

Environmental Flows and the Upper Hawkesbury Estuary

Bill Peirson

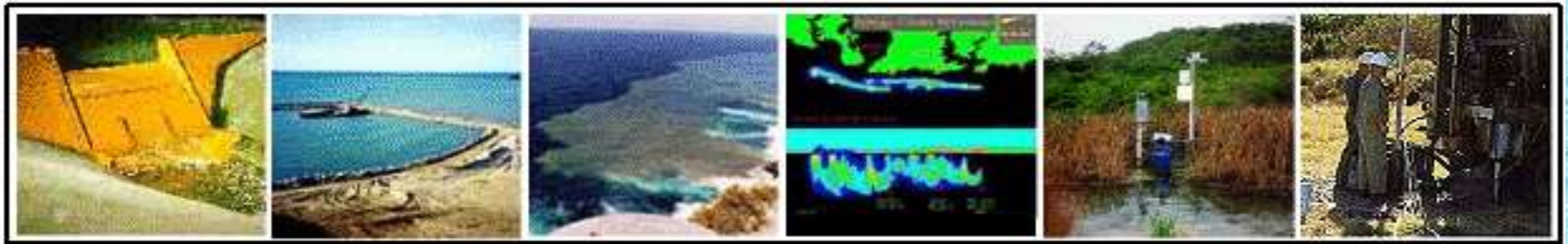
With due acknowledgement to Brett Miller, Keith Bishop, Tony Church, Debbie Cox, James Walker, Alex Kazaglis, Mitchell Harley, Duncan Rayner and Megan Wills



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- 50 year history of estuary, river and coastal engineering.
- Long-term independent involvement in the management of the Hawkesbury River
- Scholer, H. (1974) Geomorphology of New South Wales Coastal Rivers. WRL Research Report No. 139 deals extensively with the specific problems with the Hawkesbury estuary at that time.
- National strategy for determining environmental flows for Australian estuaries led by WRL staff.
- Ongoing leading research in the management of Australian estuaries and coastal wetlands.



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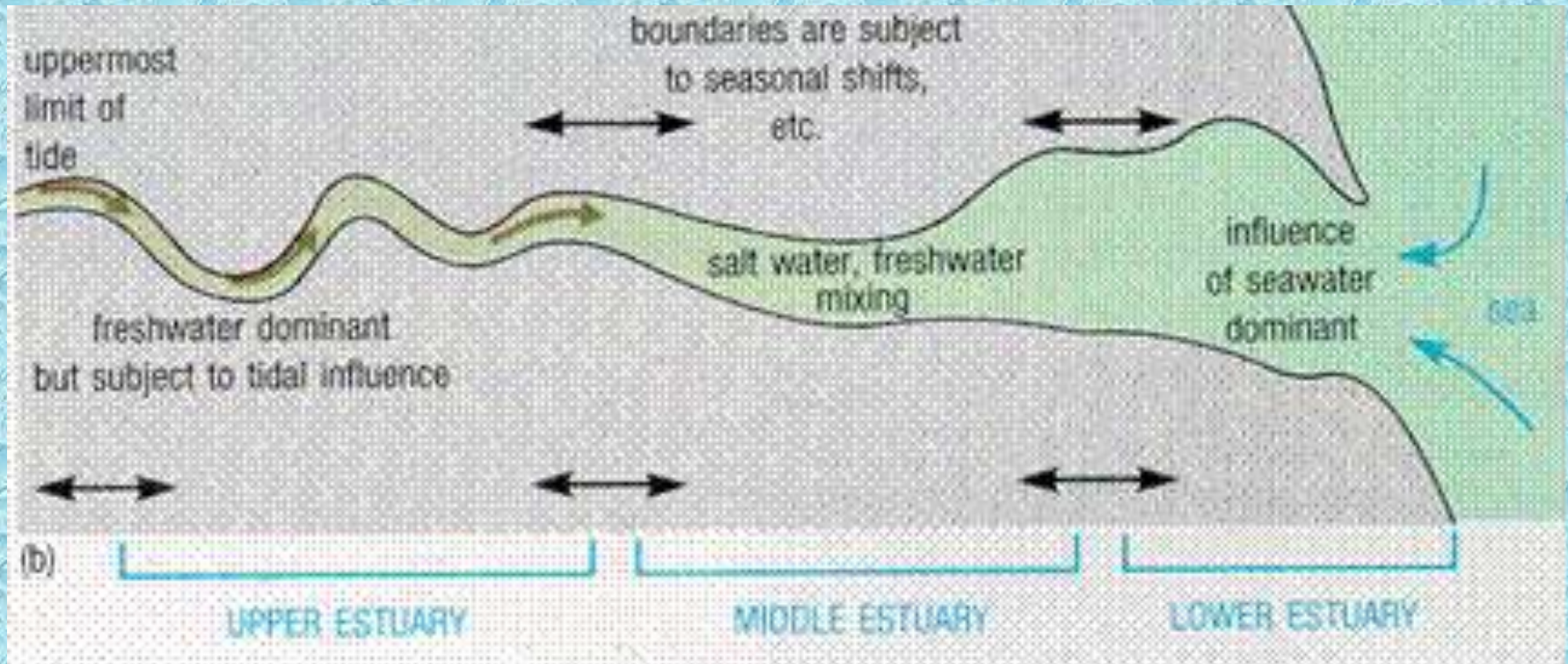
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Environmental flows are:

- water flows maintained solely for environmental reasons,
- to maintain the health and biodiversity of a particular waterbody.



