Sampling and Analysis Plan

Zinc, Nitrogen and Phosphorus measurements in the water and sediments of the Lake Richmond drains and Mangles Bay, and in the Waters of Lake Richmond.

November 2003

Cockburn Sound Management Council
Department of Environment

Background

The *Lake Richmond Drain Outlet Water Quality 2002* monitoring program identified elevated levels of zinc (42 µg/l and 62 µg/l) above aquatic ecosystem (95 percentile) trigger values. The results also identified contributions of nitrogen and phosphorus into Mangles Bay, Cockburn Sound.

Purpose of the Sampling

The Cockburn Sound Management Council (CSMC) in conjunction with the Department of Environment's Aquatic Sciences Branch and the Naregebup Rockingham Regional Environment Centre (RREC) are undertaking further investigations to assess:

1) If zinc contamination is an issue of concern, and
2) The amount of nitrogen and phosphorus present in the sediment.

In preparation for further sampling, a Sampling and Analysis Plan (SAP) has been developed to provide details of the required sampling and analysis procedures.

Purpose

This SAP describes the procedures for sampling and analysis of representative samples for:

Water Samples

- Soluble zinc (Zn), to give an indication of the amount of zinc that is bioavailable.
- Water hardness, in the form of soluble calcium (Ca) and magnesium (Mg), to enable the aquatic ecosystem trigger value to be corrected for local conditions.

Sediment Samples

- Zinc, to asses the amount of zinc present in the sediment.
- Total Nitrogen (TN), to assess the amount of nitrogen present in the sediment
- Total Phosphorus (TP), to assess the amount of phosphorus present in the sediment.
- Total Organic Carbon (TOC), to allow proper interpretation of zinc results.
- Moisture, to allow proper interpretation of zinc results.

Scope

This SAP covers documentation, description of sampling locations, equipment and methods, personal safety, quality assurance, laboratory instructions, analysis methods and reporting requirements for determining various water and sediment quality parameters for water in the Lake Richmond Drains, waters of Lake Richmond and Mangles Bay and sediments in the Lake Richmond drains and Mangles Bay.

Personal Safety

All safety matters concerning the collection of sediment and water samples will be identified and addressed prior to the commencement of the days activities.

Site registration

All sample sites will be registered with the Resource Information Branch following confirmation of site coordinates.

Documentation

Samples taken are to be accompanied by field observation forms (FOF), field notes and chain of custody forms (COC).

Sampling frequency

The sampling will be a one off event undertaken on Friday 14th November 2003.

Sampling Sites

Water and sediment samples will be taken from the Lake Richmond outlet drain (both at the original site and from a site upstream and downstream of the original site), the two main inlet drains, the waters of Lake Richmond (water samples only) and from Mangles Bay (see Table 1 below, see also Attachment 1, Sampling Site Map).

Table 1. Sample Site Locations.

Site identification	Location	Easting	Northing
MBD 1 (Original Site AWRC 6141692)	Mangles Bay Drain, exit drain from Lake Richmond, on RREC side of road culvert	378517	6427522
MBD 2	Mangles Bay Drain, exit drain from Lake Richmond on the Lake Side of the road culvert.	-32.2825	115.7110
MBD 3	Mangles Bay Drain, exit drain from Lake Richmond on the RREC Side of the road culvert, approximately 1km downstream from MBD 1.	-32.2758	115.7033
RND	Rockingham North Drain, north east corner of Lake Richmond, accessed via Fisher Street.	-32.2845	115.7203
RCD	Rockingham Central Drain. South east corner of Lake Richmond, accessed via Richmond Avenue.	-32.2903	115.7178
LR 1	Lake Richmond, east side of the Lake, 100m offshore.	-32.2865	115.7025
LR 2	Lake Richmond, centre of the lake.	-32.2852	115.7155
LR 3	Lake Richmond, west side of the lake 100m offshore.	-32.2842	115.7130
MB	Mangles Bay, next to the Mangles Bay Fishing Club jetty, off Peron Road.	-32.2745	115.7025

Sampling Methods

Drain and Lake Water (Soluble Zn, Ca & Mg)

Sample volume	125 mL
Sample bottle preparation	New high density polyethylene (HDPE) plastic bottle.
Collection technique	Decant from sample collection device.
Filling technique	Fill to just below shoulder of bottle.
Maximum sample holding time and storage conditions	Store in an esky with ice. Analyse within 24 hours if refrigerated (1-4°C) or 30 days if kept frozen (below -20°C).
Unit of measurement	µg/L.

