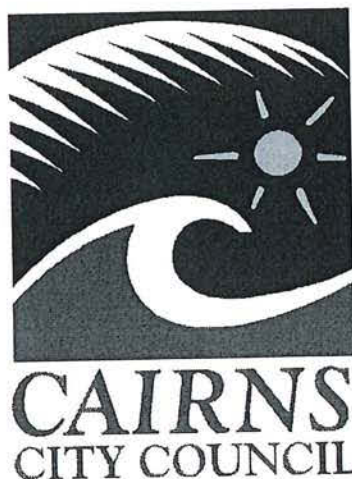




Annual Monitoring Report

For

Environmental Authority

5010000159

Reporting period:

25 June 1999 to 24 June 2000

Water and Wastewater Services Department

Date	Aluminium (mg/kg)	Cadmium (mg/kg)	Copper mg/kg	Zinc (mg/kg)
13/06/2000	2900	3	210	490

All sludge samples analysed for total organochlorine pesticides showed levels below detection limits.

2.2 Northern Water Pollution Control Plant

2.2.1 Quantity characteristics

Quantity characteristic	Maximum Release Limit (m ³ /day)	Maximum Actual Discharge (m ³ /day)	Date
Dry Weather Flow	26,000	30,630	5 March 2000
Wet Weather Flow	39,000	42,750	27 February 2000

2.2.2 Quality characteristics

Quality Characteristic	Release Limit	Actual Discharge	Limit Type
BOD ₅ (mg/L)	20	16.4	80 th percentile (long term) ¹
	25	20.6	80 th percentile (short term) ²
	60	26	Maximum
Suspended Solids (mg/L)	30	21.1	80 th percentile (long term)
	60	30.8	80 th percentile (short term)
	90	42	Maximum
pH (pH units)	6.5 – 8.5	6.8 – 7.8	Range
Dissolved Oxygen (mg/L)	2	2.3	Minimum
Free residual Chlorine (mg/L)	Tbs	0.92	Maximum
Ammonia (N) (mg/L)	Tbs	19	Maximum
Total Nitrogen (mg/L) ⁶	Tbs	19.5	50 th percentile ³
		26	maximum
Total Phosphorus (P) (mg/L)	Tbs	6.3	50 th percentile
		7.6	maximum
Oil and Grease	10	8.2	80 th percentile ⁴
Faecal Coliforms (CFU/100ml)	Tbs	17000	Median ⁵
		328000	80 th percentile ⁴

Notes:

¹ The 80th percentile (long term) is calculated on the basis of a log normal distribution, using 12 months consecutive results for the characteristic in question.

² The 80th percentile (short term) is calculated based on a normal distribution, using consecutive results from the regular weekly monitoring program. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

³ 50th percentile means that the measured values of the quality characteristic must not be greater than the stated release limit for any more than three out of six consecutive samples. For the monitoring report, the 50th percentile is calculated based on a normal distribution. The value reported is the maximum value for the 50th percentile for any 6 consecutive results for the year.

⁴ The 80th percentile means that the quality characteristic measured must not be greater than the stated release limit for any more than one out of five consecutive samples. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

⁵ Median must be based on results of at least five samples with individual samples. For the monitoring report the median is calculated on the basis of 12 months consecutive results.

⁶ Schedule 2.C – table 1 – refers to Total Oxidised Nitrogen, However Schedule 2.H table 1 refers to Total Nitrogen as the contaminant to be measured fortnightly. In this report only Total Nitrogen is reported.

2.2.3 Sludge Monitoring Results

Date	Aluminium (mg/kg)	Cadmium (mg/kg)	Copper mg/kg	Zinc (mg/kg)
12/07/1999	2900	6	770	2000
09/08/1999	5100	5	780	2000
06/09/1999	7500	4	700	2000
04/10/1999	8500	4	580	1000
01/11/1999	2500	6	470	550
29/11/1999	1900	17	500	470
29/12/1999	2200	6	700	530
24/01/2000	4200	11	770	770
21/02/2000	4600	7	670	1000
20/03/2000	5200	< 8	710	1000
10/04/2000	9100	8	890	2000
15/05/2000	4600	7	580	880
13/06/2000	1900	5	450	650

All sludge samples analysed for total organochlorine pesticides showed levels below detection limits.

2.3 Southern Water Pollution Control Plant

2.3.1 Quantity characteristics

Quantity characteristic	Maximum Release Limit (m ³ /day)	Maximum Actual Discharge (m ³ /day)	Date
Dry Weather Flow	32,000	23,918	
Wet Weather Flow	48,000	50,873	27 February 2000
Total effluent supplied for re-use		7.830	Period 1/7/1999 to 1/7/2000

2.3.2 Quality characteristics

Quality Characteristic	Release Limit	Actual Discharge	Limit Type
BOD ₅ (mg/L)	20 25 60	10.8 17.6 20	80 th percentile (long term) ¹ 80 th percentile (short term) ² Maximum
Suspended Solids (mg/L)	30 60 90	10.7 17.8 21	80 th percentile (long term) 80 th percentile (short term) Maximum
pH (pH units)	6.5 – 8.5	7.1 – 7.8	Range
Dissolved Oxygen (mg/L)	2	1.6*	Minimum
Ammonia (N) (mg/L)	Tbs	16	Maximum
Total Nitrogen (mg/L) ⁶	Tbs	19 24	50 th percentile ³ maximum
Total Phosphorus (P) (mg/L)	Tbs	6.7 7.7	50 th percentile maximum
Oil and Grease	10	15	80 th percentile ⁴
Faecal Coliforms (CFU/100ml)	Tbs	350000 800000	Median ⁵ 80 th percentile ⁴
Chlorophyll-a (µg/L)	None	12	Maximum

Notes:

¹ The 80th percentile (long term) is calculated on the basis of a log normal distribution, using 12 months consecutive results for the characteristic in question.

