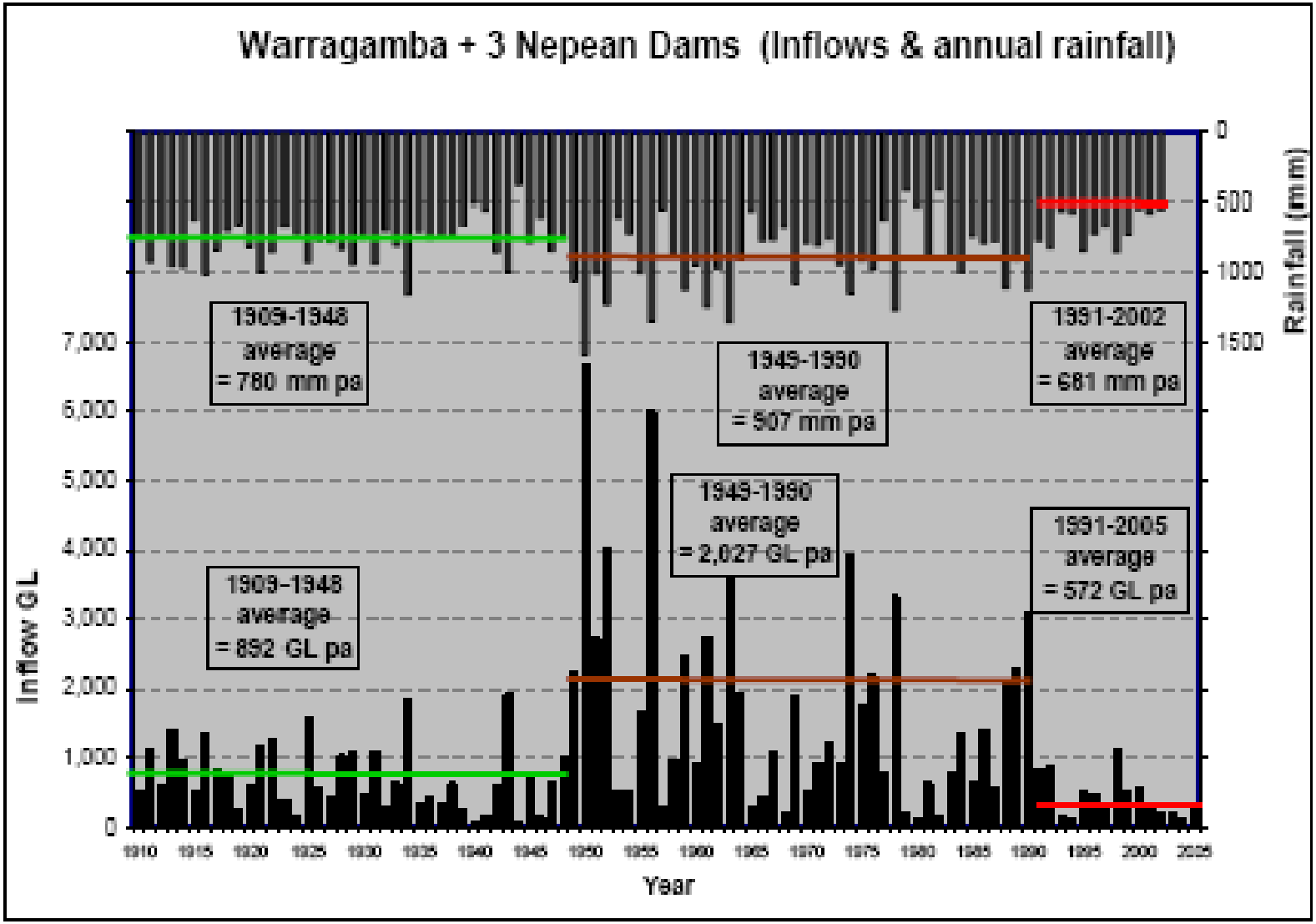


Figure 1: River Murray System inflows 1891-2008.

