COOKS RIVER VALLEY ASSOCIATION [CRVA] ANNUAL WATER QUALITY REPORT – 2010/11

Introduction

CRVA started testing water quality at several sites on the Cooks River in December 2007. This is the fourth annual report of activities and results.

CRVA also monitors major pollution incidents in the Cooks River and these are summarized in a separate report available from CRVA's Water Quality Co-ordinator.

The water quality in the Cooks River during 2010/11 was generally poor with low dissolved oxygen, high available phosphate and high *E.coli* levels. The phosphate and *E.coli* results are in line with other studies that identify sewage in the Cooks River as a major pollution source.

Beachwatch

In September 2010, the Beachwatch Programs team within the former NSW Department of Climate Change and Water conducted a sanitary inspection of several potential swimming sites in the Cooks River between Botany Bay and Canterbury.

The sanitary inspection process provides an 'assessment of the area's susceptibility of influence from human faecal contamination' (WHO 1999). It is a qualitative assessment of bacterial water quality at the site, and should, to some degree, correlate with the bacterial water quality results obtained through sampling**.**'. The inspection uses the National Health and Medical Research Council's 2008 *Guidelines for Managing Risks in Recreational Waters*, in particular Chapter 5 – Microbial Water Quality.

The investigation showed that none of the 8 sites in the Cooks River put forward for investigation are suitable for safe swimming in either wet or dry weather.[1] So, while there are swimming locations on the Georges River and Botany Bay, there are no safe swimming locations on the Cooks River and potential sites have been ruled out, in the first instance, because of high levels of bacteria [*enterococci*].

Test sites

51 test sessions were conducted throughout the year at 7 sites in the river and tributary stormwater drains along the Cooks River, viz:-

- Cooks River at Richardsons Crescent, South Marrickville
- Cooks River at Marrickville Golf Course near Bruce Street[2]
- Cooks River at Marrickville Golf Course near Wardell Road in Tennyson Street Subcatchment
- Ewart St stormwater drain in Tennyson St subcatchment draining into Cooks River
- Cooks River at Younger Avenue, Earlwood
- Younger Ave stormwater drain draining into Cooks River
- Cup and Saucer Creek Wetland [a] in the Creek just before its junction with the Cooks and [b] in the inflow and outflow of the Wetland

Appendix 3 gives further details of location and site type.

[1] *"Investigation into suitable swimming sites on the Cooks River"* including Appendix A Sanitary Inspections, Beachwatch Programs 2010.

[2] Previously known as Marrickville Golf Course near Beauchamp Street; same site

Sites fall into Marrickville LGA [Richardson Crescent, Marrickville Golf Course] and Canterbury LGA [Younger Avenue, Cup and Saucer Creek Wetland] and provide a picture of water quality both in the River itself and in the waters joining it.

A 2 year study of water quality in the Younger Avenue, Earlwood stormwater drain and nearby in the River was completed during the year and results conveyed to Canterbury Council in October 2010 with recommendations for improved pollution management. This study was prompted by a November 2008 pollution incident when a toxic discharge from the drain was responsible for a major fish kill in the Cooks River.

In the Tennyson Street subcatchment, testing moved from the River to sampling the main stormwater drain in line with a more strategic approach aimed at identifying sources of River pollution in the major drains entering the River.

CRVA was invited by Sydney Water to test water flowing in and out of the newly constructed Wetland at Cup and Saucer Creek. The Creek is a concrete stormwater drain which empties highly polluted water into the Cooks River. The offline Wetland is designed to draw low flows in the Creek into ponds where it is cleaned before meeting the rest of the flow just above the Cooks River junction.

River samples were taken close to the river bank [generally within 2 m]. As far as possible, samples were taken at mid-depth and at the same place, tide and time of day. Many factors impact on the variables measured. For example, dissolved oxygen varies greatly within any 24 hour period being higher during the day when plants are photosynthesising. Rainfall and other weather data were recorded, and in some cases have been used to analyse the data. Other observations were taken including fauna, physical pollution, odours, and - in the case of the Wetland - condition of the ponds, water levels and the effectiveness of the intake in allowing water into the Wetland.

