CURRENCY CREEK, FINNISS RIVER AND GOOLWA CHANNEL WATER QUALITY REPORT

Report 8, to 8th October 2009

OBSERVATIONS AT A GLANCE

- A combination of limestone addition, inflows from Currency Creek and Finniss River, and pumping water over the Goolwa Regulator near Clayton has increased pH to satisfactory levels at all monitored sites.
- Alkalinity levels at most sites in Currency Creek remain low indicating the water body is susceptible to further acidification.
- Alkalinity levels adjacent to and downstream of the Goolwa Regulator have significantly increased due to pumping.

BACKGROUND

The Environment Protection Authority, Department for Environment and Heritage and Department of Water, Land and Biodiversity Conservation are monitoring surface and pore water 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 www.epa.sa.gov.au/lower_lakes, Water Quality Reports). 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 uS/cm or 1000 and 1200 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 the relationship of light reflected from a given sample (higher number indicates cloudier water). Turbidity is very variable in the Lower Lakes and influenced primarily by wind events.

SAMPLING SITES

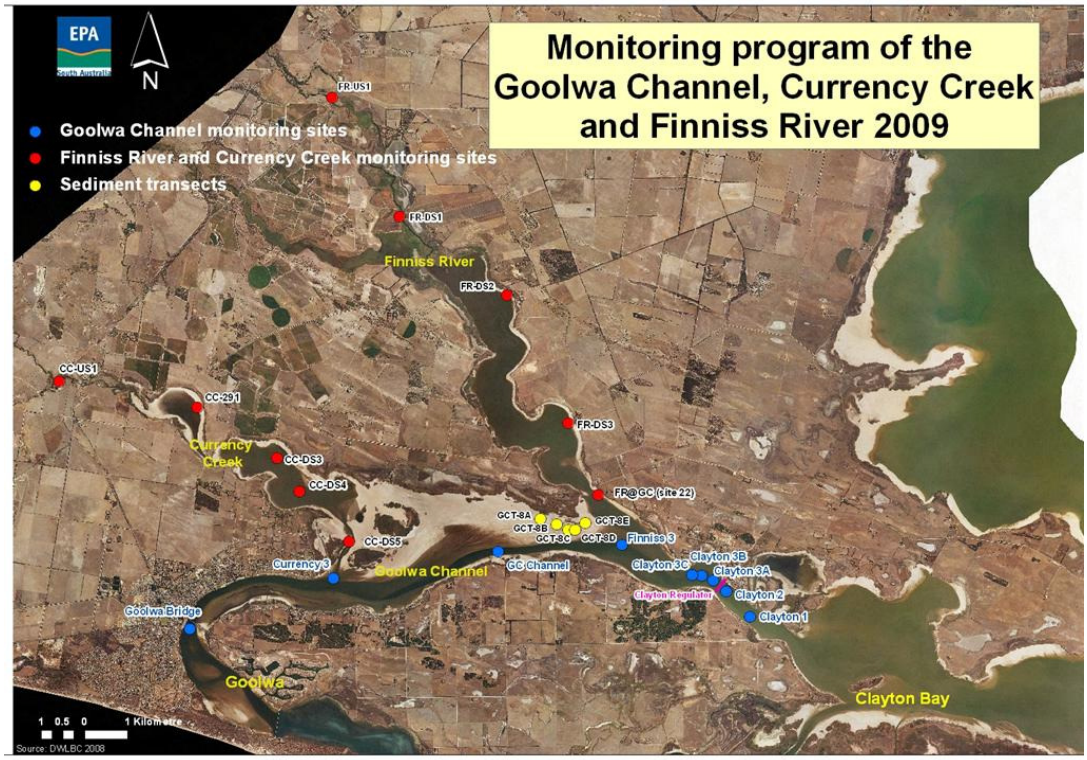
The sample sites where water quality monitoring is undertaken are shown in Figure 1. Several of these sites have been identified as high risk and as a result are being monitored as regularly as possible (in some instances up to 5 times per week).

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

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

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 Channel 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 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 6.95 and 8.47 which is within ANZECC guideline levels for protection of aquatic organisms (pH 6.5 to 9.0). Importantly, this includes the lower Currency Creek site (CCDS4) that previously had persistent low pH values (pH 6.95; 6/10/09).

Alkalinity

- Although pH is satisfactory at all Currency Creek sites, alkalinity continues to remain low and is declining. This indicates that the water body is susceptible to further acidification.

- Alkalinity at CCDS4 is 32 mg/L (6/10/09).
- Alkalinity continues to remain low at CC291 (12 mg/L; 6/10/09) compared to 66mg/L (28/09/09).
- Site CCDS3 alkalinity currently stands at 62 mg/L (6/10/09).
- Alkalinity at the mouth of Currency Creek at the Goolwa Channel (CC@GC) stands at 138 mg/L (1/10/09).

