CURRENCY CREEK, FINNISS RIVER AND GOOLWA CHANNEL WATER QUALITY REPORT

Report 14, to 15th January 2010

OBSERVATIONS AT A GLANCE

- pH and alkalinity remain at satisfactory levels at most sites.
- Alkalinity levels in the upper Currency Creek remain low (58 mg/L) indicating that the water body is susceptible to further acidification.
- Alkalinity remains satisfactory and stable at all Finniss River sites.
- Salinity at all sites is steadily increasing.
- Turbidity has decreased since pumping over the Clayton regulator stopped.

BACKGROUND

The Environment Protection Authority, Department for Environment and Heritage and Department of Water, Land and Biodiversity Conservation are monitoring water quality to assess potential water impacts associated with the exposure of acid sulfate soils and recent water level changes in the Goolwa Channel, Currency Creek and Finniss River region as a result of the Goolwa Channel Water Level Management Project. Further information regarding the project can be found at: http://www.dwlbc.sa.gov.au/murray/drought/gcll.html.

WATER QUALITY PARAMETERS

A wide range of water quality parameters is being analysed in an integrated program across the Lower Lakes (see http://www.epa.sa.gov.au/environmental_info/water_quality/monitoring_programs_and_assessments/lower_lakes). Key field-based parameters for Currency Creek, Finniss River and Goolwa Channel reported herein are pH, acidity, alkalinity, salinity and turbidity.

***pH* is an indicator of acidity or alkalinity. Neutral water has a pH of 7, acidic solutions have lower values and alkaline solutions have higher values. Prior to the recent drying and re-wetting, the pH in the region was between 8 and 8.5.**

***Alkalinity* is a measure of the buffering capacity of water, or the capacity of the water to neutralise acids and resist pH change. Alkalinity within**

water bodies is consumed as acid is released from acid sulfate soils. Adding limestone contributes alkalinity to waters helping to neutralise any acid released from the sediments. Historically, alkalinity levels within this region have been between 100 and 250 mg/L as $CaCO_3$.

Acidity is a measure of the acid (hydrogen ions) and dissolved metal ions (e.g. iron and aluminium) present in water bodies. Acidity is expressed as the volume of calcium carbonate (mg/L of $CaCO_3$) required to neutralise the acid. Acidity occurs when the alkalinity or buffering capacity has been consumed, and is not normally present in the Lower Lakes.

Salinity is a measure of the amount of dissolved salts in the water. Saline water conducts electricity more readily than freshwater so electrical conductivity (EC) is routinely used to measure salinity. As salinity increases it may become toxic to native freshwater organisms. Prior to drought conditions salinity was observed between 1000 and 1200 µS/cm (EC) within the region.

Turbidity is a measure of the cloudiness or haziness in water caused by suspended sediment. Turbidity is expressed in Nephelometric Turbidity Units (NTU) and is measured using a relationship of light reflected from a given sample. Turbidity is very variable in the Lower Lakes and influenced primarily by wind events.