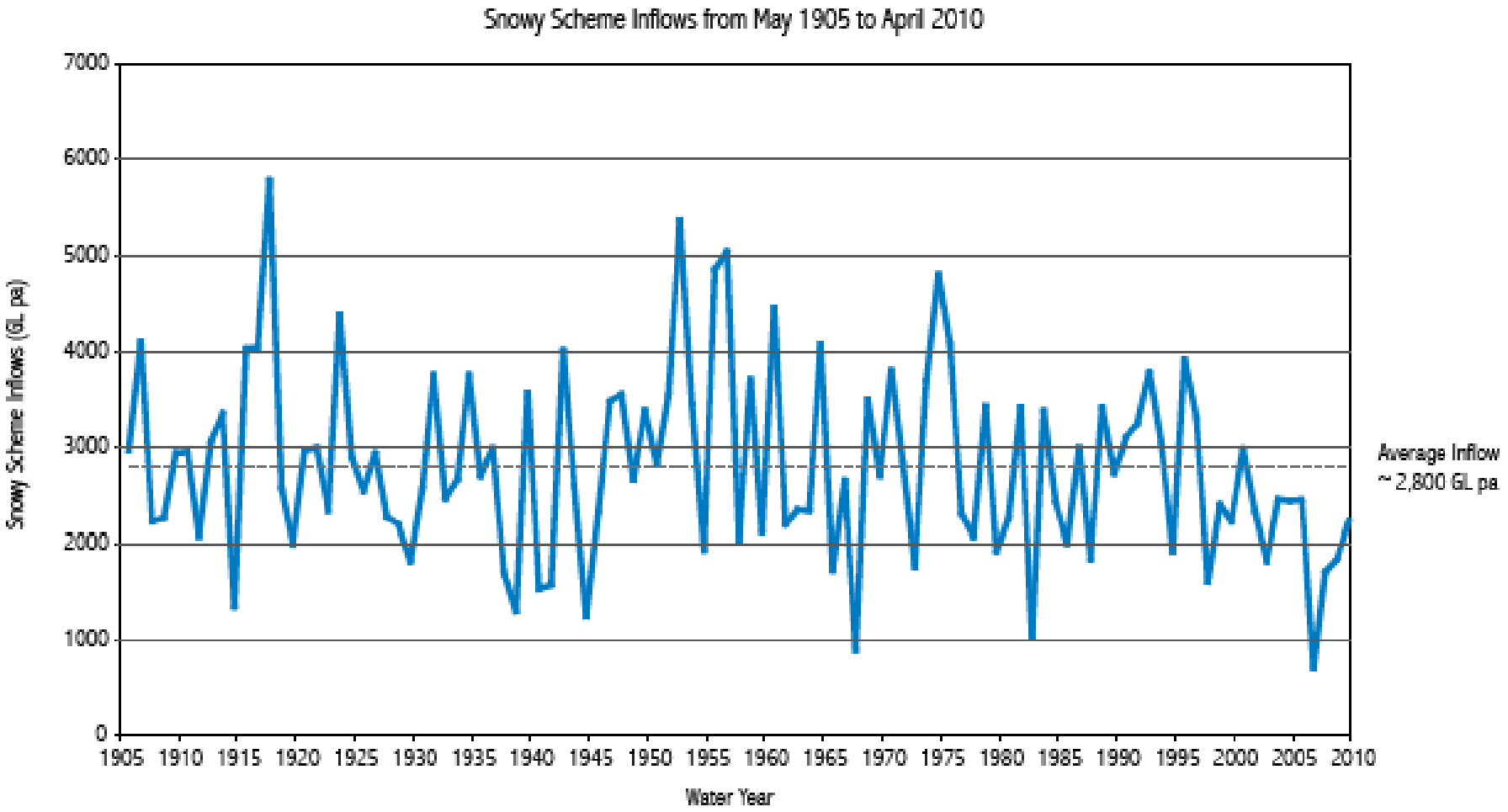
10.8 WATER STORAGE CAPACITY OF LARGE DAMS, Australia—1857–2001

