Managing Acid Sulfate Soil Risks and Impacts in the Lower Lakes

7th International Acid Sulfate Soils Conference

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Government of South Australia

Australian Government

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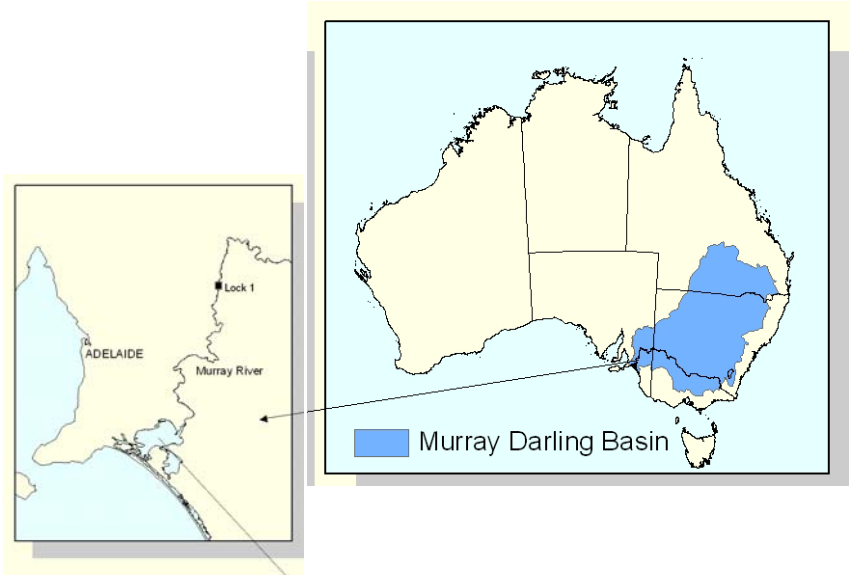
MURRAYFUTURES

