



**The pollutant trace sampling, source
detection and remediation program
STATUS REPORT 2002**

Mount Lofty Ranges Watershed Protection Office



Government
of South Australia



South Australia



WATER

The Pollutant Trace Sampling, Source Detection and Remediation Program

Status Report 2002

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INTRODUCTION

In the early part of 2001 the Environment Protection Authority's Watershed Protection Office (WPO), in conjunction with a number of stakeholders, developed the water quality snapshot (WQS) project. The objective of the project was to obtain comparable water quality samples from the 34 sub-catchments within the Mount Lofty Ranges watershed during significant runoff events over the winter-spring 2001 period. The samples collected were analysed for physical characteristics and for pollutants including pathogens, pesticides and nutrients, and heavy metals.

During that winter-spring period, approximately 700 samples were collected across the watershed during significant rainfall events. Collection and analysis of the samples allowed:

- datasets to be established
- the relative contribution of pollutants from sub-catchments to be identified
- the associated risks for each sub-catchment to be established.

The results of the sampling highlighted several sub-catchments that were contributing significantly high pollutant levels to the water supply. For this to be addressed, and the risk to water quality reduced, sampling was needed within high risk sub-catchments in an attempt to identify sources. The Pollutant Trace Sampling, Source Detection and Remediation Program (trace sampling program) was developed by the WPO to identify the pollutant sources and address the contributing factors, and ultimately improve water quality.

Purpose

The purpose of this document is to provide internal and external stakeholders with a summary of the sampling methods and a status report for the trace sampling program.

Program objectives

The objective of the program is to perform trace sampling in identified high risk sub-catchments to locate sources of pollutants and instigate remedial actions to reduce the risk and impact on water quality.

The focus of this work is to identify pollutant sources from sub-catchments during significant runoff events. Previous water quality monitoring has not incorporated trace sampling and thus does not adequately deal with the improvement of water quality by identifying the source of the problem and addressing it.

APPROACH

The approach for this program considered the sampling strategy in use for the WQS project. It was critical that samples in this program were taken under similar conditions to those in the WQS. This allowed the samples to be compared and ensured that trace samples taken were representative of those taken during the WQS project.

Sampling

The approach included:

- collecting independent grab samples from representative sites within the identified high risk sub-catchment sites during significant runoff events over winter–spring 2002 for specific pollutants
- using stream flow and rainfall stations to assess the catchment hydrology before and during each significant runoff event
- sampling as close as practicable to anticipated pollutant contributing areas as identified using WPO land use/management data and the identified high risk sub-catchment data from WQS 2001
- maximising the number of samples collected when the initial catchment runoff was contributing to increased stream flows (the rising limb of the event)
- WPO coordinating a sampling response which involved the use of several tools and assessment procedures, with a sampling response being required at any time (ie 24 hours a day).

Analysis

Table 1 lists the water quality parameters targeted by the program in 2002 and the suite of analytes tested for each. The laboratory analyses were performed by the Australian Water Quality Centre (AWQC), Bolivar, South Australia.

Table 1 Water quality parameters targeted

Trace type	Suite of analytes included in the trace *			
Pesticides	Aldrin	Dicamba	Fenitrothion	MCPA
	Atrazine	Dieldrin	Fipronil	Parathion
	Azinphos-methyl	4,4, DDD	Fipronil desulfinyl	Parathion methyl
	Chlordane-a	4,4, DDE	Heptachlor	Trichlopyr
	Chlordane-g	4,4, DDT	Heptachlor epoxide	Picloram
	Chlorpyrifos	2,4-D	Hexazinone	Prometryne
	Chlorsulfuron	2,4,5-T	Lindane	Silvex
	Chlorthal-dimethyl (dacthal)	Endosulfan 1	Malathion	Simazine
	Chlorthalalonil	Endosulfan 2	Methoxychlor	Sulfometuron
	Clopyralid	Endosulfan sulphate	Metsulfuron methyl	Trifluralin
	Diazinon	Endrin		Vinclozolin
Pathogens	Presumptive <i>Cryptosporidium</i>	<i>Enterococci</i>		Turbidity (NTU)
	Confirmed <i>Cryptosporidium</i>	Oxidised nitrogen		Colour (Hu)
	<i>Cryptosporidium</i> speciation	TKN		Conductivity (mS/cm)
	Presumptive <i>Giardia</i>	Total P		TDS
	Confirmed <i>Giardia</i>	FRP		Suspended solids
	<i>E. coli</i>	TOC		
Nutrients	Oxidised nitrogen	TOC		Colour (Hu)
	TKN	Fluoride		Conductivity (mS/cm)
	Total P	Potassium		TDS
	FRP	Turbidity (NTU)		Suspended solids
Heavy Metals	Total copper	Total zinc		
	Total lead	Soluble aluminium		
Turbidity	Turbidity (NTU)	Total P		Conductivity (mS/cm)
	Colour (Hu)	FRP		TDS
	Oxidised nitrogen	TOC		Suspended solids
	TKN			

* Some suites include analytes other than those targeted. This mostly includes testing for basic chemical and physical properties—such as nutrients, conductivity, TDS and suspended solids—in the trace types pathogens and turbidity. These tests are relatively cheap and can provide valuable information for the program.

FRP: filtered reactive phosphorus; TOC: total organic carbon; TDS: total dissolved solids

RESULTS AND DISCUSSION

Table 2 summarises the status of the program for those sub-catchments identified and agreed to by stakeholders as needing trace samples.

Table 2 Status of trace sampling in each sub-catchment

Sub-catchment	CWMB area	Target analyte	Status
Millers Creek	Torrens	Pesticides	Traced
Kenton Valley	Torrens	Pathogens	Traced
Footes Creek	Torrens	Pesticides	Traced
Hannaford Creek	Torrens	Nutrients	Not traced
Cox Creek	Onkaparinga	Pesticides	Traced
Cox Creek	Onkaparinga	Heavy metals	Traced
Malcolm Creek	Northern Adelaide & Barossa	Turbidity	Not traced
Portuguese Creek	Northern Adelaide & Barossa	Turbidity	Not traced
Myponga	n.a.	Pathogens	Traced
Myponga	n.a.	Nutrients	Traced

Traced: the planned trace sampling run was implemented for the target analyte

Not traced: the planned trace sampling run was not performed, primarily due to the climatic conditions (i.e. the sub-catchment did not have a significant runoff event)

Table 3 summarises additional sub-catchments trace sampled during 2002 by the WPO. These sub-catchments were traced after other sampling programs highlighted significantly high water quality results that needed to be identified as a priority.