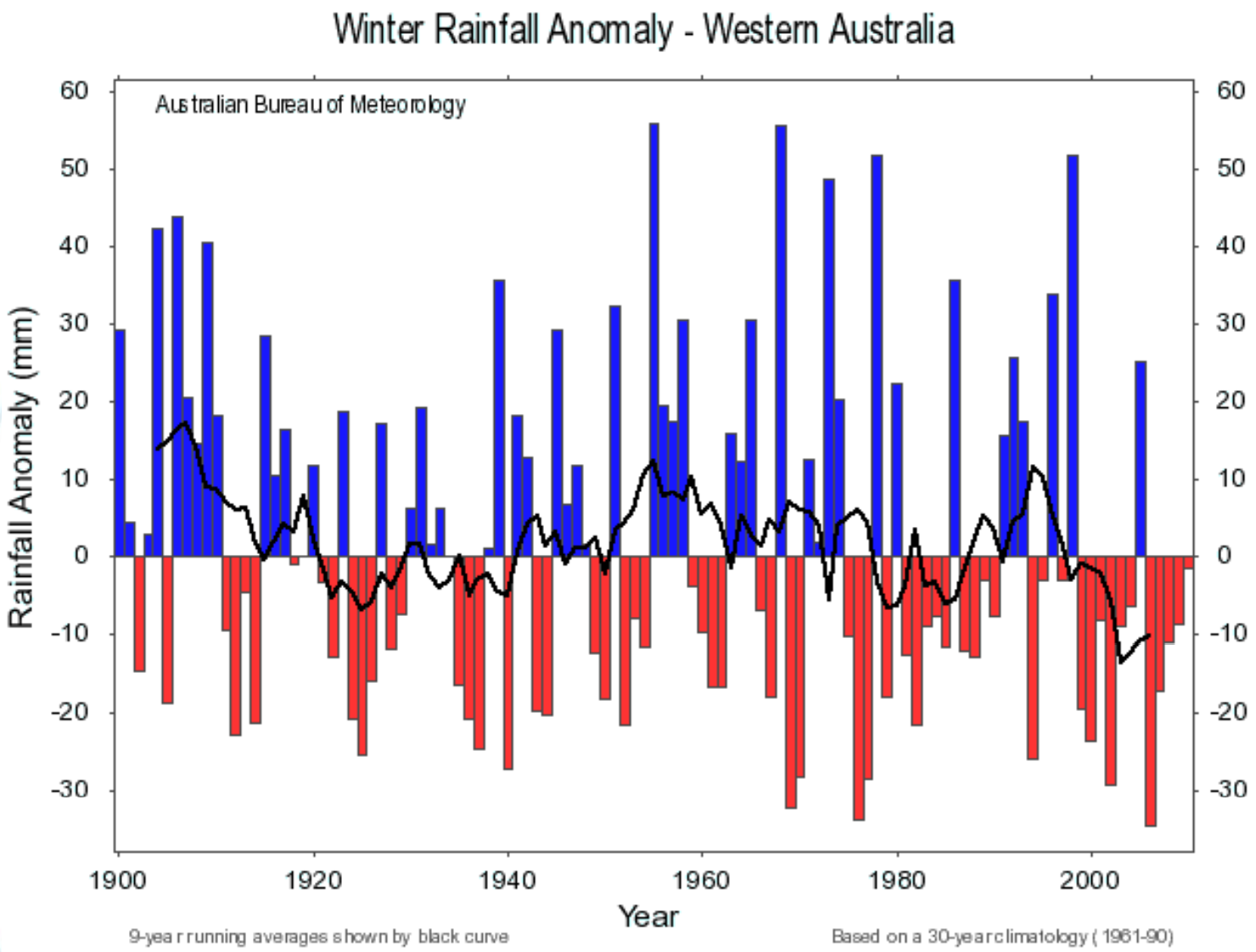


Source: Adapted from ANCOLD 2001, ActewAGL 2003, NCA 2004.



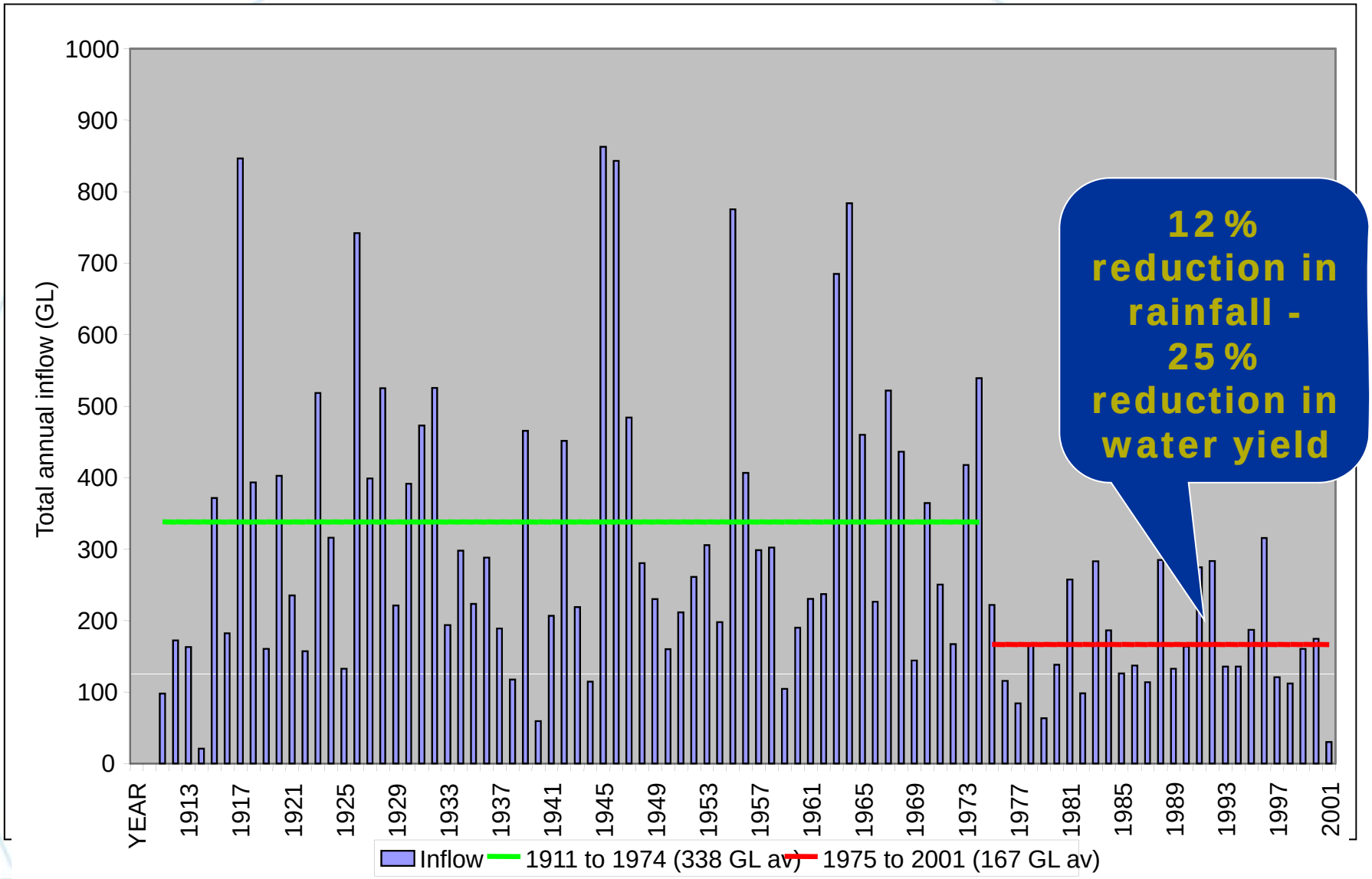
Source: Sydney Catchment Authority, 2006.