A-2 Northern Sewage Treatment Plant

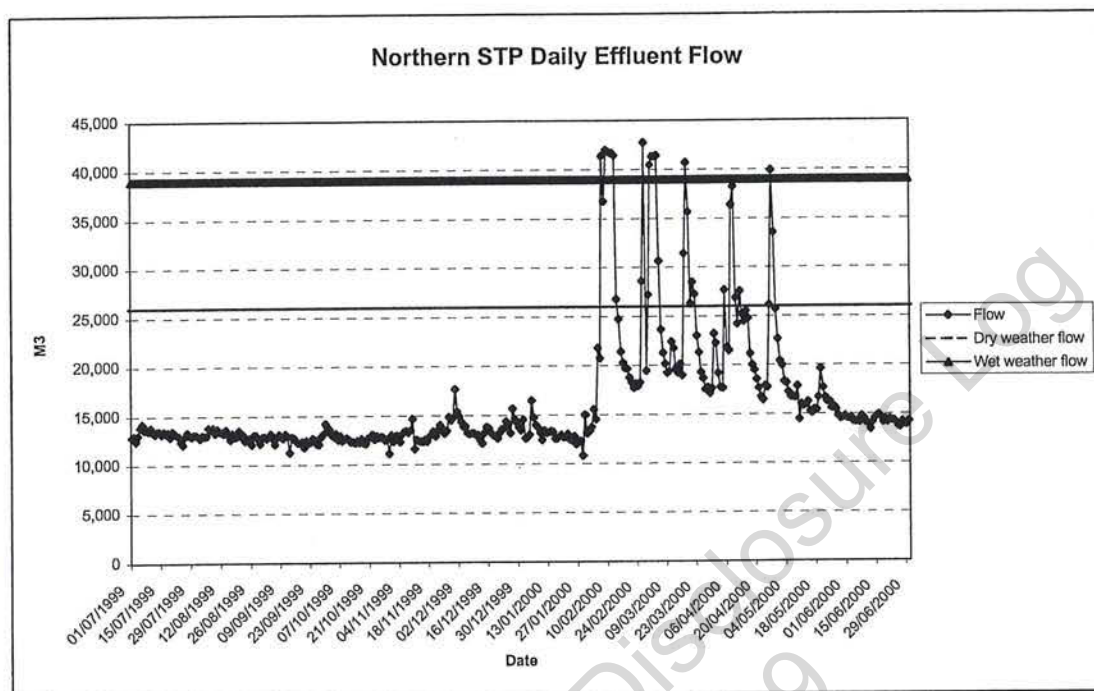


Figure A-2.1 Daily effluent Flow for reporting period

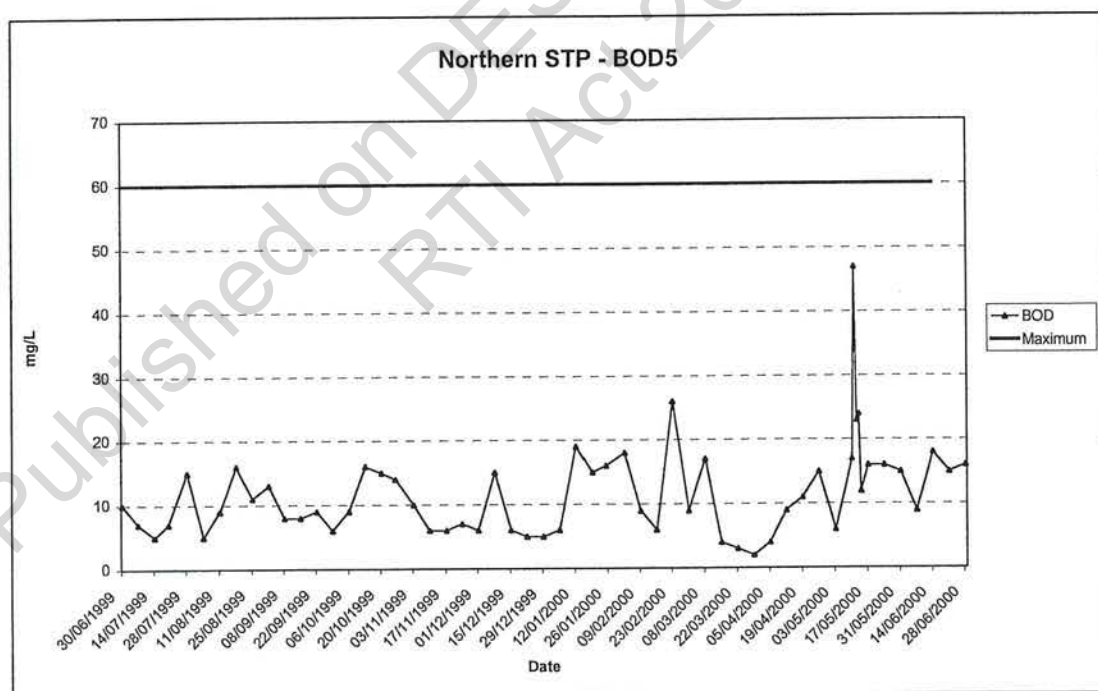


Figure A-2.2 BOD₅ concentration for reporting period

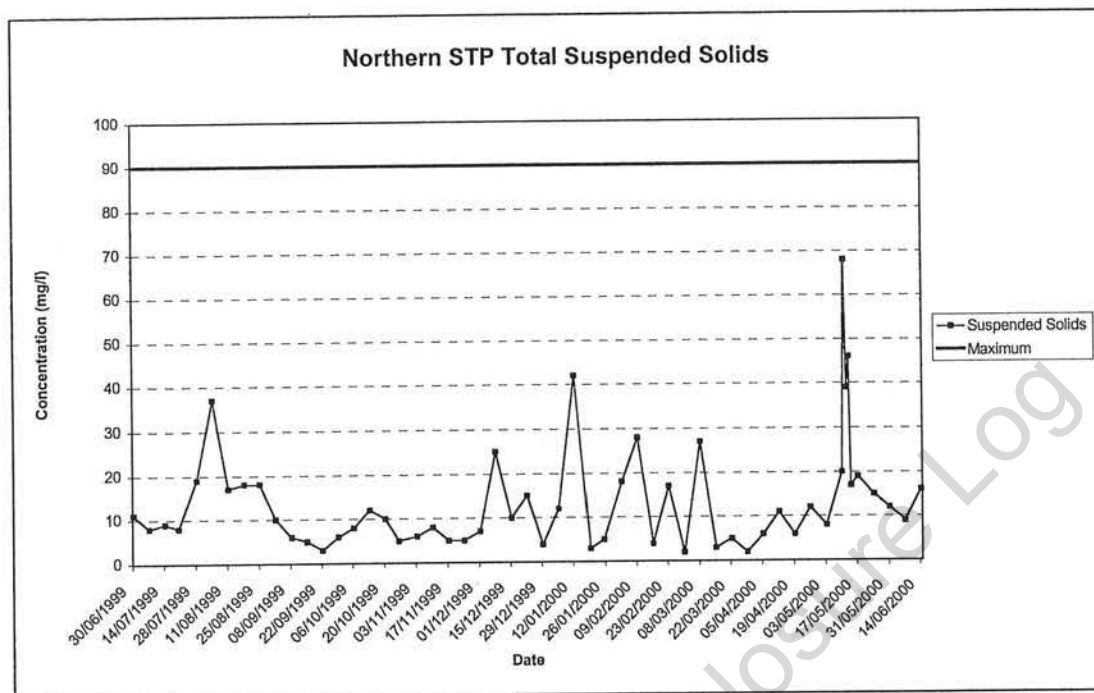


Figure A-2.3 Total Suspended Solid concentration for reporting period

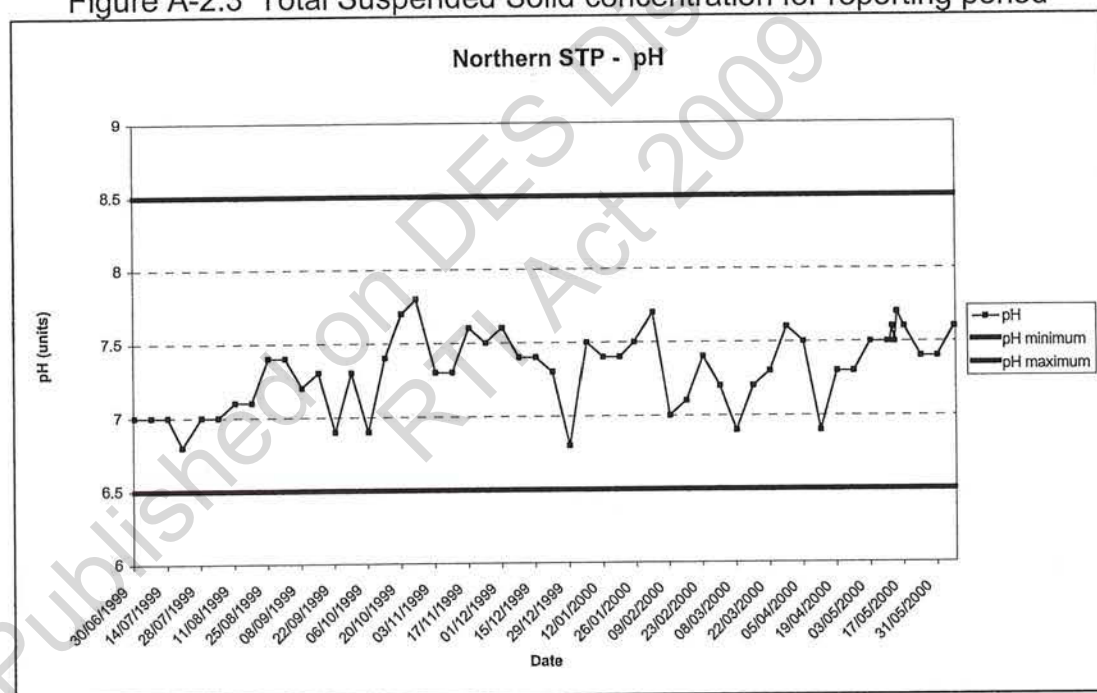


Figure A-2.4 pH readings for reporting period

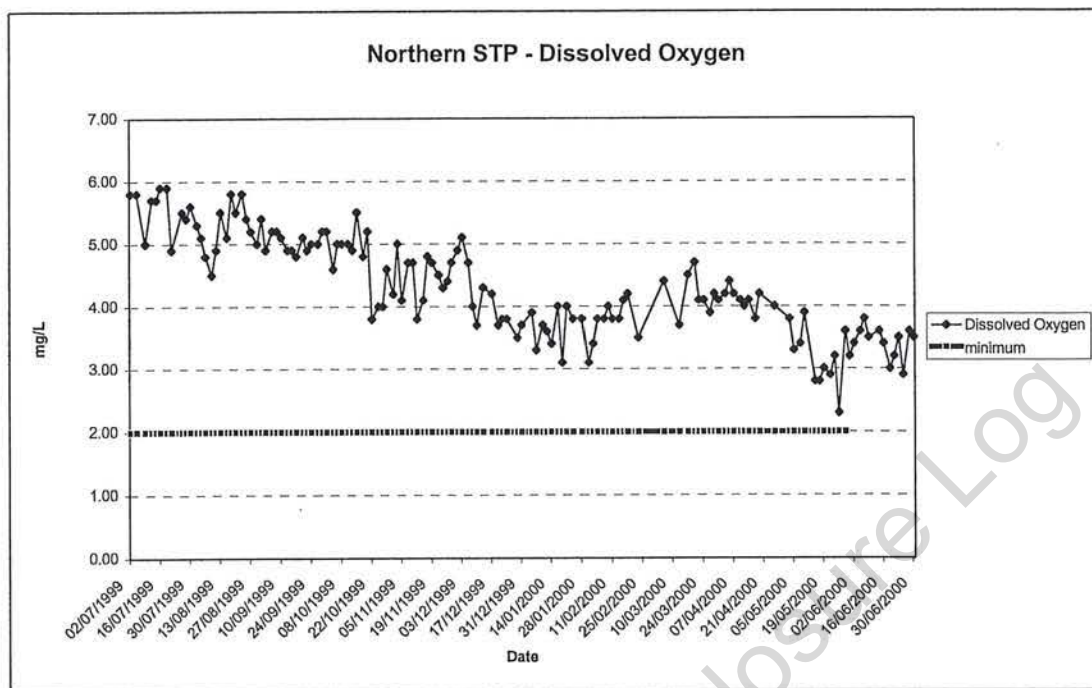


Figure A-2.5 Dissolved Oxygen Concentration for reporting period

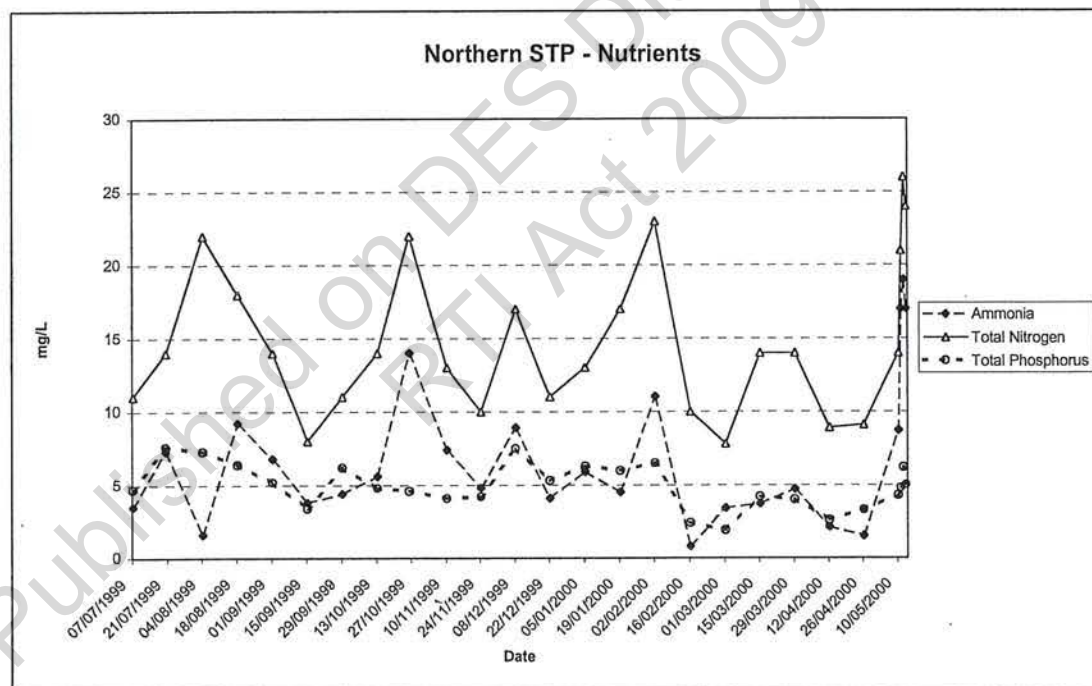


Figure A-2.6 Nutrient concentration for reporting period

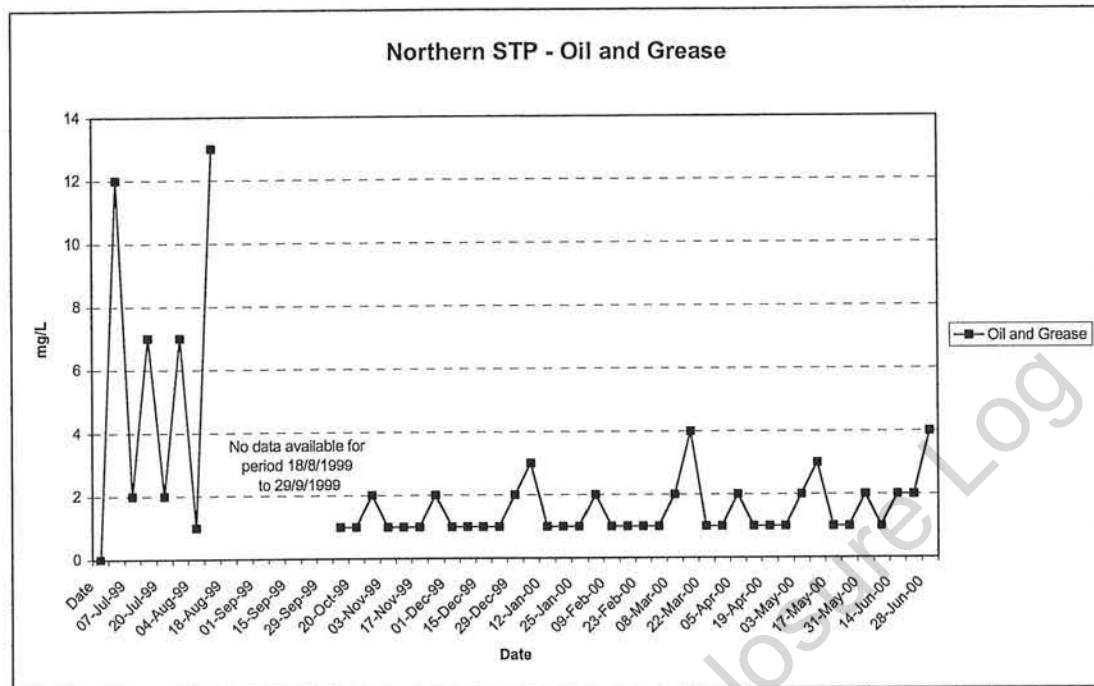


Figure A-2.7 Oil and Grease concentration for reporting period

Due to the fact that the sampling bottles supplied between July 1999 and the end of September may have been contaminated, all results between August 1999 and the start of October 1999 will be recorded as a "no result". The Council can therefore not assess compliance with the licence release limits for oil and grease during this period. **(Letter Dated 25/10/99)**

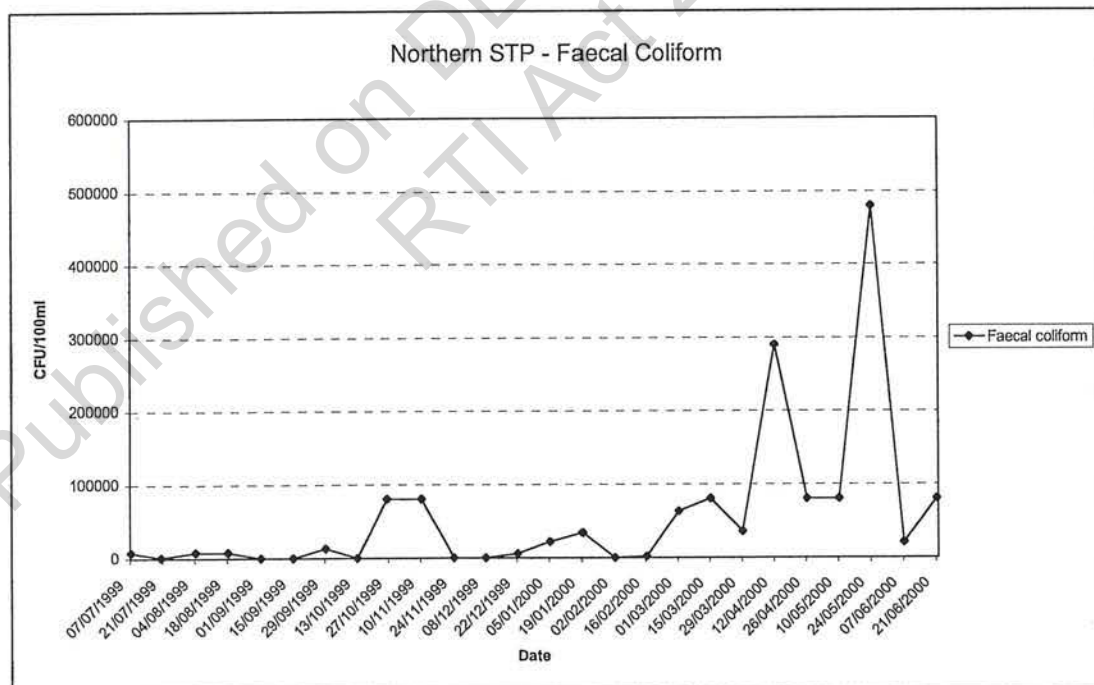


Figure A-2.8 Faecal Coliform concentration for reporting period

B-2 Northern STP Receiving Waters - Baron River (BR1 to BR8)

map

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Northern STP Receiving Waters - Baron River (BR1 to BR8)								
Site ID	Date	Time sampled	Dissolved Oxygen	Oxygen saturation	Conductivity	Salinity	pH	Temperature
			mg/l	%	mS/cm			Celsius
BR1	08/11/1999	9:30	5.8	74	26.8	16.5	7.7	28.8
BR2	08/11/1999	9:45	6.8	89	26.3	16.2	7.8	29.2
BR3	08/11/1999	10:00	8.1	105	26.1	16.1	7.8	29.2