SAMPLING SITES

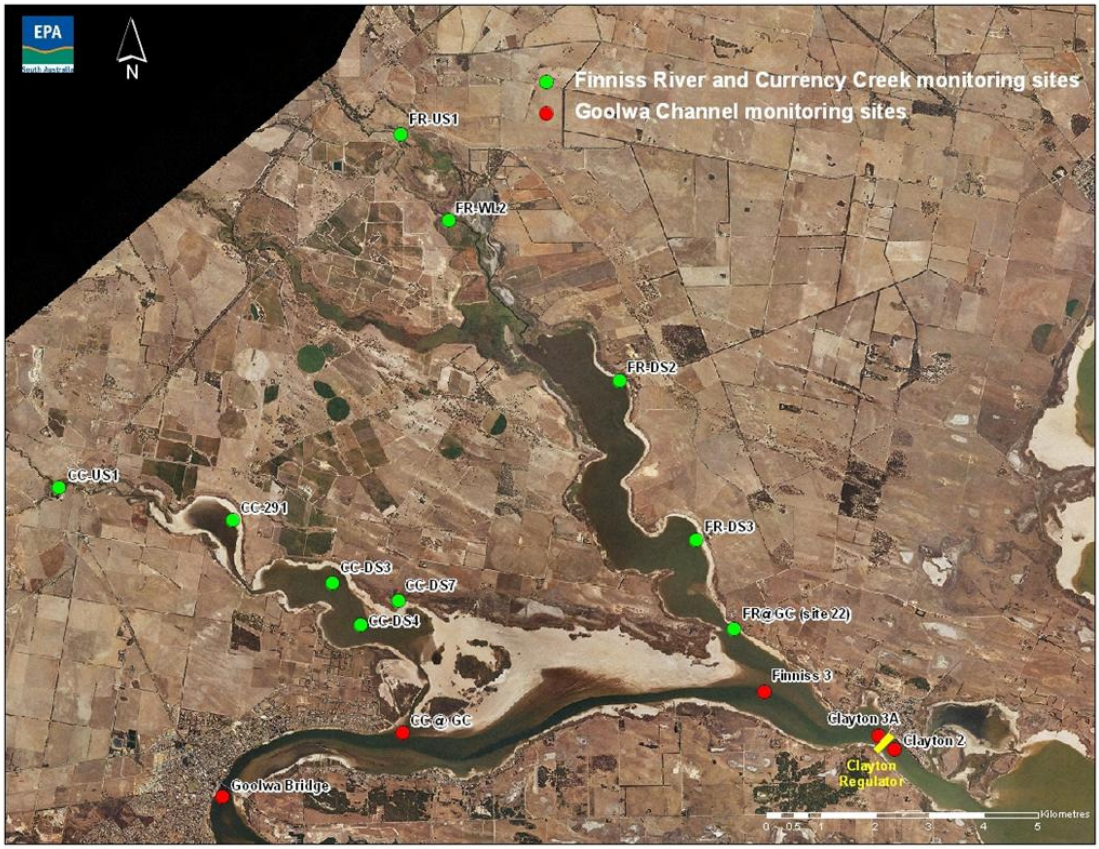
The sample sites where water quality monitoring is undertaken are shown in Figure 1. Several of these sites have been identified as high risk and as a result have been monitored as regularly as possible (in some instances up to 5 times per week).

Currency Creek and Finniss River site descriptions and justification for their selection are contained in prior reports (e.g. see Table 1, Report 7 on the EPA website).

Some of the sediment (groundwater) transects previously reported on are no longer being monitored as they have been reinundated with the rising water level behind the regulator.

The Goolwa Channel sites selected include sites both upstream (e.g. Clayton 2) and downstream (e.g. Clayton 3C, Finniss 3, GC Channel and Goolwa Bridge) of the Goolwa regulator near Clayton.

Figure 1 - Map of Sample Sites



LIMESTONE MANAGEMENT RESPONSE

Trials of various pre-emptive or reactive (to water acidity) limestone additions have been undertaken in the area between April and July 2009 to mitigate the risk of acidification. For details of locations and volumes refer to Report 5 on the EPA website. Further limestone additions may be undertaken in the future as required.

CURRENCY CREEK WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Currency Creek region. Please refer to the graphs in Figure 2 for this section and to Figure 3 for rainfall at Currency Creek.

pH

- The pH levels of all sites within Currency Creek are now between 7.80 and 8.91 (14/1/09) which is within ANZECC guideline levels for protection of aquatic organisms (pH 6.5 to 9.0).
- Overall, all of the sites within Currency Creek have shown a general trend of increasing or stable pH since approximately the 3/11/09.

Alkalinity

- Although pH is satisfactory at all Currency Creek sites, alkalinity continues to remain quite variable at different sites. However all sites in the region except CCUS1 have shown an increase since last monitored.
- CCUS1 continues to exhibit high alkalinity which is most likely a result of groundwater inputs (high alkalinity) into the Currency Creek catchment being relatively undiluted at this time of year. This increase is consistent with values observed at this site at the end of last summer. However, it must be noted that flows from Currency Creek have decreased and hence this high alkalinity source is expected to cease shortly.
- Site CC291 continues to remain low in alkalinity but has shown a slight improvement since last monitored, currently it stands at 58 mg/L (14/1/10). While these values are low it should be noted that since the 16th of November alkalinity at CC291 has remained relatively stable between 32 and 60 mg/L as $CaCO_3$.
- After showing signs of a slight declining trend in alkalinity, site CCDS4 has shown a slight improvement over the past week and has increased from 70 mg/L (11/1/10) and currently stands at 100 mg/L (14/1/10).
- Alkalinity at site CCDS3 dropped to 83 mg/L on 18/12/09, but has since increased and currently stands at 135 mg/L as $CaCO_3$ (14/1/09).
- Alkalinity at the mouth of Currency Creek at the Goolwa Channel currently stands at 180 mg/L (12/1/09). This site has exhibited an increasing trend in alkalinity after falling to a low of 27 mg/L in September of 2009.