Water quality measures

CRVA is a member of the Streamwatch program and uses the following water quality measures:

- dissolved oxygen [DO] concentration and % of total DO saturation
- temperature [T]
- pH
- electrical conductivity [EC]
- turbidity [TURB]
- available phosphate [AP]
- *E. coli*[3]

All tests were performed using Streamwatch equipment and methodology. The Petrifilm method of testing for *E.coli* was used throughout the year.

Water Quality Guidelines

As recommended by Streamwatch, results are compared with Government guidelines [viz. Australian and New Zealand Guidelines for Fresh and Marine Water Quality ANZECC 2000]. Deviations from the guidelines can cause an adverse effect on the aquatic ecosystem. In the case of *E.*coli, high levels can rule out human contact.

[3] Advice from the Department of Health is that the best indicator organism to determine risks to human health is *enterococci* done in accordance with National Health and Medical Research Council's 2008 *Guidelines for Managing Risks in Recreational Waters,* letter from NSW Parliamentary Secretary for Health, 26 March 2010. However we continue to use *E.coli* since it is supported by the Streamwatch Program and we do not have access to *enterococci* testing facilities.

The guidelines are expressed in terms of a range or recommended value for a water quality measure and vary depending on the use of the water body being tested eg environmental, recreational or drinking. The guideline values also vary according to how the ecosystem containing the site is classified, eg upland river, lowland river, estuary. Cooks River sites are classified as estuaries. Estuary guidelines are applicable to these Cooks River test sites. For example, the guideline value for dissolved oxygen [DO] [expressed as a percentage of the saturated value at a given temperature] is 80% - 110%. For a complete set of ANZECC guidelines, see Appendix 1.

Stormwater drains and Cup and Saucer Creek Wetland results are compared with estuary guidelines where they enter the River in its estuarine reach.

It is expected that individual sites will have a range of empirical values which may differ from guidelines but still represent healthy sites. These results help to build a 'normal' profile for a site from which significant deviations can help to identify pollution events.

Site results

Results for each site together with comments based on comparison with ANZECC Guidelines, are shown in the tables in Appendix 2.

Conclusions

Water quality in the Cooks River at these sites is generally poor with frequent occurrences of test results outside ANZECC guidelines.

Table 1 shows that dissolved oxygen [% saturation] was outside the guideline range [80% - 110%] at all sites on 60% or more occasions, the median %saturation at all river sites was below 56%.

Median pH was within the guideline range [7.0 – 8.5] at all river sites.

Median turbidity was above the guideline [10 NTU] at all river sites except Marrickville Golf Course at Tennyson Street.

Median levels of available phosphate [AP] were above the guideline [0.0153 mg/L] at all sites, both river and stormwater. See Table 2 below. The highest AP levels were recorded in the inflow to Cup and Saucer Creek Wetland where a level of 6.35 mg/L was recorded [415 times the guideline].

Table 1: Dissolved oxygen % saturation [DO] results by site

Site [no. tests]	Median DO % saturation	Min DO % saturation	% Occasions DO% saturation outside guidelines [80 – 110%]
Richardson Cres [8]	56%	38%	100%
Marrickville Golf Course near Bruce[4] St [8]	55%	30%	88%
Marrickville Golf Course in Tennyson St subcatchment [3]	32%	16%	100%
Tennyson St subcatchment Ewart St stormwater drain [5]	72%	64%	60%
Younger Avenue, Earlwood stormwater drain [0]	na	na	na
Younger Avenue, Earlwood	40%	11%	67%

[4] Previously called Marrickville Golf Course near Beauchamp St. Same site.

Table 1: Dissolved oxygen % saturation [DO] results by site			
Site [no. tests]	**Median DO % saturation**	**Min DO % saturation**	**% Occasions DO% saturation outside guidelines [80 – 110%]**
downstream of stormwater drain [6]			
Cup and Saucer Creek [0]	na	na	na