BR4	08/11/1999	10:10	7.5	97	26.4	16.5	7.8	29.2
BR5	08/11/1999	10:25	6.7	88	31.3	19.6	7.8	29.5
BR6	08/11/1999	10:35	7.0	92	35.2	22.5	8.0	29.5
BR7	08/11/1999	10:50	7.0	91	35.5	22.6	8.0	29.7
BR8	08/11/1999	11:10	7.2	95	40.3	25.6	8.1	29.6
BR1	10/01/2000	11:34	6.1	81	35.7	22.9	7.8	29.4
BR2	10/01/2000	11:45	6.3	83	38.6	24.6	7.8	29.5
BR3	10/01/2000	11:50	6.2	82	39.5	25.2	7.8	29.5
BR4	10/01/2000	12:05	7.2	96	35.5	22.4	7.8	30.2
BR5	10/01/2000	12:20	7.3	97	36.6	23.2	7.8	30.4
BR6	10/01/2000	12:25	7.3	97	36.2	23.1	7.8	30.7
BR7	10/01/2000	12:35	7.5	101	39.3	24.8	7.9	30.6
BR8	10/01/2000	12:45	8.1	107	41.8	27.1	7.9	30.6
BR1	06/03/2000	9:25	7.7	94	0.1	0.0	7.4	25.5
BR2	06/03/2000	9:39	7.6	93	0.2	0.0	7.4	25.5
BR3	06/03/2000	9:50	7.5	91	0.2	0.0	7.4	25.7
BR4	06/03/2000	10:00	7.4	93	0.2	0.0	7.4	25.9
BR5	06/03/2000	10:10	7.3	91	0.3	0.0	7.3	25.8
BR6	06/03/2000	10:20	7.4	91	0.6	0.1	7.3	25.9
BR7	06/03/2000	10:30	7.3	90	2.1	0.9	7.4	25.9
BR8	06/03/2000	10:40	7.3	89	2.7	1.2	7.5	25.9
BR1	02/05/2000	10:05	7.6	90	0.3	0.0	7.7	23.5
BR2	02/05/2000	10:06	7.6	89	0.3	0.0	7.4	23.5
BR3	02/05/2000	10:10	7.5	88	0.6	0.1	7.8	23.6
BR4	02/05/2000	10:20	7.7	90	0.9	0.2	7.9	23.7
BR5	02/05/2000	10:30	7.6	90	1.3	0.4	7.7	23.7
BR6	02/05/2000	10:35	7.5	90	2.2	0.9	7.8	23.7
BR7	02/05/2000	10:45	7.4	88	5.9	3.2	7.4	24.0
BR8	02/05/2000	10:55	7.4	89	7.6	3.9	7.5	24.3
BR1	04/07/2000	9:55			14.7	8.6	7.6	19.9
BR2	04/07/2000	10:15			17.9	10.1	7.6	20.0
BR3	04/07/2000	10:30			13.2	7.6	7.6	20.0
BR4	04/07/2000	10:45			16.9	10.0	7.6	20.2
BR5	04/07/2000	11:10			30.6	17.8	7.8	20.6
BR6	04/07/2000	11:30			23.4	14.1	7.8	20.8
BR7	04/07/2000	11:45			36.0	22.6	7.9	20.6
BR8	04/07/2000	12:05			35.0	21.8	7.9	20.8

