CURRENCY CREEK & FINNISS RIVER WATER QUALITY REPORT

Report 2, to 24 June 2009

OBSERVATIONS AT A GLANCE

- Low pH values, high acidities and high metal levels have been observed in pooled water in several locations in the Currency Creek region
- pH and alkalinity levels in the Finniss region have been declining
- Aerial limestone addition to Currency Creek has increased pH and alkalinity at several sites although further monitoring is required to assess these effects and dosing may be required to maintain these trends.

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 are being analysed but the key parameters reported are pH, acidity, alkalinity, salinity, and metals.

***pH* is a measure 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.**

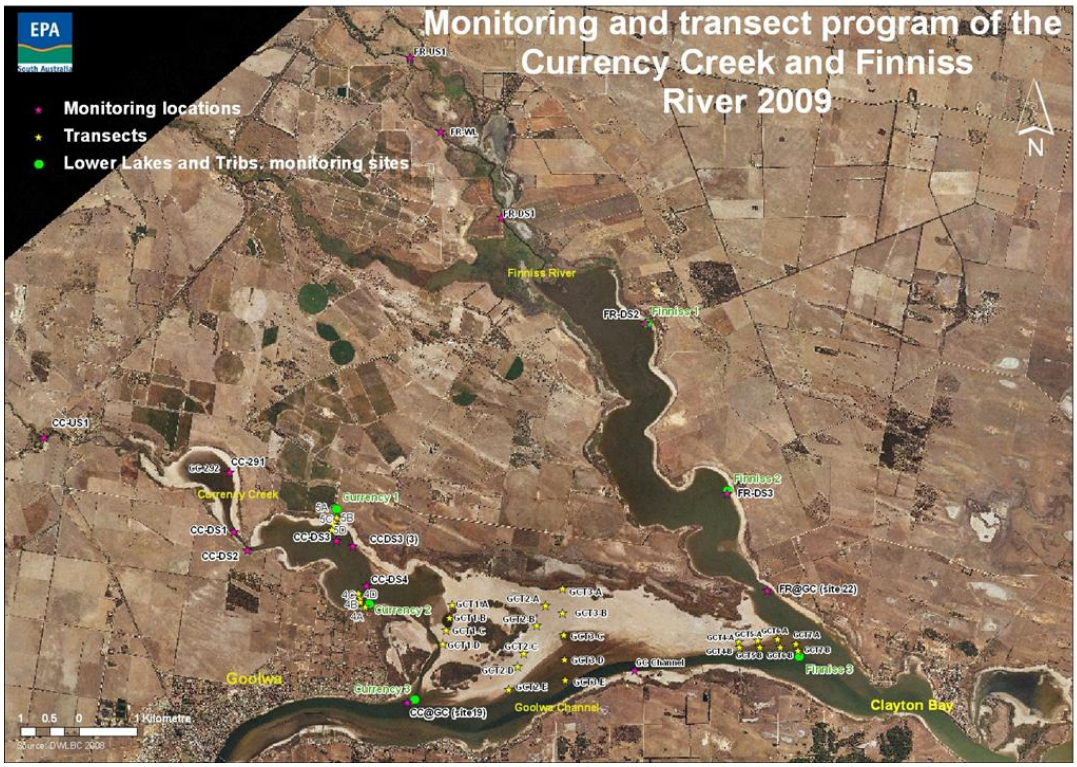
***Alkalinity* is a measure of the buffering capacity of water, or the capacity of the water to neutralise acids and resist pH change. Alkalinity within**

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 levels within this region have been measured 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 shows 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 re-inunated due to rainfall events. Catchment inflows may recommence shortly.
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 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 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.
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 Rvier 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 June 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. 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 took place between Tuesday 16th to Friday 19th June in the Currency Creek region with limestone dispersed over both the upper Currency Creek (above site DS1) and lower Currency Creek water bodies (below site DS2). This water quality report is up to the time period immediately following this dosing. Further monitoring is required to assess the effects of the aerial dosing as there are likely to be lag effects (eg slow dissolution of limestone, transfer of acidic porewater to surface water, raising of the pH in the sediment enough to stimulate bioremediation activity).

