CURRENCY CREEK & FINNISS RIVER WATER QUALITY REPORT

Report 4, to 29 July 2009

OBSERVATIONS AT A GLANCE

- Limestone addition to Currency Creek has stabilised and, in some cases, improved pH and alkalinity at most sites.
- Alkalinity levels in Currency Creek remain low indicating the water body is susceptible to further acidification.
- Low pH values and high acidities are still observed at one site (CCDS4) within the Currency Creek region.
- Declining pH and alkalinity levels in the Finniss River region have stabilised and are now showing improvements.

BACKGROUND

The Environment Protection Authority, Department for Environment and Heritage, and the South Australian Murray–Darling Basin Natural Resources Management Board are monitoring to assess potential water quality impacts associated with water level decline and the exposure of acid sulfate soils in the Goolwa Channel, Currency Creek and Finniss River region (Figure 1).

WATER QUALITY PARAMETERS

A wide range of water quality parameters is being analysed but the key parameters reported are pH, acidity, alkalinity, salinity, and metals.

***pH* is an indicator of acidity or alkalinity. Pure 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 – 8.5.**

***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 any acid. Acidity build up occurs when the alkalinity or buffering capacity has been consumed. Acidity is not normally present in the Lower Lakes.**

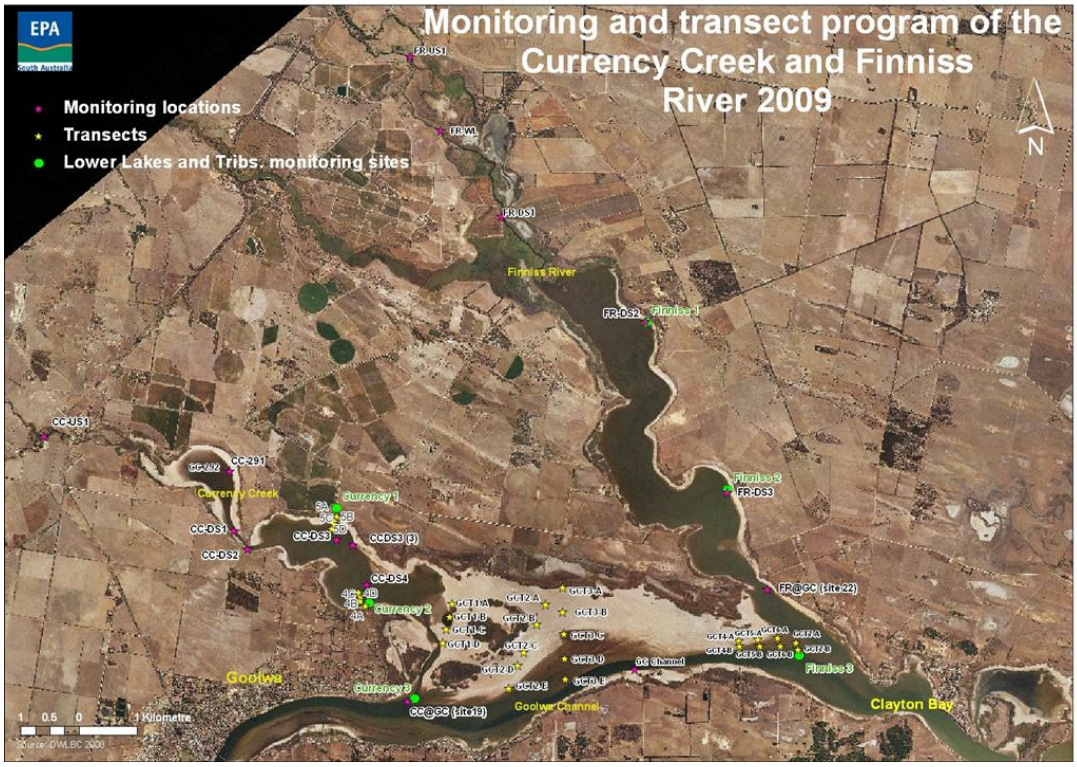
***Alkalinity* is a measure of the buffering capacity of water, or the capacity of the water to neutralise acids and resist pH change. Alkalinity within water bodies is consumed as acid is released from acid sulfate soils.**

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 – 250 mg/L as $CaCO_3$.