Northern STP Receiving Waters - Baron River (BR1 to BR8)													
		id	Faecal coliforms	id	BOD	id	Total Nitrogen	id	Total Phosphorus	id	Ammonia	id	Oxidised Nitrogen (NO2+NO3)
Site ID	Date	<	CFU/100ml	<	mg/l	<	mg/l	<	mg/l			<	mg/l
BR1	08/11/1999		240	<	1		0.28		0.03		0.11		0.082
BR2	08/11/1999		90	<	1		0.34		0.17		0.067		0.053
BR3	08/11/1999		100	<	1		0.32		0.04		0.073		0.064
BR4	08/11/1999		250	<	1		0.36		0.21		0.09		0.089
BR5	08/11/1999		110	<	1		0.28		0.04		0.093		0.08
BR6	08/11/1999		70	<	1		0.24		0.11		0.072		0.041
BR7	08/11/1999		130	<	1		0.29	<	0.02	<	0.05		0.028
BR8	08/11/1999		68	<	1		0.25		0.07	<	0.05		0.018
BR1	10/01/2000		32	<	1		0.32		0.09	<	0.05		0.055
BR2	10/01/2000		20		1		0.17		0.04	<	0.05		0.06
BR3	10/01/2000		24	<	1		0.17		0.04	<	0.05		0.048
BR4	10/01/2000		13	<	1		0.29		0.06	<	0.05		0.042
BR5	10/01/2000		6		1		0.29		0.06	<	0.05		0.028
BR6	10/01/2000		15	<	1		0.29		0.06	<	0.05		0.046
BR7	10/01/2000		6	<	1		0.24		0.05	<	0.05		0.035
BR8	10/01/2000		10		1		0.18		0.05	<	0.05		0.019
BR1	06/03/2000		50	<	1		0.29		0.03	<	0.05		0.084
BR2	06/03/2000		50	<	1		0.3		0.03	<	0.05		0.08
BR3	06/03/2000		72	<	1		0.3		0.03	<	0.05		0.087
BR4	06/03/2000		300	<	1		0.33		0.03	<	0.05		0.086
BR5	06/03/2000		1300	<	1		0.29		0.03	<	0.05		0.091
BR6	06/03/2000		140	<	1		0.28		0.03	<	0.05		0.093
BR7	06/03/2000		1800	<	1		0.31		0.03	<	0.05		0.09
BR8	06/03/2000		210	<	1		0.31	<	0.02	<	0.05		0.085
BR1	02/05/2000		70	<	1		0.25	<	0.02	<	0.05		0.12
BR2	02/05/2000		90	<	1		0.24		0.02	<	0.05		0.12
BR3	02/05/2000		110	<	1		0.29	<	0.02	<	0.05		0.11
BR4	02/05/2000		90	<	1		0.28		0.02	<	0.05		0.12
BR5	02/05/2000		210	<	1		0.26	<	0.02	<	0.05		0.12
BR6	02/05/2000		510	<	1		0.24	<	0.02	<	0.05		0.12
BR7	02/05/2000		1200	<	1		0.29		0.03	<	0.05		0.12
BR8	02/05/2000		1200	<	1		0.27		0.02	<	0.05		0.11
BR1	04/07/2000		150	<	1		0.31		0.03		0.056		0.16
BR2	04/07/2000		190	<	1		0.32		0.03	<	0.05		0.086
BR3	04/07/2000		100	<	1		0.32		0.03		0.051		0.15
BR4	04/07/2000		70	<	1		0.32		0.04		0.061		0.16
BR5	04/07/2000		100	<	1		0.34		0.04		0.1		0.13
BR6	04/07/2000		80	<	1		0.38		0.05		0.068		0.14
BR7	04/07/2000		45	<	1		0.34		0.04		0.091		0.099
BR8	04/07/2000		20	<	1		0.31		0.04		0.096		0.11

Golder Associates Pty Ltd

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**GROUNDWATER
ENVIRONMENTAL IMPACT ANALYSIS REPORT
INERT LANDFILL
LOWER FRESHWATER ROAD
KAMERUNGA, QUEENSLAND**

Submitted to :

Medalfield Pty Ltd
C/- Down to Earth Demolition
PO Box 64
Cairns Queensland 4870

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November 2000

96670123(AC)

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Appendix A	-	Results of Laboratory Testing
Appendix B	-	Graphical Plots
Appendix C	-	"Important Information About Your Environmental Site Assessment"

1.0 INTRODUCTION

Golder Associates Pty Ltd was commissioned by Medalfield Pty Ltd to conduct an Environmental Impact Analysis on the results of groundwater monitoring conducted at the inert landfill site on Lower Freshwater Road, during the past twelve months.

Background information in relation to the site's hydrogeological setting, location and construction of monitoring wells are contained in our previous report 96670123(H) dated November 1997. An evaluation of potential environmental impacts for the preceding 12 months is contained in our report 96670123(U) dated September 1999. These previous reports should be read in conjunction with this report.

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2.0 GROUNDWATER MONITORING WELLS

2.1 Water Levels

Water levels have been monitored in the wells since installation. The recorded water levels are summarised in Table 1.

Table 1 - Groundwater Levels

Well Location	Date	Water Level (RL)
MW1	5/12/96	0.50 m
	18/4/97	0.40 m
	26/8/97	0.34 m
	17/9/97	1.17 m
	15/11/97	0.40 m
	12/3/98	1.20 m
	23/06/98	0.52 m
	10/9/98	0.38 m
	9/12/98	0.53 m
	3/02/99	0.60 m
	8/07/99	0.59 m
	01/12/99	0.66m
	03/04/00	1.66m
MW2	13/06/00	0.90m
	6/12/96	1.96 m
	18/4/97	1.80 m
	26/8/97	1.30 m
	17/9/97	1.12 m
	15/11/97	0.88 m
	12/3/98	2.72 m
	23/06/98	1.41 m
	10/9/98	1.41 m
	9/12/98	1.37 m
	3/02/99	1.3 m
	8/07/99	1.07 m
	01/12/99	1.50m
MW3 MW3 (reinstalled)	03/04/00	3.56m
	13/06/00	1.75m
	6/12/96	1.76 m
	26/8/97	<0.55 m *
	17/9/97	<0.55 m *
	12/3/98	0.80 m
	23/06/98	0.24 m
	10/9/98	0.245 m
	9/12/98	0.25 m
	3/02/99	0.32 m
	8/07/99	0.245 m
	01/12/99	0.38m
	03/04/00	1.07m
	13/06/00	0.51m

Note: * Water level at or below the base of original monitoring well.

2.2 Sampling Procedures

Prior to collection of water samples, five well volumes were bailed from each well. Once the water level had equalised to pre-bailing levels a water sample was collected from each well. Water samples were collected in laboratory supplied jars and bottles, and then immediately placed in a chilled insulated container for transport to the analytical laboratory.

Golder Associates standard sampling, handling, and decontamination procedures were followed during this investigation. A copy of these procedures is available for review, on request, at our Cairns office.

3.0 LABORATORY RESULTS

Laboratory analyses were conducted by Australian Environmental Laboratories Pty Ltd (AEL) in Cairns. AEL is NATA accredited for the tests conducted. Laboratory certificates of analysis are presented in Appendix A.

The groundwater samples were analysed for the following parameters as required under the site's Environmental Authority:

- pH;
- electrical conductivity;
- dissolved oxygen;
- total dissolved solids;
- iron;
- zinc;
- lead;
- copper; and
- total oxidised nitrogen (ie. nitrate as N).

Laboratory test results for this monitoring period are summarised in Table 2. Graphical plots of the above parameters since commencement of monitoring in 1997 are presented in Appendix B.

Table 2 - Summary Of Analytical Results

PARAMETER	SAMPLE												AWQG			NWQMS
	MW1 14/9/1999	MW1 1/12/1999	MW1 3/4/2000	MW1 13/6/2000	MW2 14/9/1999	MW2 1/12/1999	MW2 3/4/2000	MW2 13/6/2000	MW3 14/9/1999	MW3 1/12/1999	MW3 3/4/2000	MW3 13/6/2000	ECOSYSTEM PROTECTION	RECREATION	AGRICULTURE	DRINKING WATER
pH	5.22	5.6	5.03	5.52	5.68	5.9	5.48	5.77	5.83	5.75	5.52	5.81	6.5-9.0	5.0-9.0	4.5-9.0	6.5-8.5
Electrical Conductivity $\mu\text{S}/\text{cm}$	116	97	110.2	90.2	164	127	114.6	122.1	390	268	245.8	283.7	1500	-	<800	-
Total Dissolved Solids mg/L	87	75	92	100	440	540	620	720	260	200	170	160	-	-	<500	500
Dissolved Oxygen mg/L	2.7	3	4.9	5.4	<0.1	<0.1	<0.1	<0.1	1.2	3.3	2.6	3.7	>6	>6	-	>85%
Iron (Fe) mg/L (filtered)	0.27	0.06	0.09	0.23	4.6	12	4.4	4.1	0.17	<0.05	<0.05	<0.05	1	1	1	0.3
Total Iron mg/L (unfiltered)	18	41	14	17	120	550	600	1400	1.4	320	63	190	-	-	-	-
Copper mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.002-0.005	0.002-0.005	0.2	1
Zinc mg/L	0.029	0.021	0.091	0.19	0.036	0.01	0.029	0.027	0.011	0.006	0.015	0.014	0.005-0.05	0.005-0.05	2.0	3
Lead (Pb) mg/L	<0.002	<0.002	<0.002	<0.002	0.01	0.015	0.011	0.02	<0.002	<0.002	<0.002	<0.002	0.001-0.05	0.001-0.05	0.2	0.01
Total Oxidised Nitrogen (Nitrate as N plus Nitrite as N) mg/L	1.3	0.87	1.9	1.2	<0.05	<0.05	0.13	0.26	1.3	0.9	1.1	0.83	0.1-0.75*	0.1-0.75*	30**	50#

Note: * Total N - Rivers and Streams

** Livestock watering

Nitrate as N

S:\DATA\99670123\wells 99-2000.xls

INPUT BY: bjl

DATE: 26/10/2000

CHECKED BY: 

DATE: 18-5-01 15.11.00

4.0 IMPACT ASSESSMENT GUIDELINES

The Environmental Protection (Water) Policy, 1997 has been used as the basis for determining assessment criteria for this site. This policy indicates that the expected range of environmental values to be protected are:

- (i) biological integrity of a modified aquatic ecosystem;
- (ii) suitability for recreational use;
- (iii) suitability for minimal treatment before supply as a drinking water;
- (iv) suitability for agricultural use; and
- (v) suitability for industrial use.

The above environmental values (i) and (ii) refer more to surface waters but are relevant at this site given the close proximity of the Barron River.

Indicators (ie. the parameters listed in Table 2) of environmental values were stated in the Environmental Authority for this site. These indicators are compared to water quality guidelines in order to assess the potential impact of site processes on ground and surface waters. The Environmental Protection (Water) Policy states that the following documents are to be used to decide the water quality guidelines for an environmental value for a water:

- (i) site specific documents;
- (ii) the Australian Water Quality Guidelines (AWQG - Reference 1);
- (iii) documents published by a recognised entity.