Upper Estuary

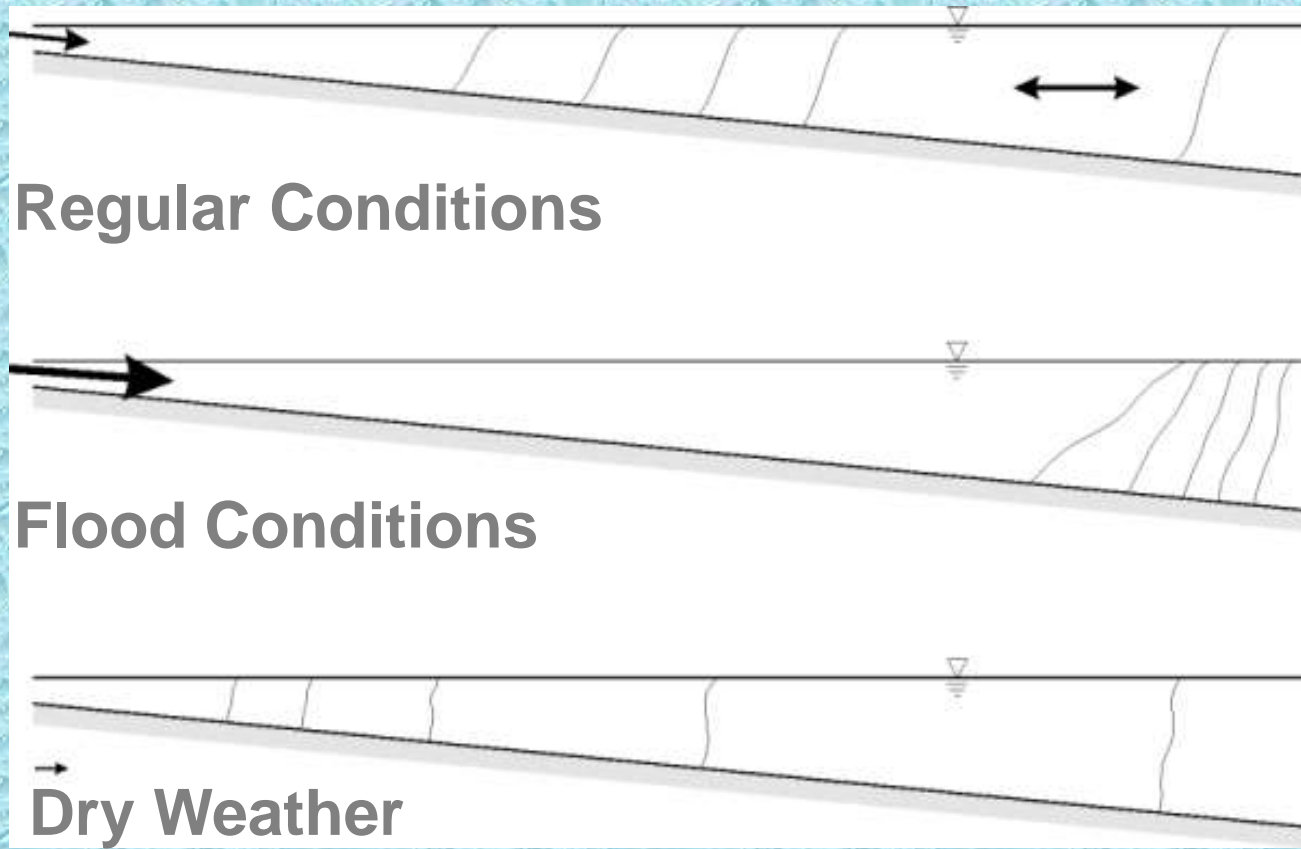


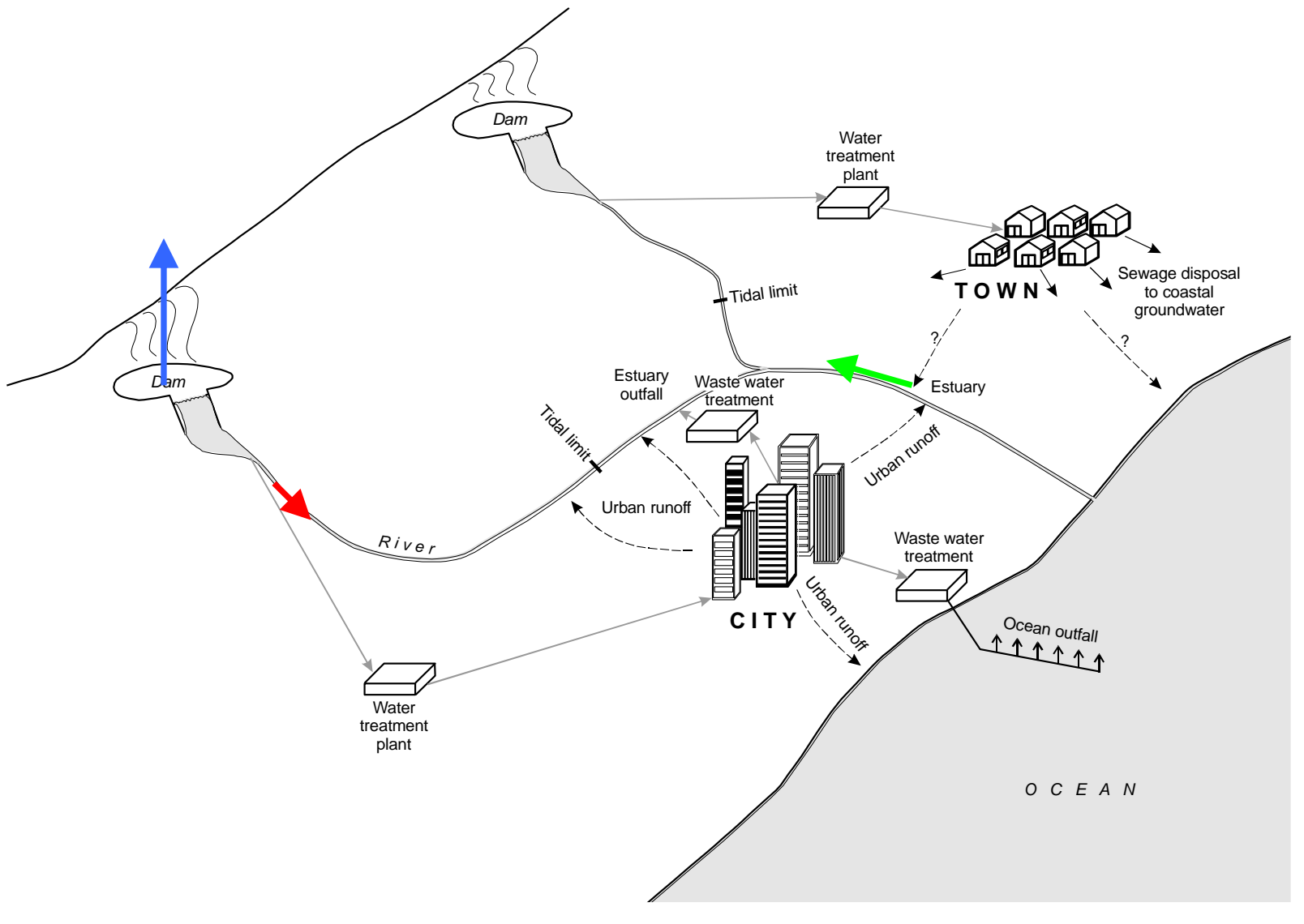
after Fig. 6.4 (b) of Waves, Tides and Shallow-Water Processes (1989).

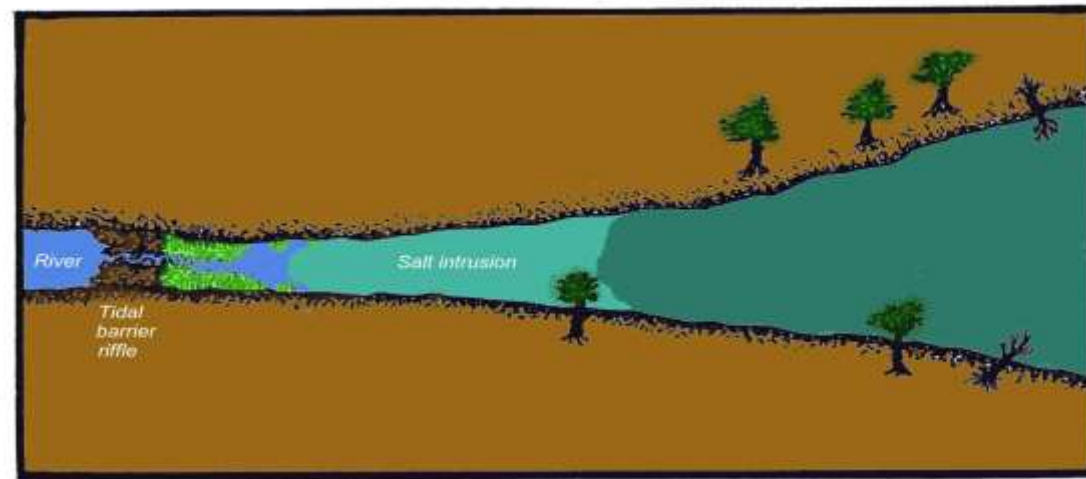
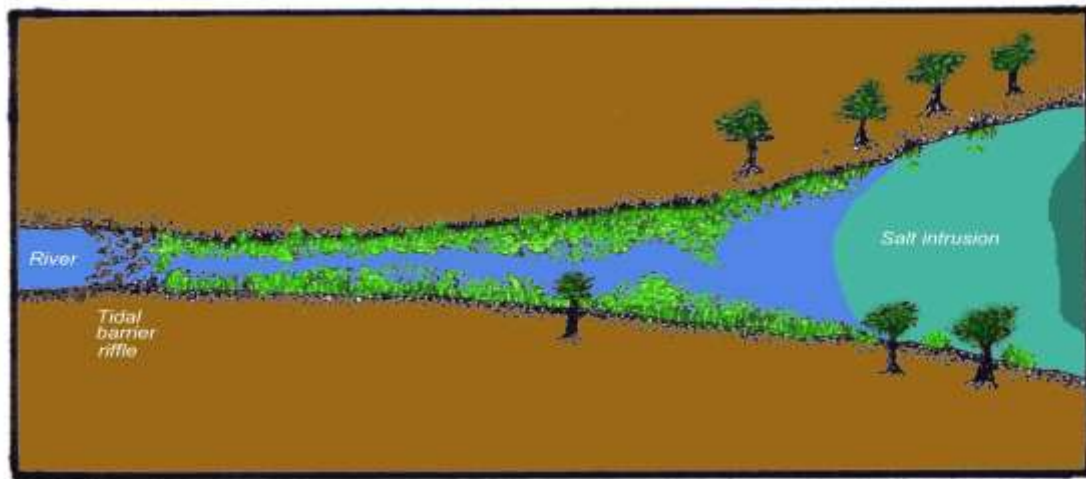


Overview of Saline Dynamics

The saline structure of the estuary is a combined influence of tides pushing saline ocean waters into the estuary and freshwater inflows pushing it back out.