Table 2: Available phosphate [AP] results by site			
Site [no. tests]	**Median AP [mg/L]**	**Max AP [mg/L]**	**% Occasions AP above guideline 0.0153 mg/L**
Richardson Cres [9]	0.14	0.28	100%
Marrickville Golf Course near Bruce[5] St [8]	0.13	0.54	100%
Marrickville Golf Course in Tennyson St subcatchment [3]	0.16	0.27	100%
Tennyson St subcatchment Ewart St stormwater drain [6]	0.15	0.42	100%
Younger Avenue, Earlwood stormwater drain [6]	0.02	0.10	50%
Younger Avenue, Earlwood downstream of stormwater drain [6]	0.18	0.39	83%
Cup and Saucer Creek inflow [6]	0.20	6.35	100%
Cup and Saucer Creek outflow [6]	0.13	0.41	100%

Median *E.coli* results varied between sites. See Table 3 below. In the River, median *E.coli* ranged from 10 cfu/100mL at Richardson Crescent, the furthest downstream site, to 2,500 cfu/100mL at Younger Avenue, the furthest upstream site. *E.coli* levels exceeded the primary contact guideline most of the time at all but one of the River sites. The highest recorded results were not in the River, viz 1.74 million cfu/100mL in Cup and Saucer Creek Wetland inflow while 70,000 cfu/100mL was recorded in the River at Younger Ave, Earlwood. This is most likely due to human sewage contamination.

Table 3: *E.coli* results by site				
Site [no. tests]	**Median *E.coli* [cfu/100ml]**	**Max *E.coli* [cfu/100ml]**	**% Occasions *E.coli* above guideline**	
			Primary contact 150	Secondary contact 1,000
Richardson Cres [5]	<100	900	40%	0%
Marrickville Golf Course near Bruce[5] St [8]	400	7300	88%	25%
Marrickville Golf Course in Tennyson St subcatchment [3]	2000	6800	100%	67%
Tennyson St subcatchment Ewart St stormwater drain [6]	2200	6000	100%	67%
Younger Avenue, Earlwood stormwater drain [6]	100	100	0%	0%
Younger Avenue, Earlwood downstream of stormwater drain [7]	2500	70,000	86%	71%
Cup and Saucer Creek inflow [6]	950	1,740,000	83%	50%
Cup and Saucer Creek outflow [6]	150	500	50%	0%

[5] Previously called Marrickville Golf Course near Beauchamp St. Same site.

Younger Ave stormwater drain was relatively clean whereas stormwaters in Tennyson Street and Cup and Saucer Creek [entering the Wetland] were poor quality. One very serious pollution incident occurred in Cup and Saucer Creek which yielded an *E.coli* result of 1.74 million cfu/100mL.

It is expected that *E.coli* results will be affected by prior rainfall. Heavy rain in the catchment usually results in stormwater ingress into the sewerage system and overflows into the waterways. Median and maximum *E.coli* results are shown by site for both wet and dry days where wet days recorded greater than 5mm of rain in the 24 hours prior to testing.[6] Figure 1 shows *E.coli* results for Cooks River sites for both wet and dry weather. Wet medians are not necessarily greater than dry medians suggesting that if *E.coli* levels are related to sewage contamination, then that contamination is not confined to wet weather.