No site specific documents or guidelines published by a recognised entity are known to exist for this site or the Barron River. The following guidelines have therefore been adopted for this assessment:

<i>Aquatic Ecosystem</i>	AWQG - freshwater ecosystems protection
<i>Recreational Use</i>	AWQG - secondary contact
<i>Drinking Water Supply</i>	NWQMS (Reference 2) - drinking water guidelines
<i>Agricultural Use</i>	AWQG - irrigation and stockwater guidelines

The protection of water for industrial purposes has not been considered as the above guideline levels are typically lower than those to be protected for industrial use.

Guideline values are listed in Table 3 along with the monitoring results.

5.0 INTERPRETATION OF RESULTS

Measured groundwater levels of the last twelve months monitoring period have fluctuated seasonally in a similar manner to that shown by previous monitoring. The highest groundwater levels recorded at the site to date occurred in April 2000, following prolonged rainfall.

Test results over the current monitoring period indicated continued acidic groundwater conditions ranging from pH 5.0 to pH 5.9 (similar to the previous monitoring period). The indicated acidity is generally lower than assessment guidelines for the environmental values under consideration. However, our experience with groundwater quality in the Cairns region suggests that acidic groundwater within the indicated range is not uncommon and therefore the monitoring results are not considered to represent a potential environmental impact. Levels of pH since commencement of monitoring have ranged between 5.0 and 6.5 (see Appendix B).

Electrical conductivities (EC) in MW1 and MW2 were generally around 100 $\mu\text{S}/\text{cm}$, and compare favourably with previous monitoring data (see Appendix B). MW3 had a maximum electrical conductivity of 390 $\mu\text{S}/\text{cm}$ in late 1999 which gradually decreased to a low of

246 $\mu\text{S}/\text{cm}$ in April 2000. Monitoring data to date (see Appendix B) shows a gradual decrease in EC concentrations at MW3. This may be related to the reduced seepage/infiltration through the original landfill Pit 1 which was completed and capped in August 1998. EC concentrations at all monitoring locations are well below impact assessment guideline levels for aquatic ecosystem protection and agricultural use.

Total dissolved solids (TDS) levels in MW3 show a similar trend to EC results (see Appendix B) with a gradual decrease in concentration. TDS levels at MW1 over the monitoring period have remained relatively constant and are similar to previously recorded results. TDS concentrations in MW1 and MW3 remain below impact assessment guideline levels. TDS levels at MW2 have increased steadily over the monitoring period, rising from 440 mg/L in September 1999 to 720 mg/L in June 2000. The later result exceeds impact assessment guideline levels for agricultural use and drinking water. Dissolved oxygen levels in MW2 over the current monitoring period have remained below the laboratory detection level of 0.1 mg/L.

The concentrations of lead at MW2 have also increased over the current monitoring period from 0.01 mg/L to 0.02 mg/L. These concentrations exceed drinking water guidelines but are below impact assessment guideline levels for ecosystem protection and agricultural use. Groundwater in the immediate vicinity of the site is not used as a source of drinking water and therefore the risks to human health are presently considered to be negligible. Lead concentrations in MW1 and MW3 have remained below laboratory detection limits over the current monitoring period.

Concentrations of copper were below the laboratory detection limits in all monitoring wells and it is not considered to represent a source of impact to the environmental values of the groundwater or Barron River.

Zinc levels in MW2 and MW3 have remained below impact assessment guideline levels over the current monitoring period and compare favourably with past monitoring results (see Appendix B). Zinc levels at MW1 over the current monitoring period have risen gradually and in April and June 2000, exceeded levels for impact assessment guideline levels for ecosystem protection and recreation but were below agriculture and drinking water levels. Previous trends (see Appendix B) suggest a seasonal variation in zinc concentrations. As the zinc concentrations were measured in groundwater and not in a river or stream (which

ecosystem protection and recreation levels refer to) and that significant dilution and dispersion are likely to occur prior to this groundwater discharging into the Barron River the present zinc levels at MW1 are not considered to represent a source of serious impact to the environmental values of the Barron River, although continued monitoring is recommended.

Iron (filtered) concentrations in the monitoring wells MW1 and MW3 over the current monitoring period have remained below the impact assessment guideline levels for aquatic ecosystem protection, recreational, agricultural and drinking water use. The concentrations in MW2 were above all impact assessment guideline levels over the current monitoring period. The concentrations were also generally higher than previously recorded concentrations (see Appendix B) but within the range of concentrations in the Barron River near the Captain Cook Highway measured by the Cairns Port Authority between 1995 and 1997. These iron concentrations are therefore not considered to represent a source of serious impact to the environmental values of the Barron River.

Total (unfiltered) iron concentrations in all groundwater samples exceeded all impact assessment criteria. However, these results are likely to have been effected by suspended soil particles (all field sheets record these water samples as being "cloudy" or "turbid") and are not considered to be representative of dissolved iron. Graphs summarising iron concentrations since commencement of monitoring are presented in Appendix B.

Nitrate (TON) concentrations in water samples from MW1, MW2 and MW3 generally exceeded impact assessment guideline levels for ecosystem protection and recreational use but were well below assessment levels for agriculture and drinking water use. Given that the nitrate concentrations measured were in groundwater and not in a river or stream (which ecosystem protection and recreation levels refer to) and that significant dilution and dispersion are likely to occur prior to this groundwater discharging into the Barron River, the present nitrate concentrations are not considered to represent a source of serious impact to the environmental values of the Barron River.

6.0 CONCLUSIONS & RECOMMENDATIONS

The results for the monitoring period at MW1 and MW3 indicate generally good water quality within the impact assessment guidelines for environmental values. These results are considered to provide a reasonable approximation of groundwater quality in this region of Cairns. Decreasing EC and TDS at MW3 indicate an ongoing improvement in water quality which may be related to capping (in August 1998) of the former landfill area adjacent to this monitoring well.

Results at MW2 over the current monitoring period suggest a gradual decrease in water quality with increasing concentrations of TDS and lead, and decreased dissolved oxygen. The current concentrations are not considered to represent a source of serious impact to the environmental values of the Barron River but continued monitoring and implementation of some corrective measures are considered to be warranted. It is recommended that a sump (or sumps) is formed near the eastern end of Pit 2 (the current disposal pit) to allow surface water runoff and groundwater to be collected. The water from the sump should be removed by pumping and used for irrigation of the adjacent sugar cane field and dust suppression of onsite roads. The available data suggests that the water is of suitable quality for these purposes. Provided application rates are controlled then no adverse environmental impacts are expected.

7.0 LIMITATIONS OF THIS REPORT

This report has been prepared in accordance with the agreement between Medalfield Pty Ltd and Golder Associates Pty Ltd (Golder Associates). The services performed by Golder Associates have been conducted in a manner consistent with the level of quality and skill generally exercised by members of its profession and consulting practice. No warranty or guarantee of site conditions is intended.

This report is solely for the use of Medalfield Pty Ltd and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Golder Associates.

The information in this report is considered to be accurate at the date of issue in accordance to the current conditions of the site. Subsurface conditions can vary across a particular site which cannot be explicitly defined by investigation. Therefore, it is unlikely that the results and estimations expressed in this report will represent the extremes of conditions within the site. Subsurface conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used after a significant delay in time.

Attached as Appendix C is a document entitled "Important Information About Your Environmental Site Assessment" which should be read in conjunction with this report. We would be pleased to answer any questions about this important information.

GOLDER ASSOCIATES PTY LTD

sch4p4(6) Personal Information

North Queensland Manager

\\Karen's-drive\Data\96670123\70123Rac.doc
BJL:PKS:MSC:klm

8.0 REFERENCES

1. Australian & New Zealand Environment & Conservation Council, "Australian Water Quality Guidelines for Fresh and Marine Waters", November 1992, Australia.
2. National Health and Medical Research Council & Agriculture and Resource Management Council of Australia and New Zealand "National Water Quality Management Strategy - Australian Drinking Water Guidelines", 1996.

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Appendix A

Results of Laboratory Testing

CERTIFICATE OF ANALYSIS

COPY

23 September, 1999

sch4p4(6) Personal Info

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

Your Order No: - CQ-627
Your Project No: - 96670123
Laboratory Report No: 40725

Date Received: 14 September 1999

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following tables. Please find the final results in the attached report.

Yours faithfully,

AUSTRALIAN ENVIRONMENTAL LABORATORIES

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



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NATA Endorsed Test Report

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Page 1 of 2



RESULTS

AEL Reference		40725-01	40725-02	40725-03	Detection Limit	Analytical Method*
Your Reference	Units	MW 1	MW 2	MW 3		
Parameter	Units					
pH		5.7	5.8	6.0	0.1	4500 H ⁺ B
Electrical Conductivity	µS/cm	86	100	360	5	2510B
Total Dissolved Solids	mg/L	87	440	260	10	2540-C
Total Oxidised Nitrogen	mg/L as N	1.3	<0.05	1.3	0.05	AEL method CEI-001
Dissolved Oxygen†	mg/L	2.7	<0.1	1.2	0.1	4500-OC
Total Iron (Fe)*	mg/L	18	120	1.4	0.05	AEL Method CEI-018
Iron (Fe)	mg/L	0.27	4.6	0.17	0.05	"
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	0.05	"
Zinc (Zn)	mg/L	0.029	0.036	0.011	0.005	"
Lead (Pb)	mg/L	<0.002	0.010	<0.002	0.002	AEL Method CEI-020

* Methods sourced from APHA 20th Ed., 1998 unless otherwise stated.

† NATA accreditation does not cover the performance of this service.

‡ This analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



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CERTIFICATE OF ANALYSIS

15 December, 1999

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96670123

sch4p4(6) Personal Info

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

Your Order No: - CQ-627
Your Project No: - 96670123
Laboratory Report No: 40986

Date Received: 2 December 1999

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following tables. Please find the final results in the attached report.