Table 3 Additional sub-catchments trace sampled during 2002

Sub-catchment	CWMB area	Target analyte	Status
Millers Creek	Torrens	Pathogens	Traced
Lenswood Creek	Onkaparinga	Pathogens	Traced
Balhannah Creek	Onkaparinga	Pesticides	Traced
Victoria Creek	Northern Adelaide & Barossa	Pesticides	Traced

Traced: the planned trace sampling run was implemented for the target analyte

The following section lists the results for each sub-catchment trace sampled. Each table has a column (**Hazard threshold value**) which can be used to compare results obtained with a raw water threshold value agreed to by an expert technical panel. These values are a combination of many water quality guideline values which best reflect our local water quality situation. Sources include the Australian Drinking Water Guidelines (ADWG), the United States Environment Protection Agency (US EPA), the Australian New Zealand Environment and Conservation Council (ANZECC) and Environment Protection (Water Quality) Policy (Water Quality EPP).

Footes Creek—Pesticides

The trace, performed on 14 June 2002, gave low results, which suggests pesticides may not have been used at that time of the year. The trace was probably performed too early and a plan was developed to implement another trace later in the year (i.e. spring) when pesticides were more likely to be used. However, there was insufficient rainfall in spring to perform the planned second trace. Table 4 lists the pesticide results for the trace sampling performed in Footes Creek. Figure 1 shows the location of trace sampling sites in the Footes Creek sub-catchment.

Table 4 Pesticide results for Footes Creek sub-catchment

Pesticide	Result			Hazard threshold value	Units
	Site 1 (T8)	Site 2 (2A)	Site 3 (3A)		
Picloram	<0.5	2.0	<0.5	0.3	µg/L
Trichlopyr	<0.5	1.7	<0.5	0.01	µg/L

All other pesticides tested for were below the reporting limit.

Millers Creek—Pesticides

The trace was performed on 14 June 2002. Results were low and suggest pesticides may not have been used at that time of the year. The trace was probably performed too early and a plan was developed to implement another trace later in the year (i.e. spring) when pesticides were more likely to be used. There was insufficient rainfall in spring to perform the planned second trace. Table 5 lists the pesticide results for the trace sampling performed in Millers Creek. Figure 2 shows the location of trace sampling sites in the Millers Creek sub-catchment.

Table 5 Pesticide results for Millers Creek sub-catchment

Pesticide	Result			Hazard threshold value	Units
	Site 1 (T2)	Site 2 (2A)	Site 3 (3A)		
Dieldrin	<0.01	0.08	<0.01	0.0003	µg/L
Picloram	0.7	<0.5	1.2	0.3	µg/L

All other pesticides tested for were below the reporting limit.

Millers Creek—Pathogens

This site was targeted to confirm that remedial actions performed in the sub-catchment in 2001 rectified the problems identified through the WQS sampling during that year. The sample was taken at the Forreston township on 14 June 2002. The results of trace sampling for pathogens in Millers Creek are shown in Table 6. Figure 2 shows the location of trace sampling sites in the Millers Creek sub-catchment.

The results show that the remediation works did impact on the level of pathogens in the stream. However, relatively high levels of *Cryptosporidium* required further investigation, which was conducted by the watershed protection officer, Wastewater/Stormwater, on 8 July 2002.

Table 6 Pathogen results for Millers Creek sub-catchment

Analyte	Results 2001 *	Result 2002 (2B)	Hazard threshold value **	Unit
Confirmed <i>Cryptosporidium</i>	214	240	10	per 10 L
Confirmed <i>Giardia</i>	1,253	2.0	10	per 10 L
Total dissolved solids	387	600	500	mg/L
Conductivity	701	1080	n.a.	μS/cm
Suspended solids	n.a.	7	n.a.	mg/L
Turbidity	135	4.8	100	NTU
Colour	126	54.6	100	HU
Fluoride	n.a.	0.54	1.5	mg/L
FRP as P	0.1	0.030	0.1	mg/L
Total phosphorus as P	0.4	0.064	0.5	mg/L
TKN as nitrogen	2.1	0.56	5	mg/L
Nitrate + nitrite as N	0.7	0.294	0.5	mg/L
Nitrate + nitrite as NO ₃	n.a.	1.30	n.a.	mg/L

*The 2001 results are the average of 3 separate samples taken during June and July 2001.

During the investigation, ten potential sources were identified. These included grazing animals in close proximity to the stream and potential septic tank failures. The most likely source was identified as a sewage holding tank that was probably under-sized and potentially overflowing to the nearby creek.

The Adelaide Hills Council environmental health officer was advised of the issue. The officer subsequently investigated it and has advised that:

- a notice has been served on the property owner responsible for the sewage holding tank to upgrade their system
- a notice has been served on another property to upgrade their system
- a third property is installing a sullage tank.

A comprehensive report (Routley 2002a) was developed, describing in detail the method and findings of trace sampling in the Millers Creek sub-catchment. The full report can be obtained from the WPO.

