GOOLWA WATER LEVEL MANAGEMENT WATER QUALITY REPORT

Report 7, to 16 September 2009

OBSERVATIONS AT A GLANCE

- A combination of limestone addition and inflows of water from Currency Creek, Finniss River and Goolwa Channel pumping and has increased pH to satisfactory levels at all sites.
- Alkalinity levels at most sites in Currency Creek remain low, indicating the water body is susceptible to further acidification.
- Goolwa Channel pumping has increased alkalinity adjacent to the Clayton regulator.
- Groundwater under exposed sediments in the Goolwa Channel had low pH and high acidity.

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 water level changes in the Goolwa Channel, Currency Creek and Finniss River region (Figures 1 and 1A).

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). Key field-based parameters reported herein are pH, acidity, alkalinity and salinity.

***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 – 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 – 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.*

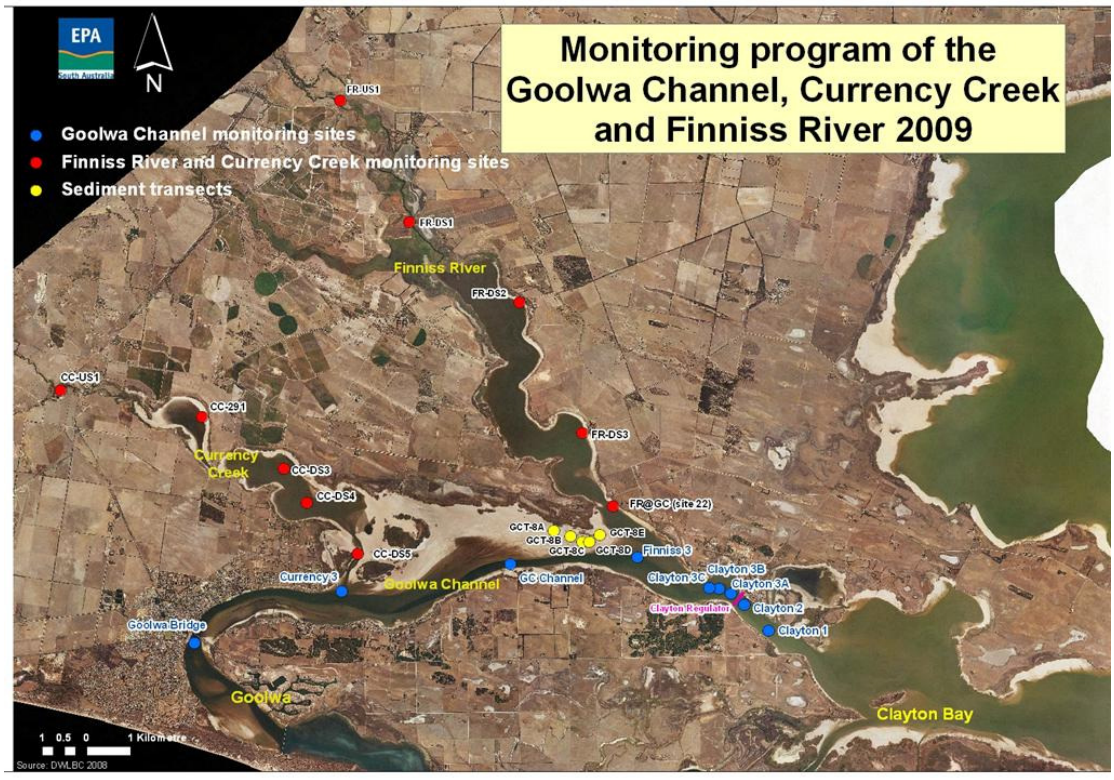
***Salinity** is a measure of the amount of dissolved salts in the water. Saline water conducts electricity more readily than freshwater so electrical conductivity (EC) is routinely used to measure salinity. As salinity levels increase it may become toxic to native freshwater organisms. Prior to drought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

***Turbidity** is a measure of the cloudiness or haziness in water caused by individual particles suspended in water. Turbidity is expressed in Nephelometric Turbidity Units (NTU)and is the relationship of light reflected from a given sample (higher number indicates cloudier water). For freshwater ecosystems a guideline value of 50 NTU is often used.*

WATER QUALITY PARAMETERS

The sample sites where water quality monitoring is undertaken are shown in Figure 1. A number of 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).

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 "*Currency Creek and Finniss River Report 5".* Further limestone additions may be undertaken as required.

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 2 for this section

pH

- The pH of all sites 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 stable at most sites. When pumping commenced there was 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. As pumping continues this trend is expected to continue.