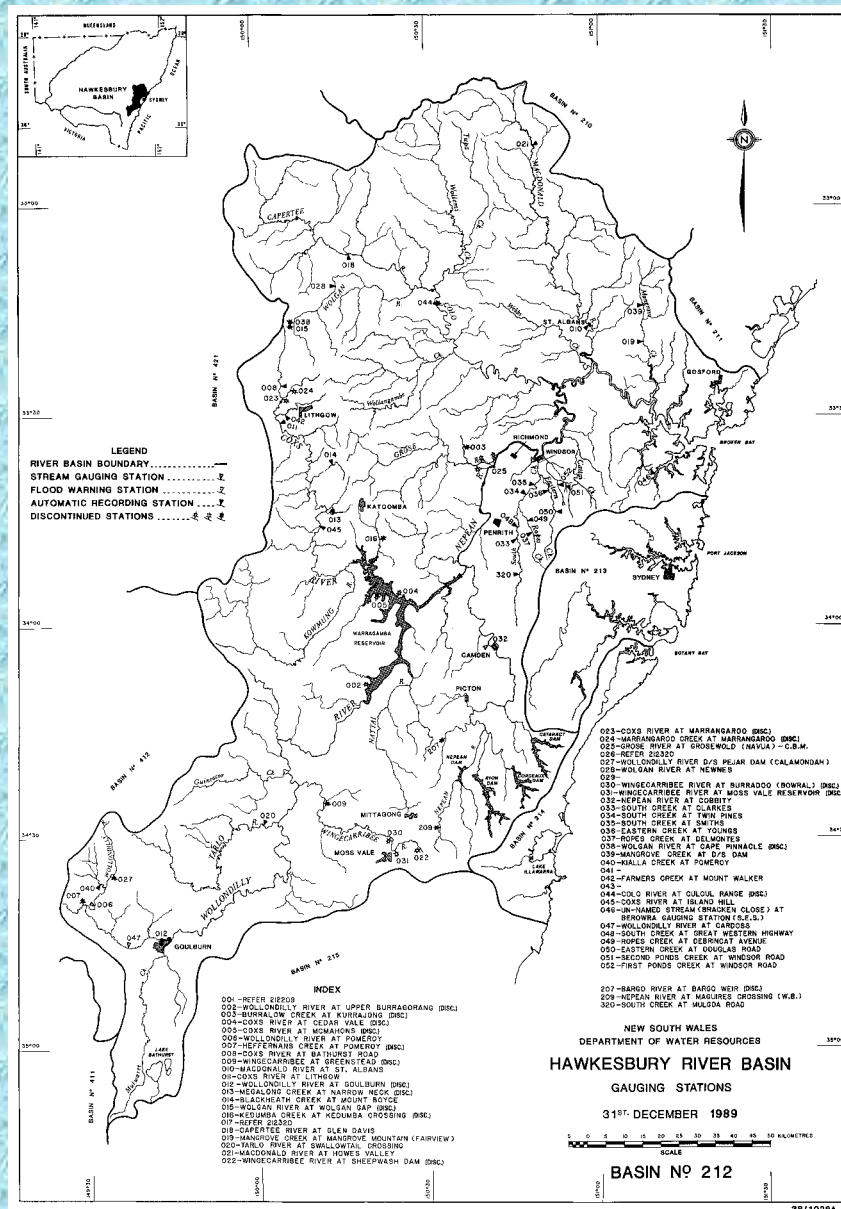


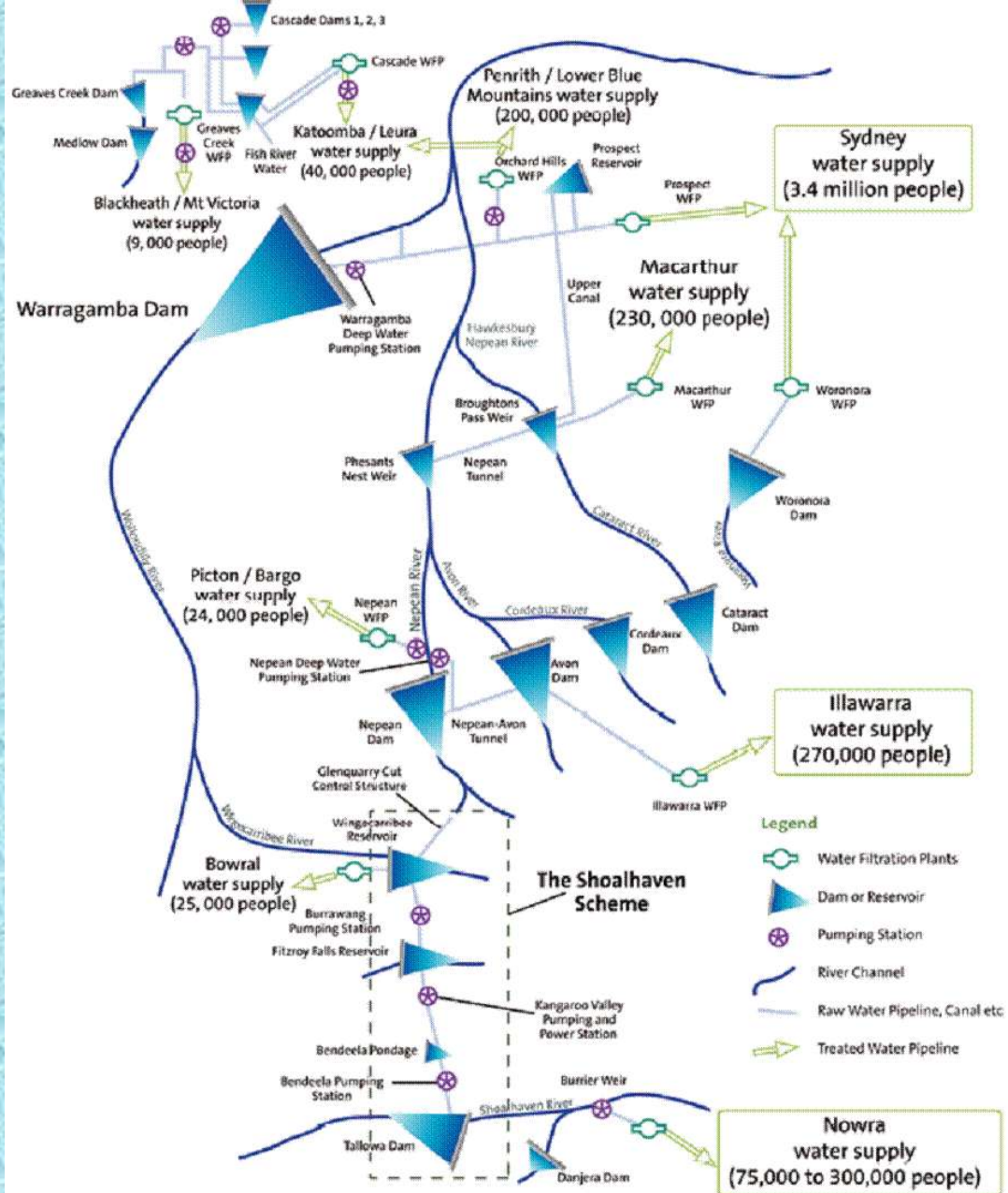


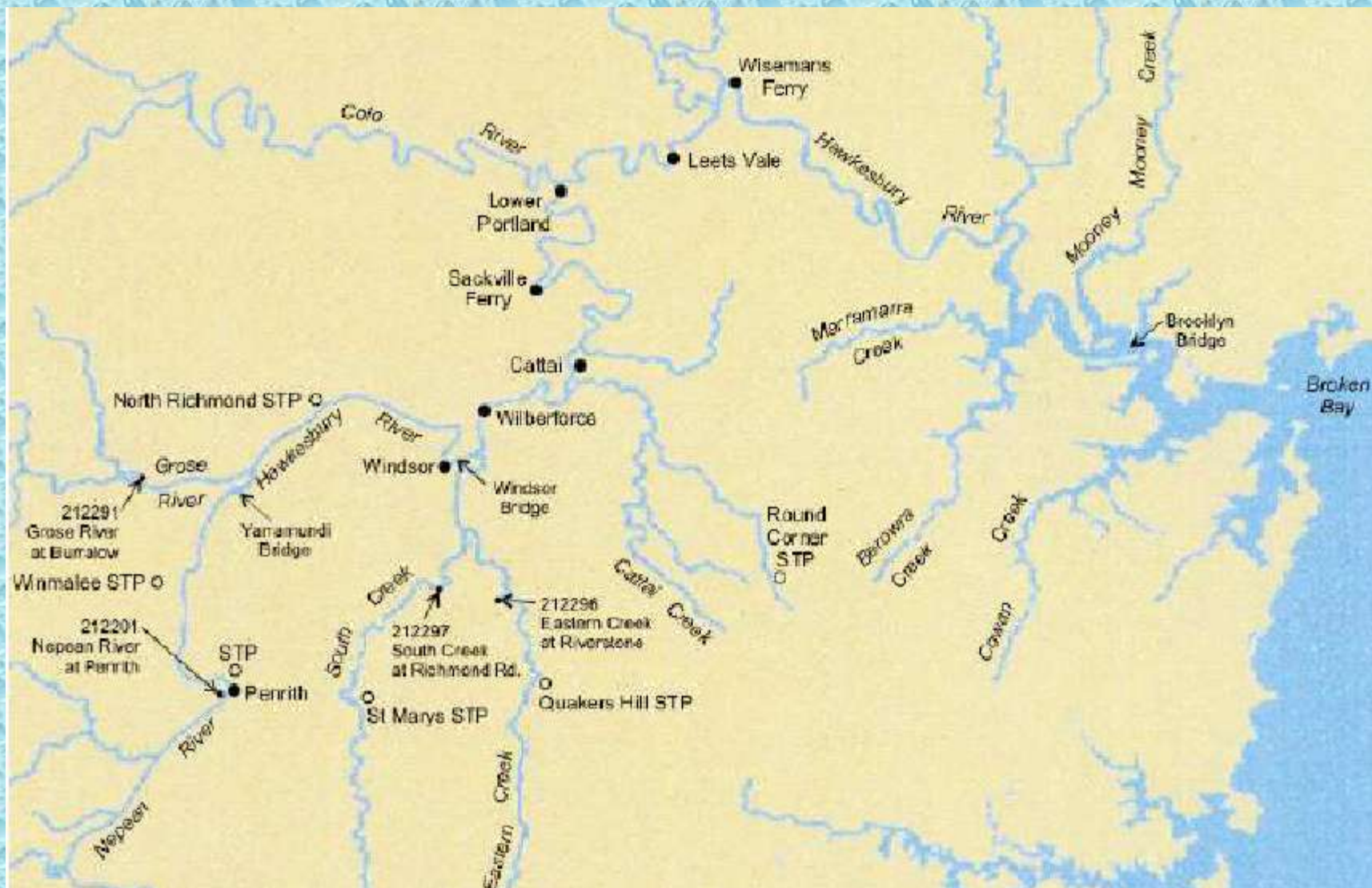
Peirson et al. (2002) Environmental Water Requirements of Australian Estuaries

- 1 Why do estuaries need specific attention?
- 2 What things do we need to be looking for? → a checklist
- 3 What to do? → a method
- 4 Future work









Hawkesbury Nepean Catchment Management Forum

- A hydrodynamic and saline dynamic understanding of the Hawkesbury Nepean estuary through 87 years (1909-1995) of simulation.
- The magnitude of inflows to the Hawkesbury are dramatically altered from natural conditions and now comprise
 - catchment runoff,
 - dam releases,
 - sewage treatment plant discharges,
 - extractions for irrigation purposes.
- Scenarios of predicted salinity structure of the estuary and potential impacts on the aquatic ecosystem.
- Preliminary ecological assessments.