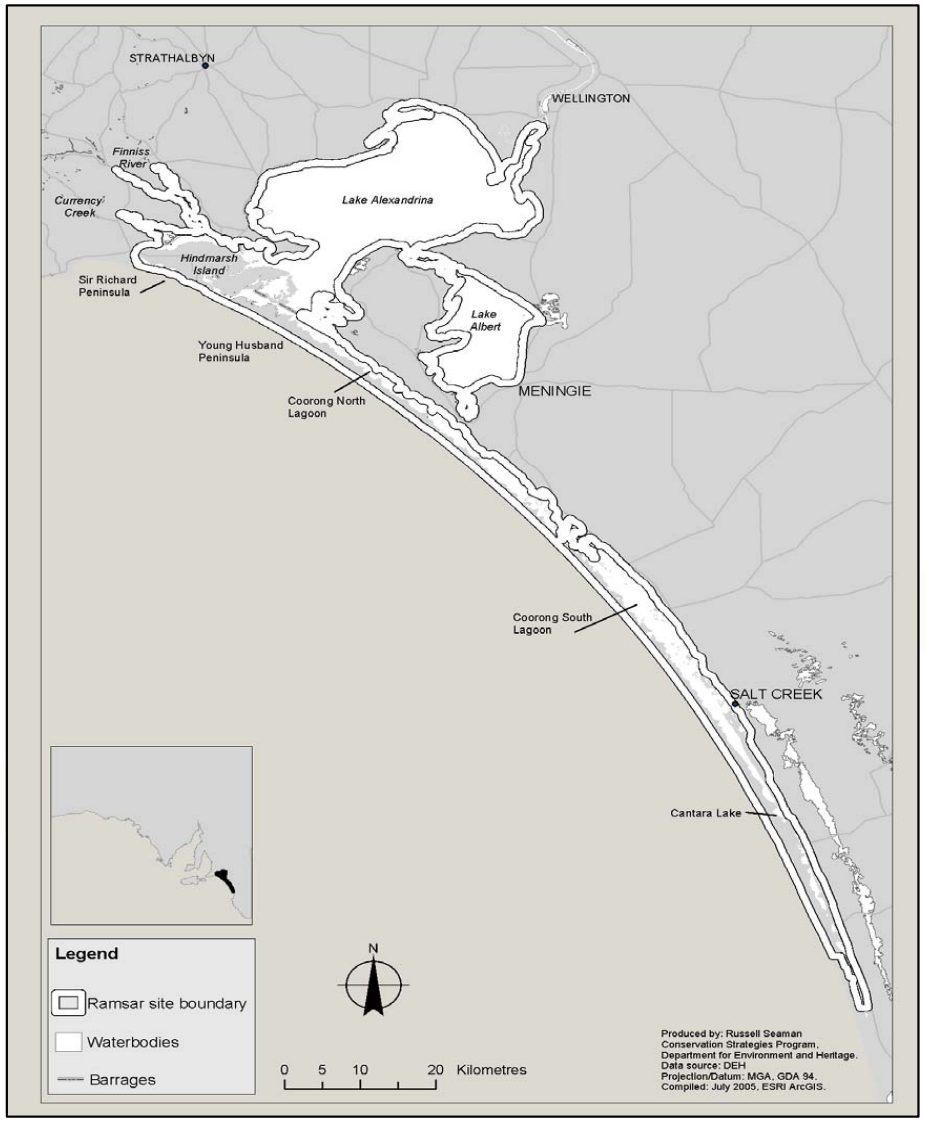
Lower Lakes & Coorong Recovery

Coorong and Lakes Alexandrina and Albert



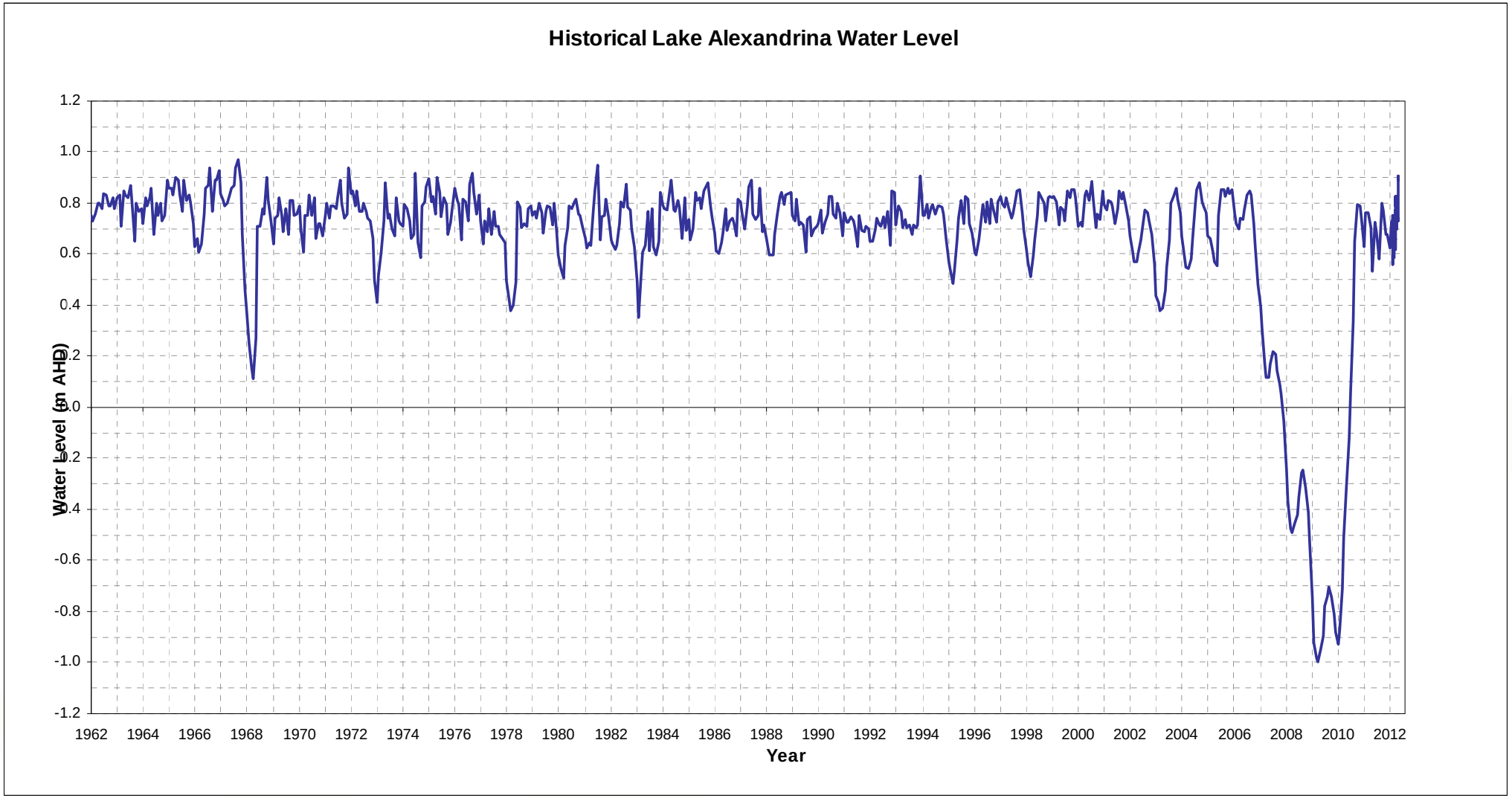
Environmental and cultural significance:

- Declared a wetland of international importance in 1985 (**Ramsar**)
- Coorong National Park
- Estimated the area receives over 200,000 visitors per year
- The traditional owners of the region are the Ngarrindjeri people