Yours faithfully,

AUSTRALIAN ENVIRONMENTAL LABORATORIES

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



National Association of Testing Authorities, Australia

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RESULTS

Parameter	Units	40986-01 MW 1	40986-02 MW 2	40986-03 MW 3	Detection Limit	Analytical Method*
pH		5.7	5.9	6.2	0.1	4500 H ⁺ B
Electrical Conductivity	µS/cm	86	120	270	5	2510B
Total Dissolved Solids	mg/L	75	540	200	10	2540-C
Total Oxidised Nitrogen	mg/L as N	0.87	<0.05	0.90	0.05	AEL method CEI-001
Dissolved Oxygen†	mg/L	3.0	<0.1	3.3	0.1	4500-OC
Total Iron (Fe)*	mg/L	41	550	320	0.05	AEL Method CEI-018
Iron (Fe)	mg/L	0.06	12	<0.05	0.05	"
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	0.05	"
Zinc (Zn)	mg/L	0.021	0.010	0.006	0.005	"
Lead (Pb)	mg/L	<0.002	0.015	<0.002	0.002	AEL Method CEI-020

*Methods sourced from APHA 20th Ed. 1998 unless otherwise stated.

†NATA accreditation does not cover the performance of this service.

This analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.

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CERTIFICATE OF ANALYSIS

19 April, 2000

sch4p4(6) Personal Info

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

COPY

GOLDER ASSOCIATES PTY LTD

96670123

26 APR 2000

Your Order No: - CQ-627
Your Project No: - 96670123
Laboratory Report No: 41387

Date Received: 3 April 2000

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following tables. Please find the final results in the attached report.

Yours faithfully,

AUSTRALIAN ENVIRONMENTAL LABORATORIES

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



National Association of Testing Authorities, Australia

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RESULTS

AEL Reference		41387-01	41387-02	41387-03	Detection Limit	Analytical Method*
Your Reference	Units	MW 1	MW 2	MW 3		
Total Dissolved Solids	mg/L	92	620	170	10	2540-C
Total Oxidised Nitrogen	mg/L as N	1.9	0.13	1.1	0.05	AEL method CEI-001
Dissolved Oxygen	mg/L	4.9	<0.1	2.6	0.1	4500-OC
Total Iron (Fe)	mg/L	14	600	63	0.05	AEL Method CEI-018
Iron (Fe)	mg/L	0.09	4.4	<0.05	0.05	"
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	0.05	"
Zinc (Zn)	mg/L	0.091	0.029	0.015	0.005	"
Lead (Pb)	mg/L	<0.002	0.011	<0.002	0.002	AEL Method CEI-020

* Methods sourced from APHA 20th Ed., 1998 unless otherwise stated.

¹ NATA accreditation does not cover the performance of this service.

² This analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



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CERTIFICATE OF ANALYSIS

27 June, 2000

COPY

sch4p4(6) Personal Information

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

GOLDER ASSOCIATES PTY LTD
96670123
4 JUL 2000

Your Order No: - CQ-627
Your Project No: - 96670123
Laboratory Report No: 41600

Date Received: 13 June 2000

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following tables. Please find the final results in the attached report.

Yours faithfully,

AUSTRALIAN ENVIRONMENTAL LABORATORIES

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



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RESULTS

Parameter	Units	41600-01 MW 1	41600-02 MW 2	41600-03 MW 3	Detection Limit	Analytical Method*
Total Dissolved Solids	mg/L	100	720	160	10	2540-C
Total Oxidised Nitrogen	mg/L as N	1.2	0.26	0.83	0.05	AEI. method CEI-001
Dissolved Oxygen	mg/L	5.4	<0.1	3.7	0.1	4500-OC
Total Iron (Fe)	mg/L	17	1400	190	0.05	AEI. Method CEI-018
Iron (Fe)	mg/L	0.23	4.1	<0.05	0.05	"
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	0.05	"
Zinc (Zn)	mg/L	0.19	0.027	0.014	0.005	"
Lead (Pb)	mg/L	<0.002	0.020	<0.002	0.002	AEI. Method CEI-020

* Methods sourced from APHA 20th Ed., 1998 unless otherwise stated.

* NATA accreditation does not cover the performance of this service.

This analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



National Association of Testing Authorities, Australia

NATA Endorsed Test Report

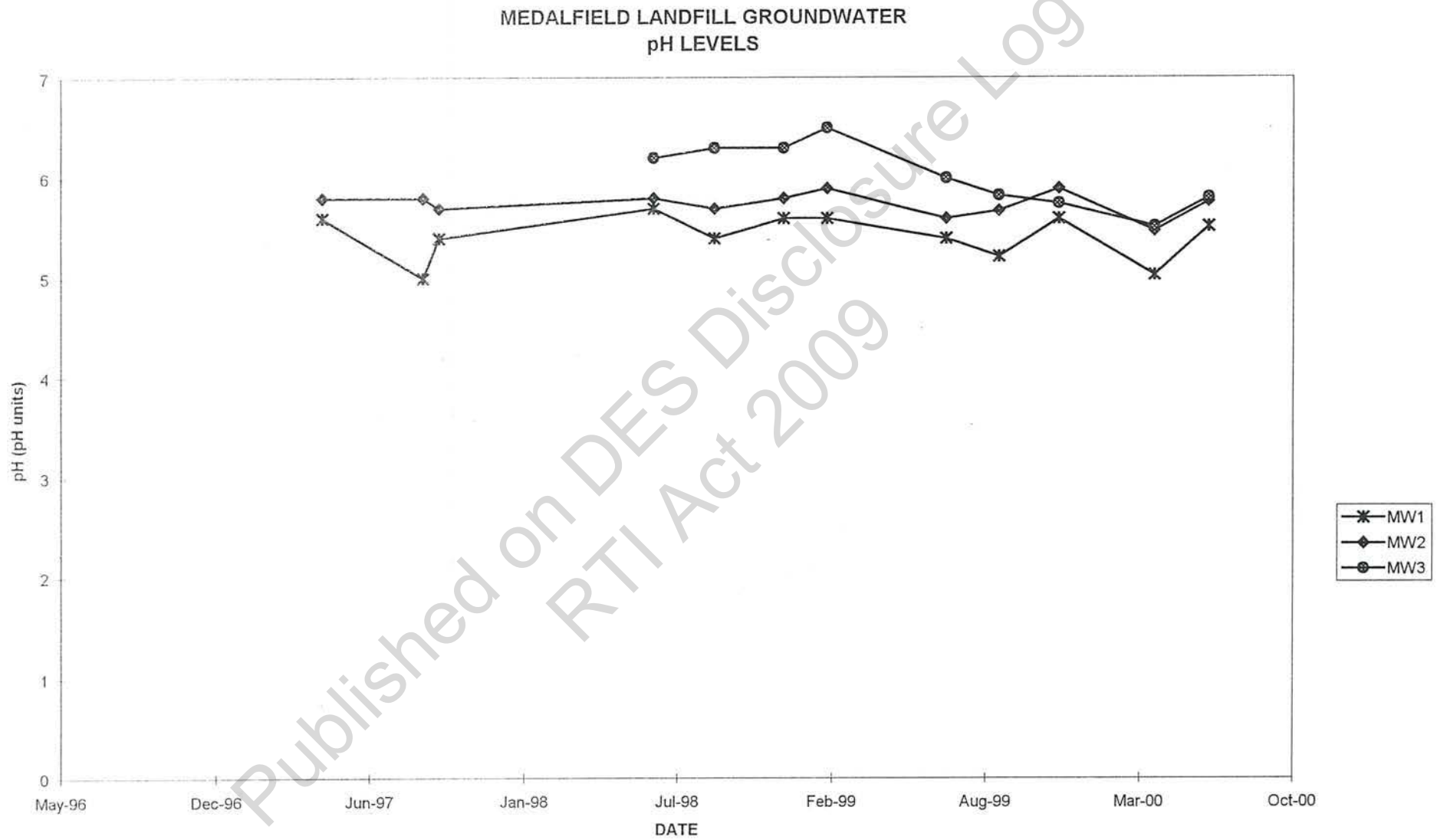
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Appendix B