Snowy Scheme Inflows from May 1905 to April 2010
Snowy Scheme Inflows (GL pa)
7000
6000
5000
4000
3000
2000
1000
0
1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010
Water Year
Average Inflow
~ 2,800 GL pa



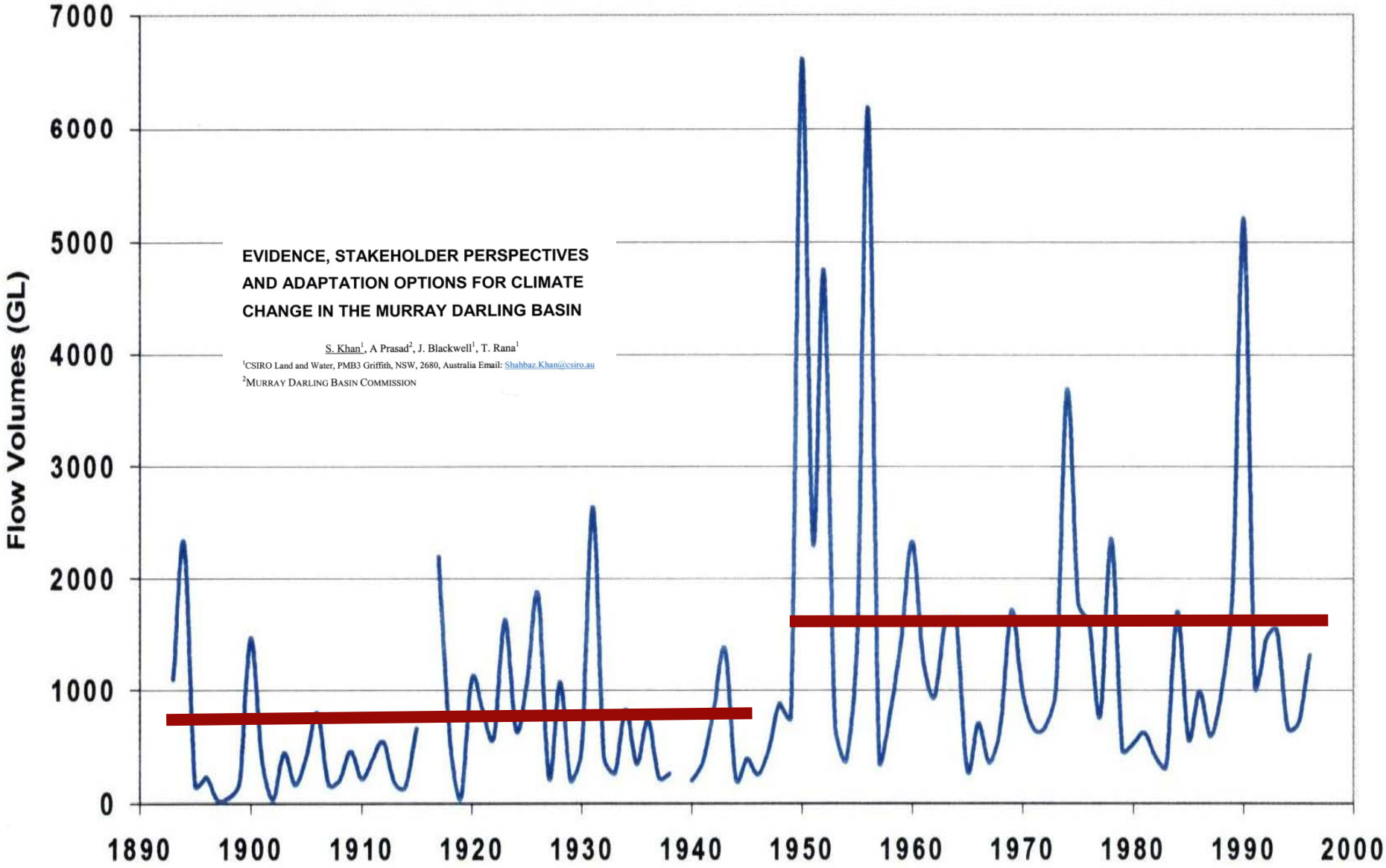
http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi?graph=rranom&area=wa&season=0608&ave_yr=9

Perth: reservoir water yield



Note: A year is taken as May to April and labelled year is start (winter) of year
Year 2001 inflows are not for a full year