UNSW Undergraduate Environmental Engineering Students

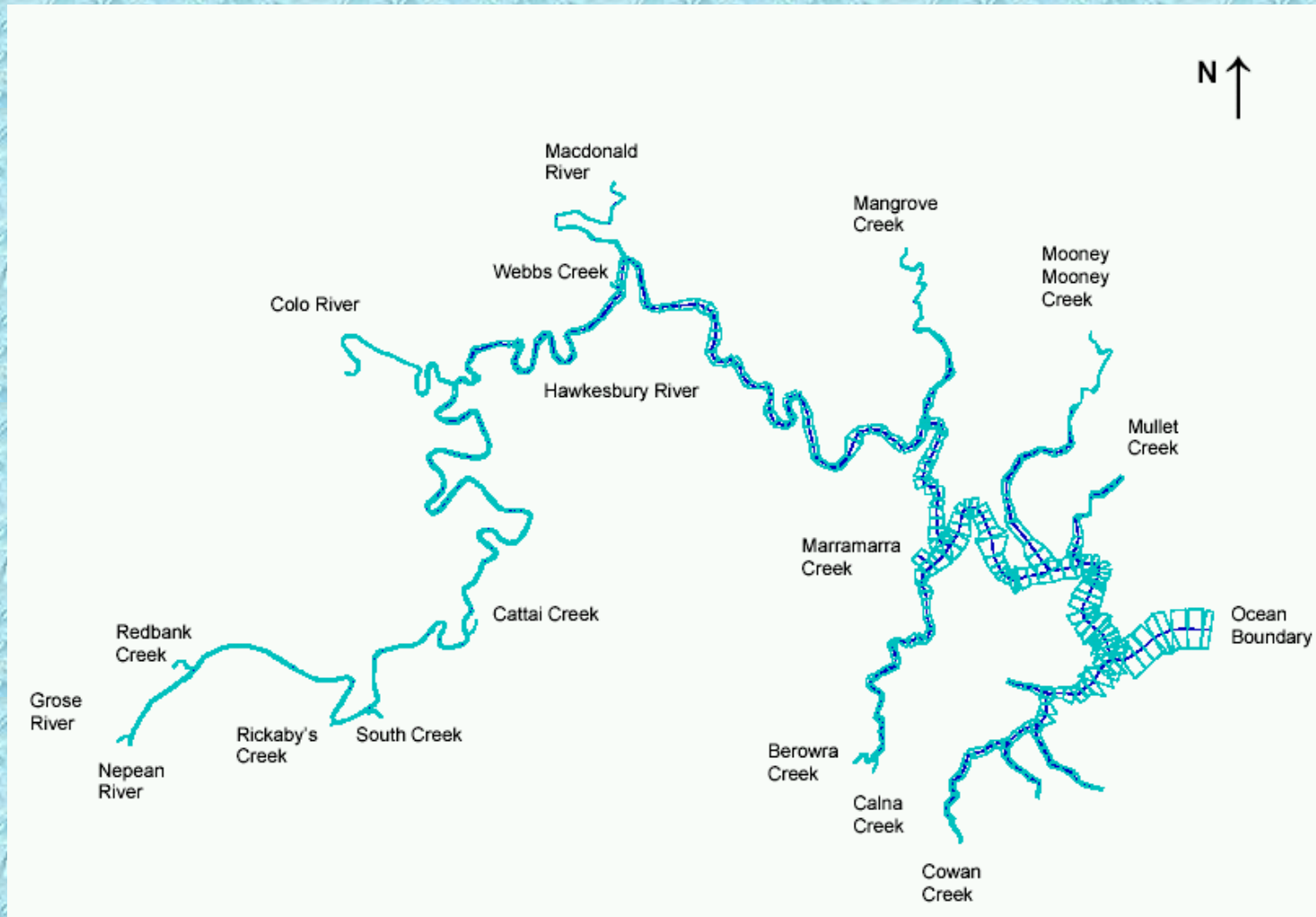
- Developing numerical models of increasingly sophisticated biotic reactions



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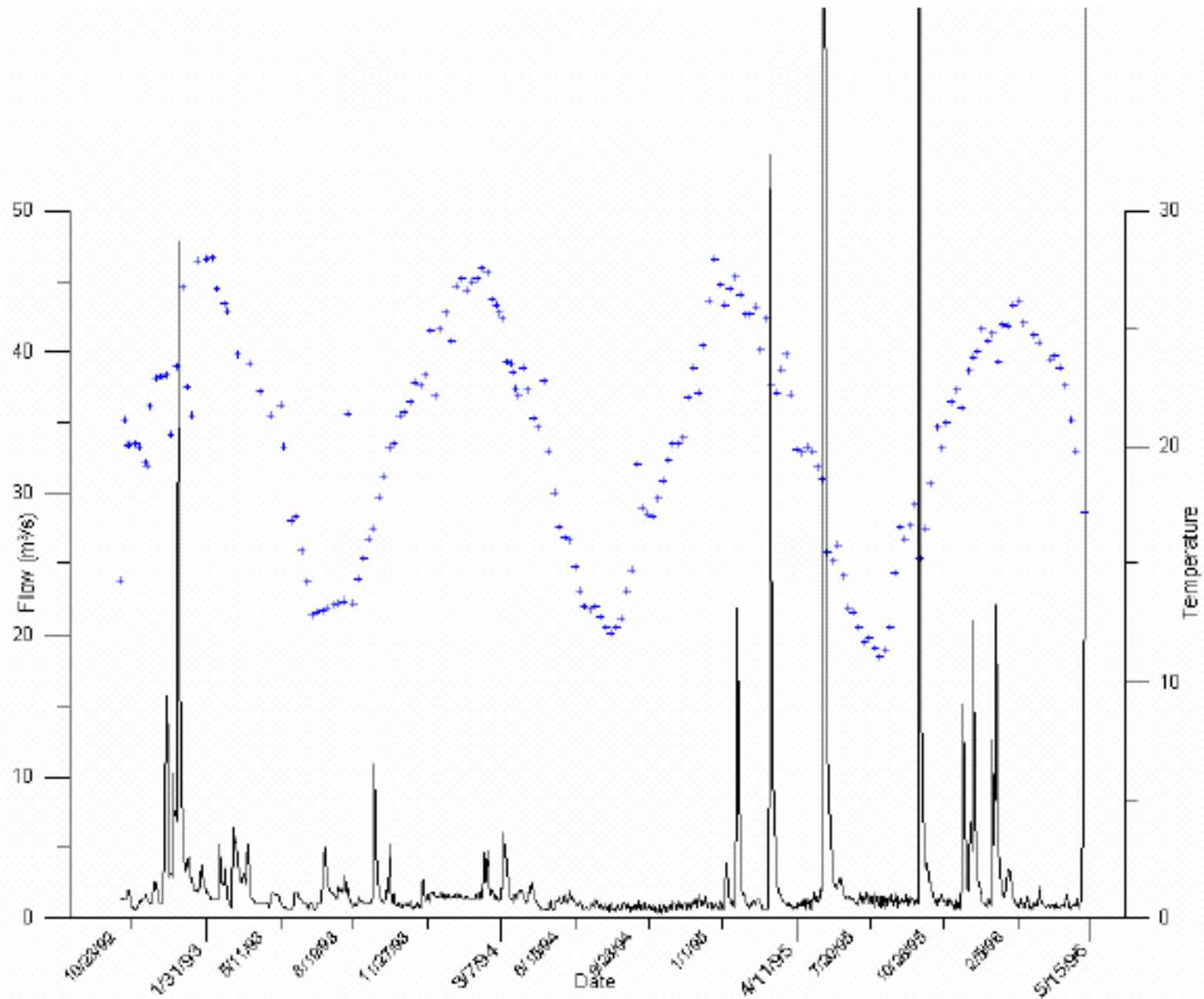
Hawkesbury River