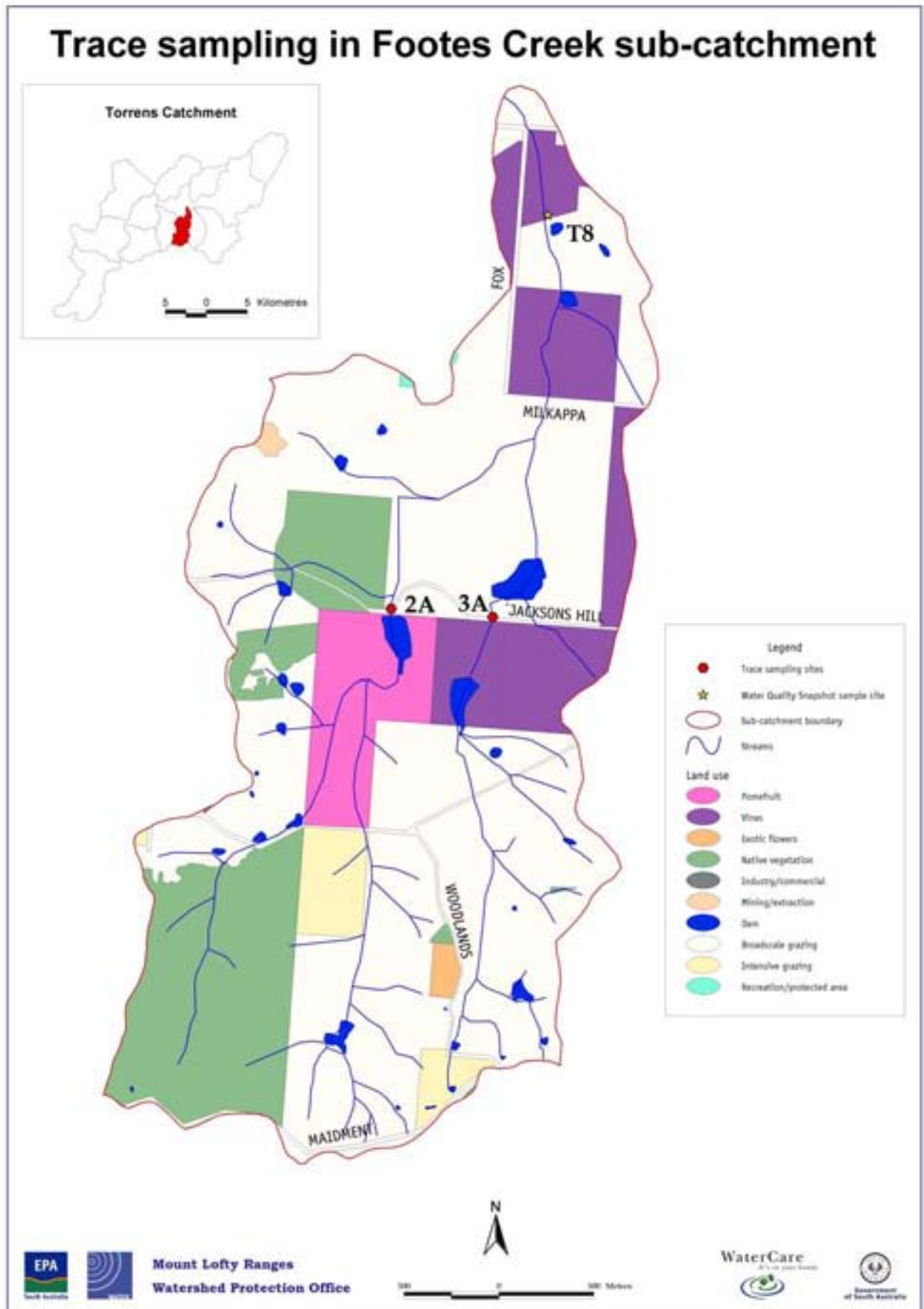


Figure 1 Trace sampling sites in Footes Creek sub-catchment

Kenton Valley—Pathogens

The trace was performed on 14 June 2002 and the results are shown in Table 7. Figure 3 shows the location of trace sampling sites in the Kenton Valley sub-catchment.

Table 7 Pathogen results for Kenton Valley sub-catchment

Analyte	Result					Hazard threshold value	Unit
	Site 1 (T9)	Site 2 (2B)	Site 3 (3B)	Site 4 (4B)	Site 5 (5B)		
Confirmed <i>Cryptosporidium</i>	130	170	84	29	25	10	per 10 L
Confirmed <i>Giardia</i>	10	10	<2.0	<2.0	<6.0	10	per 10 L
Total dissolved solids	520	260	520	300	840	500	mg/L
Conductivity	944	481	947	545	1520	n.a.	µS/cm
Suspended solids	70	710	176	66	30	n.a.	mg/L
Turbidity	400	1100	250	120	35	100	NTU
Colour	97.7	139	125	174	94.5	100	HU
Fluoride	0.41	0.20	0.33	0.37	0.31	1.5	mg/L
FRP as P	0.104	0.024	0.125	0.064	0.134	0.1	mg/L
Total phosphorus as P	0.804	1.27	0.540	0.285	0.311	0.5	mg/L
TKN as nitrogen	3.86	5.95	3.18	2.32	2.88	5	mg/L
Nitrate + nitrite as N	0.806	2.73	1.48	1.13	2.08	0.5	mg/L
Nitrate + nitrite as NO ₃	3.57	12.1	6.54	5.02	9.19	n.a.	mg/L

Two analyte levels were excessively high from this trace and justified further investigation: Site 1 (bottom of sub-catchment) results showed very high turbidity (400 NTU); and site 2, 1100 NTU. The target analyte for this trace, pathogens, yielded a result of 170 oocysts/10 L at site 2.

The information from this trace was supplied to the watershed protection officer, Policy, Planning and Compliance, on 5 July 2002 and potential sources were investigated the same day.

The turbidity issue was traced to a newly established vineyard on Coleman Road, Gumeracha. Plate 1 shows the vineyard thought to be the source of sediment entering the creek and elevating the turbidity of the water. Note the bare soil, the slope and the proximity to the drainage line. Plate 2 shows rill erosion occurring between the rows of vines. This is the likely source of sediment causing high turbidity levels found in the creek. Plate 3 clearly shows that soil from the vineyard has moved with the rainfall event to the creek. This photo was taken at the base of the slope between the vineyard and the stream.

The WPO raised the issue of vineyard establishment with the Adelaide Hills Wine Region group on 9 July 2002. The group agreed that this was a problem for the industry and that the code of practice for establishment should be revised and used by contractors when establishing vines.

On the same day the WPO sent a letter to the Northern Hills Soil Conservation Board raising the matter of inappropriate activities leading to the high turbidity found in the stream. A Board representative visited the site on Monday 15 July 2002 and, on 23 July 2002, the Board replied thus:

- The creek was flowing and the water was clear where it exited the property. The Board could therefore not comment on the matter.



Plate 1 Vineyard on Coleman Road



Plate 2 Rill erosion at the vineyard on Coleman Road



Plate 3 Sediment from the vineyard on Coleman Road

- Board members saw no evidence of erosion on the property, but did notice a collapsing of the bank on the road reserve. This is a matter of ongoing education of local government and Transport SA, and the Board is not in a position to take individual action in these cases.
- The vineyard was established according to standard practice. It was noted the headland/buffer had been cultivated with the establishment of the vineyard and vegetation (planted or volunteer) was developing on these headlands and between the rows.
- The Board could not comment on the establishment of the vineyard until degradation occurs.