Acidity

- There is no water acidity recorded at the Currency Creek sites. This is likely due to a combination of limestone addition, dilution from increased flow from Currency Creek, sulfate reduction in the sediment (neutralises acidity), and increased connectivity and input from the alkaline water pumped into Goolwa Channel from Lake Alexandrina.

Salinity (EC)

- Salinity levels at CC291, CCDS3, CCDS4 and CC@GC have generally remained stable over the past few months. There is however an increasing salinity trend observable since the 9th of December. This is primarily due to evaporation and subsequent concentration of salts. Currently salinity at all four sites remain quite similar between 10854 µS/cm and 12507 µS/cm (14/1/09).

Figure 2 – Currency Creek Water Quality

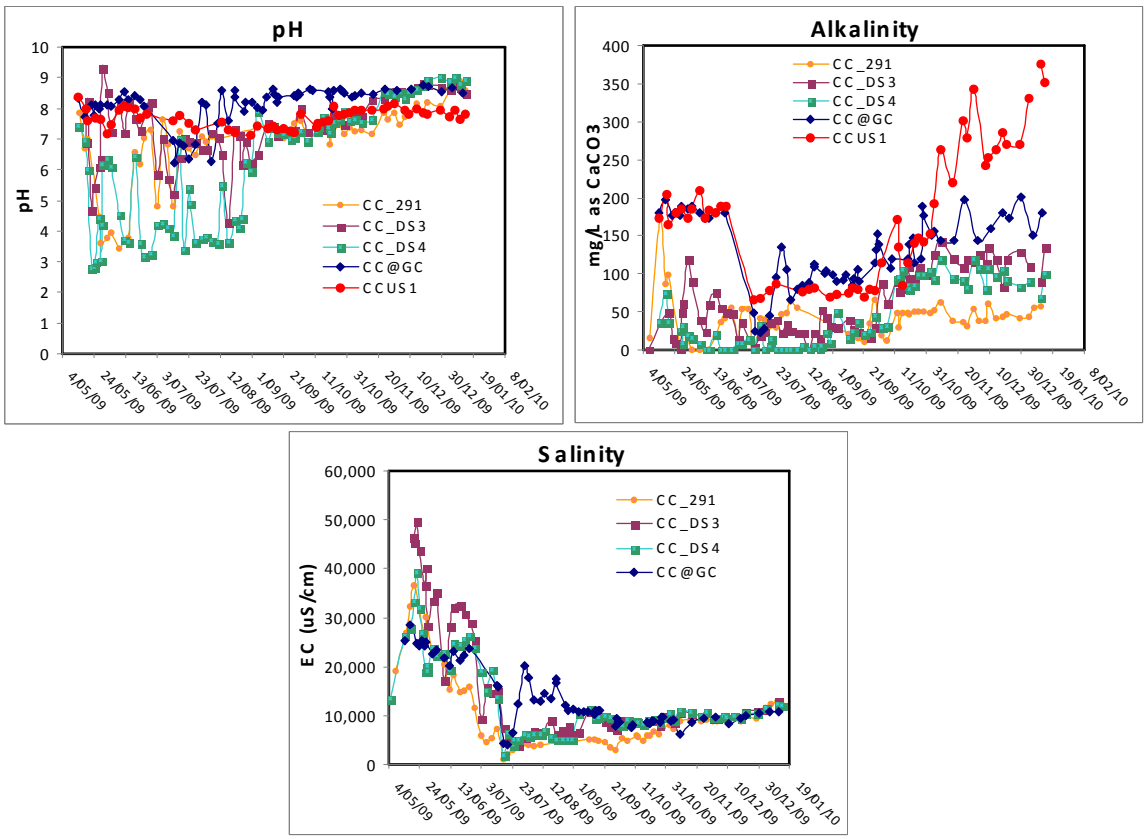
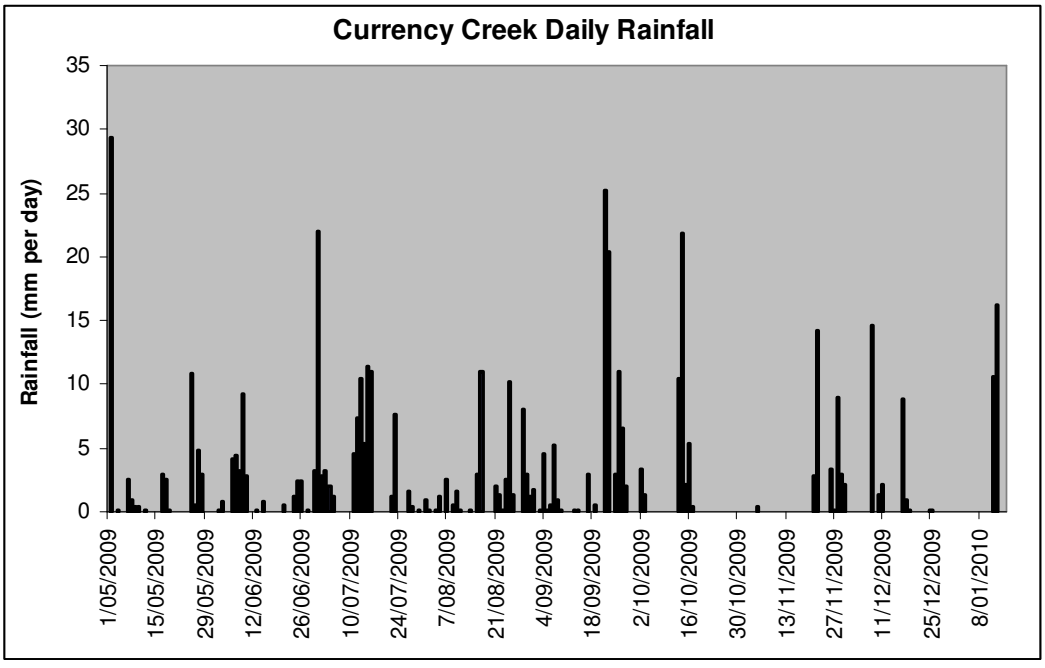