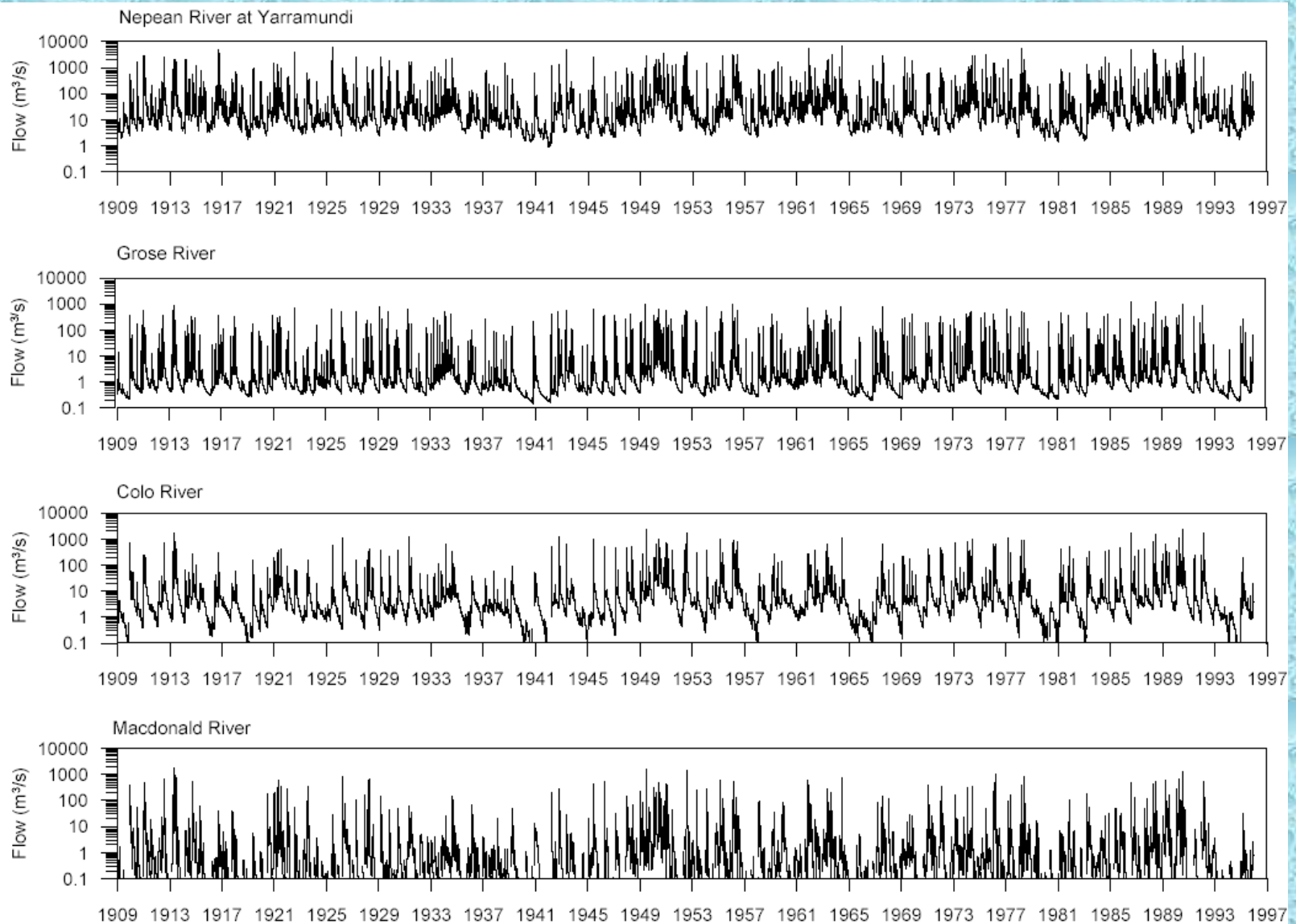


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Example Flow and Temperature Conditions