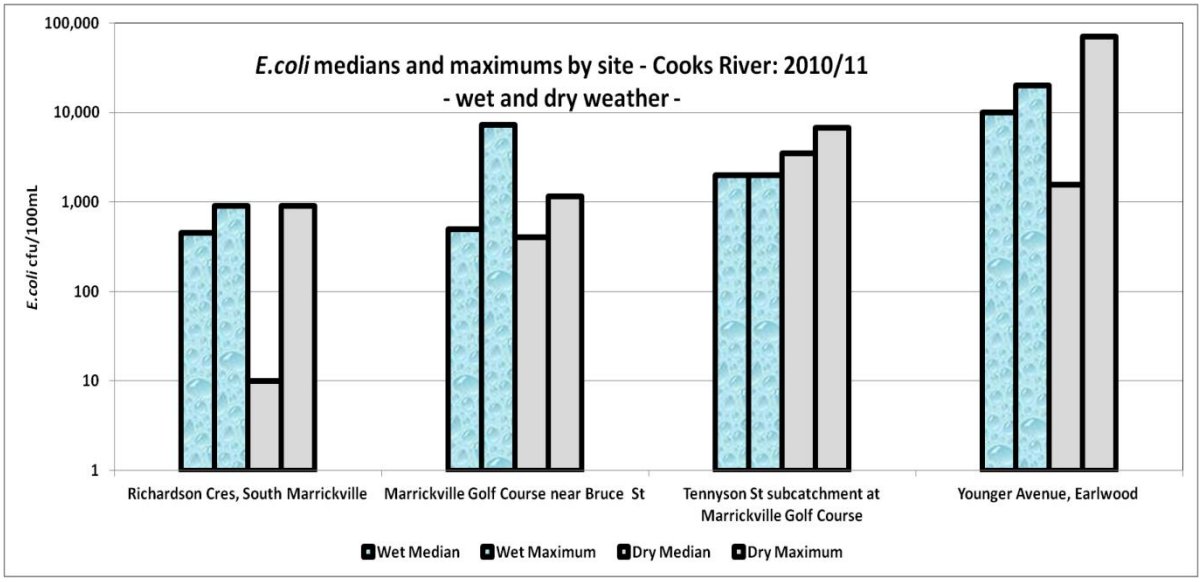

Figure 1 *E.coli* medians and maximums for river sites in both wet and dry weather

Acknowledgements

CRVA relies on dedicated volunteers to test water quality regularly and rigorously. Thanks are due to the following for the results reported here:

Gayle Adams, John Butcher, Christine Hay, Penny Hopkins, Keith Mashman, Peter Munro, Geoff Pollard, Julie O'Connor, Rebecca Whitehall and Esther Wittey.

CRVA is a member of the Streamwatch program which provides training, equipment and support to undertake water testing. Thanks are due to our Streamwatch Co-ordinators, Claire Evans and Hayley Bates, who provided guidance and assistance throughout the year.

CRVA would also like to acknowledge the following for assistance:

- Canterbury and Marrickville Councils for help with equipment, advice and prompt follow up of pollution events detected during water quality testing and reported by CRVA members under its CooksEye program
- Marrickville Council for access to Ewart St stormwater drain
- Sydney Water for access to Cup and Saucer Creek Wetland in and outflows

[6] Previously, wet days were defined as those where the Antecedent Wetness Index was <5mm. As well as rainfall in 24 hours prior, AWI reflects earlier rainfall in amounts that decrease with time. Advice from David Knights that rainfall in 24 hours prior is more relevant has resulted in the change in definition.

Further information

Comments and queries are welcome. For a full set of CRVA results or further information, contact:

Gayle Adams, CRVA Water Quality Co-ordinator, info'at'crva.org.au

April 2012

APPENDIX 1

Water Quality Guidelines

CRVA compares its results with Government guidelines [viz. Australian and New Zealand Guidelines for Fresh and Marine Water Quality[7] and the Australian Drinking Water Guidelines]. Deviations from the guidelines can cause an adverse effect on the aquatic ecosystem, or, in the case of *E.coli*, make the water unsafe for boating or swimming. Because the Cooks River is polluted, results often lie outside these guidelines.

The guidelines are expressed in terms of a range or recommended upper or lower level for a parameter [eg pH] and vary depending on the use of the water body being tested eg environmental, recreational or drinking. The guideline values also vary according to the type of ecosystem, eg upland river, lowland river, estuary. For the Cooks River we use the estuary guidelines. For example, the guideline values for dissolved oxygen [DO] expressed as a percentage of the saturated value at a given temperature are 80% - 110%. Guidelines for each parameter tested by CRVA are reproduced from the Streamwatch Manual[8] in the tables below.

Dissolved oxygen levels [DO and DO%saturation]

Dissolved oxygen is vital for fish, aquatic invertebrates and amphibians living in the river. Prolonged exposure to low dissolved oxygen levels will stress them and very low levels result in death. The guideline is expressed in terms of the amount of oxygen in the water as a percentage of the maximum amount the water can contain at its current temperature [saturation]. Values outside this range can kill fish.

Ecosystem type	Guideline range [%DO]
Estuary	80% – 110% of saturation

Electrical conductivity [EC]

Ecosystem type	Guideline range
Estuary	Guideline trigger values do not exist for estuarine ecosystems. These areas experience high variability in conductivity due to the convergence of fresh and salt waters.

pH

Ecosystem type	Guideline range [pH units]
Estuary	7.0 – 8.5

Turbidity [TURB]

Ecosystem type	Guideline range [NTU]
Estuary	0 - 10

Temperature [T]

The guideline value is relevant for recreational water quality and aesthetics.