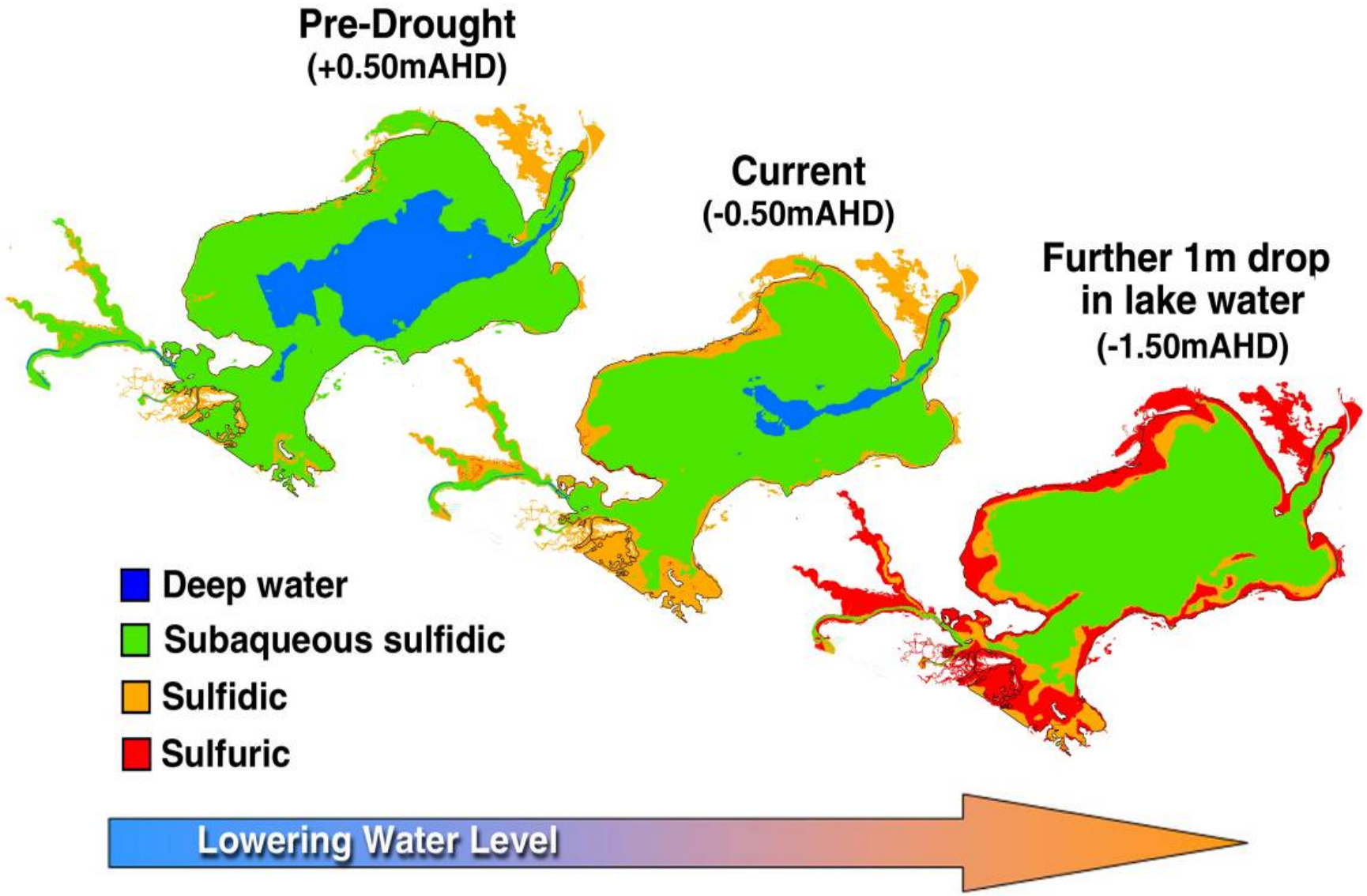


Lower lakes barrages

Water levels in Lake Alexandrina

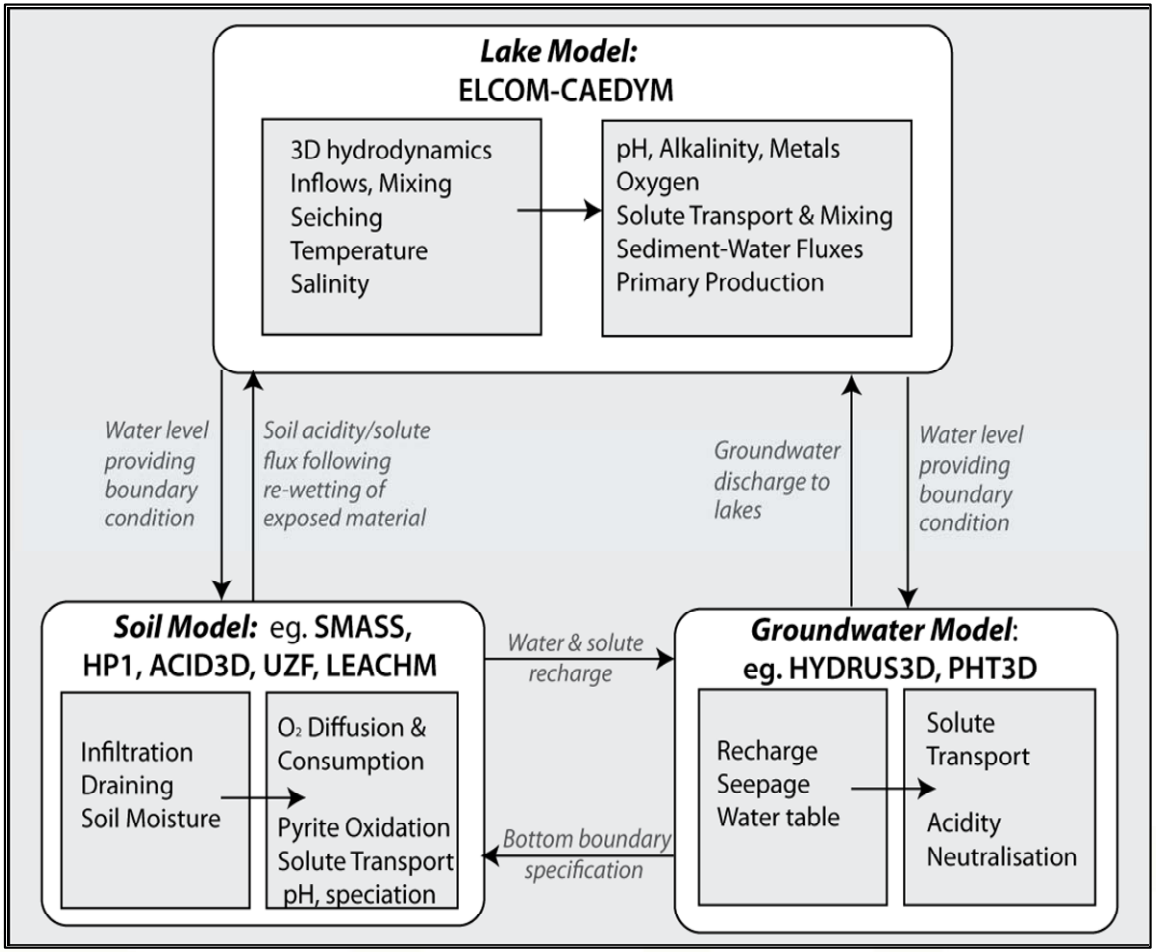


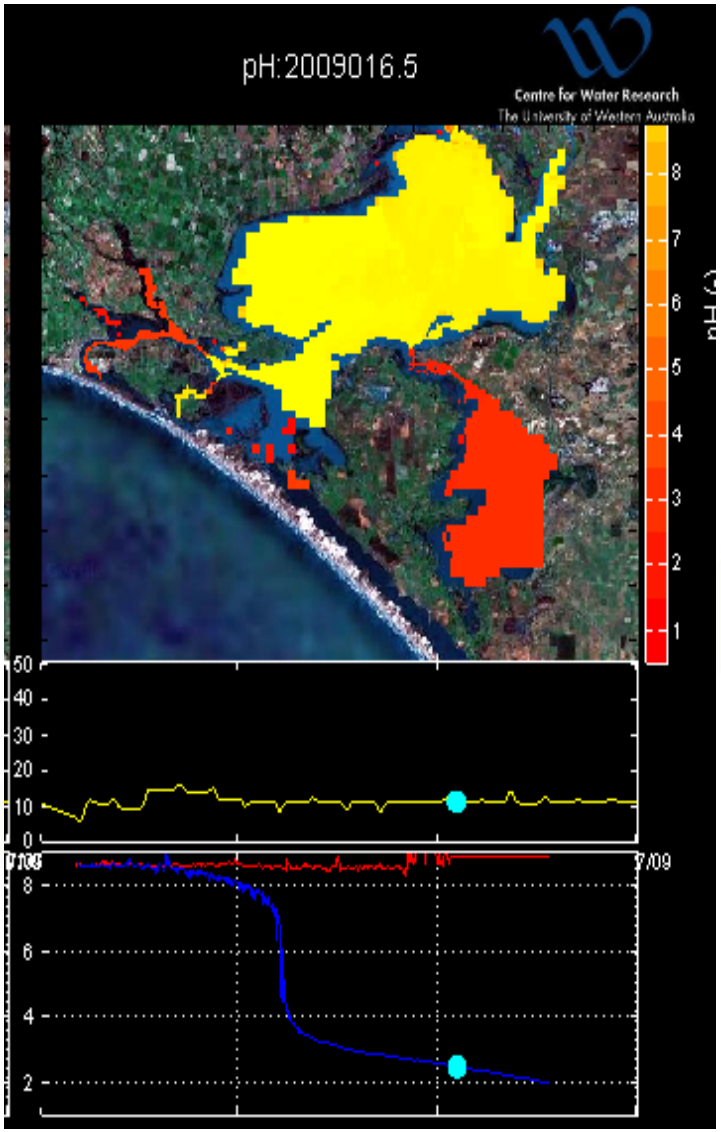
ASS conceptual modelling



Source: CSIRO

Hydrodynamic modelling





Modeling indicated acidification when water levels reach below -0.8 m AHD

Source: University of Western Australia

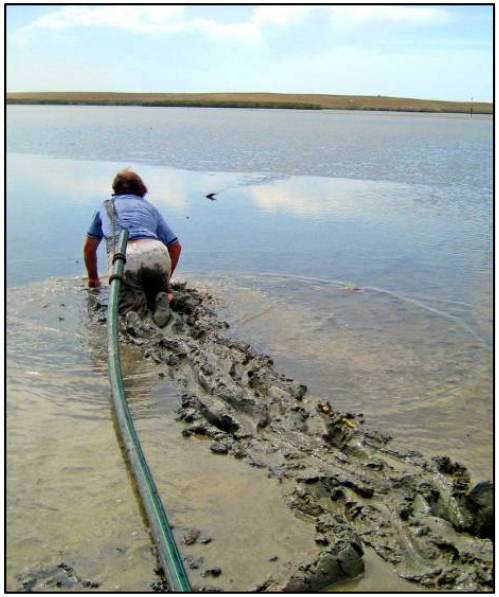
Real Time Management Strategy

Approved by the Murray Darling Basin Ministerial Council:

- Monitoring water levels and pH (alkalinity)
- Construction of a bund separating the lakes and pumping water from Lake Alexandrina to Lake Albert
- Management triggers:
  - A minimum 25mg/L of Carbonate in either waterbody