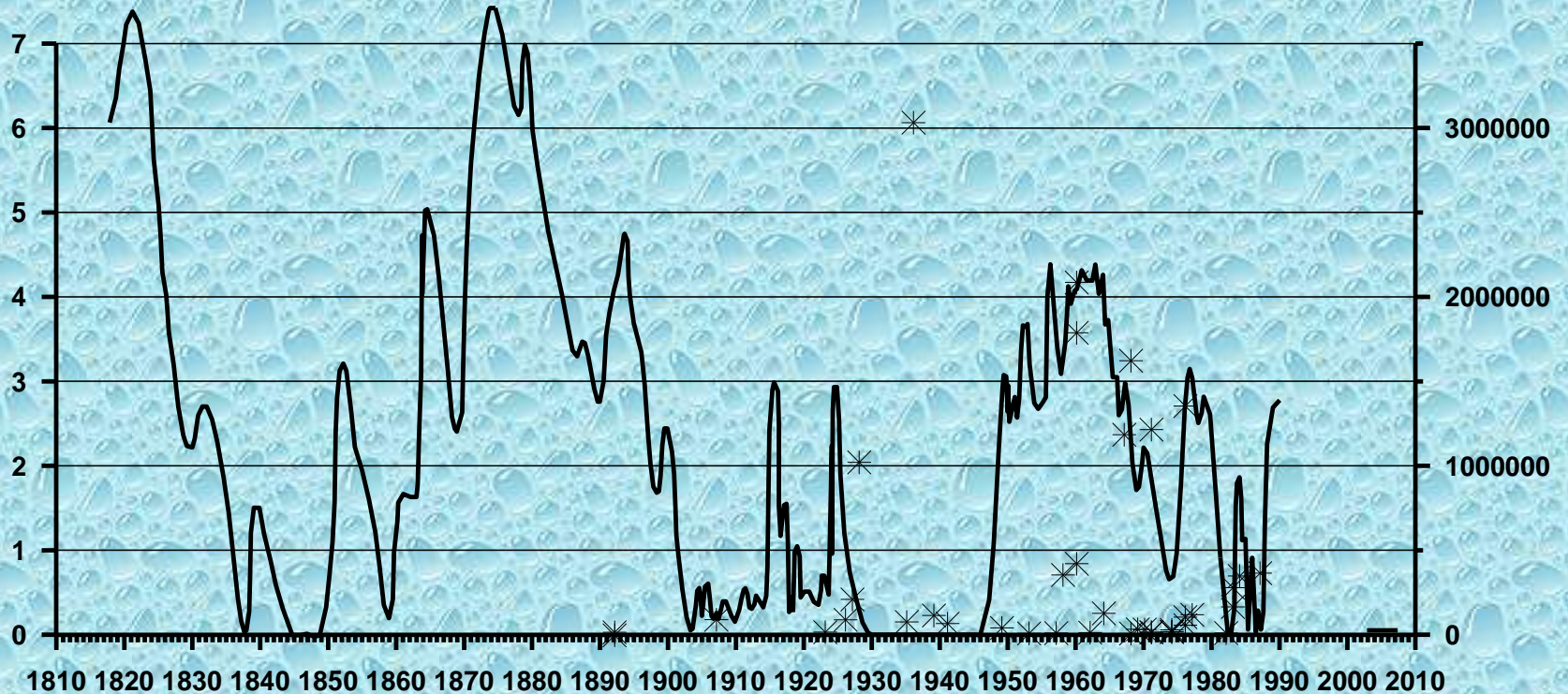




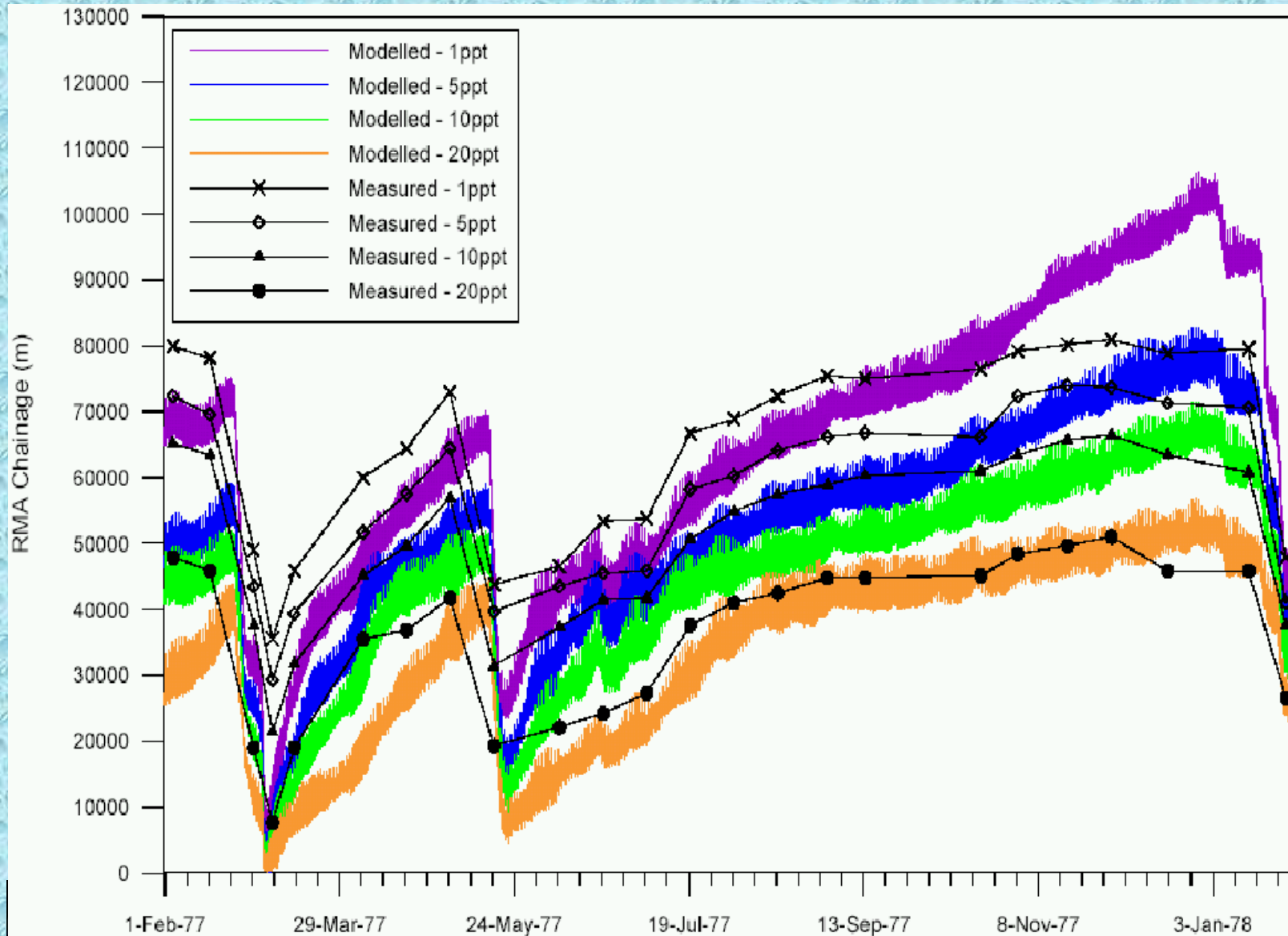
An historical view

Water Level in Lake George (m), Datum: lowest known bed level

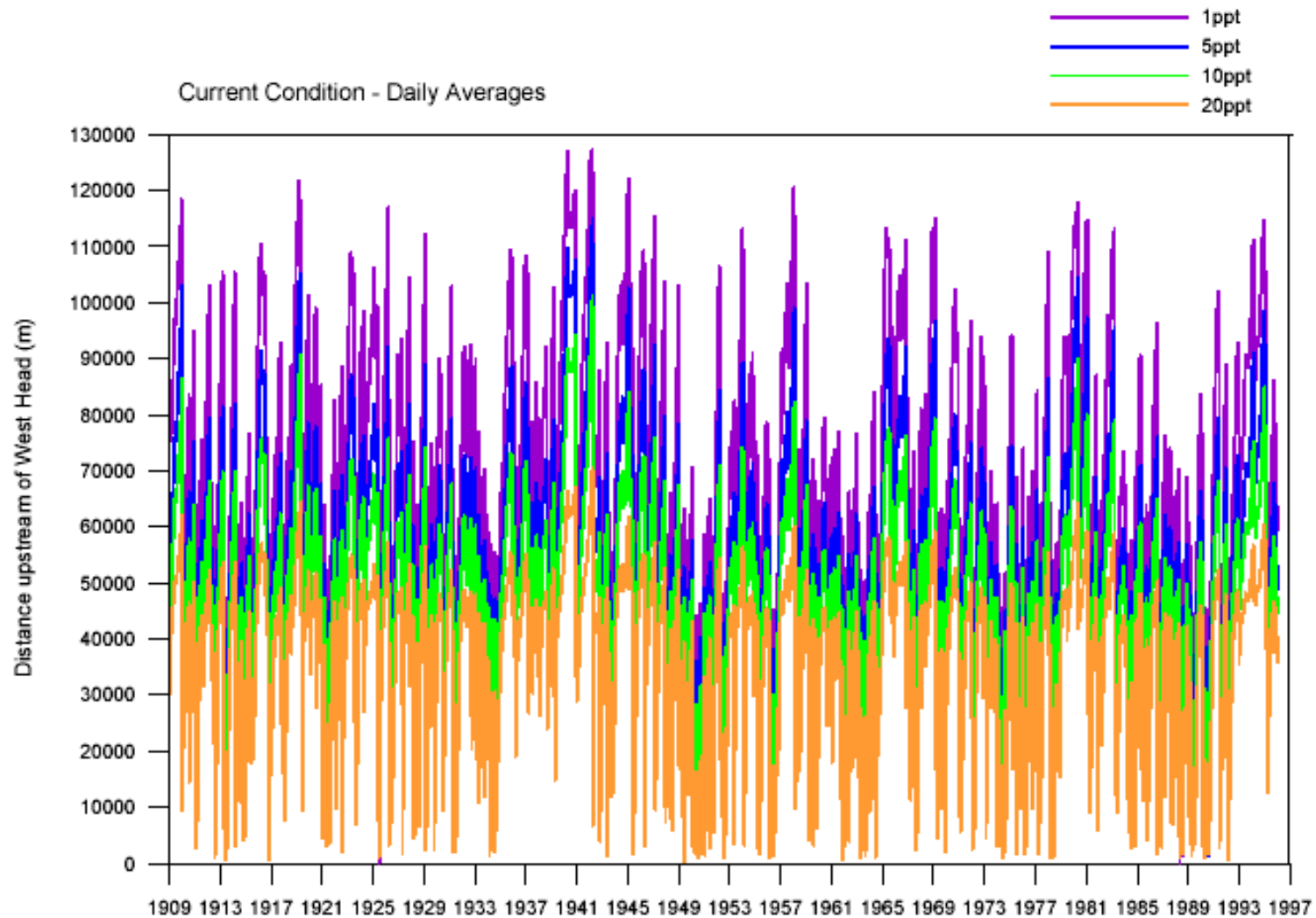
Built Dam Capacity (MI)