Acidity

- There is no acidity present 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 CCDS3 and CCDS4 appear to have stabilised since mid September. Current salinity levels at CCDS3 stand at 8650 µS/cm and 9234 µS/cm at CCDS4 (6/10/09).
- Salinity levels at CC291 have shown a slight increase from 3080 µS/cm (28/09/09) to 4750 µS/cm (6/10/09). This site appears to be showing the first signs of mixing and interaction with the more saline water found downstream.

Figure 2 – Currency Creek Water Quality

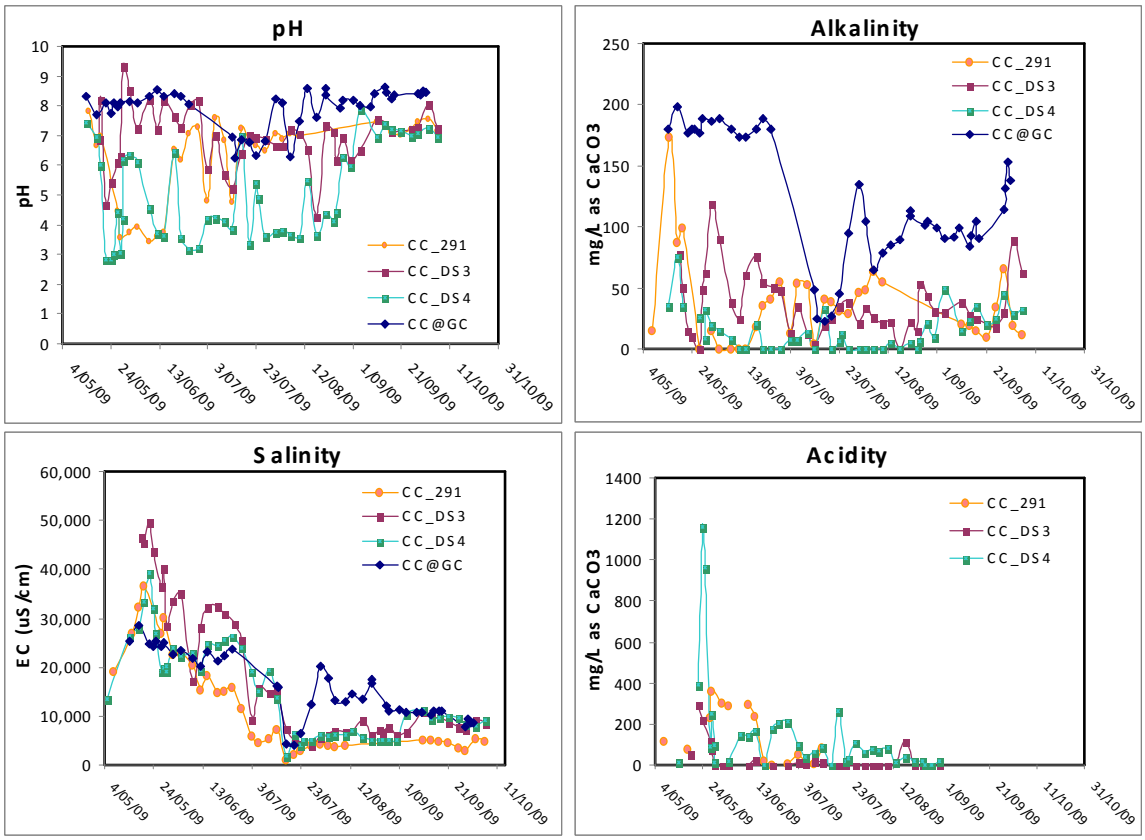
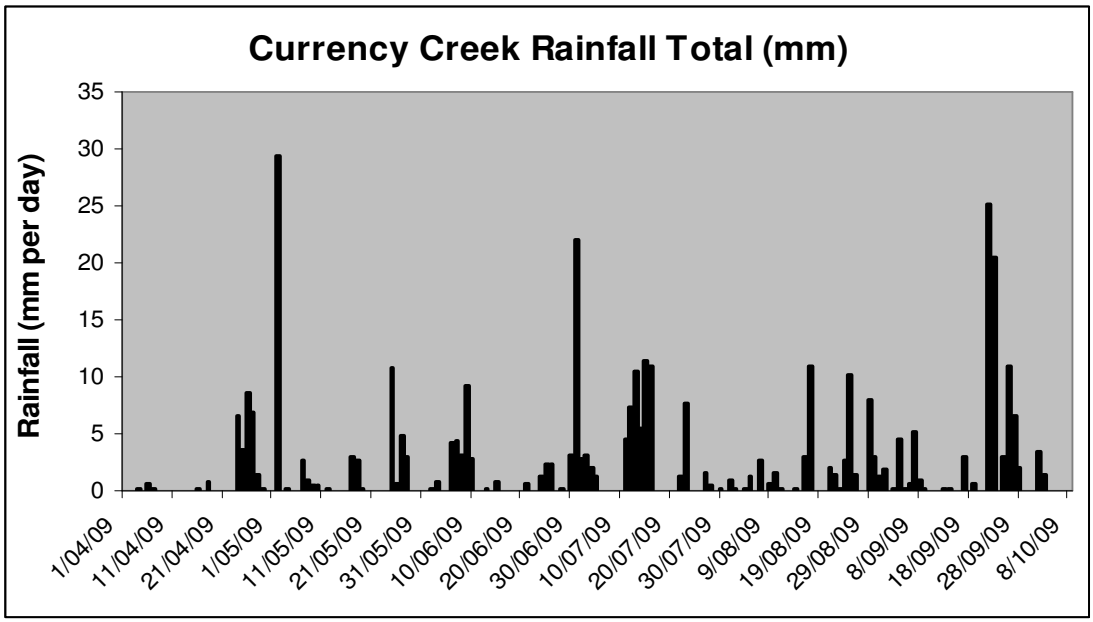