  - Water levels of -1.5 m AHD in Lake Alexandrina and -0.5 m AHD in Lake Albert
- If either met introduce seawater through the Barrages
- Action is subject to approvals in the Environment Protection and Biodiversity Conservation *Act 1991*

photos: EPA and DEWNR

Consequences of low water levels



photos: EPA, CSIRO and DEWNR

Research program

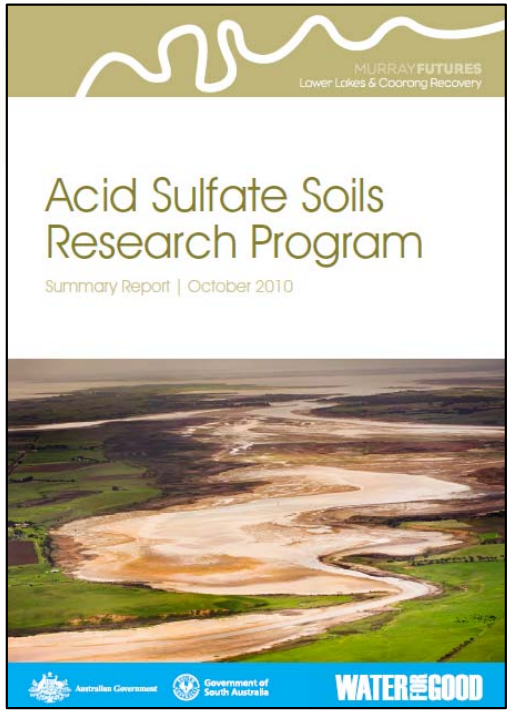
Spatial heterogeneity mapping: net acidity hazard

Acid generation: oxidation rate of pyrite

Mobilisation dynamics: contaminant generation, neutralisation and transport

Seawater contaminant mobilisation: laboratory and field studies

3-D geochemical and hydrodynamic modelling (ELCOM CAEDYM): simulations and management scenarios