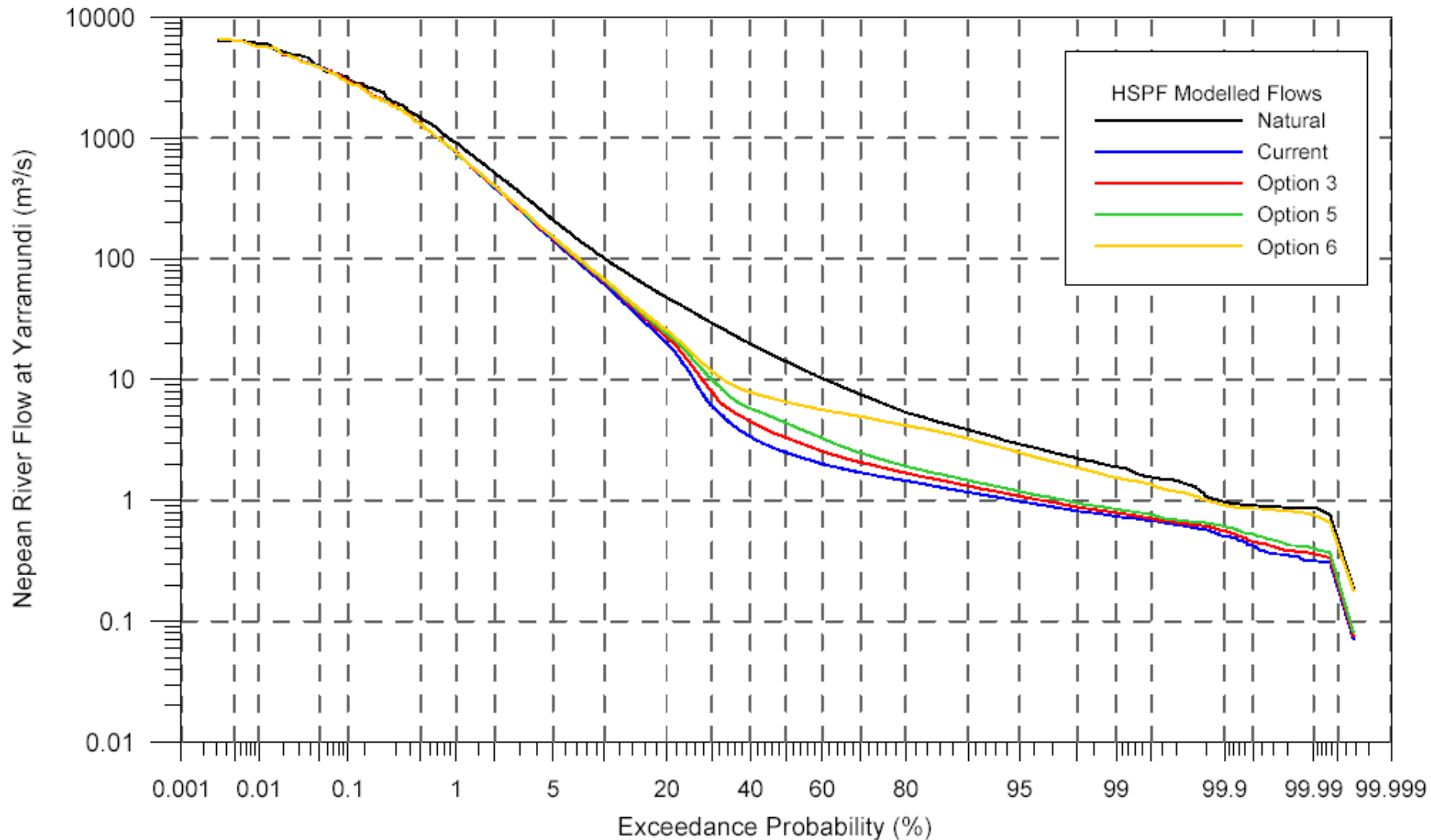
Hawkesbury River



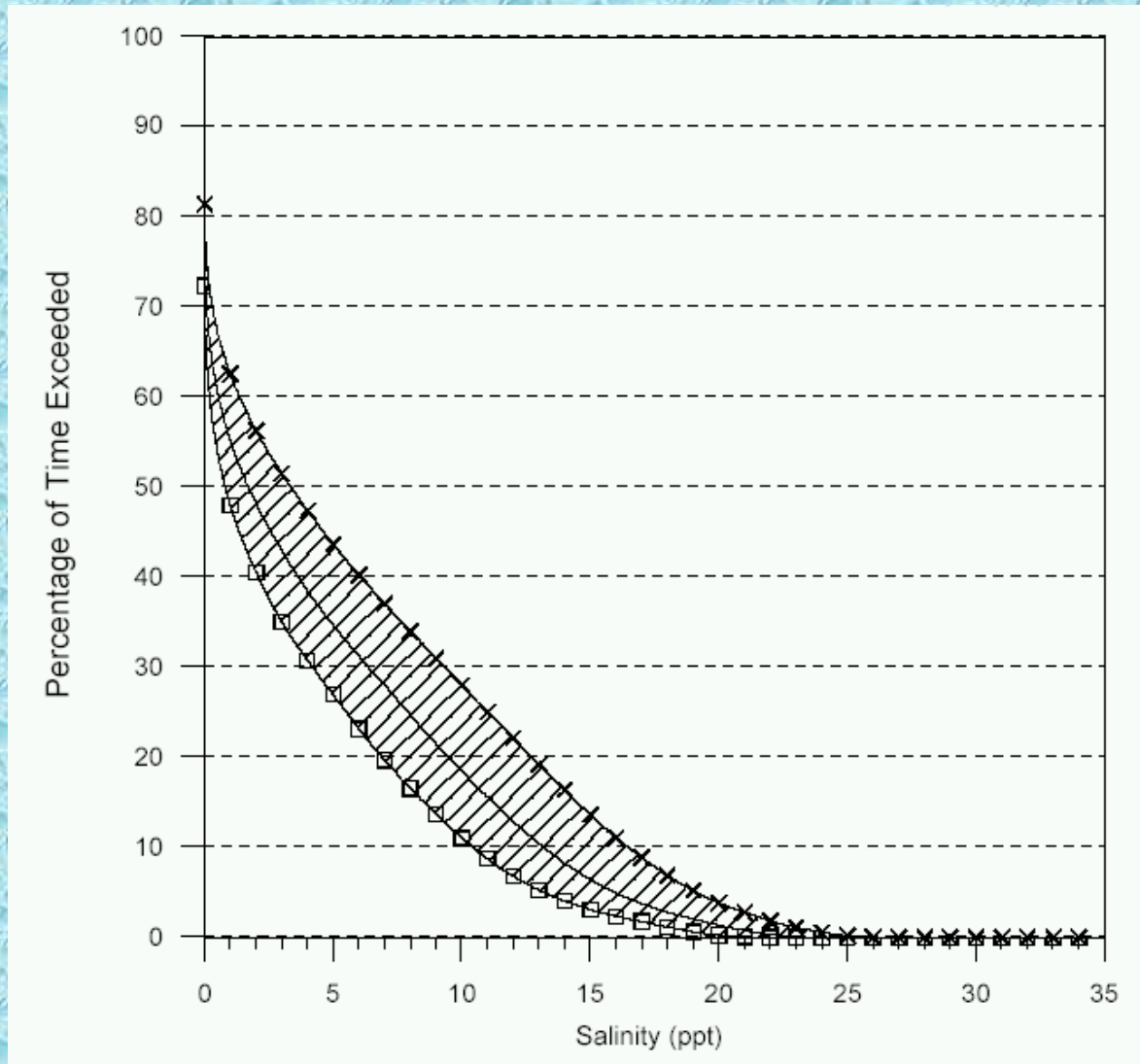
Saline Conditions Effected by Long Term Drought and Wet Cycles



Altered Flow Regimes



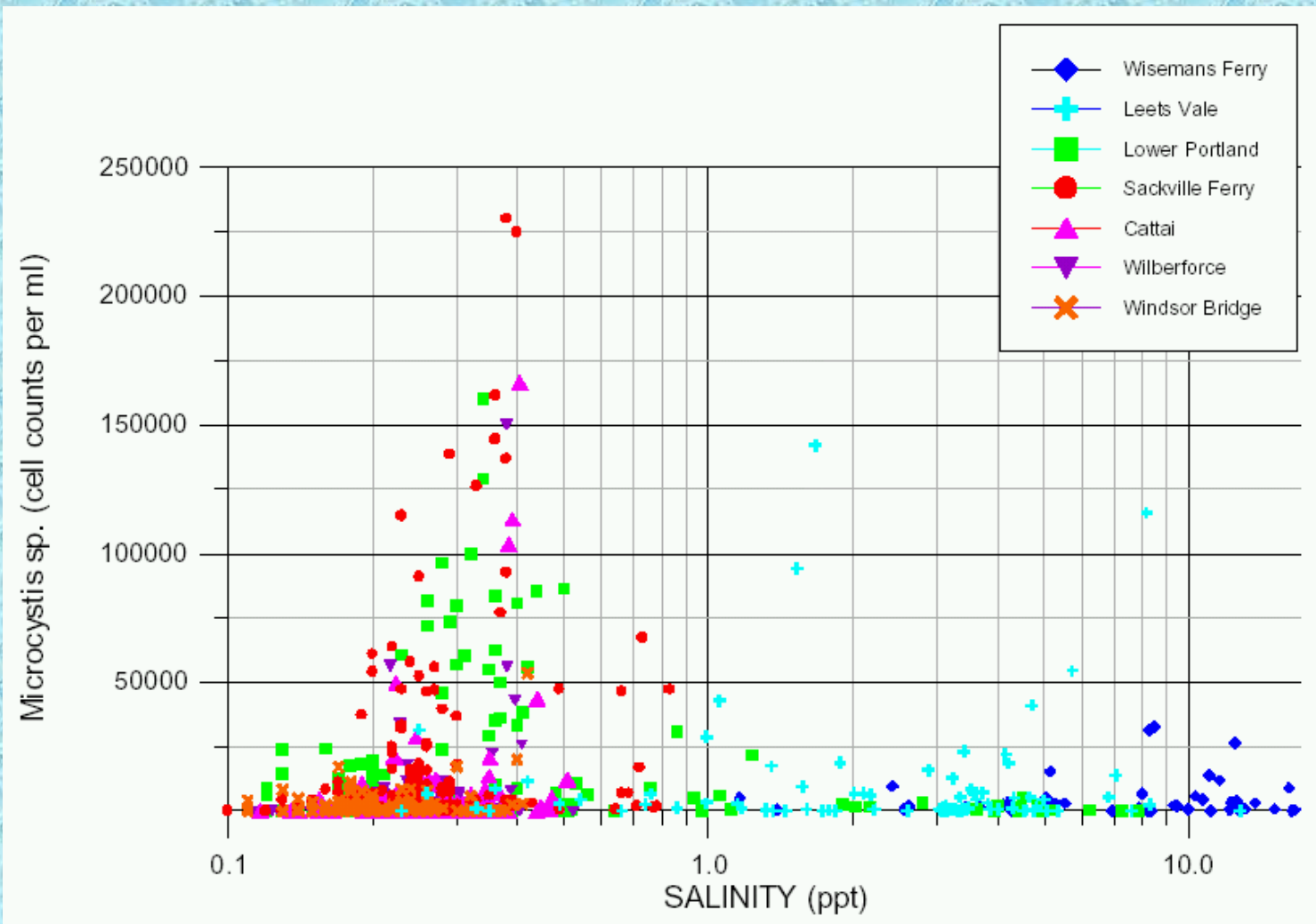
Hawkesbury River: Wisemans Ferry salinity exposure