Drain Sediments (Zn, TN, TP & Moisture)

Sample volume	250ml composited sample
Sample bottle preparation	Glass jar, solvent washed
Collection technique	Sediment corer
Filling technique	Composite of 3 separate samples.
Maximum sample holding time and storage conditions	Store in an esky with ice.
Unit of measurement	mg/kg dry weight (moisture= %)

Drain Sediments (TOC)

Sample volume	250ml composited sample
Sample bottle preparation	Glass jar, solvent washed
Collection technique	Sediment corer
Filling technique	Composite of 3 separate samples.
Maximum sample holding time and storage conditions	Store in an esky with ice.
Unit of measurement	mg/kg dry weight

Labelling

The sample containers should be labelled with sequential sample registration number, the date of collection, the type of preservation (if any) and the client identification.

Sample bottle will be labelled prior to sampling. This ensures that the correct number of bottles are filled at each site whilst in the field, and that on return to the laboratory the correct number of sample bottles are filled and sent of for analysis. This will also ensure that the labelling is correct for each bottle.

Example of bottle label:

Sample site identification number	Site LRD 01
Sample number	Provided by WRC
Date	14.11.03
Agency	CSMC

Sampling equipment

Water samples will be taken with a 500ml plastic bottle attached to an extendable sampling pole and the mouth of the bottle placed below the level of the water in the drain. Rinse the sample apparatus three times with sample water at the sample site before taking a sample. Make sure the rinsate is poured out down stream of the sample site (see sampling protocol) .

Sediment samples will be taken with a 50 mm diameter polycarbonate sediment corer of variable length (30 –45 cm in length) (see sampling protocol).

Sampling protocol

Once arriving at the site, samples are collected as follows

Water samples

1. A 500 ml polyethylene bottle is attached to an extendable pole. The bottle is placed in to the water such that the mouth of the bottle faces upstream. The bottle is moved into the oncoming flow such that no water from behind the bottle washes back into the bottle.
2. The 500 ml bottle is rinsed 3 times with sample water and poured downstream.
3. The 500 mL bottle is filled up and the sample water so collected is used to rinse the 125ml HDPE bottle three times after which it is filled with the sample water.
4. The 125ml bottle is placed into an esky with ice.

Sediment samples

1. Three sediment sub-cores are composited from each drain site.
2. Each sub-core is collected using a 50 mm diameter polycarbonate sediment corer of variable length (30 – 45 cm in length). A clean corer tube is used at

each site or alternatively, the corer is washed at the site to remove all evidence of pervious sediment before use at the new site.

3. The tube is pressed into the drain sediment up to a depth between 15 – 25 cm, depending on the degree of consolidation of the sediment. Sediment cores will tend to be longer for less consolidated sediments as the corer is pressed down to reach more consolidated layers.
4. By placing a hand over the top of the corer, a slight vacuum is created when the corer is lift allowing a sediment core to be taken.
5. A red rubber bung is inserted into the bottom of the corer preventing the core from slipping out of the tube when the hand is removed and the vacuum is released.
6. As much water as possible is then removed without disturbing the surface of the sediment core.
7. The top 5cm of the core is then transferred into a new polyethylene bowl and mixed with a new wooden spoon until the sample is homogeneous.
8. A clean 250ml glass jar is filled to the top with the composited sample. The sample is kept cool in an esky with ice blocks.

Quality controls

Field blank, water only (done in the field)

The purpose of the field blank is to integrate all source of contamination associated with taking the sample bottle into the field, returning the full bottles to the lab, dividing the sample into their respective bottles for analysis, and sending the sample to the laboratory for analysis.