Figure 3 – Rainfall at Currency Creek



Data from South Australian Murray-Darling Basin NRM Board weather station (refer to http://www.samdbnrm.sa.gov.au/Portals/7/AWMN/awsview.php)

FINNISS RIVER WATER QUALITY

Water quality results are discussed below for selected sites and parameters in the Finniss River region**.** Please refer to the graphs in Figure 4 for this section.

pH

- pH levels at all Finniss River sites remain within the ANZECC guidelines for protection of aquatic ecosystems. Most sites have exhibited a slight trend of increasing pH since the beginning of October 2009 however it must be noted that most sites have exhibited a slight decreasing trend since the 29/12/09.

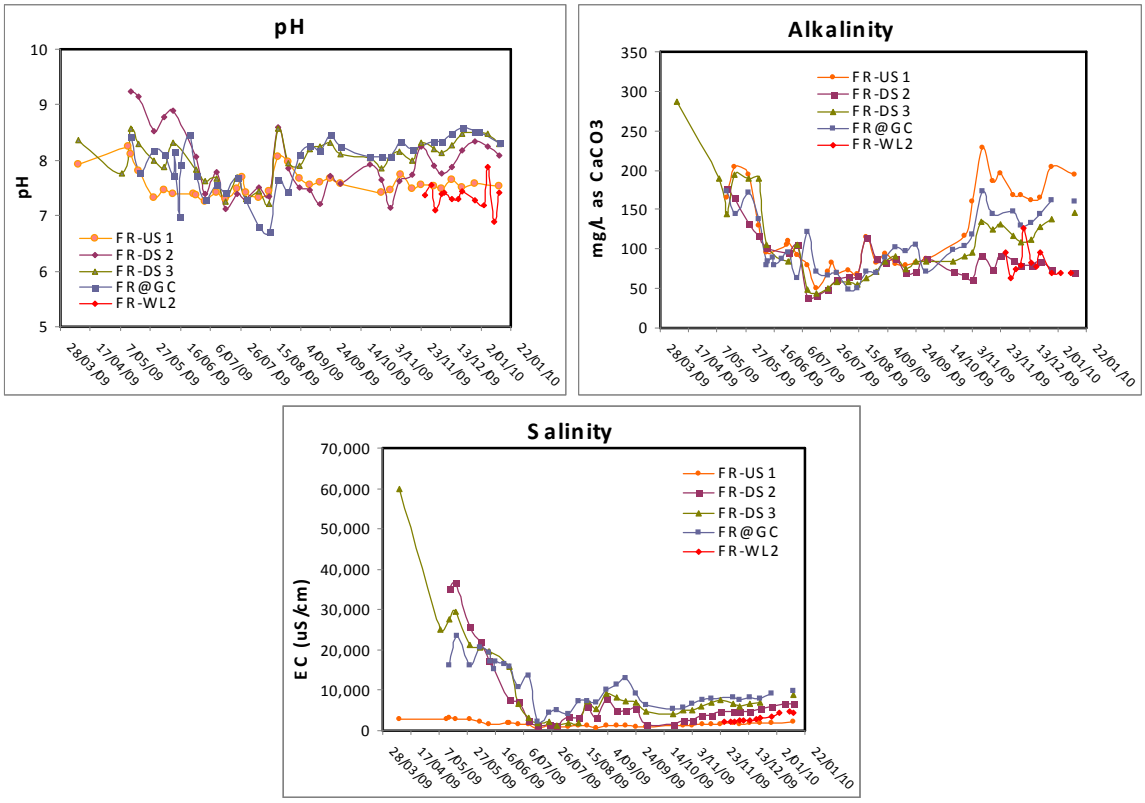
Alkalinity

- Sites in the Finniss River have satisfactory alkalinity levels (between 70 mg/L and 195 mg/L on 14/1/10).
- Alkalinity has generally been enhanced by the more alkaline Lake Alexandrina water pumped over the Goolwa Channel regulator between September and November.
- Sites FRUS1, FR@GC and FRDS3 all exhibited an increasing trend in alkalinity from the 7th of December up until 29/12/09. Levels have remained stable since the 29th December and currently (14/1/10) stand at 146 mg/L (FRDS3), 160 mg/L (FR@GC) and 195 mg/L (FRUS1).
- FRDS2 and FRWL2 are exhibiting quite different trends in alkalinity compared to other sites within the Finniss region. These two sites have lower alkalinity values and appear at the moment to be extremely variable with an overall declining trend which has been apparent since the 26th of November 2009. Currently (14/1/10) alkalinity levels stand at 70 mg/L at both sites which is between 76 and 119 mg/L less than the other Finniss River sites.

Salinity (EC)

- An increase in Finniss River flow driven by rainfall resulted in salinity levels remaining stable (countering some evaporation) up until the beginning of December. Since this time all four sites have exhibited an increasing salinity trend. Currently (14/1/10) all sites range between 2276 µS/cm and 9871 µS/cm.

Figure 4 - Finniss River Water Quality



GOOLWA CHANNEL WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Goolwa Channel region. Please refer to the graphs in Figure 5 for this section. Many of these sites were added as the Goolwa regulator near Clayton neared completion and pumping began on 11 September 2009. Pumping was ceased on 9 November 2009.

pH

- The pH of all sites monitored in the Goolwa Channel remains within the ANZECC guideline values for protection of aquatic organisms. All sites have remained steady and above pH 8.0 since mid September.

Alkalinity

- Alkalinity in the Goolwa Channel has remained at satisfactory levels at all sites (above 180 mg/L; 12/01/10). As a result of pumping there had been an overall increase in alkalinity at all sites in the Goolwa channel.