Figure 3 – Rainfall at Currency Creek



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.

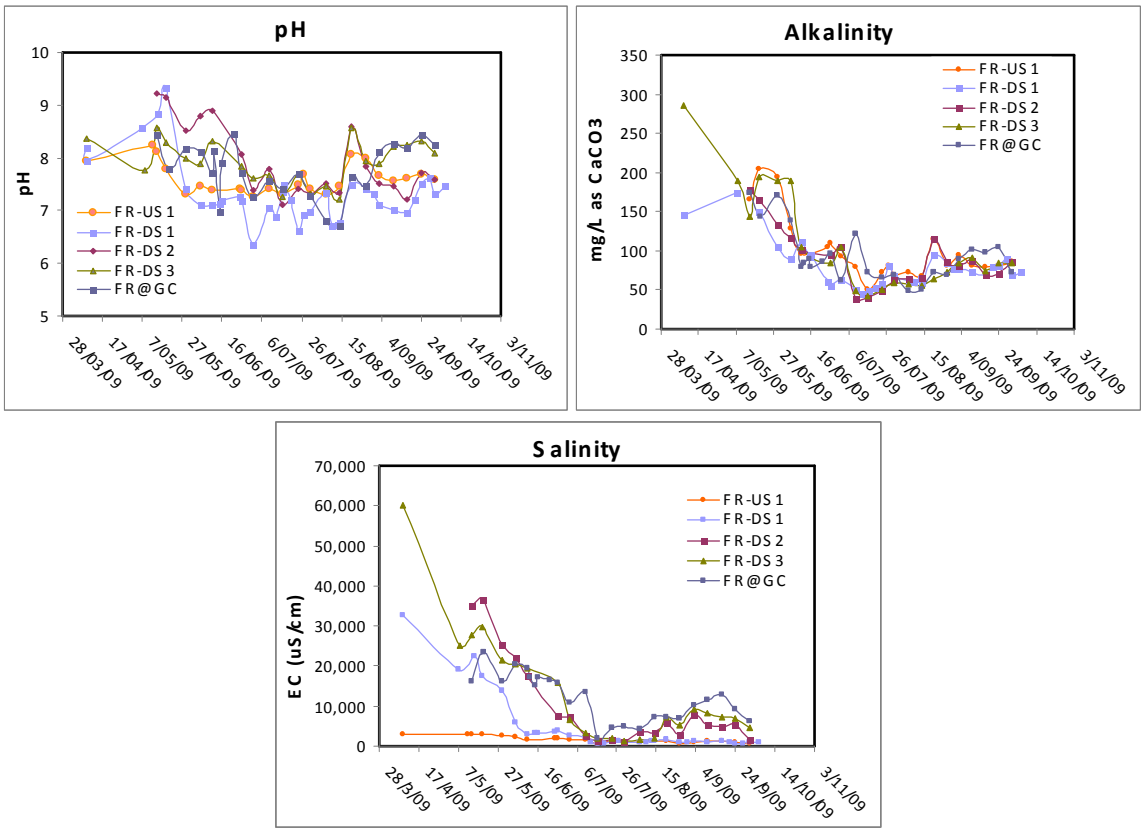
Alkalinity

- Most sites within the Finniss River region have shown slight increases in alkalinity to concentrations between 72 and 87 mg/L (6/10/09). This is likely due to mixing with the more alkaline Goolwa Channel water being pumped over the Goolwa Channel Regulator from Lake Alexandrina.

Salinity (EC)

- After showing an increase in salinity from August to mid September, sites FRDS2, FRDS3 and FR@GC have declined slightly in salinity in recent weeks to 1674, 4747 and 6355 µS/cm, respectively (1/10/09). This is likely due to dilution from recent rainfall events in the region between the 22nd and 28th of September (68.2mm see Figure 3).