Situation	Guideline range [°C]
Prolonged exposure	15°C – 35°C

[7] Australian and New Zealand Guidelines for Fresh and Marine Water Quality released in 2000 by Australian and New Zealand Environment and Conservation Council [ANZECC] and Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ]

[8] The Streamwatch Manual, 3rd edition. Sydney Water www.streamwatch.org.au

Available phosphate levels [AP]

Available phosphate is a measure of the phosphate compounds that are soluble in water and therefore available to be absorbed by plants. High phosphate levels can adversely affect life in the river eg they can lead to reductions in dissolved oxygen and promote an overabundance of algae and aquatic weeds. Values above this guideline may cause nuisance plant growth.

Ecosystem type	Guideline range [mg/L]
Estuary	0.000 - 0.0153

Faecal coliform [FC] and E.coli levels[9]

Faecal coliforms[10] are an indicator of contamination by sewage waste from various sources including human sewerage systems and runoff containing animal faeces. ANZECC guidelines for human contact with FCs distinguish between primary and secondary contact activities. Primary contact refers to activities like swimming and diving where people are completely immersed in water. Contact without complete immersion is secondary contact and includes boating. FC results are highly variable and greatly influenced by heavy rain and sewage overflows. High values may cause loss of native biota.

Type of contact	Guideline value [cfu/100mL]
Primary	The median bacterial content in fresh and marine waters should not exceed 150 faecal coliform organisms/100mL
Secondary	The median bacterial content in fresh and marine waters should not exceed 1000 faecal coliform organisms/100mL

[9] The ANZECC guidelines refer to total faecal coliform counts rather than *E.coli* which are tested here using the Petrifilm method. Streamwatch has advised "that approximately 98% of all FCs are *E.coli* and therefore we can infer that if there are 1-2 E.coli colonies/1 ml this would indicate the trigger for primary contact and counts >10 would indicate the trigger for secondary contact." [Email from Dr Manu Black, Community Education Officer, Sydney Water, 27 August 2009]. Therefore the guidelines for *E.coli* are assumed to be the same as for FCs.

[10] Advice from the Department of Health is that the best indicator organism to determine risks to human health is *enterococci* done in accordance with National Health and Medical Research Council's 2008 *Guidelines for Managing Risks in Recreational Waters,* letter from NSW Parliamentary Secretary for Health, 26 March 2010. However we continue to use *E.coli* since it is supported by the Streamwatch Program.

APPENDIX 2

RESULTS BY SITE: 2010/11

Sites in Marrickville LGA

Site: Richardson Crescent: Jul 10 – Jun 11				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide
DO [% of saturated value]	38 – 68 %	56%	8	8
T [°C]	12 – 29	21	9	3
pH	8.0 – 9.0	8.0	9	3
EC [mS/cm]	33 – 61	49	8	na
TURB [NTU]	10 - 20	15	9	6
AP [mg/L]	0.09-0.28	0.14	9	9
E.coli [cfu/100mL] ALL -wet -dry	<100 – 900 <100 – 900 <100 - 900	<100 <100 <100	6 3 3	2 primary; 0 secondary
Comments				
DO results are consistently below the guideline. Median turbidity exceeds guideline. AP results are well above the guideline, ranging from 5.9 to 18 times the guideline. *E.coli* results are variable with the swimming limit exceeded one-third of occasions.				

Site: Marrickville Golf Course near Bruce St: Jul 10 – Jun 11				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide
DO [% of saturated value]	30 – 82 %	55%	8	7
T [°C]	14 – 25	20	8	2
pH	8.0 – 9.0	8.5	8	3
EC [mS/cm]	23 – 60	51	8	na
TURB [NTU]	10 – 15	15*	8	5
AP [mg/L]	0.04 – 0.54	0.13	8	8
E.coli [cfu/100mL] ALL -wet -dry	100 – 7300 400 – 7300 100 - 1150	400 500 400	8 3 5	7 primary; 2 secondary
Comments				
* 5 occurrences of TURB = 15 DO results were generally well below the guideline. pH was just above guideline on 67% of occasions. Median turbidity exceeded guideline. AP exceeded guideline on every occasion with the median and maxium being 8.5 and 35 times higher, respectively than the guideline. *E.coli* levels generally exceeded the swimming limit.				