The pathogen problem was traced to a house on Coleman Road. A spoon drain had been dug to drain the surface water from the property. The spoon drain was situated directly across the inlet to the property's septic tank. The inlet was broken and raw sewage was flowing down the spoon drain (see Plate 4) to a roadside drain before entering the creek.

The Adelaide Hills Council environmental health officer was advised of the issue and subsequently investigated it. The officer has advised that a new aerobic water treatment system has been installed on the property replacing the failing septic tank.

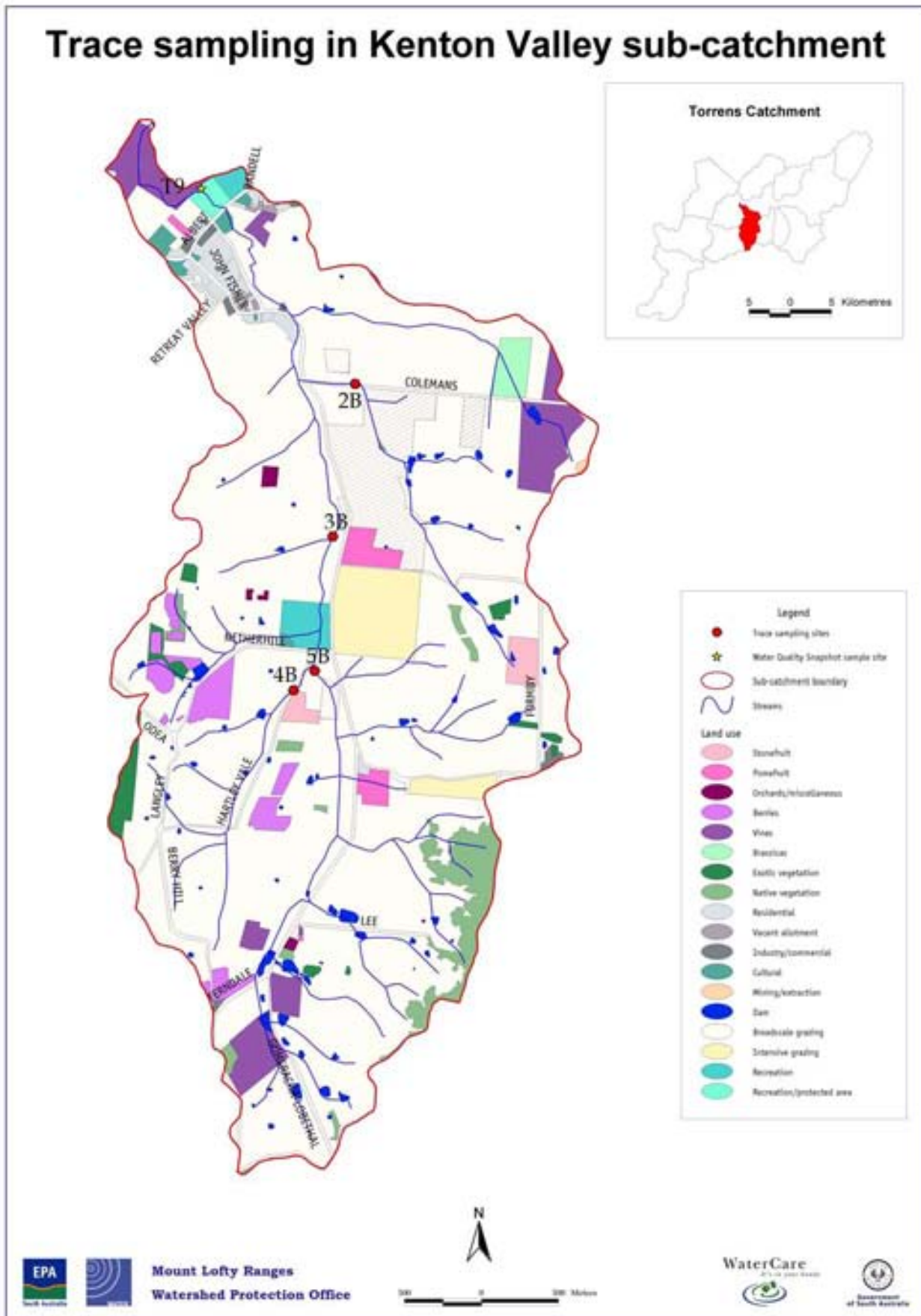


Figure 3 Trace sampling sites in Kenton Valley sub-catchment



Plate 4 Overland wastewater flow from septic tank on Coleman Road

Lenswood Creek—Pathogens

Sampling was performed on 3 July 2002 as part of the WQS project and the results are shown in Table 8. Figure 4 shows the location of the sampling site in the Lenswood Creek sub-catchment.

Table 8 Pathogen results for Lenswood Creek sub-catchment

Analyte	Site 1 (05)	Hazard threshold value	Unit
Confirmed <i>Cryptosporidium</i>	120	10	per 10 L
Confirmed <i>Giardia</i>	8.0	10	per 10 L
Total dissolved solids	360	500	mg/L
Conductivity	662	n.a.	$\mu\text{S}/\text{cm}$
Suspended solids	73	n.a.	mg/L
Turbidity	26	100	NTU
Colour	59.6	100	HU
Fluoride	0.24	1.5	mg/L
FRP as P	0.041	0.1	mg/L
Total phosphorus as P	0.234	0.5	mg/L
TKN as nitrogen	1.38	5	mg/L
Nitrate + nitrite as N	0.404	0.5	mg/L
Nitrate + nitrite as NO_3	1.79	n.a.	mg/L

Pathogen results were high (type 1 incident 120 crypto oocysts/10 L), with associated *Giardia* (8/10 L), indicating a possible human source. On 16 and 20 August, the watershed protection officer, Wastewater/Stormwater, investigated possible sources.

During the investigation 18 properties were visited. Of these, five were reported as having significant failures that would be likely to contribute wastewater to Lenswood Creek. A further four required further investigation and some possible improvement. Plates 5 and 6 show examples of inadequate systems that display significant failures at two sites. Both are significantly undersized, do not have soakage fields and overflow directly to the surface; such wastewater can easily enter the nearby Lenswood Creek. Plate 7 shows wastewater on the ground surface from the overflow of a failing septic tank in Lenswood Creek.