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 levels increase it may become toxic to native freshwater organisms. Prior to drought conditions salinity was observed between 1 and 1.2 mS/cm (1000-1200 EC) within the region.

Metals may be toxic to aquatic organisms if they are found at high levels. Acidification of soils releases metals which can subsequently enter into adjacent water bodies (e.g. through shallow groundwater flow, or vertical mobilisation out of the soil during rewetting).

Figure 1 Map of sample sites



A number of sites have been identified as high risk sites and as a result are being monitored as regularly as possible (in some instances up to 5 times per week). Table 1 includes basic descriptions and justifications for the selection of high risk monitoring sites within the Goolwa Channel, Currency Creek and Finniss River region.

Table 1 Selection and description of high risk sites

Site	Location	Description
CC-291	Currency	On the northern margin of the upper Currency Creek representing the transition from creek to open channel. The site is located over sediments exposed in summer that have now been saturated or re-inundated due to rainfall events. Catchment inflows are now occurring.
CCDS2	Currency	A narrow midway bottle neck that formerly was a disconnected pool in summer. It is now reconnected to pooled water in the upper and lower Currency tributary due to rainfall events.
CCDS3	Currency	On the northern margin of the lower Currency Creek within the closest pooled water to Goolwa Channel. The site is located over sediments that were exposed in summer and now have been saturated or re-inundated due to rainfall events.
CCDS4	Currency	On the southern margin of the lower Currency Creek within the closest pooled water to Goolwa Channel. The site is located over sediments that were exposed in summer and have now been saturated or re-inundated due to rainfall events.
CC@GC	Currency/ Goolwa Channel	At the mouth of Currency Creek where it enters the Goolwa Channel. The site is located within the Goolwa Channel and has remained inundated. It is an important site to monitor the buffering capacity of Lake Alexandrina water and potential impact of outflows from the Currency Creek region.
FRUS1	Finniss	In the upper Finniss channel upstream of wetlands that have shown signs of ASS.
FRDS1	Finniss	Within the upper Finniss River and adjacent to wetlands that have shown signs of ASS driven acidity on rewetting. Minor flow in the region continued over summer that has now increased with rainfall events and catchment inflows.
FRDS2	Finniss	On the eastern margin of the Finniss River downstream of where it initially enters Lake Alexandrina. The site remained inundated in summer although water levels shallowed markedly and nearly disconnected from the Goolwa channel.
FRDS3	Finniss	On the eastern margin of the Finniss River further downstream of FRDS3 and closer to where it connects with the Goolwa Channel. The site remained inundated in summer although water levels shallowed markedly and nearly disconnected from the Goolwa channel.
FR@GC	Finniss/ Goolwa Channel	Located at the mouth of Finniss River where it enters the Goolwa Channel. It is an important site to monitor the buffering capacity of Lake Alexandrina water and potential impact of outflows from the Finniss River region.

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.

Initially, up to 600 tonnes (t) of pre-emptive limestone were placed in Currency Creek and the Finniss River in late April. Approximately 200 t were placed in upper Currency Creek above CC291, 100 t at the bottle neck near CCDS2, and around 300 t in the Finniss River downstream of Wally's Landing but upstream of FRDS1. The limestone was placed in these areas prior to rainfall events in late April so that any inflows would be intercepted.

Following several more rainfall events in May and acidification of water pooled in Currency Creek, two limestone barriers were constructed in lower Currency Creek below CCDS4 and one immediately downstream of the Currency Creek bottle neck near CCDS2 to stop acidic water from reaching the Goolwa Channel.

Shoreline limestone dosing was first trialled from 10 to 12 June into acidic water in lower Currency Creek near CCDS4. This method proved to be slow and so other dosing methods were considered.