Site: Marrickville Golf Course in Tennyson St subcatchment: Jul 10 – Nov 10				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide
DO [% of saturated value]	16 – 67 %	32%	3	3
T [°C]	14 - 19	19*	3	1
pH	8.0	8.0	3	0
EC [mS/cm]	27 – 45	30	3	na
TURB [NTU]	<10 – 20	10**	3	1
AP [mg/L]	0.08 – 0.27	0.16	3	3
E.coli [cfu/100mL] ALL -wet -dry	200 – 6,800 2000 200 - 6800	2000 2000 3500	3 1 2	3 primary; 2 secondary
Comments				
* 2 occurrences of T = 19; **<10, 10, 20 NTU Small number of tests at this site. DO results were consistently below the guideline. AP was consistently above guideline. *E.coli* levels were consistently above the swimming limit and generally above the boating limit.				

Site: Tennyson St subcatchment, Ewart St stormwater drain [new site]: Dec 10 – Jun 11				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide[b]
DO [% of saturated value]	64 – 96 %	72%	5	3
T [°C]	14 – 23	20	6	1
pH	6.5 – 7.5	7.0	6	2
EC [mS/cm]	0.2 – 1.3	0.5	6	na
TURB [NTU]	15 – 80	30	6	6
AP [mg/L]	0.08 – 0.42	0.15	6	6
E.coli [cfu/100mL] ALL -wet -dry	900 – 6,000 900 – 6000 1700 - 2700	2,200 2800 2200	6 4 2	6 primary; 4 secondary
Comments				
[b]Guidelines may not apply specifically to stormwater but Marrickville Council confirms they are relevant since the drain flows into the River. DO results were generally below guideline. Turbidity and AP were consistently higher than guideline. *E.coli* levels were high. This water was unsuitable for swimming and generally unsuitable for boating.				

Sites in Canterbury LGA

Younger Avenue sites

Site: Younger Avenue Stormwater Drain – water in the drain: Jul 10 – Dec 10				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide[a]
DO [% of saturated value]	na	na	0	
T [°C]	na	na	0	
pH	5.5 – 7.0	6.5	6	4[a]
EC [mS/cm]	0.5 – 0.7	0.5*	6	na
TURB [NTU]	10 – 15	10**	6	1
AP [mg/L]	0.01 – 0.10	0.02	6	3
E.coli [cfu/100mL] ALL -wet -dry	<100 – 100 100 <100 - 100	100 100 <100	6 3 3	0 primary; 0 secondary
Comments				
*5 occurrences of EC = 0.5 **5 occurrences of TURB = 10 [a]ANZECC guidelines for estuaries are relevant to the Younger Avenue River sites into which this water is draining, not necessarily the water in the drain itself. This drain flows continuously. Results appear to be consistent with clean and contaminated stormwater and ground water. DO, T not done due to restricted access. Median AP exceeds guideline. *E.coli* results were generally good and below the swimming limit.				

Site: Younger Avenue – 70 m downstream of drain in the River: Jul 10 – Dec 10				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide
DO [% of saturated value]	11 – 98%	40%	6	4
T [°C]	12 – 24	19	6	1
pH	7.5 – 9.0	8.5	6	3
EC [mS/cm]	21 - 34	27	6	na
TURB [NTU]	15 – 30	18	6	6
AP [mg/L]	0.00 – 0.39	0.18	6	5
E.coli [cfu/100mL] ALL -wet -dry	100 – 70,000 1700 – 20,000 100 – 70,000	2500 10,000 1550	7 3 4	6 primary; 5 secondary
Comments				
DO was generally below guideline. Turbidity was consistently above guideline. AP was generally above guideline with median and maximum being 11.8 and 25 times higher, respectively, than the guideline. Median *E.coli* results were generally high.				