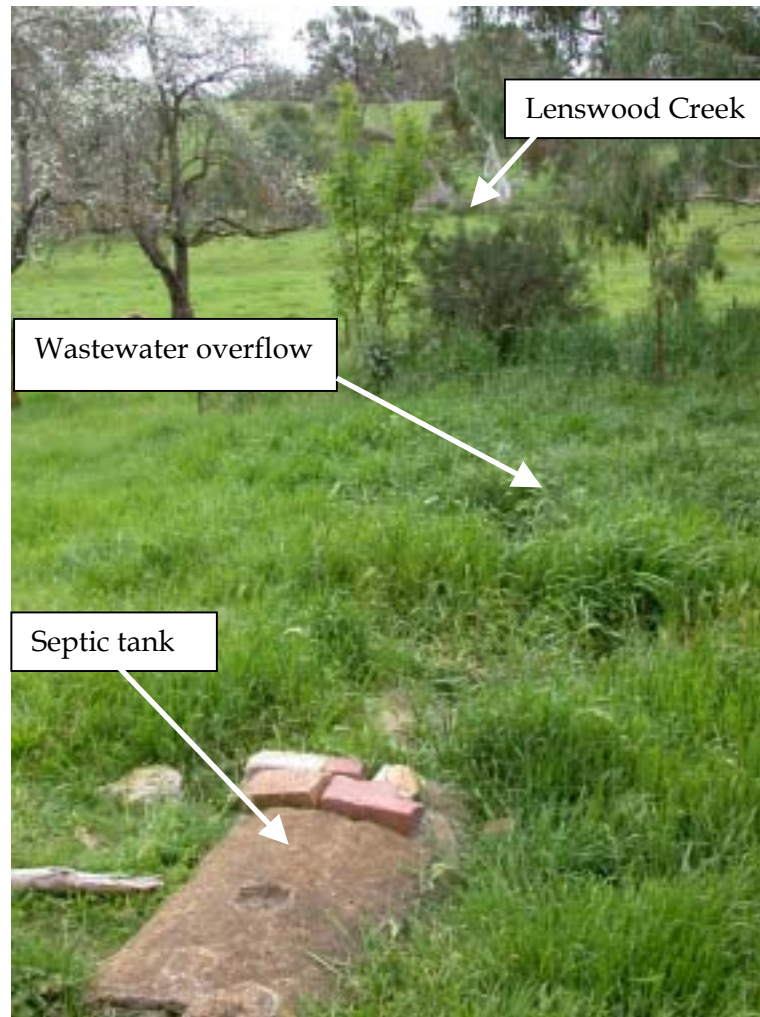


Plate 5 Failing septic tank in the Lenswood Creek sub-catchment

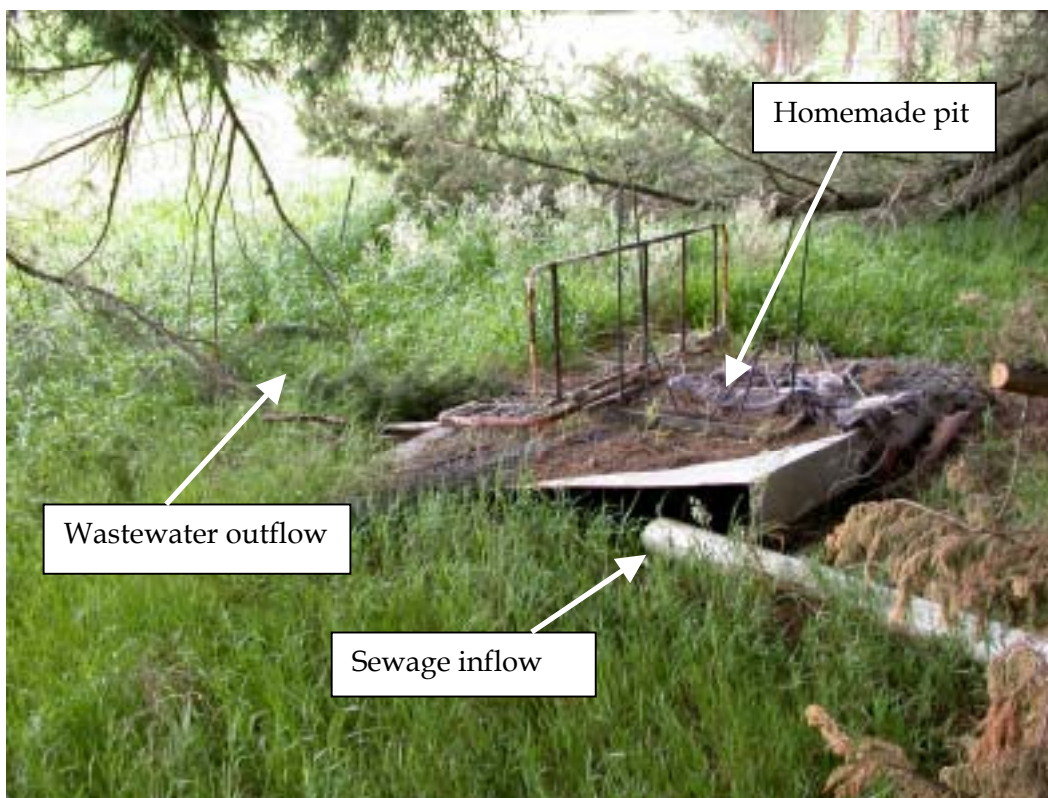


Plate 6 Failing septic tank in the Lenswood Creek sub-catchment



Plate 7 Effluent leaving a septic tank in the Lenswood Creek sub-catchment

The Adelaide Hills Council environmental health officer was advised of the issue and subsequently investigated it. The officer has advised that of the five significant failures:

- one property owner is now upgrading their system
- two property owners did not respond to council letters and Adelaide Hills Council has now served a notice to the landowners to upgrade their systems
- an application to put in a new system was given to another of the properties
- the fifth property owner believes their system is functioning effectively and Adelaide Hills Council will inspect the system again and discuss the landowner's concerns.

A comprehensive report (Routley 2002b) describes in detail the method and findings of the investigation performed in the Lenswood Creek sub-catchments. The full report can be obtained from the WPO.