1. Rinse a 500ml sampling bottle three times with AGAL DI water before filling it with AGAL DI water, in the field.
2. Rinse a 125mL HDPE bottle three times with the DI water from the 500ml sampling bottle and then pour 125mL of the DI water from the 500ml bottle into 125mL HDPE bottle.

Duplicate, water and sediment (done in the field)

The purpose of taking a duplicate is to provide confidence in the reliability of the measured value provided by the laboratory from single samples. If duplicate values are different by more than 10%, then the data should not be relied upon and the lab requested to re-analyse the sample.

1. Duplicate samples will be taken from one site, picked at random, prior to commencing the sampling.
2. Duplicates will be collected in the same manner as outlined in the methods section for taking both water and sediment samples.

Sampling Regime	Parameter	Sampling Occasions	Sites	Samples/ site	Dupli cate	Field Blank	No. of samples	Sample Volume	Bottle Type	Total Number Bottles
Water	Soluble Zn, Ca & Mg	1	9	1	1	1	11	125	New HDPE	11
Sediment	Soluble Zn, TN & TP, Moisture	1	6	Composite	1		7	250	Glass Jar	7
Sediment	TOC	1	6	Composite	1		7	250	Glass Jar	7

Table 2: Sample Bottle Requirements.

Analysis methods and limit of reporting

The tables below detail the analysis method codes and limits of reporting for Australian Government Analytical Laboratories (AGAL):

Table 3: Water Samples

Method description	AGAL Lab Method code	Limit of Reporting (LOR)* mg/L
Trace metals in water by ICP-MS or ICP-AES or flame AAS or graphite furnace	WL 272	ZN <0.005
Ca	WL 125	<1
Mg	WL 125	<1
Hardness as CaCO3	WL 125	<5

* Lowest LORs, calculated as 10 x standard deviation of the reagent blank (or sample solution) read 7 times on a well tuned instrument.

Table 4: Sediment samples

Method description	AGAL Lab Method code	Limit of Reporting (LOR)* mg/kg dry weight
Trace metals in sediments by ICP-MS	VL 250	Zn 0.2
TP	WL 195	<5
TN	WL132 WL119	<50
% Moisture	WL 170	N/A
TOC	NW_S15	N/A

* Lowest LORs, calculated as 10 x standard deviation of the reagent blank (or sample solution) read 7 times on a well tuned instrument.

Laboratory Report

The laboratory report must report the following in both electronic and final laboratory reports:

- Date and time of sample analysis
- Method code and description
- All laboratory Quality Control results including analyte recovery, accepted recovery range, lab blanks, lab duplicates, lab blank spike recovery, matrix spike recovery.

Sending samples to the laboratory

- Storage

Store the samples in an Esky chilled to 4 °C with cold packs and send the Esky with the samples to the Laboratory.

Cooling the inside of the Esky while not necessary for metals analysis is necessary for the other analyses.

- Documentation

A completed COC and a copy must be included in the Esky.

Once the samples are received, the laboratory will place their sampling code on the COC and FAX this to the Resource Information branch.

- Turnaround time

The turnaround time is 21-30 days.

Comparison of Results with Guidelines

The results for Lake Richmond and the drains will be compared to the guidelines set out in the Aquatic Ecosystem (95 percentile) trigger values. It was decided to compare results to the 95% value (slightly to moderately disturbed ecosystems) as the water from Lake Richmond and its drains flow into Mangles Bay, which is classified as a high protection area for ecosystem health.

The Mangles Bay marine results will be compared to the guidelines for ecosystem health in an area of high protection, as stated in the draft Revised Environmental Quality Criteria Reference Document (Cockburn Sound).