Aerial limestone dosing first took place between Tuesday 16th and Friday 19th June in Currency Creek with limestone dispersed over both the upper Currency Creek (above site DS1) and lower Currency Creek water bodies (below site DS2). A second phase of aerial dosing occurred between Wednesday 15th and Monday 20th July focusing on lower Currency Creek as a result of the main limestone barrier below CCDS4 breaching and an acidic pulse of water entering the Goolwa Channel. In all, up to 1,000 t of limestone have been aerially dosed throughout Currency Creek.

There are likely to be lag effects in the Currency Creek water body response following limestone dosing (e.g. slow dissolution of limestone, transfer of acidic porewater to surface water, raising of the pH in the sediment enough to stimulate bioremediation activity), which should be reflected in ongoing water quality monitoring.

CURRENCY CREEK WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Currency Creek region. Please refer to graphs in Figure 2 for this section (and to Figure 4 for rainfall at Currency Creek).

Alkalinity

- Sites within Currency (CC291, CCDS2 and CCDS3) have remained stable since the last monitoring event. All sites recorded alkalinity between 26 and 39 mg/L. These alkalinity levels are very low indicating the water body is susceptible to further acidification.
- Alkalinity continues to be absent at site CCDS4 despite aerial limestone application in mid July. This is likely due to further input of acid from the sediment to the water following wind seiching.
- CC@GC has shown improvement post limestone application. Alkalinity has recovered from 27 mg/L (20th July) and 45 mg/L (23rd July) to currently stand at 95 mg/L.

Acidity

- CC291, CCDS2 and CCDS3 have no observed acidity (mg/L as $CaCO_3$), as a consequence of aerial limestone dosing and increased dilution flow.
- CCDS4 acidity levels remain highly variable. Levels increased from 0 on the 17th July to 256 mg/L as $CaCO_3$ (20th July). Levels decreased to 33 (24th July) but have steadily increased to currently stand at 110 mg/L as $CaCO_3$.

pH

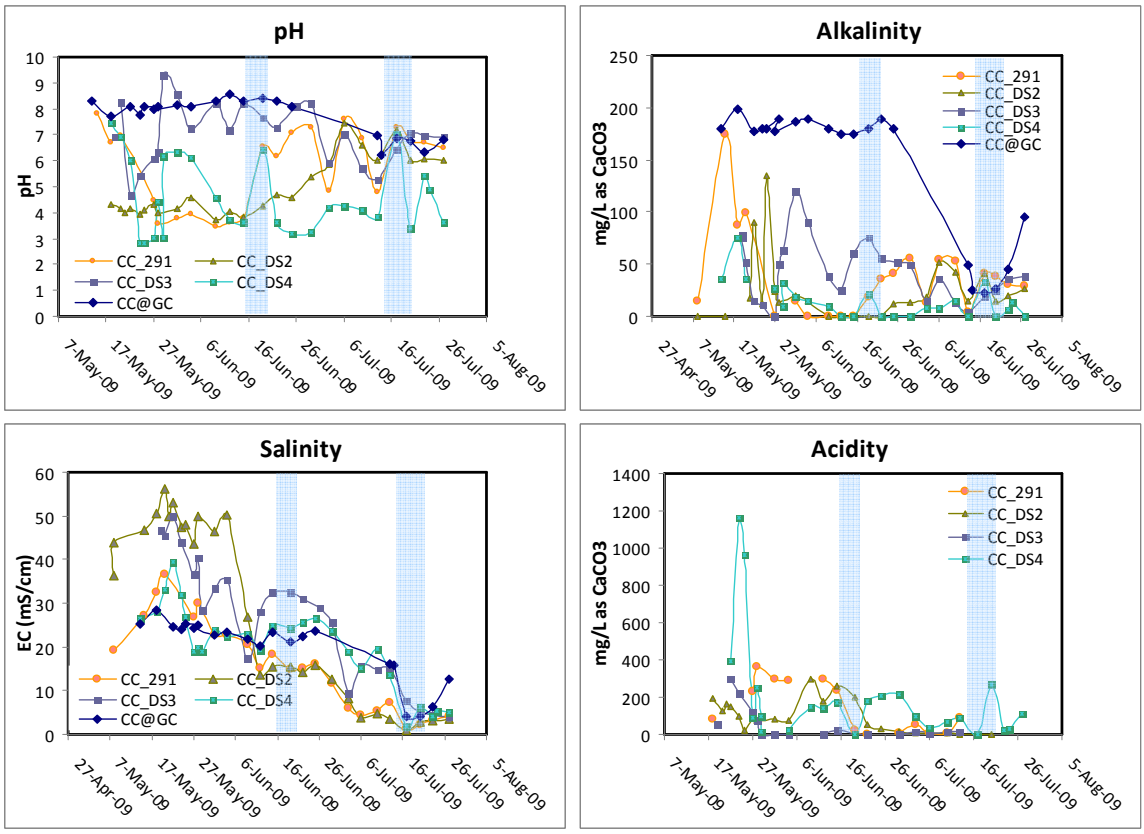
- pH levels remain at or below the ANZECC guideline level of pH<6.5 at CC291 (6.5) and CCDS2 (6.0)
- The pH at CCDS4 remains well below the ANZECC guideline level of pH<6.5. Figure 2 shows that the site has been highly variable in recent weeks. This is presumably a result of initial response to the most recent program of aerial limestone dosing.
- pH levels at CCDS3 (6.89) and CC@GC (6.81) remain slightly above ANZECC guidelines.