Source: EPA and DEWNR

Management strategies

PREVENTION

minimise oxidation of ASS by inundation with freshwater (avoid saltwater cation exchange)

LOCALISED PREVENTION ↔ **CONTROL VIA BIOREMEDIATION** ↔ **TREATMENT**

Temporary bund/regulators:
maintain water levels in hotspots

Vegetation:
reduce evaporation and soil temp, and increase soil moisture; less soil erosion

Organic carbon inputs:
increase sulfate reducing bacterial activity, generates alkalinity

Neutralisation:
via ultrafine limestone (not hydrated lime)

Groundwater mounding

Irrigation

Chemical ameliorants

monitor water level and quality, soil and groundwater parameters

Localised prevention

Construction of the bund and temporary regulators

Goolwa regulator:

- played fundamental role in controlling water levels via water pumped from Lake Alexandrina

Currency Creek regulator:

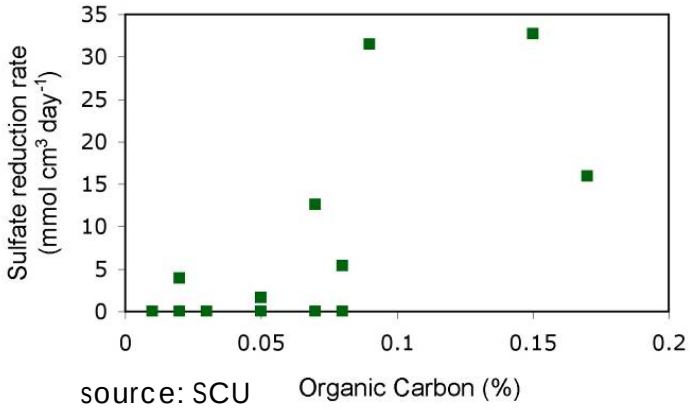
- risk mitigation to stop the transport of acidity into the Goolwa Channel

Goolwa regulator near Clayton with pumps

Currency Creek regulator with spillway

Bioremediation/revegetation

- Increases organic matter around exposed shorelines for sulfate-reducing bacteria to consume



source: SCU

- Assists in soil erosion control and also provides ecological outcomes for the region