Cox Creek—Pesticides

Sampling was undertaken on 3 July 2002. Results were low and suggest pesticides may not have been used at that time of the year. The trace was probably performed too early and a plan was developed to implement another trace later in the year (i.e. spring) when pesticides are more likely to be used. There was insufficient rainfall in spring to perform the planned second trace.

Table 9 lists the pesticide results for the trace performed in Cox Creek sub-catchment. Figure 5 shows the trace sampling sites within Cox Creek sub-catchment.

Table 9 Pesticide results for Cox Creek sub-catchment

Pesticide	Result				Hazard threshold value	Units
	Site 1 (09)	Site 2 (2A)	Site 3 (3A)	Site 4 (4A)		
Dieldrin	0.02	<0.01	<0.01	<0.01	0.0003	µg/L
MCPA	<0.5	<0.5	1.3	<0.5	0.1	µg/L

All other pesticides tested for were below the reporting limit.

Cox Creek—Heavy metals

Sampling was undertaken on 3 July 2002. Results showed that analytes at most sites were below guideline values for health and aesthetics. Figure 5 shows the trace sampling sites within Cox Creek sub-catchment and Table 10 lists the heavy metal results for the trace.

Table 10 Heavy metal results for Cox Creek sub-catchment

Analyte	Result					Hazard threshold value	Unit
	Site 1 (09)	Site 2 (2C)	Site 3 (3C)	Site 4 (4C)	Site 5 (5C)		
Aluminium—soluble	0.064	0.096	0.083	0.026	0.102	0.2	mg/L
Copper—total	0.018	0.023	0.016	0.002	0.013	2	mg/L
Lead—total	0.0265	0.0394	0.0258	0.0012	0.0155	0.01	mg/L
Zinc—total	0.085	0.110	0.070	0.008	0.051	3	mg/L

The values obtained from the trace sampling were compared to results from two studies into heavy metals and runoff performed elsewhere – one by Transport SA into heavy metal runoff from roads, the other an honours project by a Flinders University student into heavy metals in runoff at Woodside. The comparison is shown below in Table 11.

Table 11 Comparison of heavy metal results for Cox Creek.

Source of results	Copper		Lead		Zinc		Aluminium	
	Max	Min	Max	Min	Max	Min	Max	Min
Trace sampling	0.018	0.002	0.0394	0.0012	0.11	0.051	0.102	0.026
Transport SA	0.58	0.104	1.08	0.18	4.5	0.77	n.a.	n.a.
Flinders Uni	0.054	0.017	0.247	0.163	0.233	0.049	n.a.	n.a.

The results obtained for Cox Creek are below guideline values in most instances and below those found during other studies. These results do not warrant any further investigation and generally indicate that heavy metals are diffuse in nature.

Myponga—Pathogens and nutrients

Sampling was performed on 28 July 2002. Figure 6 shows the trace sampling sites in the Myponga-Pages Flat sub-catchment. The results are shown in Table 12.