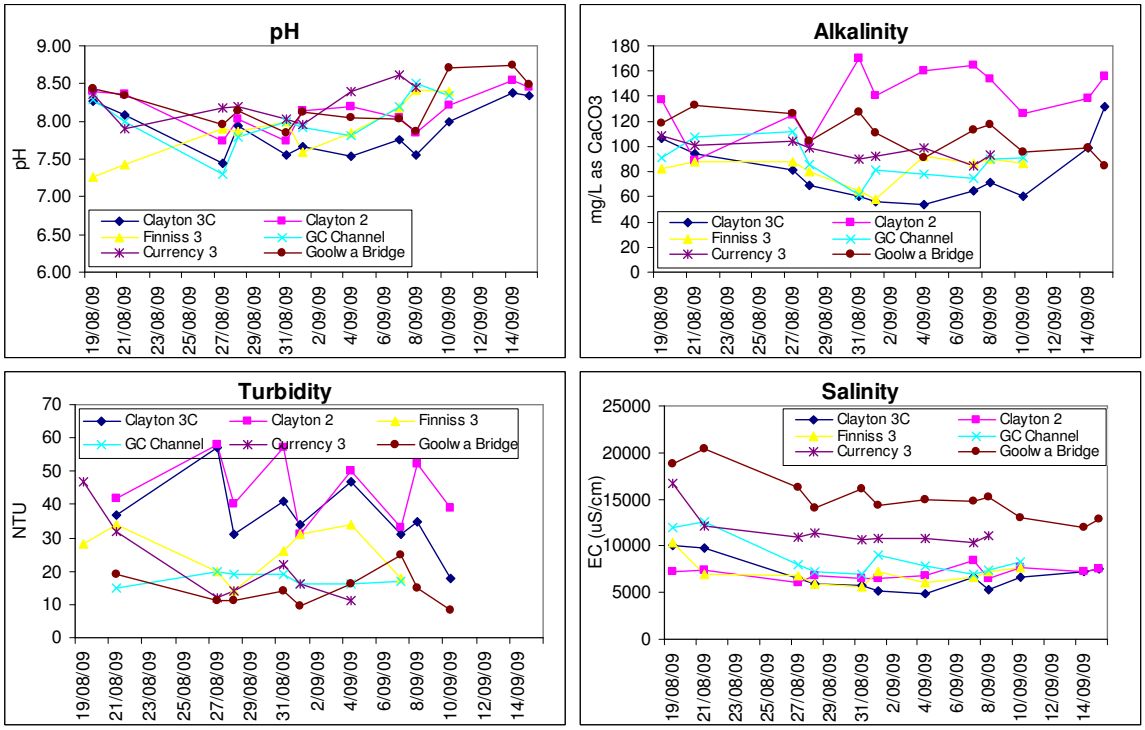
Salinity (EC)

- Salinity levels within Goolwa Channel remain high, averaging around 10000 uS/cm. This is due to previous leakage through the Goolwa barrage and the salinity is expected to fall as pumping continues over the coming weeks.

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 2 – Goolwa Channel Water Quality



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 3 for this section and to Figure 4 for rainfall at Currency Creek.

pH

- The pH levels of all sites within the Currency Creek are now between 7.1 and 7.4 which is within ANZECC guideline levels for protection of aquatic organisms (pH 6.5 to 9.0). Importantly this includes the lower Currency site (CCDS4) that previously had persistent low pH values.

Alkalinity

- Although pH is now neutral, alkalinity continues to remain low at CCDS4. Currently alkalinity is 24 mg/L (14th September) which indicates the water body is susceptible to further acidification.
- Alkalinity also continues to remain low at CCDS3 (28 mg/L) and CC291 (19 mg/L).

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, and increased connectivity and input from the alkaline Goolwa Channel.

Salinity (EC)

- The salinity levels at CC@GC, CCDS5 and CCDS6 have increased. Trends at these sites are influenced by mixing with more saline Goolwa Channel water as water levels rise behind the regulator.
- Salinity levels at CCDS4 and CCDS3 have also increased in recent weeks driven by the interactions mentioned above. Currently (14th September) salinity levels stand at 9340 uS/cm (CCDS4) and 9920 uS/cm (CCDS3). This interaction has now been severed by the completion of the Currency Creek regulator.
- The salinity level at CCDS5 has shown a slight increase in recent weeks and currently stands at 14900 uS/cm (14th September).
- Salinity levels at CC291 have been stable and currently stand at 5230 uS/cm (14th September). This site is closest to the creek inflow and currently does not appear to be influenced by mixing from the more saline water downstream.