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.

Alkalinity

- Alkalinity at CC291 has shown improvement since aerial limestone dosing commenced with an increase from 0 mg/L (15th June) to 18 mg/L (19th June) to 36 mg/L (22nd June).
- Alkalinity at CCDS2 remains absent.
- Alkalinity levels showed some improvements at sites CCDS3 and CCDS4 on the 19th June. This was presumably as a result of aerial dosing being conducted prior to and at the time of sampling. Levels rose to 76 and 21 mg/L respectively on the 19th June, however when sampled on the 22nd June alkalinity had declined to 55 mg/L at CCDS3 and had returned to 0mg/L CCDS4.

- Alkalinity at the Goolwa Channel (CC@GC) site continues to remain steady at 180 mg/L.

Acidity

- CC291 and CCDS3 no longer have acidity (mg/L as $CaCO_3$), presumably as a consequence of aerial dosing.

- CCDS2 has shown a large reduction in acidity with levels declining from those pre-dosing (260 mg/L on 15th June) to post-dosing (50 mg/L on 22nd June).
- CCDS4 exhibited levels of 150 mg/L (15th June) before aerial dosing commenced. After dosing the site showed a decline to 0 mg/L of acidity (19th June). However acidity returned and was observed to be 180 mg/L as $CaCO_3$ on 22nd June. This may be a consequence of an additional flux of acidity from the sediment.

pH

- pH levels remain below the ANZECC guideline level of pH<6.5 at all Currency Creek sites except CCDS3 which recorded a pH of 7.20.
- CC291, CCDS2 and CCDS4 did show some improvements in pH after aerial dosing. At CCDS4 the pH rose from 3.64 (15th June) to 6.45 (19th June) but then deteriorated to 3.60 (22nd June).

Salinity (EC)

- Salinity levels at all sites have stabilised and range between 14.6 and 31 mS/cm (14600-31000 EC). It is expected that salinity levels will decline as more catchment inflow occurs over winter.

Metals

- Soluble metal levels (in particular Aluminium) were high at all sites which have low pH. This is a result of the acidity dissolving the soil mineral surfaces and structure. Aluminium levels (>100mg/L) at some sites exceed ANZECC guidelines (0.0008 mg/L aluminium at pH<6.5) by 100,000 times. These high metal levels could result in some inactivation of the neutralising ability of the limestone (due to precipitation of metals on the limestone surfaces).

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

- FRDS1 and FR@GC showed alkalinity declines but appear to have stabilised at between 94 and 87 mg/L respectively. The alkalinity declines could have been due to dilution from recent rainfall (Figure 4) and catchment runoff, with the possibility of additional acid inputs from the exposed sediment.
- All other sites have alkalinity about 100 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)

- Levels continue to remain steady at FRUS1 (currently 1.5 mS/cm).
- Salinity levels have stabilised at approximately 17 mS/cm for the downstream sites (FRDS1, 2 & 3).
- Levels at FR@GC have also stabilised but remain variable between 15 and 17.5 mS/cm.

GOOLWA CHANNEL EXPOSED SEDIMENTS POREWATER TRANSECTS

- Sediment sampling was conducted on the 18th and 23rd of June and water in soil pits sampled.
- Some sites, predominantly in the higher elevations of the exposed sediments, exhibited low pH and high acidities in the soil pits (see Table 2 for data and Figure 1 for locations).This indicates sediment areas which could pose a risk to surface water quality when the area is rewet.