Cup and Saucer Creek Wetland sites

The Wetland at the junction of Cup and Saucer Creek and the Cooks River in Canterbury was officially opened in September 2010. Its main objectives were

1. To help reduce pollution of the Cooks River, and
2. To create a diverse habitat for plants and wildlife to thrive

By diverting polluted water coming down Cup and Saucer Creek into the Wetland through a series of ponds to rejoin the Creek just before its junction with the Cooks, Sydney Water believed there would be a significant improvement in the quality of water entering the Cooks from this Creek.

The CRVA had previously raised concerns about the very poor quality of water in Cup and Saucer Creek. Sydney Water installed monitoring pits in the Wetland inflow and outflow and invited CRVA to test water quality. Full testing commenced in January 2011.

Assuming the water tested in the inflow is similar in quality to the water flowing down the Creek above it, the inflow results show water quality in the Creek is poor. The high *E.coli* median during the 5 dry testing days suggest sewage leaks are occurring during dry weather.

Site: Cup and Saucer Creek Wetland Inflow: Jan 11 – Jun 11				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide[a]
DO [% of saturated value]	na	na	0	na
T [°C]	na	na	0	na
pH	7.0 – 9.5	7.8	6	2
EC [mS/cm]	0.7 – 1.4	1.3	6	na
TURB [NTU]	10 - 200	10	6	2
AP [mg/L]	0.03 - 6.35	0.20	6	6
E.coli [cfu/100mL] ALL -wet -dry	100 – 1,740,000 200 100 – 1,740,000	950* 200 1100**	6 1 5	5 primary; 3 secondary
Comments				
DO, T not done due to constricted access. [a]ANZECC guidelines for estuaries are relevant to the Cooks River into which this water is draining, not necessarily the water in Cup and Saucer Creek itself. *Median drops to 800 if extreme value 1,740,000 is removed. **Median drops to 950 if extreme value 1,740,000 is removed. The very high range phosphate and *E.coli* results relate to a sewage pollution incident which occurred during the test session on 11/3/11. AP results are consistently well above the guideline, with median and maximum being 13 and 415 times higher respectively than the guideline. *E.coli* results are high and thought to be due to sewage leaks and overflows.				

Site: Cup and Saucer Creek Wetland Outflow: Jan 11 – Jun 11				
Test	**Range**	**Median**	**No. Tests**	
			All tests	Tests outside ANZECC Guide[a]
DO [% of saturated value]	na	na	0	
T [°C]	na	na	0	
pH	7.0 – 9.5	7.3	6	1
EC [mS/cm]	0.9 – 1.5	1.2	6	na
TURB [NTU]	10 - 10	10	6	0
AP [mg/L]	0.05 – 0.41	0.13	6	6
E.coli [cfu/100mL]..ALL -wet -dry	<100 – 500 200 <100 - 500	150 200 100	6 1 5	3 primary; 0 secondary
Comments				

Site: Cup and Saucer Creek Wetland Outflow: Jan 11 – Jun 11
DO, T not done due to constricted access. [a]ANZECC guidelines for estuaries are relevant to the Cooks River into which this water is flowing, not necessarily the water in Cup and Saucer Creek itself. AP results are consistently above the guideline, with median and maximum being 8.5 and 27 times higher respectively than the guideline. *E.coli* results are consistently below the boating limit but above the swimming limit on 50% of tests.

There were 2 major pollution events during the period:

1. On 9/2/11 a quantity of oily sludge from the drain [at least 300L] entered the Wetland and deposited on the perimeter of Pond#2 doing significant damage to sedges
2. On 11/3/11 a major break in a Sydney Water sewer resulted in sewage flowing down the drain and into the Wetland; this was the cause of the high *E.coli* result at the inflow [1,740,000 cfu/100mL]

Cup and Saucer Creek Wetland sites – Wetland performance

The Wetland has the potential to reduce pollution in the Cooks River entering via Cup and Saucer Creek. The extent to which pollution is reduced by the Wetland over a given period depends on 2 factors:

1. The amount of water diverted from the Creek into the Wetland in the period. To illustrate with an extreme example, if no water gets into the Wetland, then the reduction in pollution is nil.
2. The net quantity of pollutants [eg kg of phosphates] removed from the inflow by the Wetland in the period.