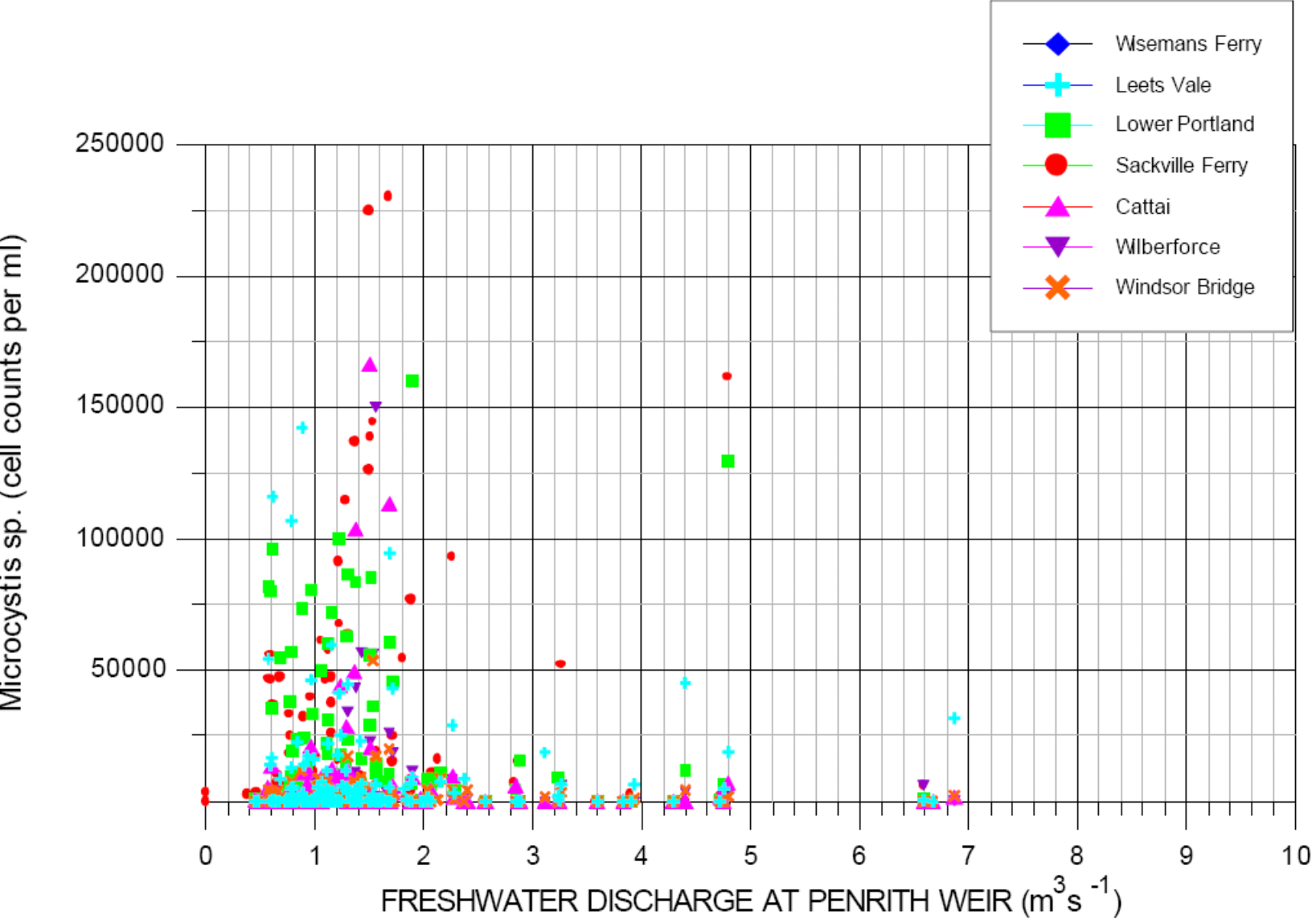


Hawkesbury River: cyanobacteria and salinity exposure

Bill Peirson and Tony Church*

*SKM





A flow threshold of $\sim 2\text{m}^3/\text{s}$ appears important

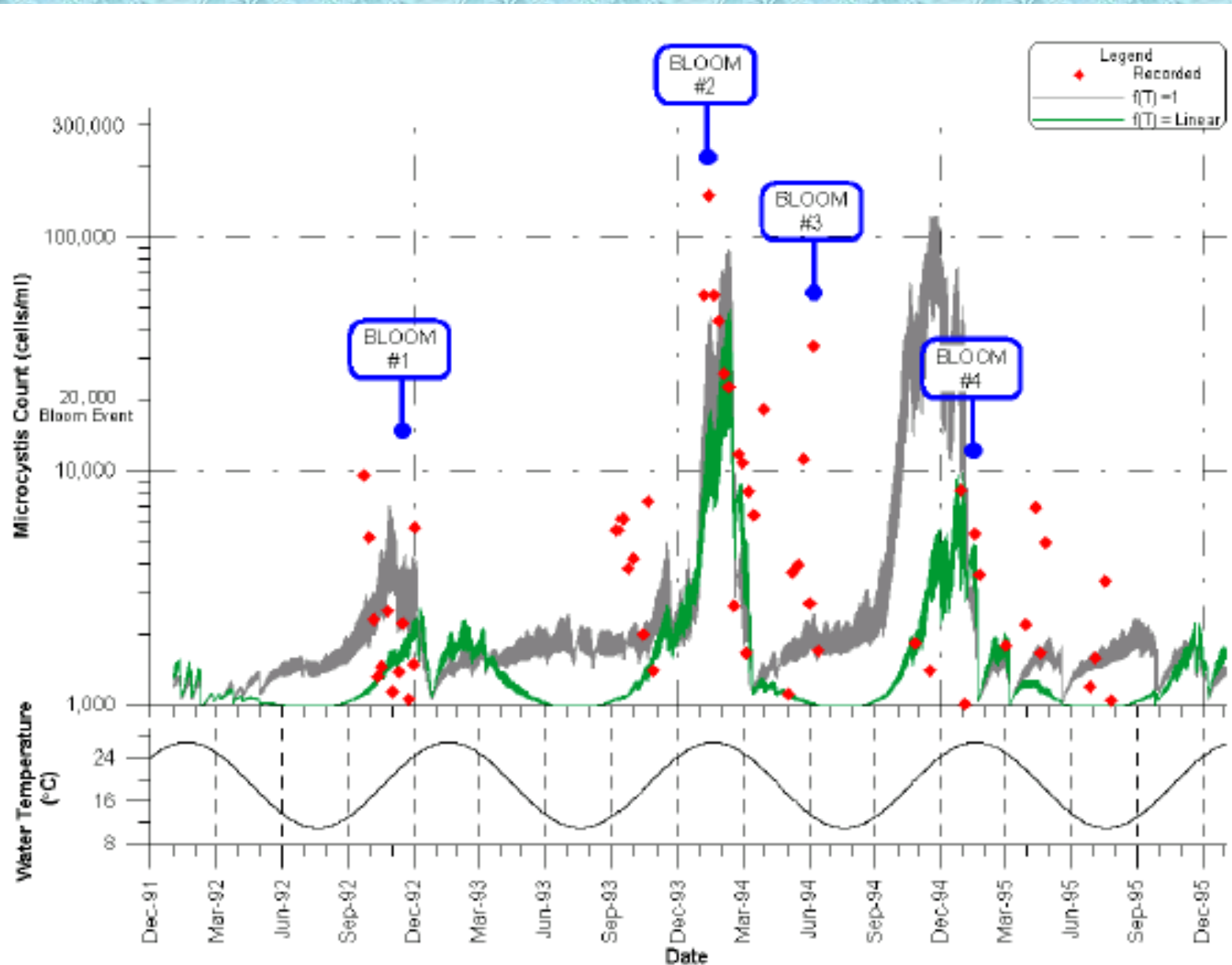


Temperature Observations During Observed Cyanobacterial Blooms

| Location | Bloom Size (cells/ml) | | | |
|--------------------------|-----------------------|----------|----------|-----------|
| | > 20,000 | > 50,000 | >100,000 | > 200,000 |
| Wisemans Ferry | 24.1 | - | - | - |
| Leets Vale | 20.8 | 22.2 | 23.2 | - |
| Lower Portland | 22.2 | 22.0 | 26.6 | - |
| Sackville Ferry | 22.6 | 22.6 | 25.3 | 26.5 |
| Cattai | 25.2 | 26.7 | 26.8 | 27.2 |
| Wilberforce | 24.6 | 26.1 | 26.8 | - |
| Windsor Bridge | 26.7 | 26.4 | - | - |
| Average of all locations | 23.8 | 24.3 | 25.7 | 26.9 |



Model Results Upper Estuary





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Conclusions

- A conceptual understanding of the physical and ecological behaviour of the upper Hawkesbury estuary exists
- The present situation in the upper Hawkesbury estuary has developed as a response to present climatic conditions and modifications to catchment drainage and water management
- Present student work continues to investigate specific problems within the estuary.
- Significant changes and function of the upper estuary will require: *MT RH5-1 Estuary and coastal management plans: Implementing or assisting with implementation of relevant, high priority actions in estuary management or other management plans. (HAWKESBURY-NEPEAN CATCHMENT ACTION PLAN 2007 – 2016)*, with an integrated catchment perspective.