Table 2 Selected sediment acidity data (see Figure 1 for sample locations)

Transect Site	pH	Acidity (mg/L as $CaCO_3$)
GCT3-B	3.00	>2000
GCT4-A	2.78	1955
GCT4-B	5.63	240
GCT5-A	5.49	305
GCT5-B	5.72	515

Figure 2 - Currency Creek Water Quality

(Blue shading indicates time period of recent aerial limestone dosing program)

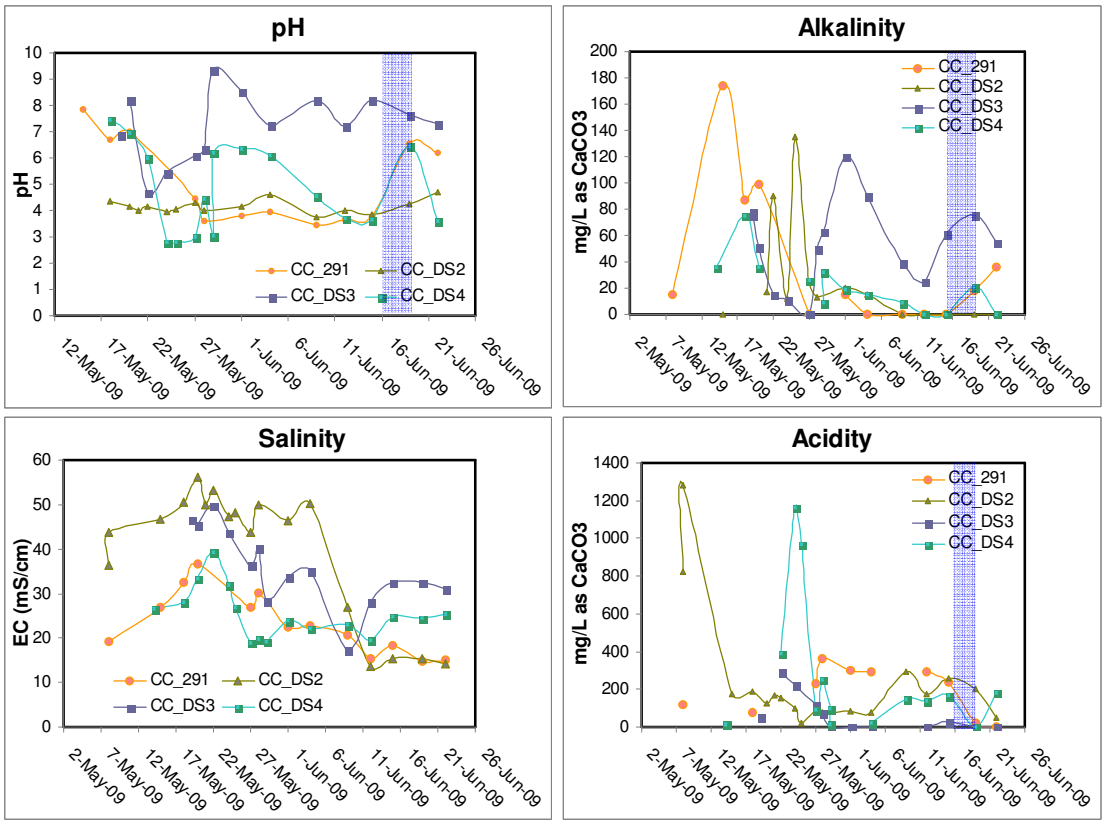


Figure 3 - Finniss water quality

(Blue shading indicates time period of recent aerial limestone dosing program)