photos: SCU, Rural Solutions and DEWNR

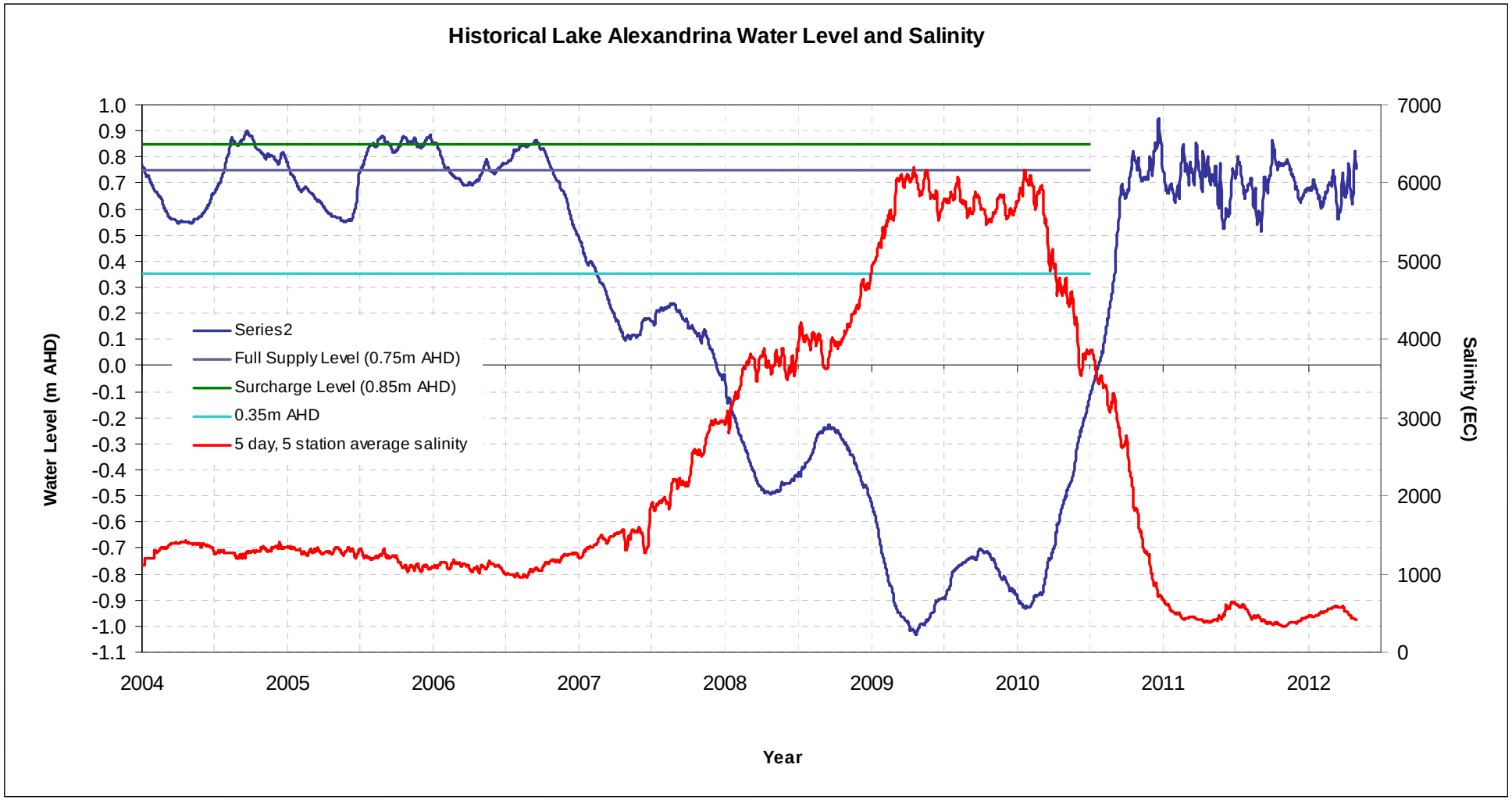
Treatment

Add ultrafine limestone to neutralise acidic waterbodies and soils

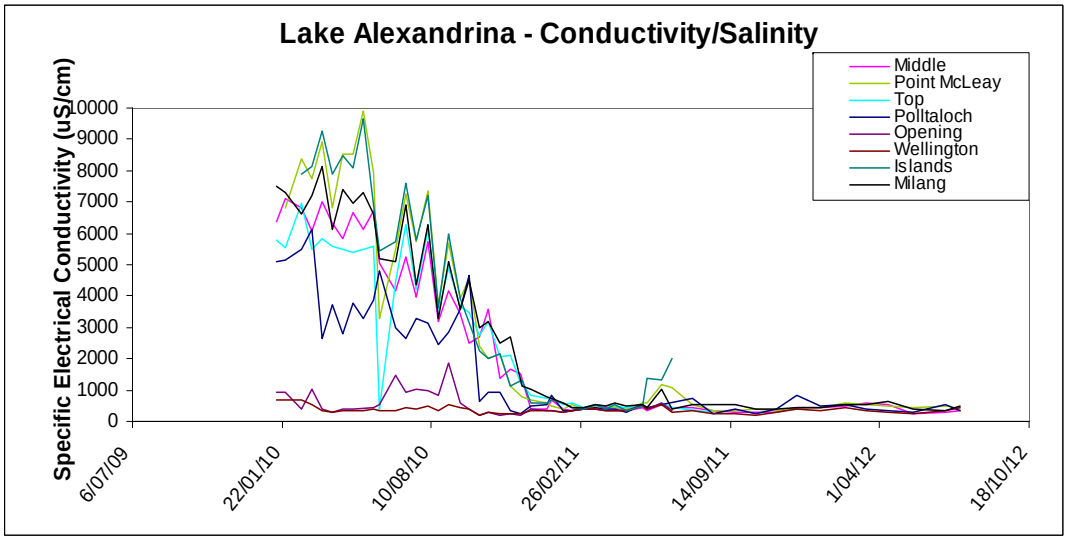
photos: EPA Rural Solutions and DEWNR

mid 2010 - return of inflows

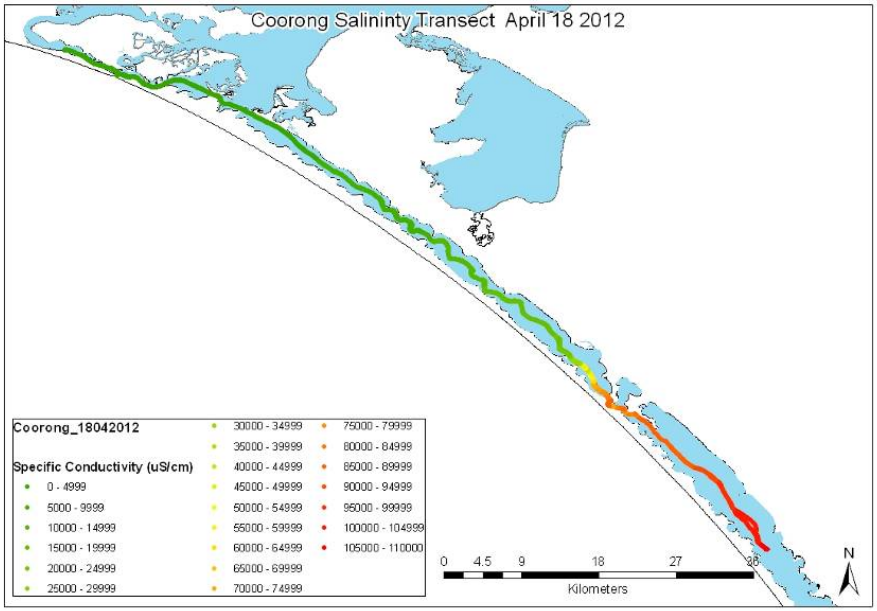
(Basin flooding)