On each test occasion, water was found to be diverting into the Wetland. A rough estimate was made by observation of the split between water flowing into the Wetland and water continuing straight down the Creek into the River. On other occasions, passersby reported water was excluded from the Wetland because of the buildup of litter on the inlet trench. On those occasions all the water in the Creek flowed directly into the River. The information from these water quality tests does not permit a quantitative assessment of the amount of water going through the Wetland.

The net quantity of a given pollutant removed from the inflow is the difference between the quantity absorbed from the water flowing in as it passes through the ponds and the quantity returned to the water from plants, etc in the ponds as the water passes through.

The quantity of pollutant going in [kg/min] =
concentration of pollutant in the inflow [kg/L] X flow rate [L/min]

The quantity of pollutant coming out [kg/min] =
concentration of pollutant in the outflow [kg/L] X flow rate [L/min]

Since it takes some time for the water flowing in to emerge in the outflow, perhaps 48 to 72 hours, the difference between pollutant concentrations in the inflow and outflow is time related.

However the water samples taken from the inflow and outflow by the CRVA are taken **on the same day**. A comparison of concentrations of pollutants in the inflow and outflow at a single test session does not measure the impact of the Wetland for the following reasons:

1. No flow rates are measured in CRVA tests; only concentrations.
2. Since inflow and outflow are sampled at the same time [within 60 minutes], there is no allowance for the time taken for the water to pass through the Wetland. For example, a short pollution event 48 hours prior to testing could result in an elevated concentration of pollutant in the outflow but normal concentration in the inflow.

However it is interesting to note that the water flowing in was generally more polluted in terms of AP and *E.coli* than the water flowing out when measured at the same time. No further conclusions are drawn from these results regarding the performance of the Wetland in removing pollutants. Care should be taken when reporting these results.

In Feb 2011 CRVA requested assistance from Sydney Water to help resolve this issue. In the meantime, CRVA has received advice from Dr Stuart Khan at UNSW's Water Research Centre "A careful understanding of the hydraulic retention time will be important to properly assess the performance of the wetland system. This can be monitored by adding various "tracer" chemicals to the influent or just by monitoring variations in flow rates in and out (if they are sufficiently variable and not highly buffered within the system)." Based on this advice, CRVA does not have the resources to monitor the performance of the Wetland in relation to impact on the water quality of outflow.

APPENDIX 3

TEST SITES 2010/11

Name	Location	Site Type	ANZECC ecosystem type	LGA	Lat/Long
Richardsons Cres, Marrickville	At the River Canoe Club near Tempe and opposite Gough Whitlam Park	River	Estuarine	M	-33.92374 151.15532
At Marrickville Golf Course near Bruce Street, Marrickville	In Riverview Cres subcatchment	River	Estuarine	M	-33.91762 151.14003
Marrickville Golf Course near Wardell Road, Marrickville	In Tennyson Street subcatchment	River	Estuarine	M	-33.91348 151.13662
Stormwater drain at Ewart Street	In Tennyson Street subcatchment	Stormwater drain	Estuarine/freshwater	M	-33.910448 151.1386
Younger Ave, Earlwood	Cooks River 70m downstream of stormwater drain in Younger Avenue subcatchment	River	Estuarine	C	-33.91622 151.12921
Younger Ave, Earlwood stormwater drain	Younger Avenue subcatchment drain at exit to Cooks River	Stormwater drain	Estuarine/freshwater	C	-33.915862 151.128504
Cup and Saucer Creek Wetland - inflow	Heynes Reserve, Canterbury	Stormwater diverted into Wetland; sampled via underground monitoring pit	Estuarine/freshwater	C	-33.91602 151.12005
Cup and Saucer Creek Wetland - outflow	Heynes Reserve, Canterbury	Wetland water returning to Cup and Saucer Creek; sampled via underground monitoring pit	Estuarine/freshwater	C	-33.91534 151.12032
Cup and Saucer Creek stormwater drain	Heynes Reserve, Canterbury	Water in the stormwater drain; sampled immediately downstream of inlet to Wetland	Estuarine/freshwater	C	-33.91658 151.11964