Salinity (EC)

- Salinity levels at all sites within the Currency Creek region (excluding CC@GC) have stabilised and range between 3.32 and 5.14 mS/cm (3320-5140 EC). It is expected that salinity levels will decline as further catchment inflow occurs over winter.
- Salinity levels at CC@GC have increased to 12.50 mS/cm indicating flows from recent rainfall are not diluting the salinity at this site.

Figure 2 - Currency Creek Water Quality

(Blue shading indicates time period aerial limestone dosing program)



FINNISS RIVER WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Finniss River region**.** Please refer to graphs in Figure 3 for this section.

Alkalinity

- All sites in the Finniss River exhibited alkalinity declines up to the 16th July. Since then there has been a steady increase in alkalinity throughout the region as flow has increased driven by recent rainfall. Currently, all sites within the Finniss River region exhibit alkalinity between 50 and 82 mg/L.

pH

- pH levels at all Finniss River sites remain within the ANZECC guidelines for aquatic ecosystems (pH 6.5 to 9).

Salinity (EC)

- Salinity levels at all Finniss River region sites (excluding FR@GC) remain below 2.10 mS/cm.
- Salinity levels at site FR@GC are observed at 4.10 mS/cm.

Figure 3 - Finniss River Water Quality

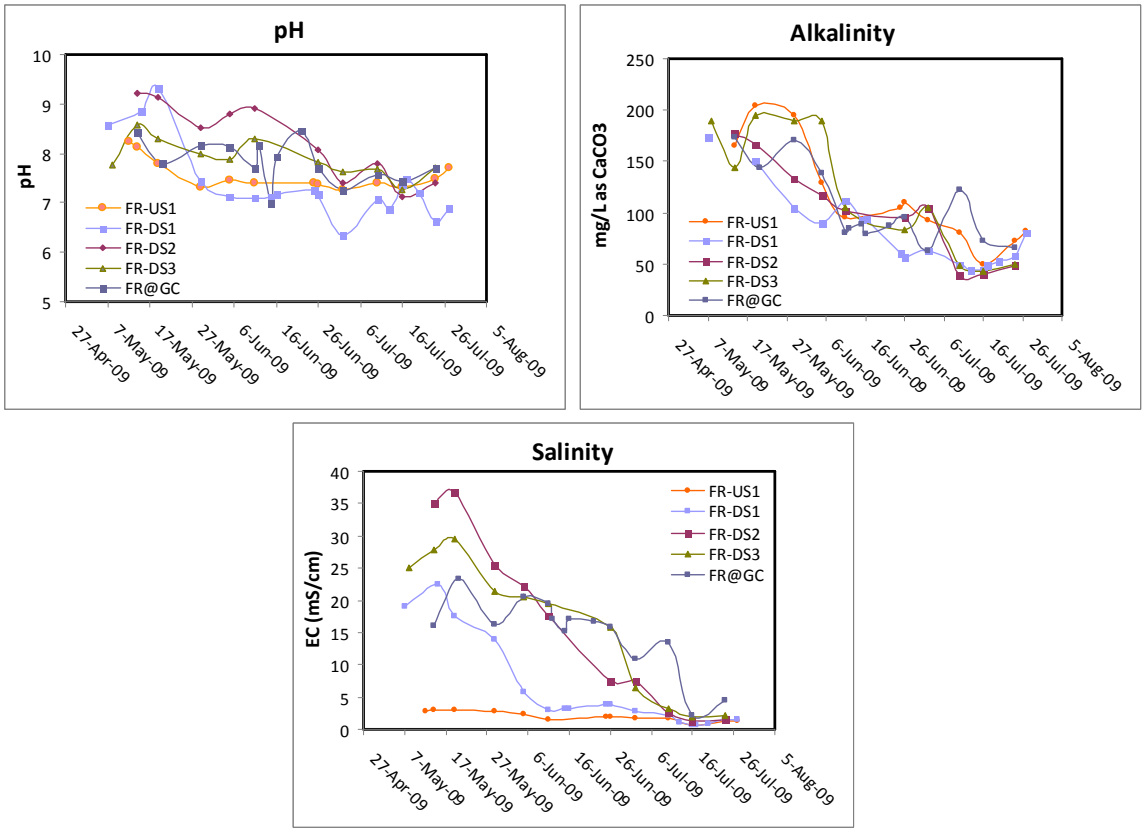
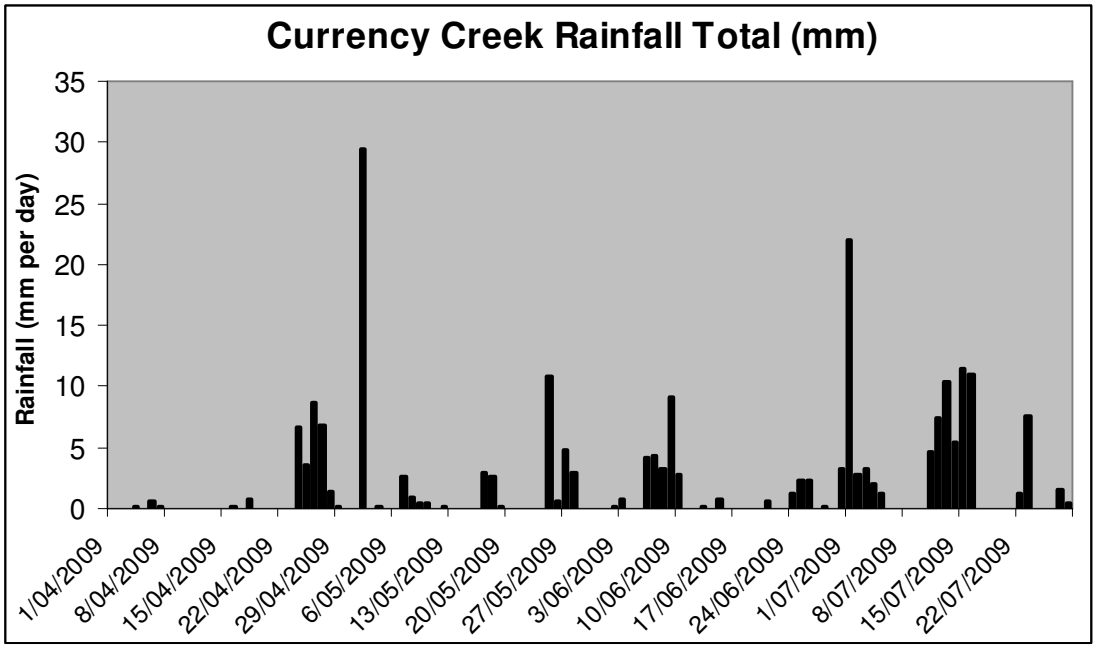


Figure 4 - Rainfall at Currency Creek



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

Further information on water quality and quantity can be found on the following websites:

- **Department for Environment and Heritage** http://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
- **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