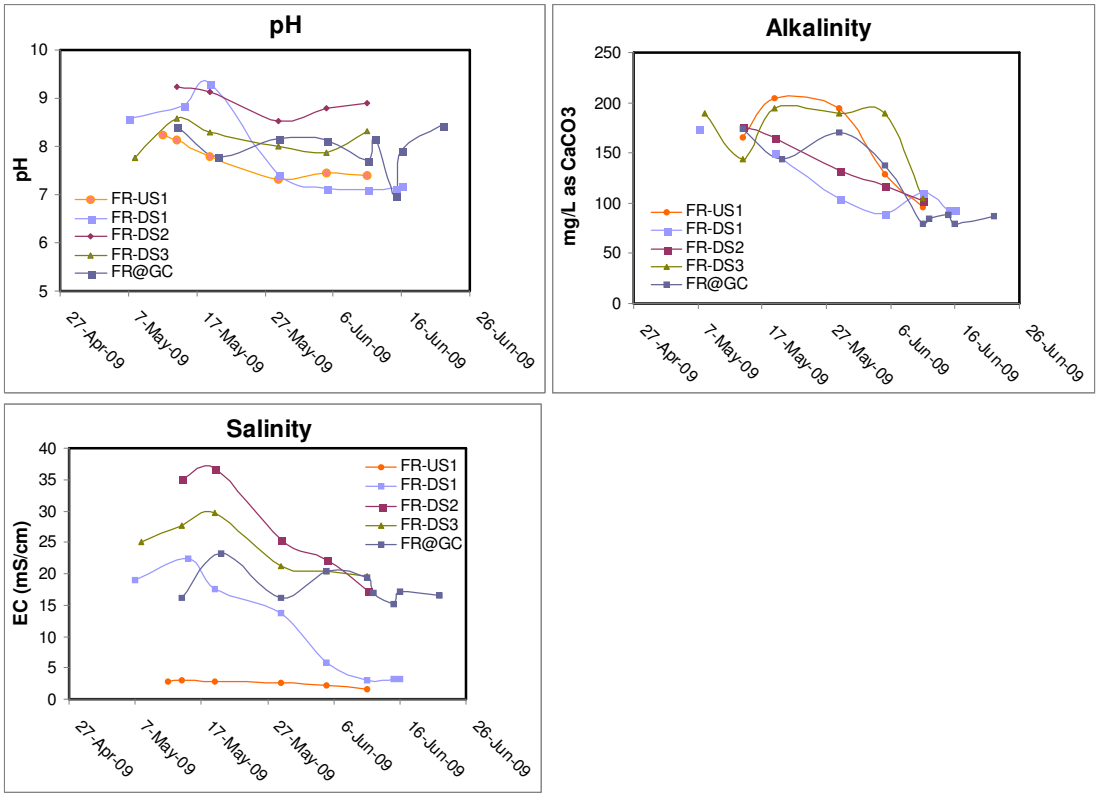
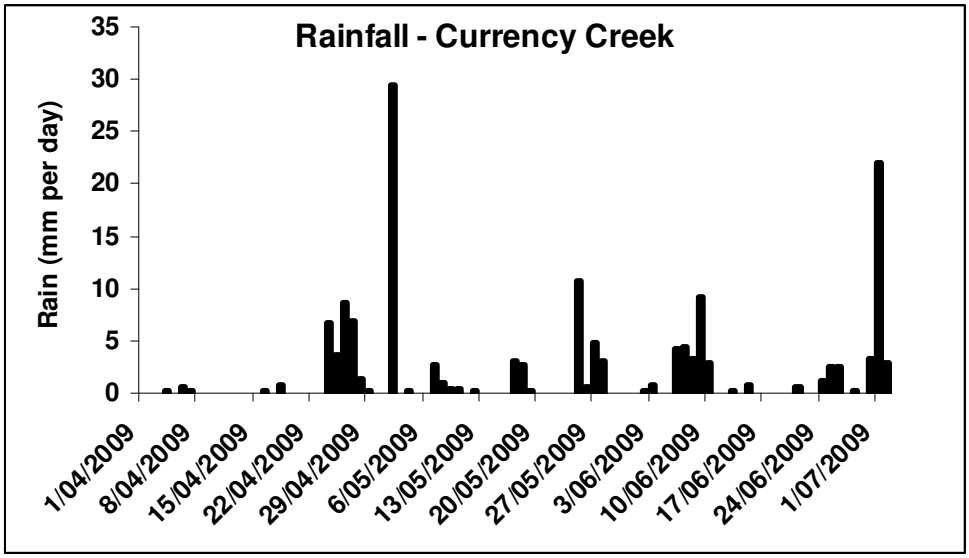


Figure 4 – Rainfall at Currency Creek



Data from South Australian Murray-Darling Basin NRM Board weather station (see website 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