Annual Flows - Lachlan River at Forbes



EVIDENCE, STAKEHOLDER PERSPECTIVES AND ADAPTATION OPTIONS FOR CLIMATE CHANGE IN THE MURRAY DARLING BASIN

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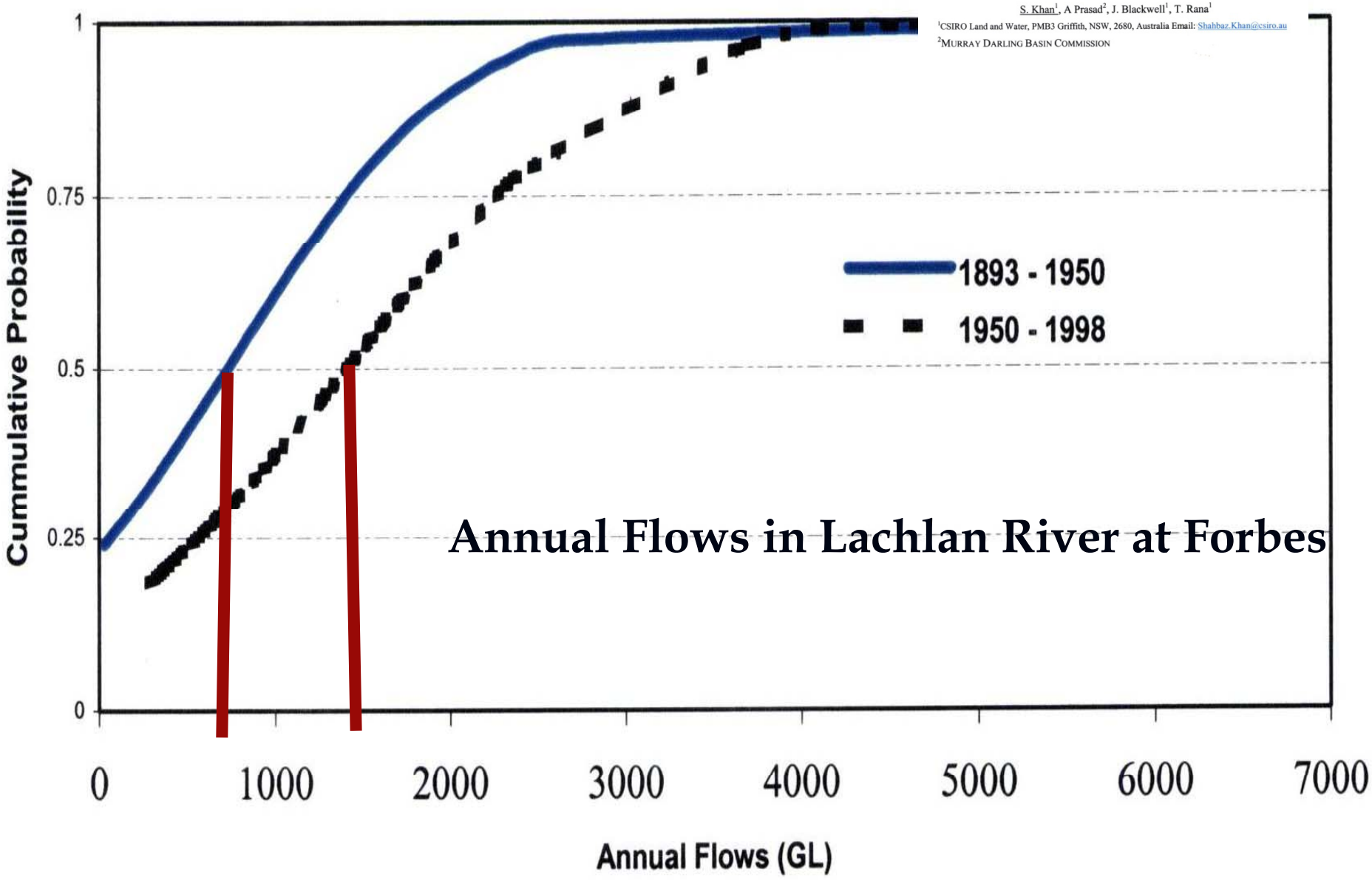
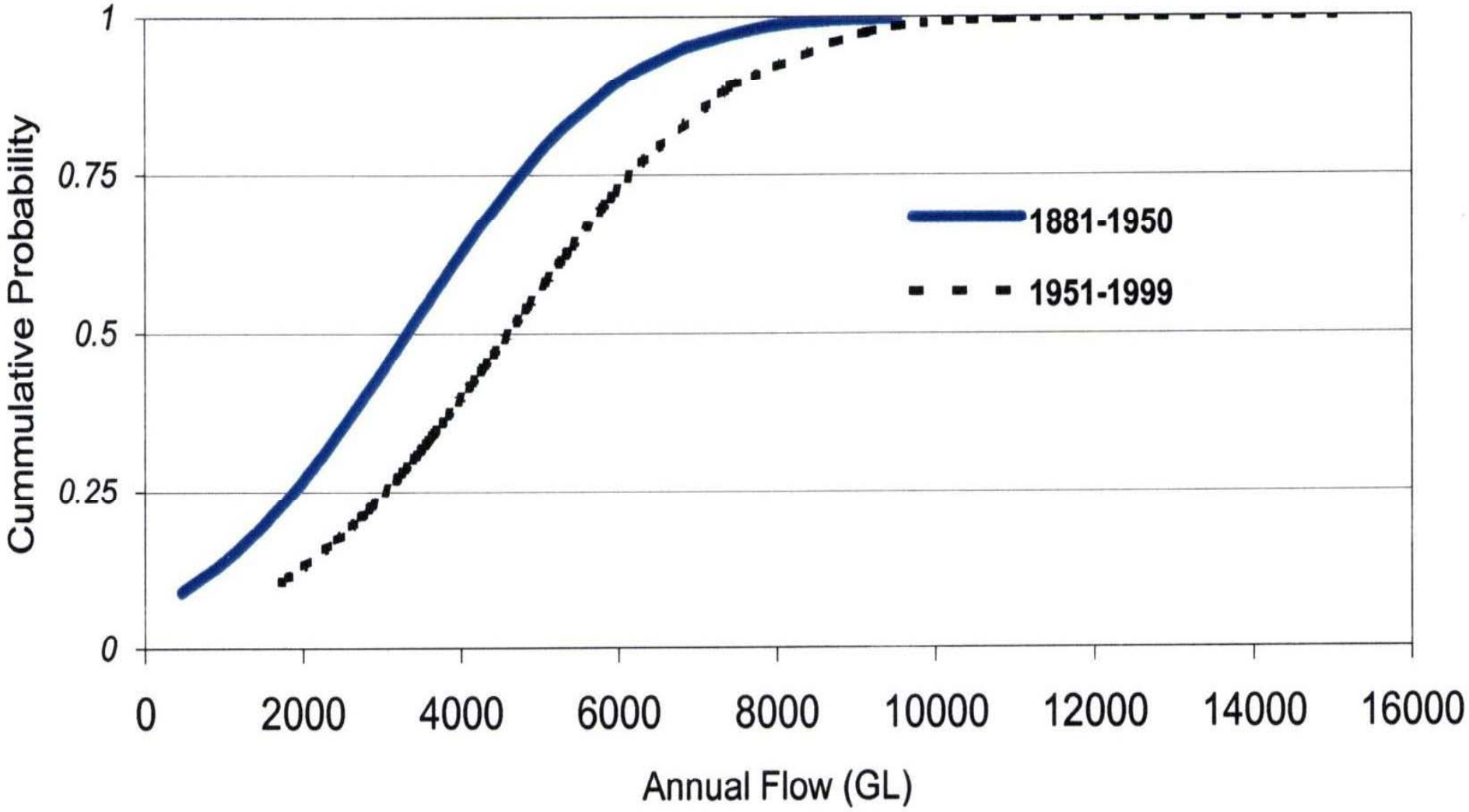
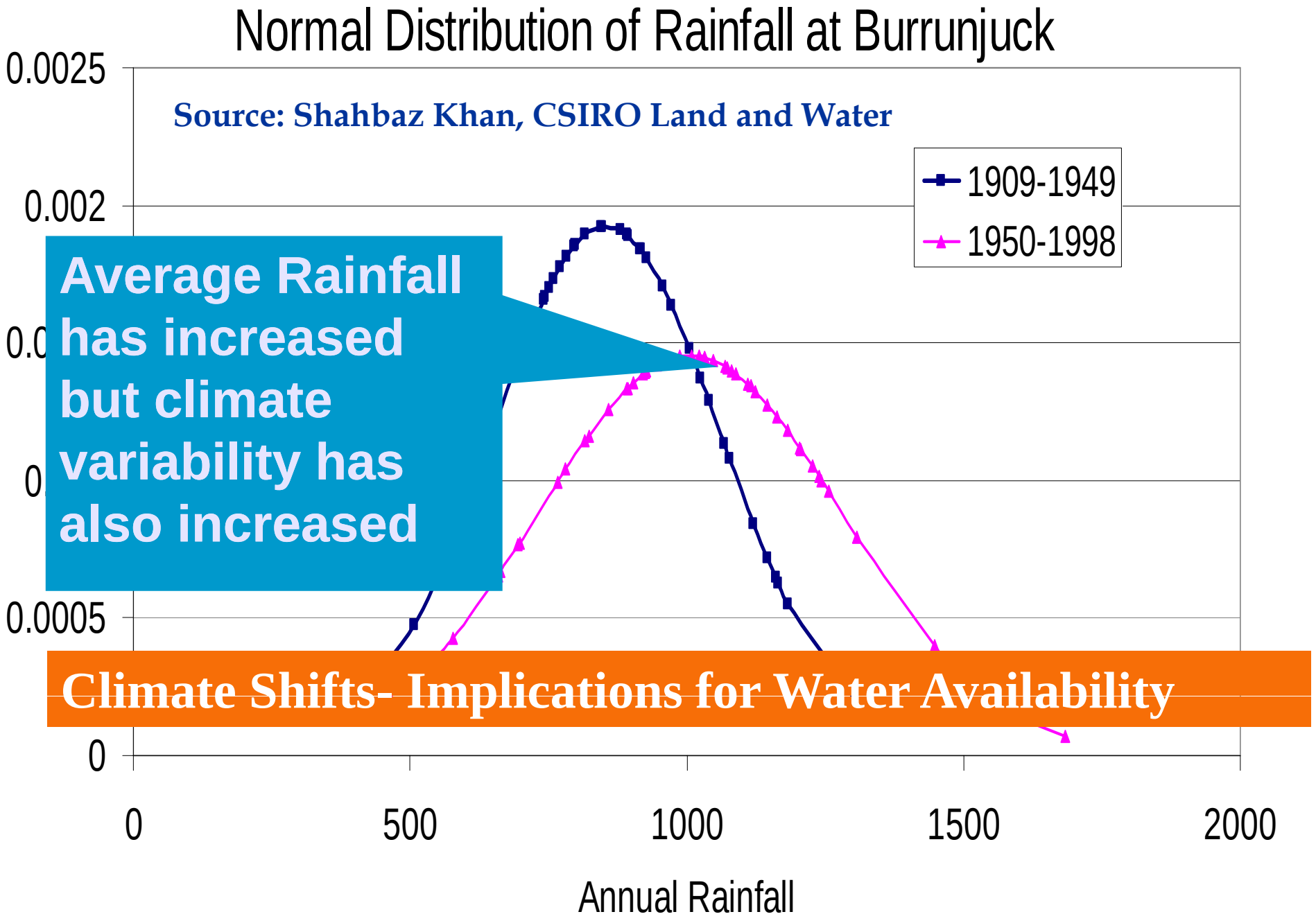
[2]MURRAY DARLING BASIN COMMISSION