Figure 3 - Currency Creek Water Quality

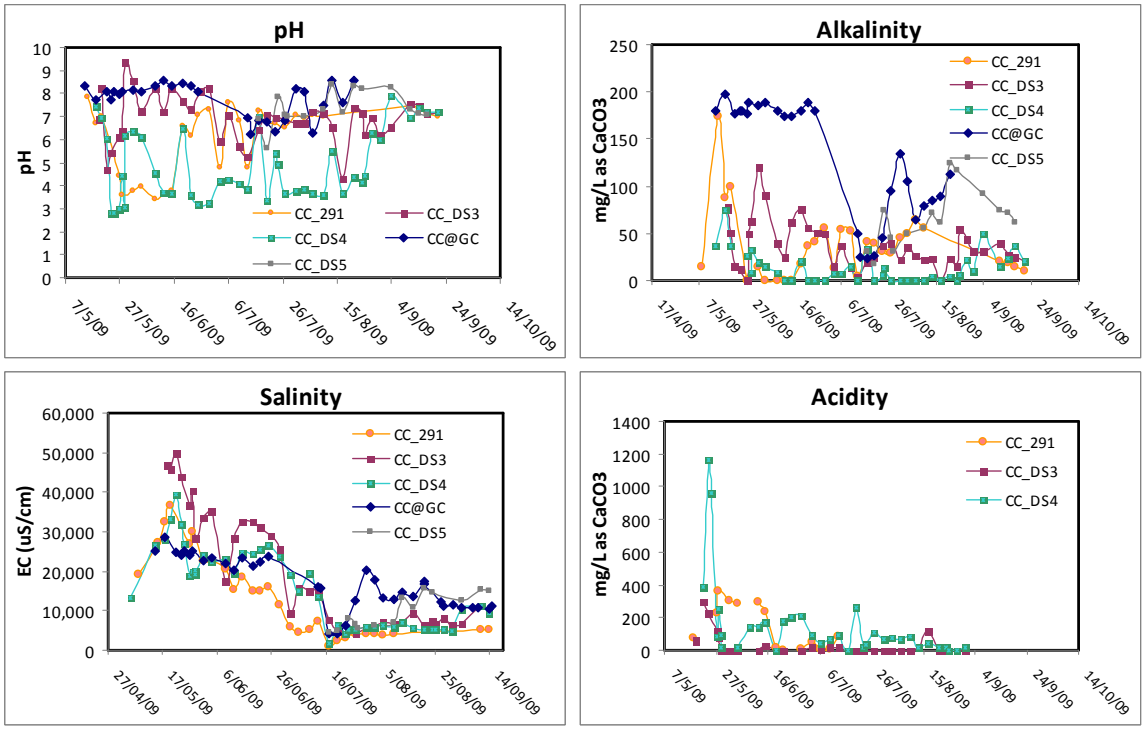
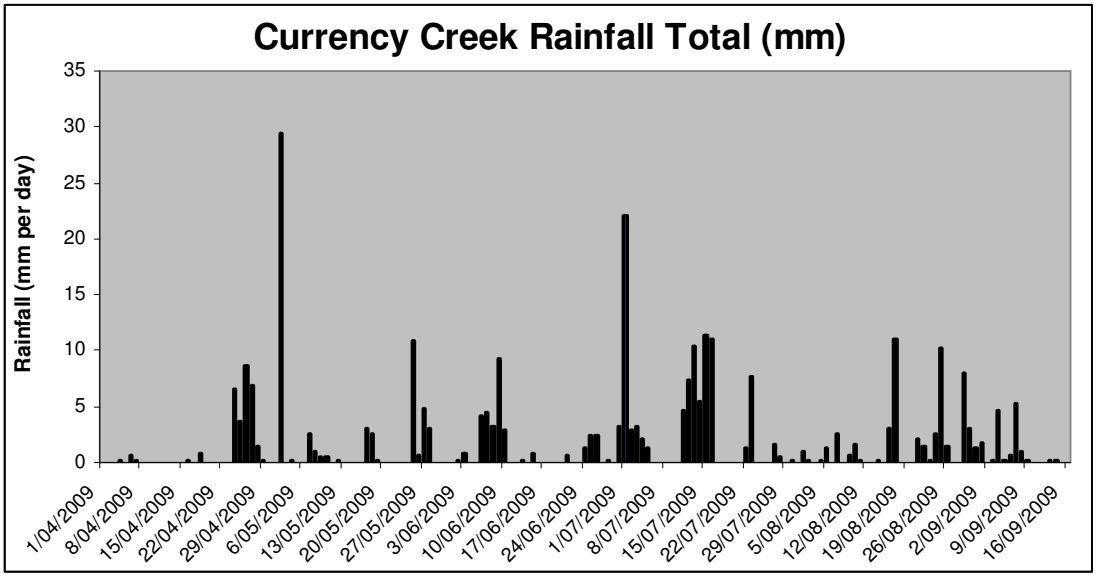


Figure 4 – Rainfall at Currency Creek



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

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 5 for this section.

pH

- pH levels at all Finniss River sites remain within the ANZECC guidelines for protection of aquatic ecosystems.