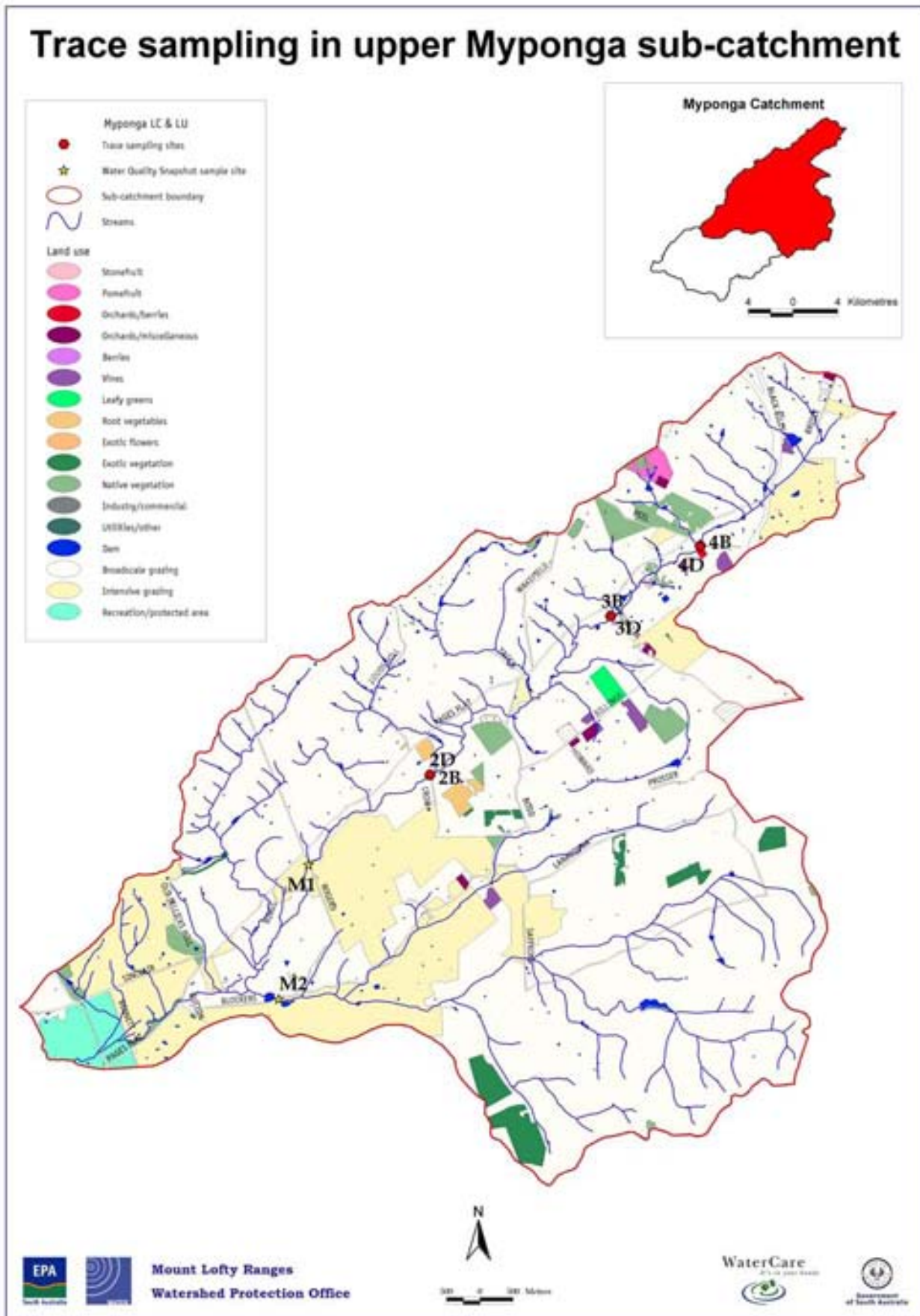


Figure 6 Trace sampling in upper Myponga sub-catchment

Table 12 Pathogen and nutrient results for the Myponga–Pages Flat sub-catchment

Analyte	Result				Hazard threshold value	Units
	Site 1 (M1)	Site 2 (2B)	Site 3 (3B)	Site 4 (4B)		
Confirmed <i>Cryptosporidium</i>	110	4.0	58	350	10	per 10 L
Confirmed <i>Giardia</i>	5.0	<1.0	<1.0	3.0	10	per 10 L
Total dissolved solids	350	410	890	830	500	mg/L
Conductivity	646	753	1610	1500	n.a.	µS/cm
Turbidity	93	19	49	180	100	NTU
Colour	132	122	84.4	119	100	HU
Fluoride	0.18	0.08	0.11	0.14	1.5	mg/L
Filtered reactive phosphorus as P	0.221	0.029	0.029	0.273	0.1	mg/L
Phosphorus – total as P	0.495	0.106	0.134	0.850	0.5	mg/L
TKN as nitrogen	2.60	1.38	1.32	3.54	5	mg/L
Nitrate + nitrite as N	0.317	0.046	0.129	0.201	0.5	mg/L
Nitrate + nitrite as NO ₃	1.40	0.20	0.57	0.89	n.a.	mg/L

The pathogen results from the trace sampling were high (Table 13).

Table 13 Pathogen results for Myponga

Site	<i>Cryptosporidium</i> (confirmed)	<i>Giardia</i> (confirmed)
Site 1 (M1)	110 oocysts/10 L	5/10 L
Site 2 (2B)	4 oocysts/10 L	None detected
Site 3 (3B)	58 oocysts/10 L	None detected
Site 4 (4B)	350 oocysts/10 L	3/10 L

The results indicate that the source would most likely be animal as the amount of *Giardia* in relation to *Cryptosporidium* was low. There are a number of dairy enterprises in the Myponga area and from the land status data it appeared that the high results were downstream of dairies in all cases. The nutrient results mirrored the pathogen results.

The WPO performs dairy audits to ensure dairy enterprises in the Mount Lofty Ranges comply with the Environment Protection (Milking Shed Effluent Management) Policy 1997. The watershed protection officer, Industry Systems, was approached on 6 August 2002 to establish if the dairies near the sampling sites complied. Two of four dairies had been audited.

On 7 August 2002 the officer visited three of the four dairies. All three systems were compliant with the policy and upon inspection two of the three were found not likely to be the source of pathogens and nutrients to the Myponga River. The other dairy, however, had issues with calf management and could be a source of pathogens and nutrients. This is being followed up.

On 30 October 2002 the officer visited the remaining dairy, which was compliant with the policy and was found to be unlikely as the source of pathogens and nutrients to the Myponga River.

The WPO, in conjunction with the CWMBs, SA Water and the CRC for Water Quality and Treatment, is undertaking a project to investigate pathogens in a number of sub-catchments in the Mount Lofty Ranges, one of which is Myponga. A component of the project is sampling for faecal sterols. This was done at the same sites as the pathogen and nutrient trace sampling. The results of the faecal sterol sampling indicated that the source of contamination is 100% herbivore in origin.

Subsequent visits to the area have identified a number of properties of concern upstream of the sampling sites. On these properties grazing cattle have direct access to the river and in some instances are present in significant numbers. At the time of sampling it is also likely that these cattle had young calves at foot. This is now the focus of investigation and follow up work will be initiated. Landholders in the areas of concern will be encouraged through the Myponga River Restoration Program to fence off and rehabilitate the riparian areas. This is a project being managed by the WPO.

Balhannah and Victoria creeks—Pesticides

On 5 September 2002, trace sampling was undertaken in the Balhannah Creek sub-catchment. Figure 7 shows the trace sampling sites and Table 14 shows the surface water results of trace sampling. Plate 8 shows a sample being taken from an in-stream dam on Balhannah Creek.

Table 14 Surface water sampling results for Balhannah Creek

Surface water sampling results for Simazine—Balhannah sub-catchment					
Chemical	Unit	Concentration			
		B-SW-01	B-SW-02	B-SW-03	B-SW-04
<i>Pesticides</i>					
Simazine	mg/L	<0.0005	< 0.0005	0.0015	0.0010
<i>General chemistry</i>					
pH	pH units	7.7	7.7	8.1	8.4
Total dissolved solids (by EC)	mg/L	840	770	370	740
Total organic carbon	mg/L	10.6	6.3	13.3	16.6
Conductivity	mg/L	1520	1390	666	1350



Plate 8 Taking water samples in Balhannah Creek

Surface soil sampling results for Balhannah Creek are shown in Table 15. Plate 9 is a typical Adelaide Hills vineyard. This photo shows that the base of the vines have been treated with a pesticide to limit the growth of unwanted vegetation. Soil samples were taken at this site.

Table 15 Surface soil sampling results for Balhannah Creek

Simazine and TOC results in surface soil and leachate				
Sampling locations	Concentration results			
	TOC %	Simazine–soil mg/kg	Simazine–leachate mg/L	Human health value mg/L
B-S01		0.25		
B-S02	0.3	9.4	0.33	>0.02
B-S03	1.1	0.5	0.001 U	<0.02
B-S04		0.01 U		
B-S06		0.02		
B-S07		0.01 U		
B-S08		0.01 U		

U: not detected above the practical quantification limit



Plate 9 Vineyard in the Balhannah Creek sub-catchment

On 5 September 2002, trace sampling was performed in the Victoria Creek sub-catchment at the sites shown in Figure 8. Soil sampling results are shown in Table 16. Plate 10 depicts a section of roadside drain in the Victoria Creek sub-catchment at Williamstown that had been sprayed with Simazine. Note the contrast between vegetation in the paddock and on the roadside.