Annual Flows in Lachlan River at Forbes

Annual Flows in Murrimbidgee at Wagga Wagga




Normal Distribution of Rainfall at Burrunjuck
Source: Shahbaz Khan, CSIRO Land and Water
1909-1949
1950-1998
0.0025
0.002
0.0005
0
0
500
1000
1500
2000
Annual Rainfall
Average Rainfall has increased but climate variability has also increased
Climate Shifts- Implications for Water Availability

Climatic influence on shallow fractured-rock groundwater systems in the Murray–Darling Basin, NSW

natural resources commission

Department of Environment & Climate Change NSW

Prepared by:

Aleksandra Rančić [1,2], Gabriel Salas [3], Amrit Kathuria [4], Ian Acworth [2], William Johnston [3], Ann Smithson [3] and Geoffrey Beale [3]

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[3] Former Department of Infrastructure Planning and Natural Resources (DIPNR) and Department of Natural Resources (DNR)

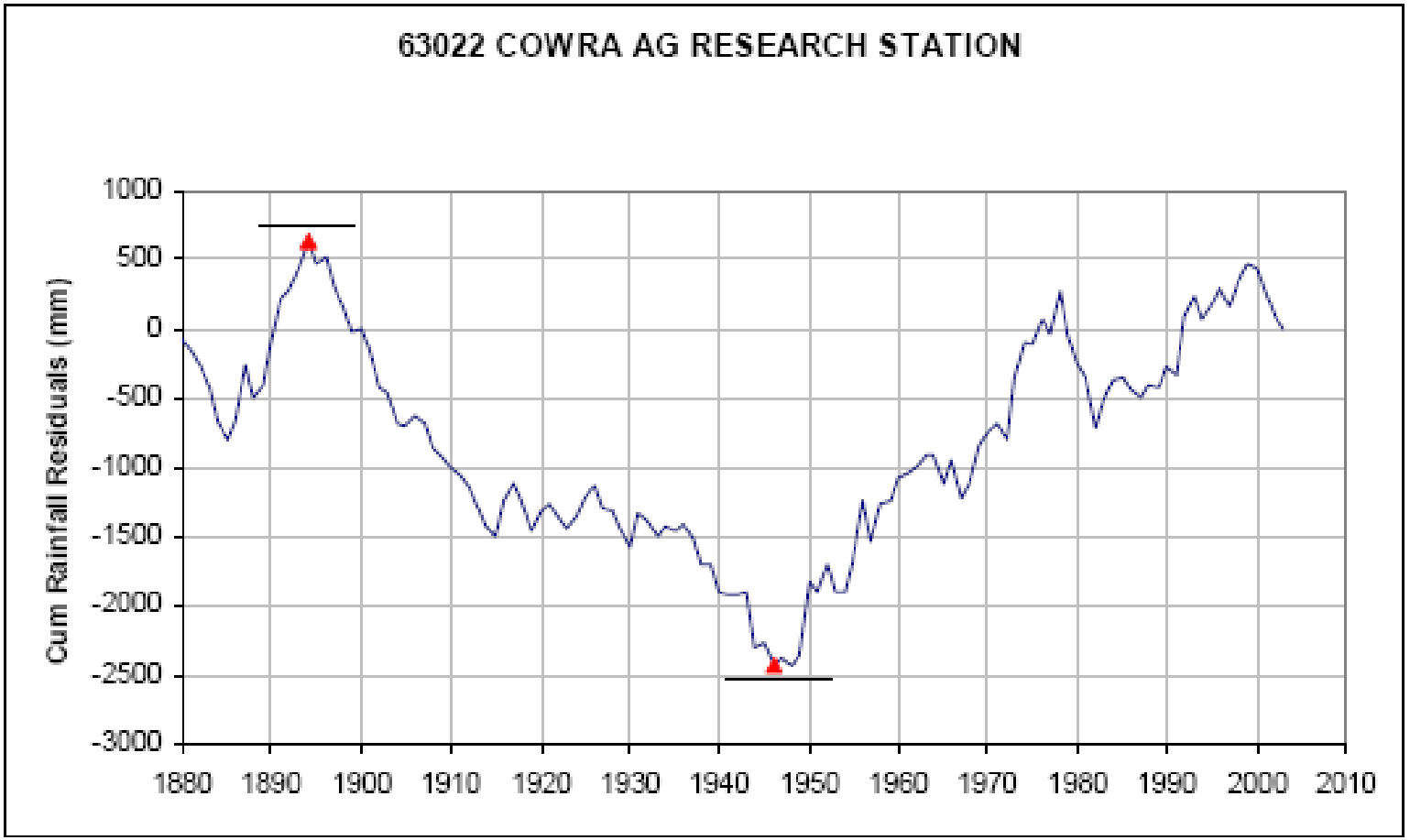


Figure 8: Example of residual mass curve (in blue) with extremes (red triangles) which show the timing of two major changes in rainfall regimes