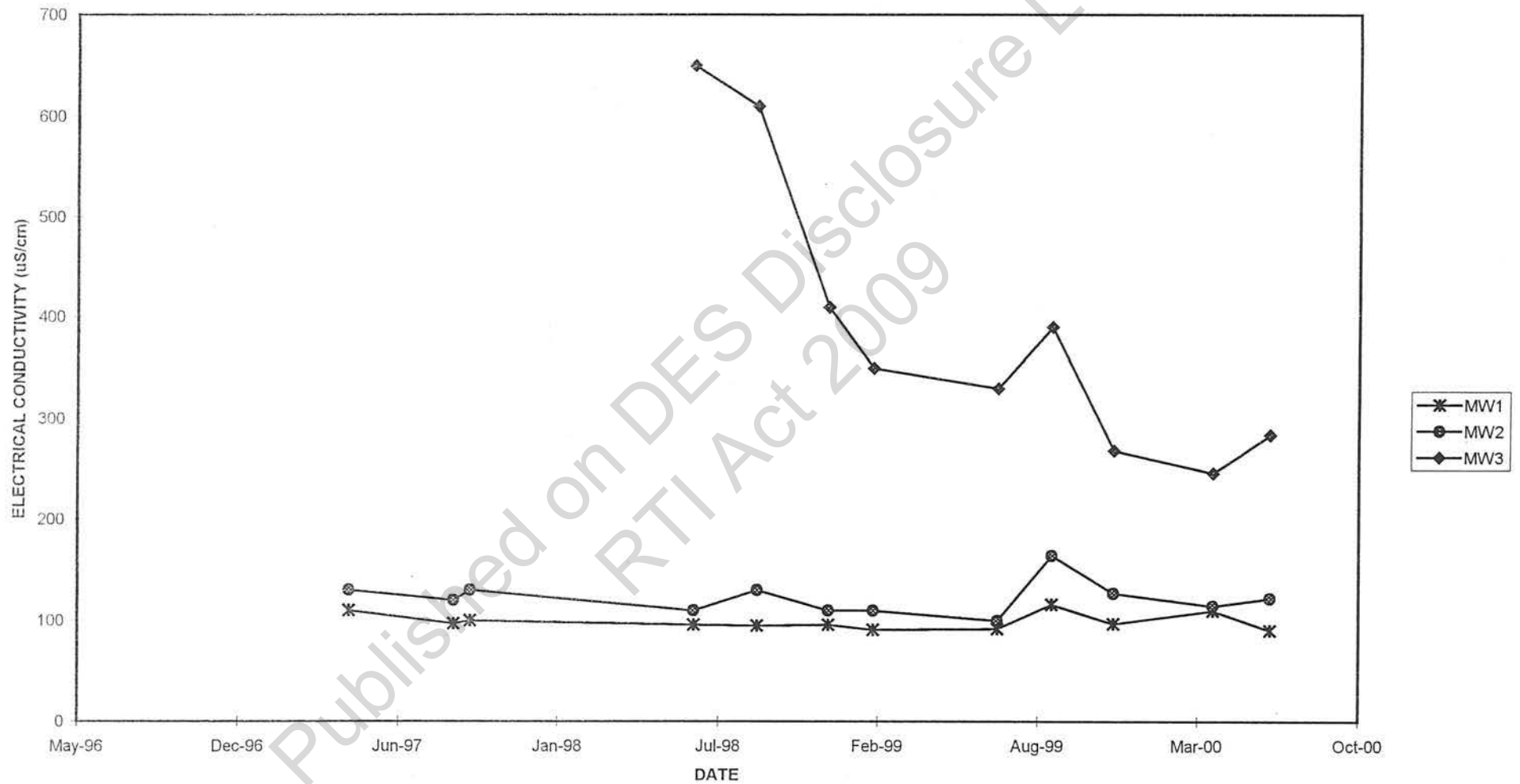
Graphical Plots

Golder Associates



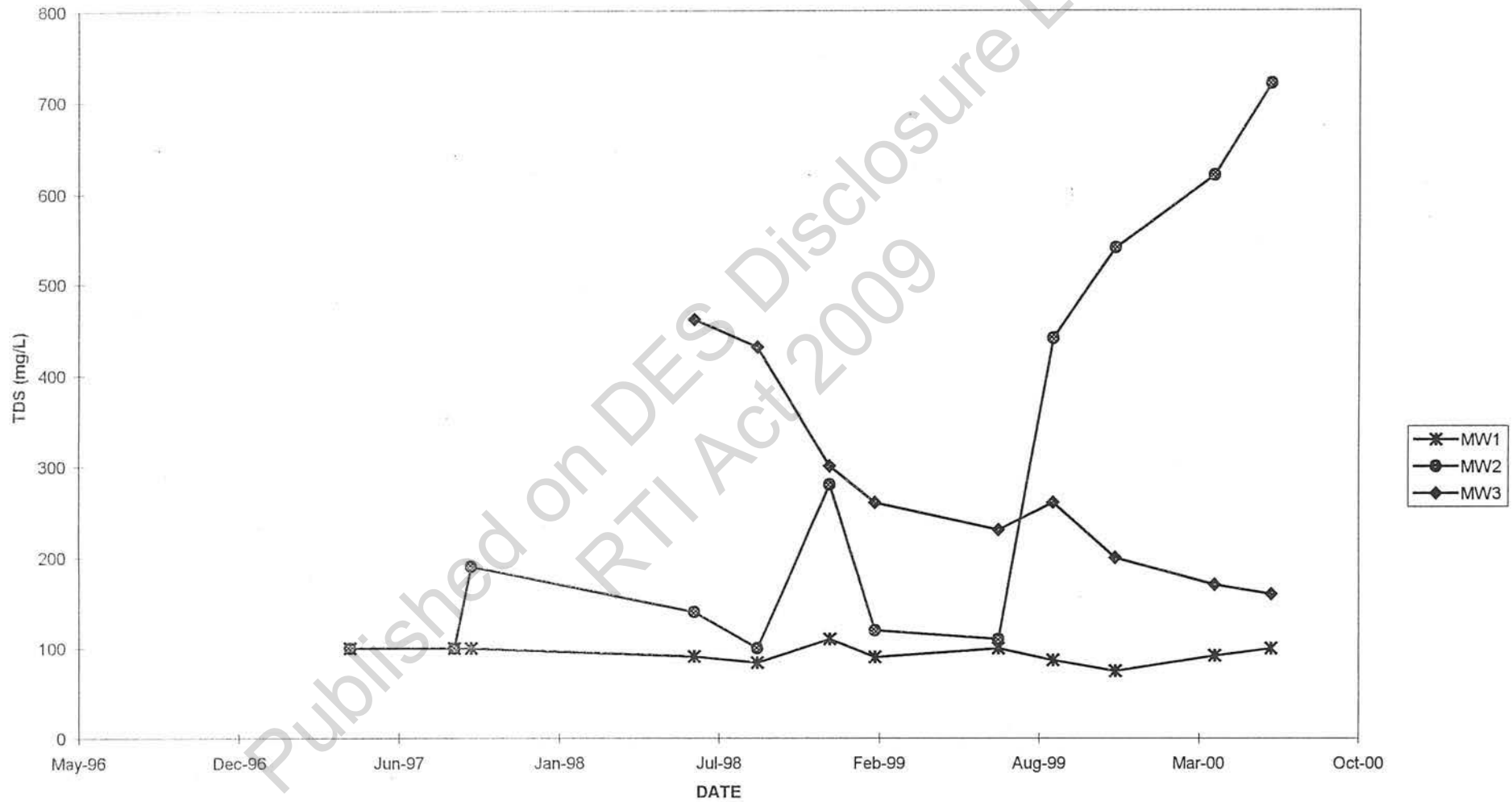
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 CHECKED BY: Sch4n4/
 DATE: 18.11.00
 18-541

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DATE: 14/11/2000
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DATE: 14.11.00
18-541