Table 16 Surface soil sampling results for Victoria Creek sub-catchment

Simazine and TOC results in surface soil and leachate				
Sampling locations	Concentration results			
	TOC %	Simazine–soil mg/kg	Simazine–leachate mg/L	Human health value mg/L
VC-S01a		0.98		
VC-S01b	3.3	1.7	0.02	>0.02
VC-S02a	0.09	0.04	0.001 U	<0.02
VC-S02b		0.33		
VC-S03		0.5 U		
VC-S03a		2.4		
VC-S04	2.2	4	0.08	> 0.02

U : not detected above the practical quantitation limit



Plate 10 Roadside drain at Williamstown (Victoria Creek sub-catchment)

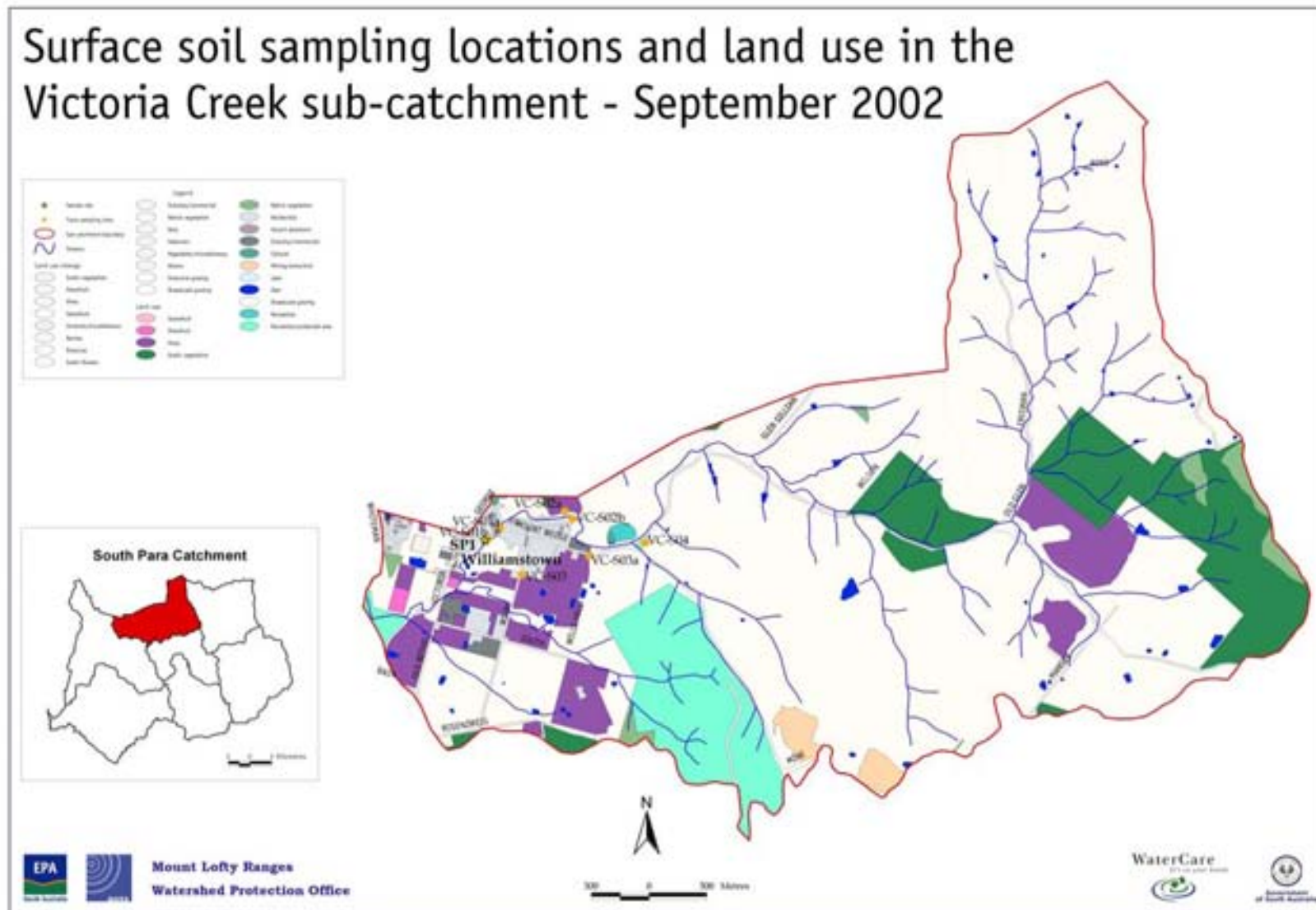


Figure 8 Trace sampling in Victoria Creek sub-catchment

Based on surface water, soil and leachate results, and findings from interviews with landholders, industry peak body members, councils and spray contractors, there is some evidence that general land management practices are the primary cause for elevated Simazine detections in Balhannah Creek (3 August 2002) and Victoria Creek (5 July 2002). No evidence of reckless behaviours (such as emptying Simazine container contents into the creeks) was observed but it cannot be excluded as a potential cause for the detected concentrations.

The most likely potential sources for elevated Simazine concentrations in the creeks were identified as:

- surface water runoff/shallow soil erosion after council contractor spray activities, near and on storm drains and along steep slopes near the creeks before rainfall events.
- surface and shallow subsurface water runoff via high permeability soils near collection storm drains after railroad corridor spraying activities.

To gain further knowledge of herbicide handling procedures by several industries and to prevent future Simazine reporting incidents, there will be follow-up with:

- councils and council spray contractors to ensure Simazine is deleted from their list of chemicals to be used near watercourses
- railroad company on pesticide management, handling and application practices on railway corridors.

A comprehensive report (Frizenschaf 2002) describes in detail the method and findings of trace sampling in the Balhannah and Victoria Creek sub-catchments. The full report can be obtained from the WPO.

CONCLUSION

It has been clearly demonstrated that pollutant sources can be located using the technique developed in this program. It is expected that pollutant loads leaving the target sub-catchments will be reduced due to the work performed this year as part of the trace sampling program. This should be fully confirmed next year by taking water samples in those sub-catchments where pollutants were identified, sourced and rectified.

Based on this year's success, it is recommended that the program continue in the coming year. The design of the program and use of the land status data allowed the program to be effectively and efficiently planned so that a minimal number of sample sites were required to successfully source pollutants. This reduced the overall cost of the program by reducing logistics and sampling costs.

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