Climate - rainfall

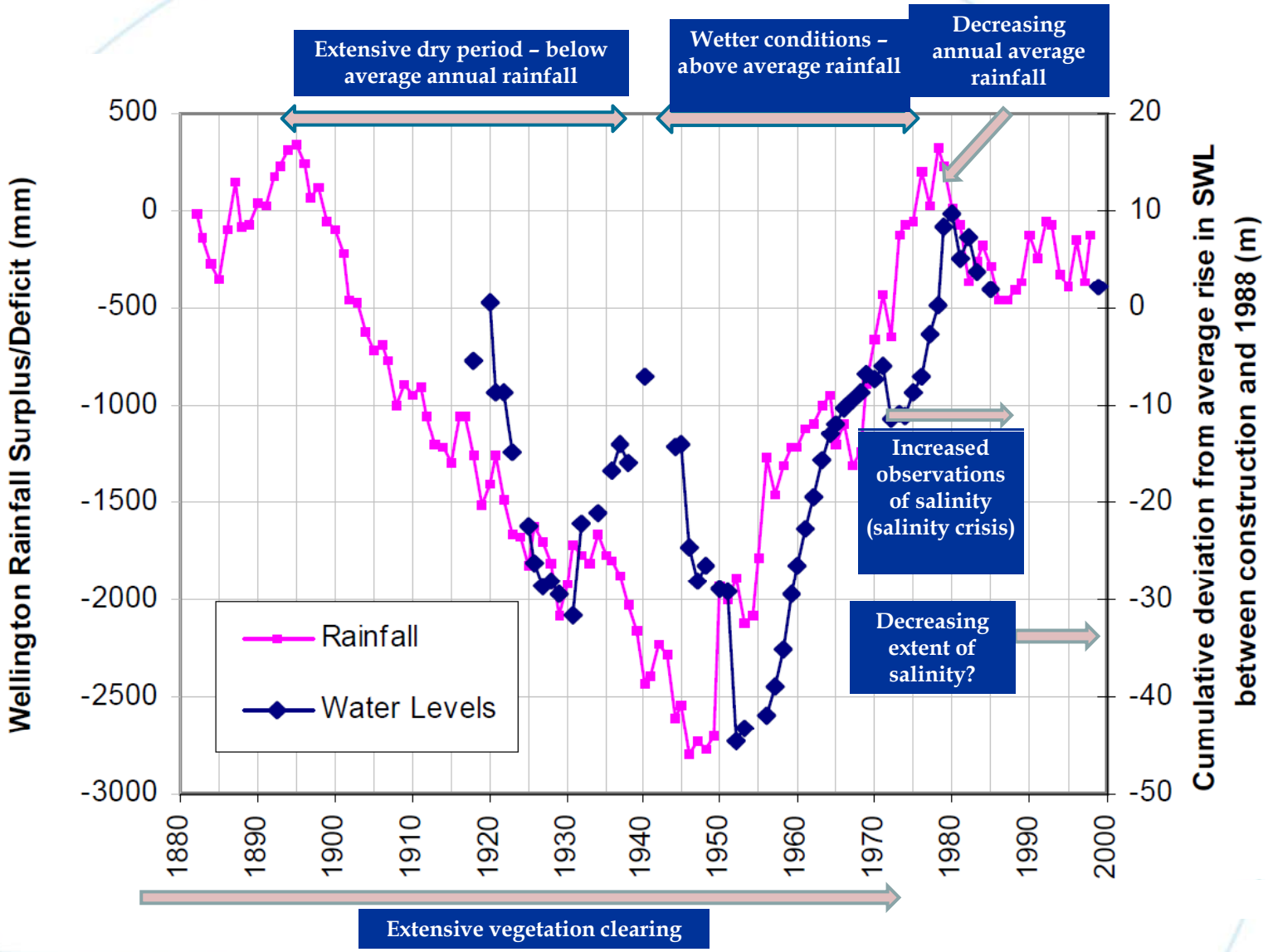
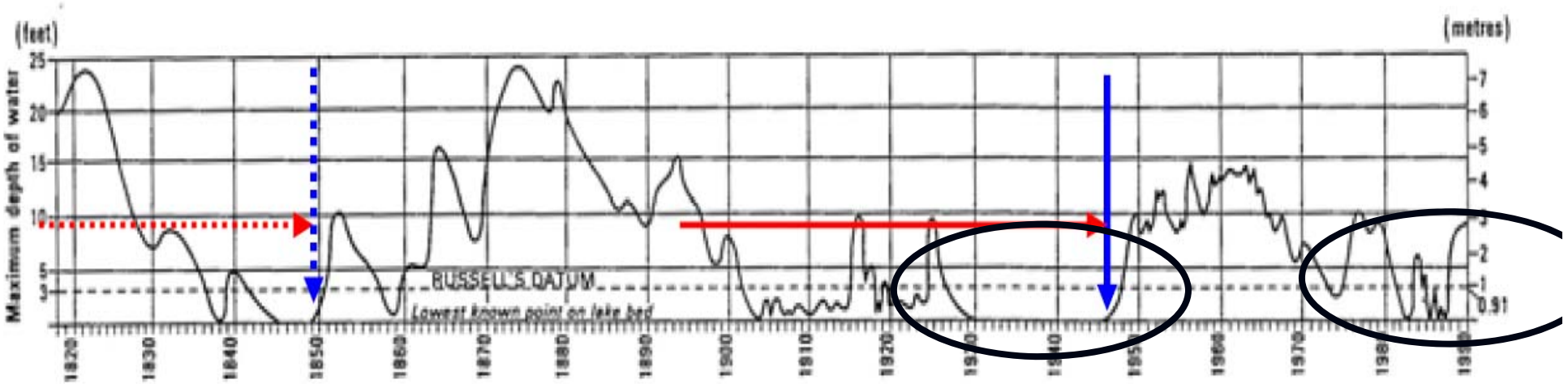


Figure 21: Fluctuations in water level in Lake George, 1819–1990



Jacobson, G., Jankowski, J. & Abell, R. 1991, Groundwater and surface water interaction at Lake George, New South Wales, *BMR J. Aust. Geol. Geophys.*, **12**, 161–189.

Water Resources and River Management Face a Double Whammy.....

- Adjustment to
  - drier cycle-climate shift to more of 1900-1949 rainfall patterns...prudent to be able to deal with climate patterns we have experienced.
  - over-allocation in period of plenty
- Adjustment to climate change-higher temperatures and lower rainfall