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. These sites were added as the regulator at Clayton neared completion and pumping began (11th September 2009). Please refer to graphs in Figure 5 for this section

pH

- The pH of sites monitored in the Goolwa Channel is within ANZECC guideline values for protection of aquatic organisms (pH 6.5 to 9.0).

Alkalinity

- Alkalinity in the Goolwa Channel has remained at satisfactory levels at all sites (i.e. above 114 mg/L; 1/10/09). With pumping there has been an increase in alkalinity from the sites closest to the regulator. This is due to the pumps drawing more alkaline water from the Lake Alexandrina side. This trend is expected to continue until pumping stops (anticipated by the end of October).

Salinity (EC)

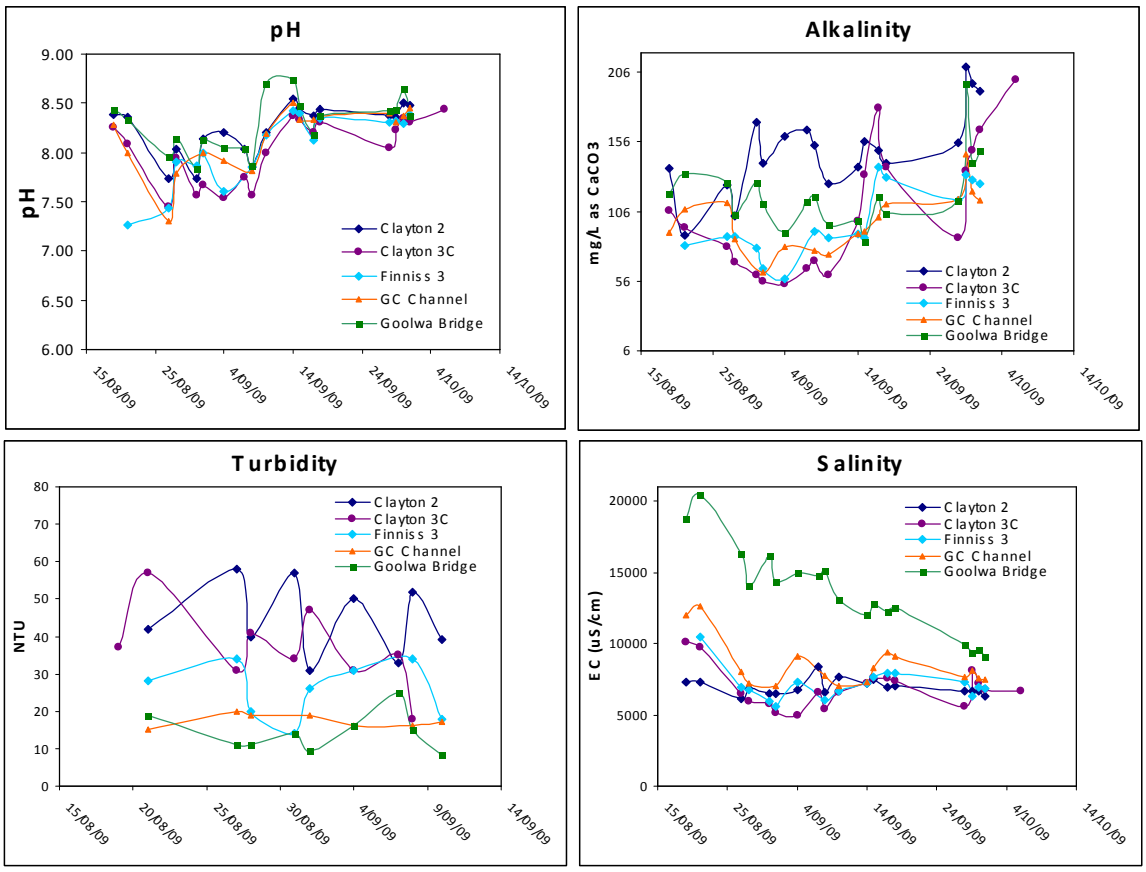
- Salinity has decreased at all sites due to tributary inflows and pumping from Lake Alexandrina. Salinity at Clayton 3C is has levelled at around 6714 µS/cm (6/10/09). The Goolwa Bridge site (most saline site closest

to the barrages) has showed the largest decrease in salinity to 9128 µS/cm (1/10/09).

Turbidity

- Turbidity has been monitored in the pool to identify whether pumping is suspending sediment into the water. Current indications are that while turbidity has been quite variable (influenced by wind), pumping has not contributed to increasing the overall turbidity of the pool.

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** 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
- **CSIRO acid sulfate soils** www.clw.csiro.au/acidsulfatesoils/murray.html