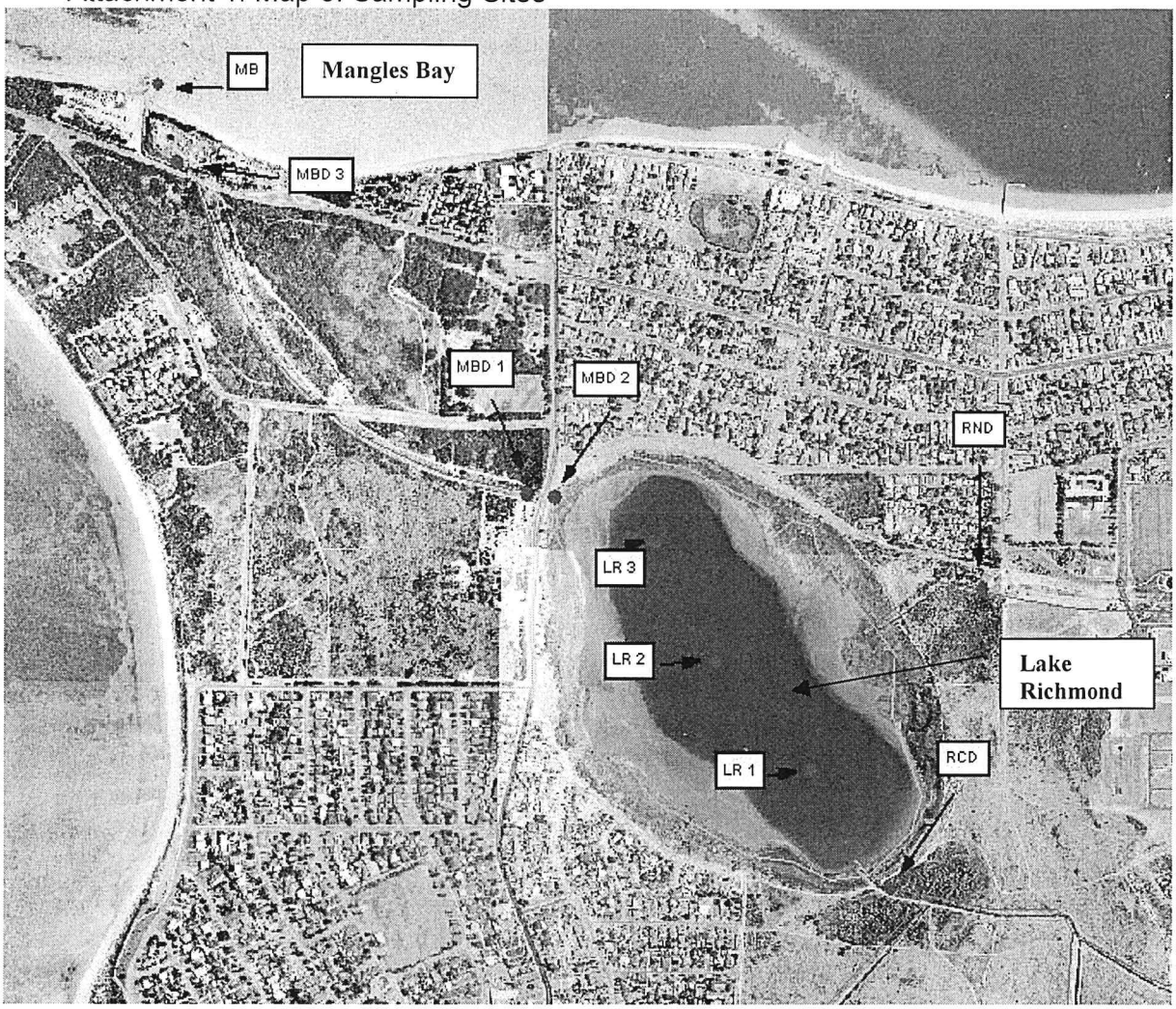
Roles and Responsibilities

The Cockburn Sound Management Council has overall responsibility for this project. They are responsible for planning and carrying out the sampling program and preparing a final report of the results.

The Aquatic Science branch will provide assistance and support for planning and carrying out the sampling. They will also provide assistance with preparing the final report.

The Environment Centre will provide assistance and support for carrying out the sampling.

Attachment 1: Map of Sampling Sites



Lake Richmond Monitoring Sites
Compensating Basin
Local Authority Drain
Open Drain
Piped Drain
Swan Coastal Plain South 1m Orthomosaic - DOLA 01/02