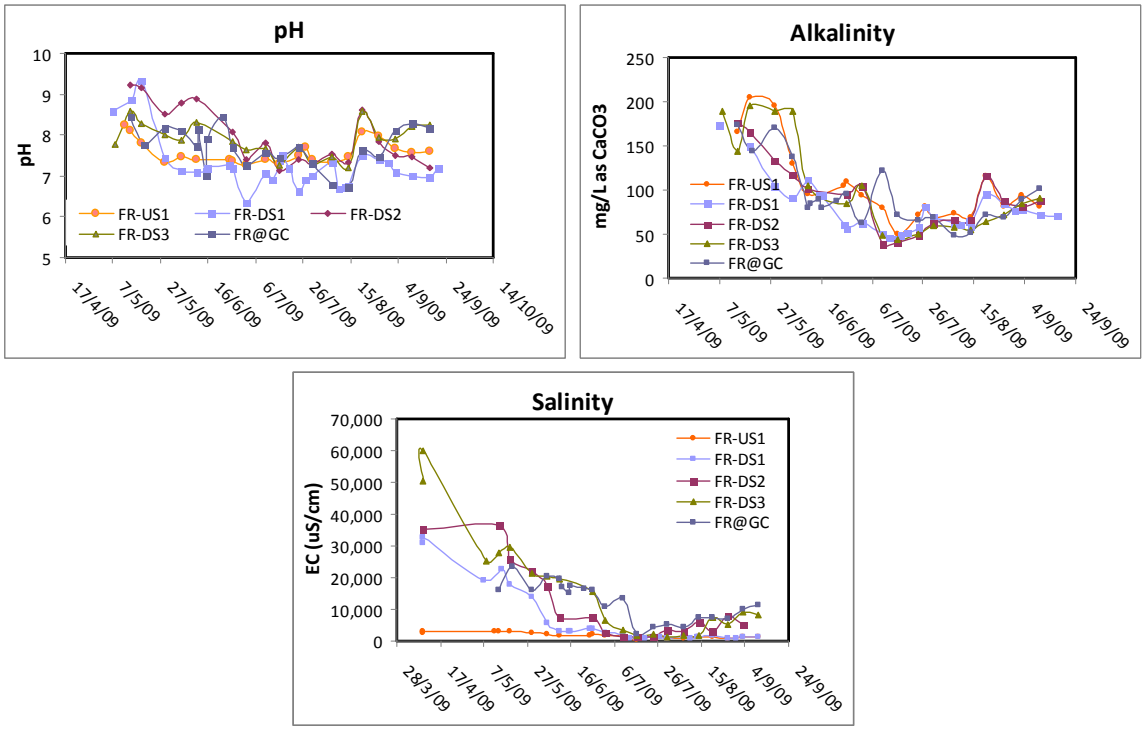
Alkalinity

- Most sites within the Finniss River region have shown increases in alkalinity to concentrations between 78 and 94 mg/L. This is likely due to mixing with the more alkaline Goolwa Channel water as the pool fills behind the Clayton regulator.

Salinity (EC)

- Sites FRDS2, FRDS3 and FR@GC have shown an increase in salinity in recent weeks. Currently levels stand at 7810 uS/cm (FRDS2), 9210 uS/cm (FRDS3) and 10210 uS/cm (FR@GC). This is likely due to a decrease in freshwater flows from the Finniss River catchment and mixing with the higher salinity Goolwa Channel water.

Figure 5 - Finniss River Water Quality



GOOLWA CHANNEL TRANSECTS

On the 15th of September, shallow groundwater quality was analysed along exposed sediments in the Goolwa Channel near the mouth of the Finniss River (see Figure 1). The monitoring results (Table 1) show some low pH and high acidities, highlighting the risk still posed by acid sulfate soils in the Goolwa Channel region.

Table 1 - Goolwa Channel Transect Data

Sample Name	Sample Type	pH	Acidity (mg/L as CaCO3)
GCT-8A	Pore	3.66	305
GCT-8B	Pore	5.97	0
GCT-8C	Pore	6.75	0
GCT-8D	Pore	2.71	1540
GCT-8E	Pore	4.07	680

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