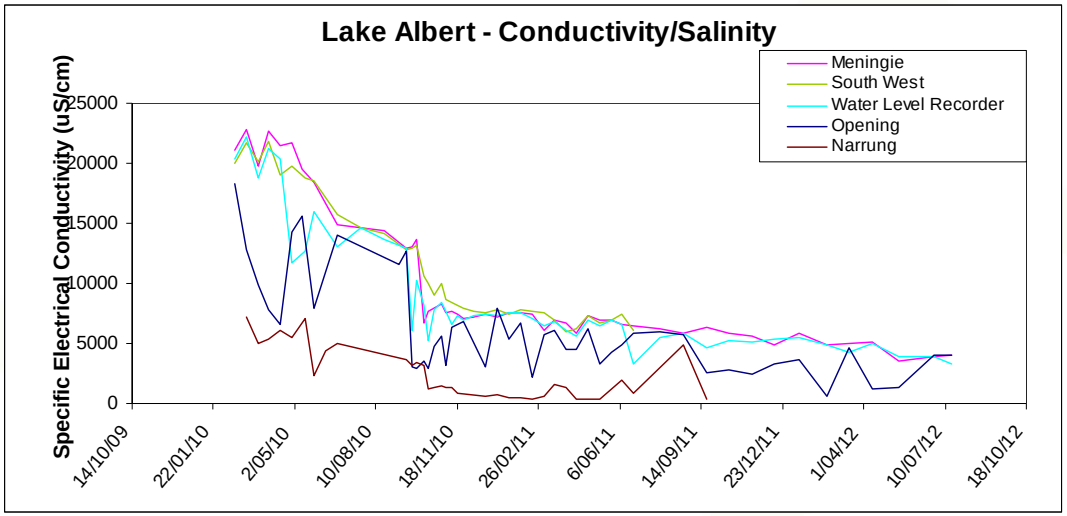
Ongoing issues - salinity



Now less than 1000 EC



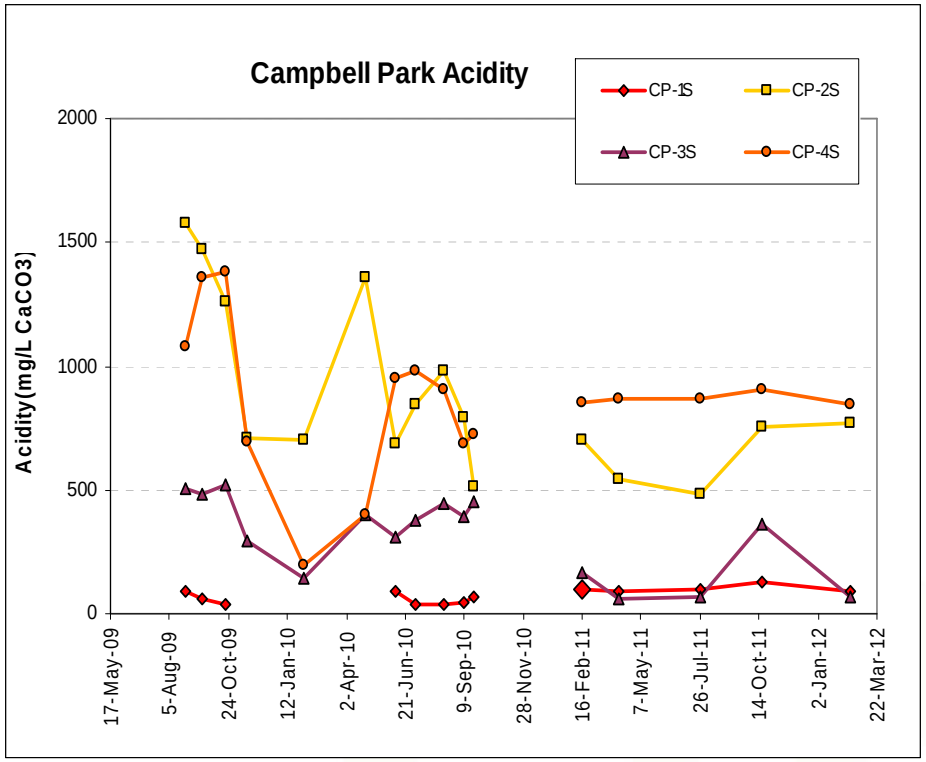
~ 20 and 100 ppt (up to 118,500 EC); seawater – 35 ppt

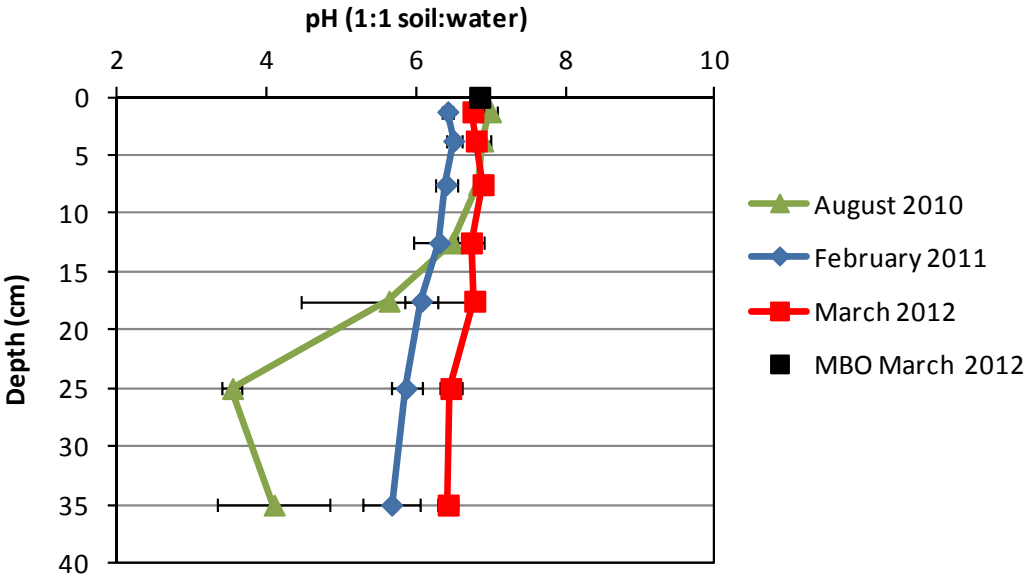


Current range ~ 3000 to 4500 EC (average ~1500 EC)

water cycling

Ongoing issues - groundwater acidity, sulfide reaccumulation





pH dynamics at the established *Phragmites* Waltowa site

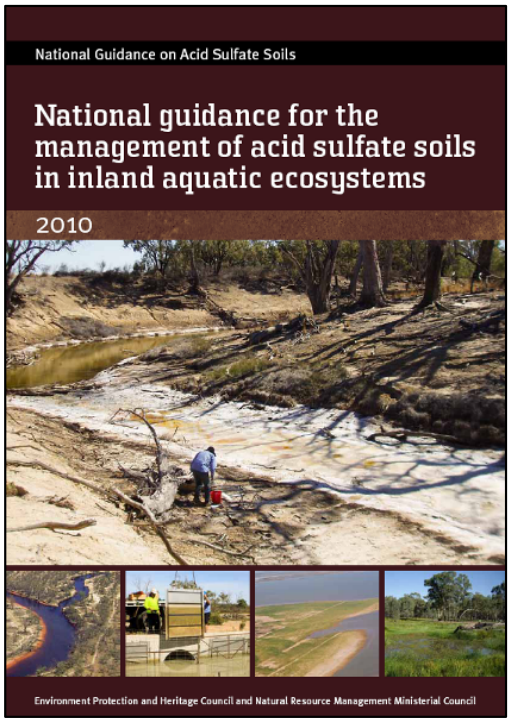
Acidity remediation via alkalinity:

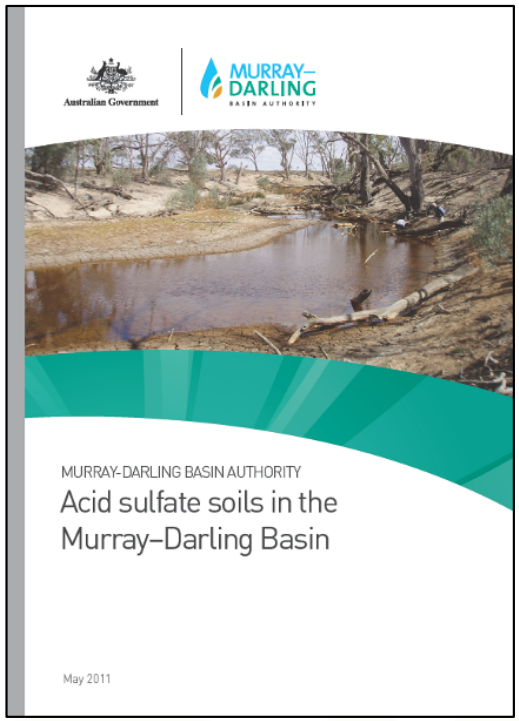
- in the lake waters
- organic matter from inundation tolerant vegetation

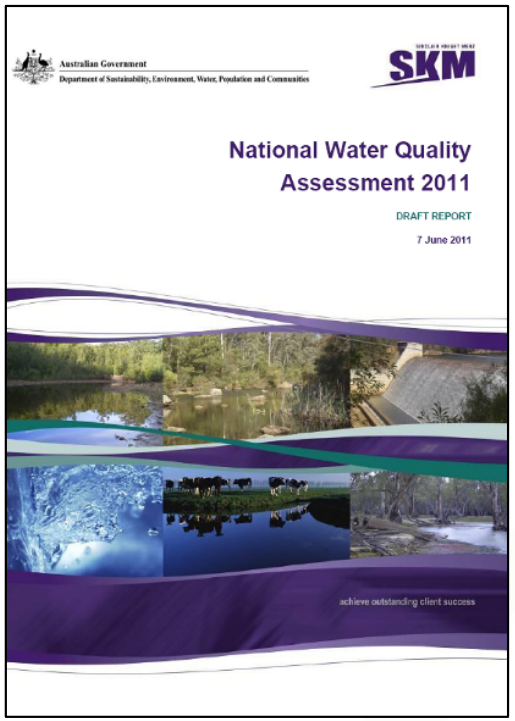
Sulfate reduction and accumulation of reduced inorganic sulfides (especially pyrite and monosulfides)

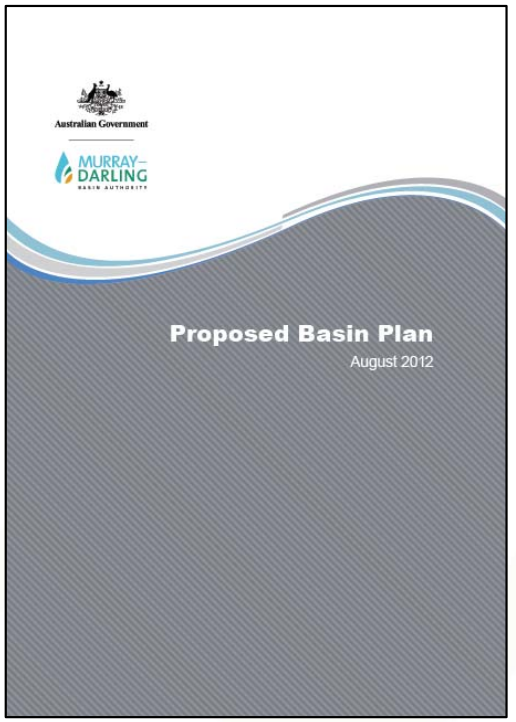
Source: EPA, SCU

Input to national guidances and planning









Proposed Basin Plan (Water Act 2007)

- Ensure enough environmental water is delivered to the Coorong, Lower Lakes and Murray mouth to support:
  - sufficient flows and suitable water levels
  - salinity export and water quality
  - ecosystem response
- >10,000 GL/y for consumptive uses
- Aim is to return a long-term average of at least 2,750 GL/y with an adjustment mechanism for water savings

Key messages

We have a better understanding of:

- Acidification and related risks (metals, MBOs)
- Salinity issues and ecological limits of acceptable change

We now have the knowledge to better manage the CLLMM site - management triggers/strategies

We are working with the community and Ngarrindjeri people to deliver management actions

But…
Ecosystem recovery is slow compared to drought impact

We need suitable environmental flows to assist with recovery and avoid future degradation of this unique region

Thank you
Acknowledgements

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- Drs Rob Fitzpatrick, Paul Shand, Warren Hicks (CSIRO) and team
- Profs Leigh Sullivan, Richard Bush (Southern Cross University) and team
- Dr Matt Hipsey (University of WA)
- Dr Jeff Taylor, Sophie Pape (Earth Systems)
- Dr Freeman Cook
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Community members:

Colin Grudy, Mike South , Anne Hartnett for land access and assistance

Google CLLMM
or go to:
http://www.environment.sa.gov.au/Conservation/Rivers_wetlands/Coorong_Lower_Lakes_Murray_Mouth/The_environment/Acid_sulfate_soils