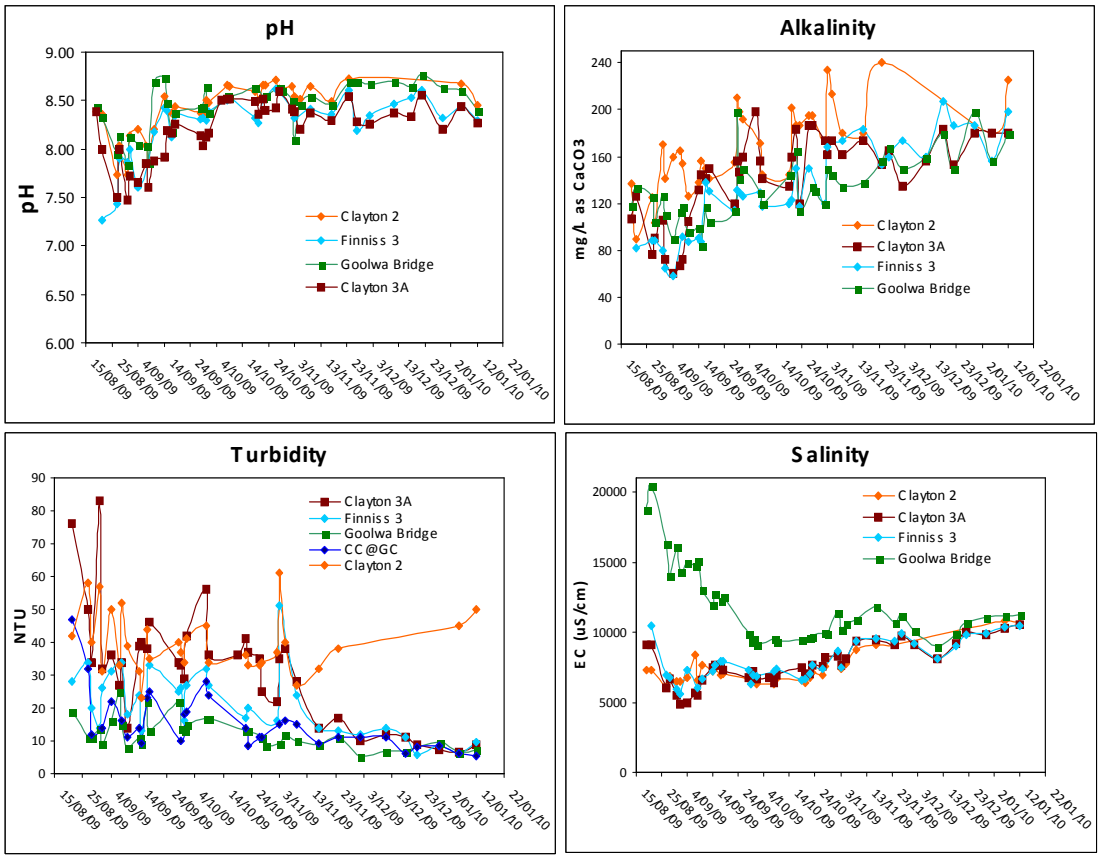
Salinity (EC)

- Salinity decreased substantially at all sites due to the tributary inflows and pumping from Lake Alexandrina between 27/11/09 and 11/12/09. However since mid December, salinity levels at all sites have exhibited increasing salinity trends. Currently salinity levels at all sites remain between 10491µS/cm and 11223 µS/cm (12/01/10).

Turbidity

Pumping at the Goolwa Regulator near Clayton ceased on November 9, 2009. Since this time the turbidity at the sites closest to the regulator (Finniss 3, Clayton 3A) decreased markedly. Currently all four sites range between 5.4 and 9.8 NTU (12/1/10) and have a declining trend. Site Clayton 2 which is located on the opposite side of the Goolwa Regulator is an exception to this trend. Currently (12/1/10) turbidity stands at 50 NTU, which despite being higher than the other sites inside the regulator, is similar to other sites in Lake Alexandrina.

Figure 5 – Goolwa Channel Water Quality



Further information on water quality and quantity, and acid sulfate soils, can be found on the following websites:

- **Department for Environment and Heritage** www.environment.sa.gov.au/cllmm/
- **River Murray Data** http://data.rivermurray.sa.gov.au/ (real-time data)
- **Environment Protection Authority** www.epa.sa.gov.au or for specific Lower Lakes data see www.epa.sa.gov.au/environmental_info/water_quality/monitoring_programs_and_assessments/lower_lakes

- **Department of Water, Land and Biodiversity Conservation** www.dwlbc.sa.gov.au
- **South Australian Murray–Darling Basin Natural Resource Management Board** www.samdbnrm.sa.gov.au
- **Murray–Darling Basin Authority** www.mdba.gov.au
- **Waterwatch** www.waterwatch.org.au
- **CSIRO acid sulfate soils** www.clw.csiro.au/acidsulfatesoils/murray.html