MEDALFIELD LANDFILL GROUNDWATER TOTAL DISSOLVED SOLID LEVELS

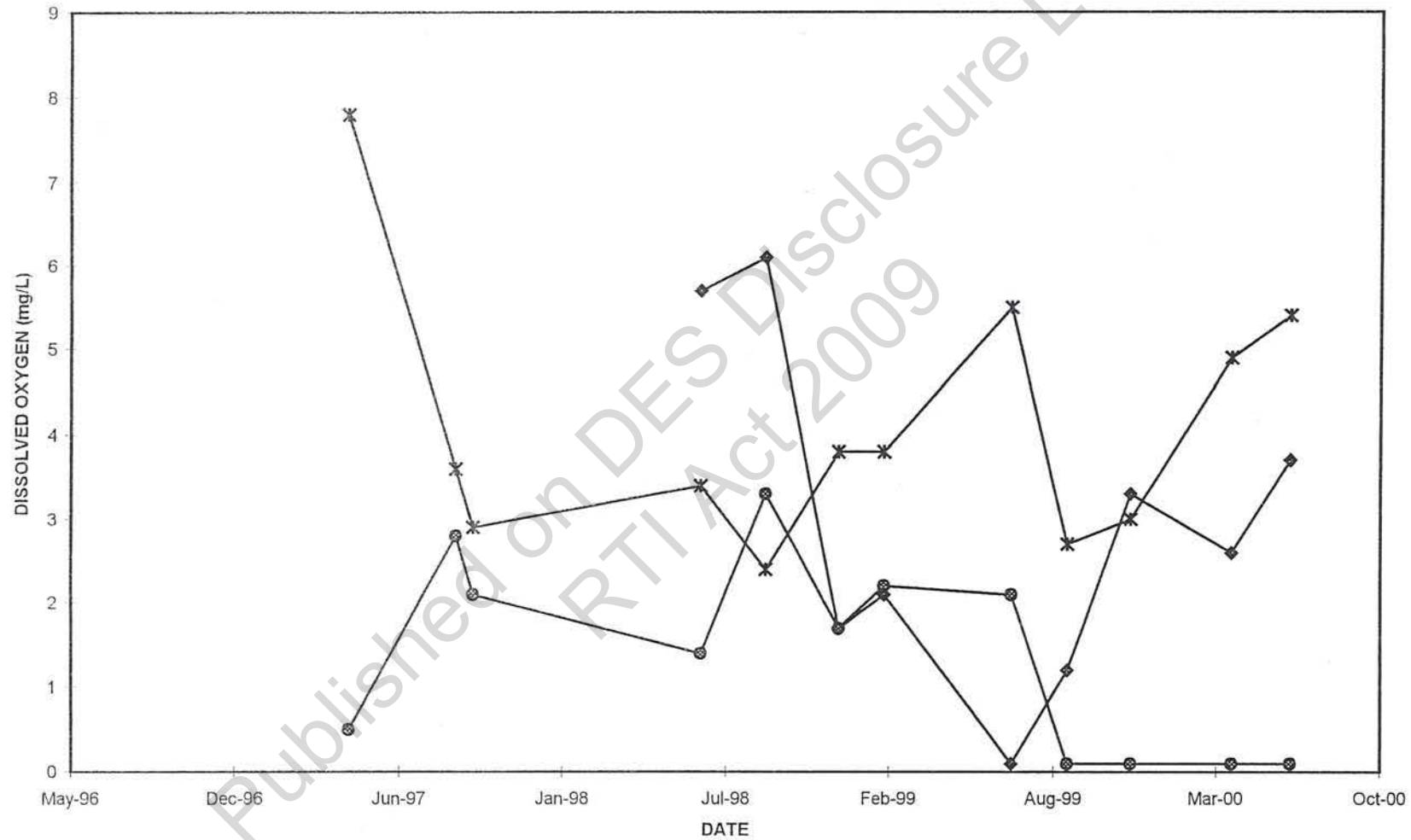


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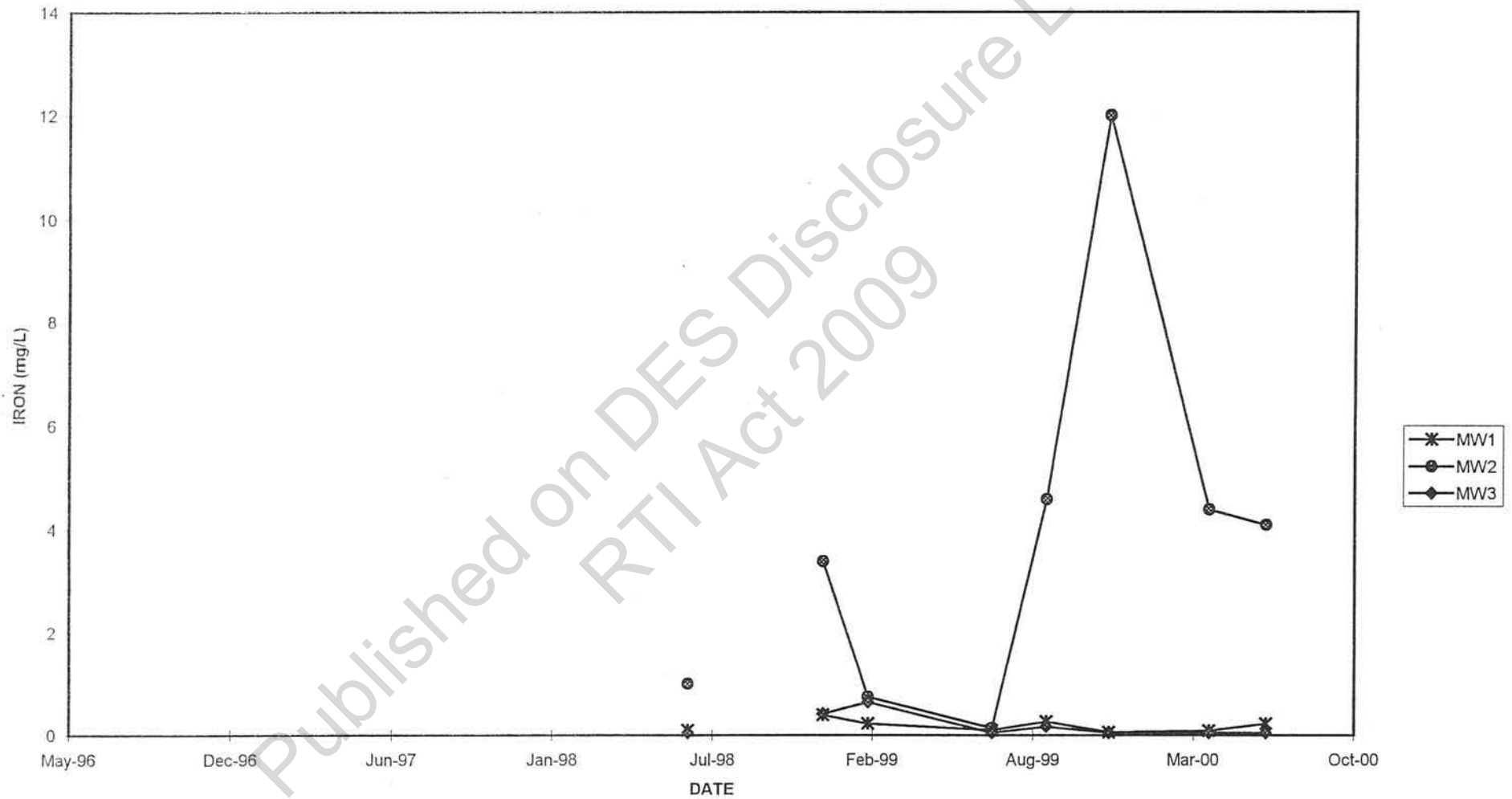
18-541

File A

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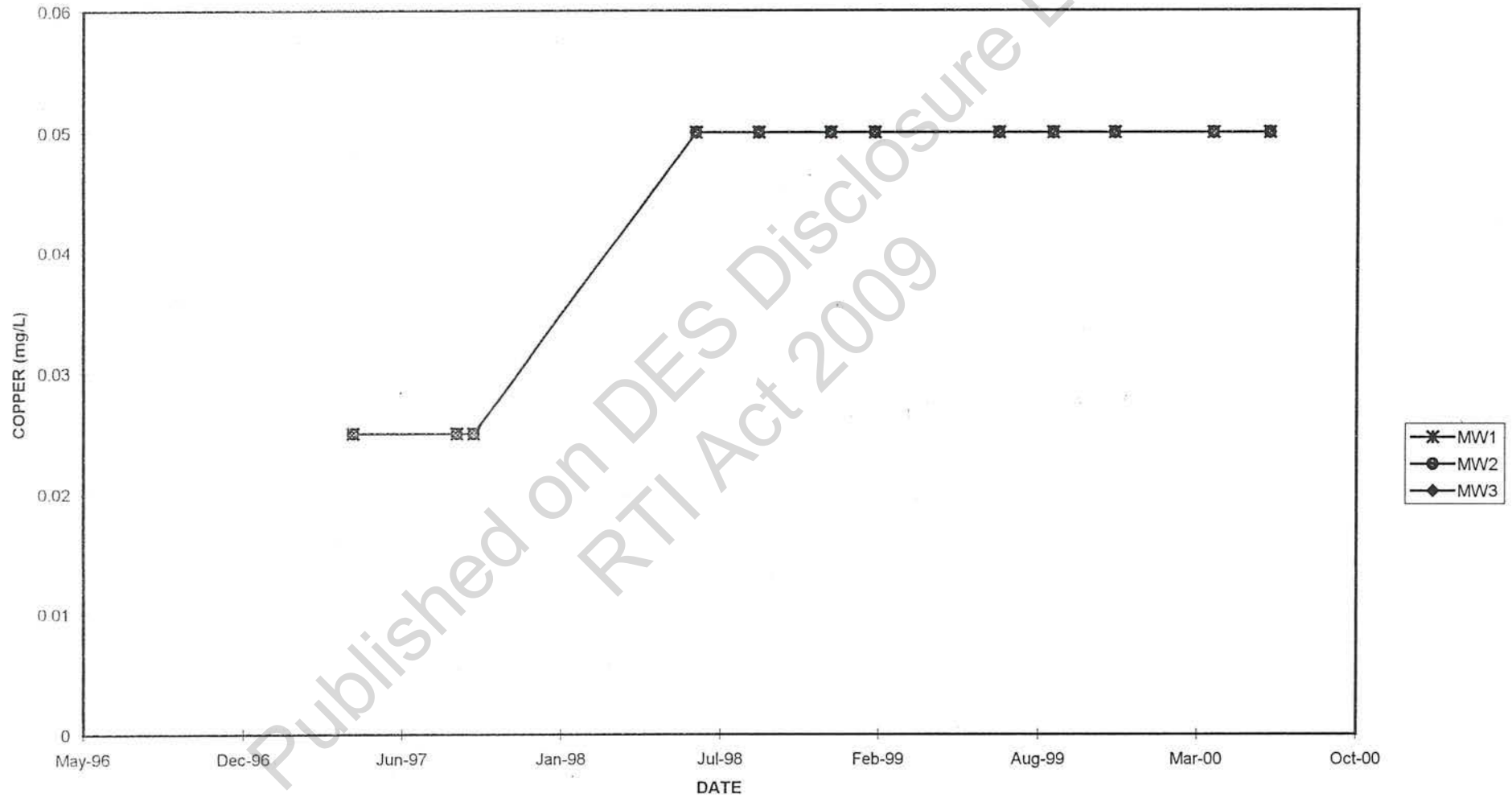


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DATE: 14.11.00

MEDALFIELD LANDFILL GROUNDWATER COPPER CONCENTRATIONS

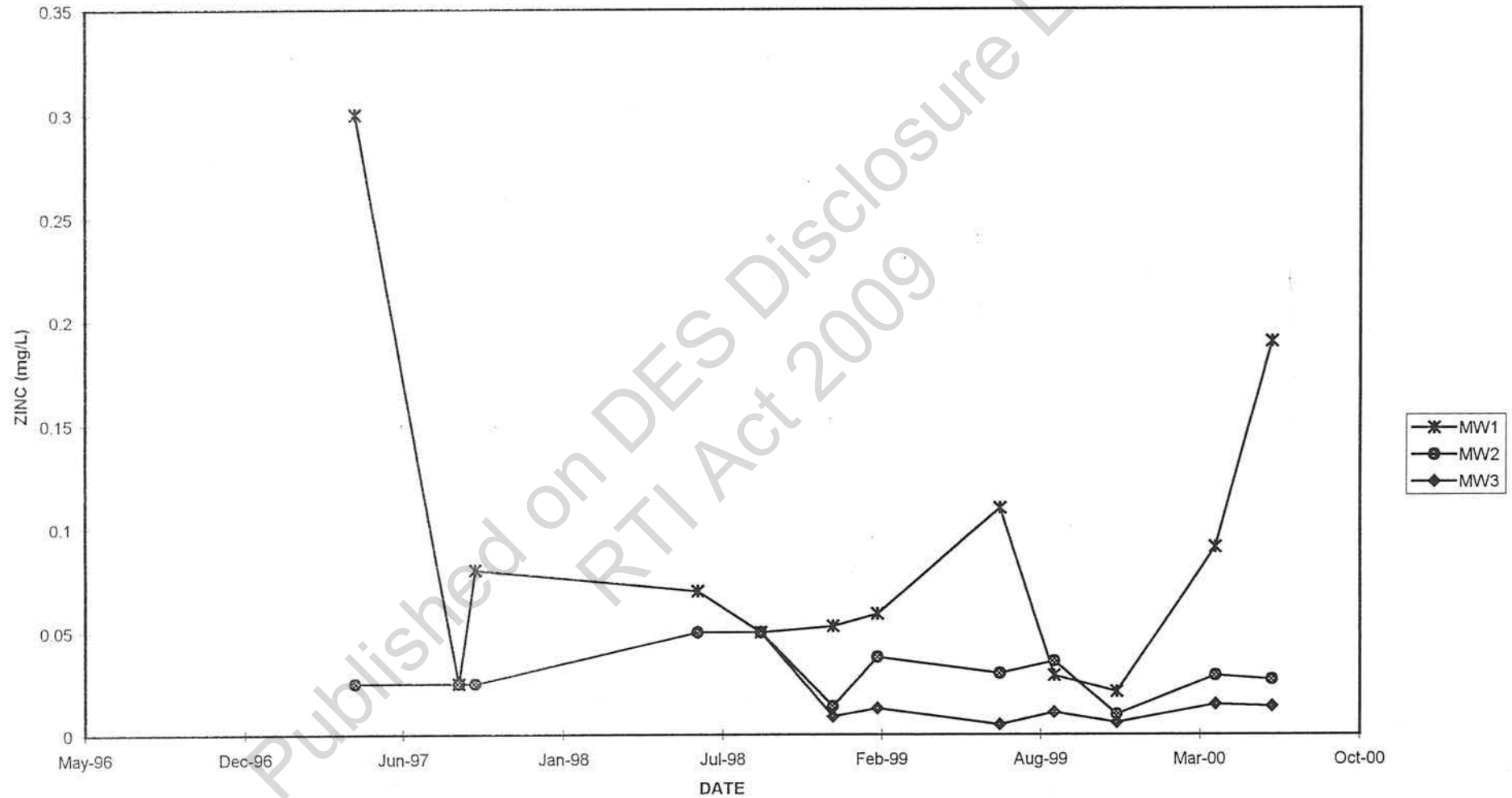


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18-541

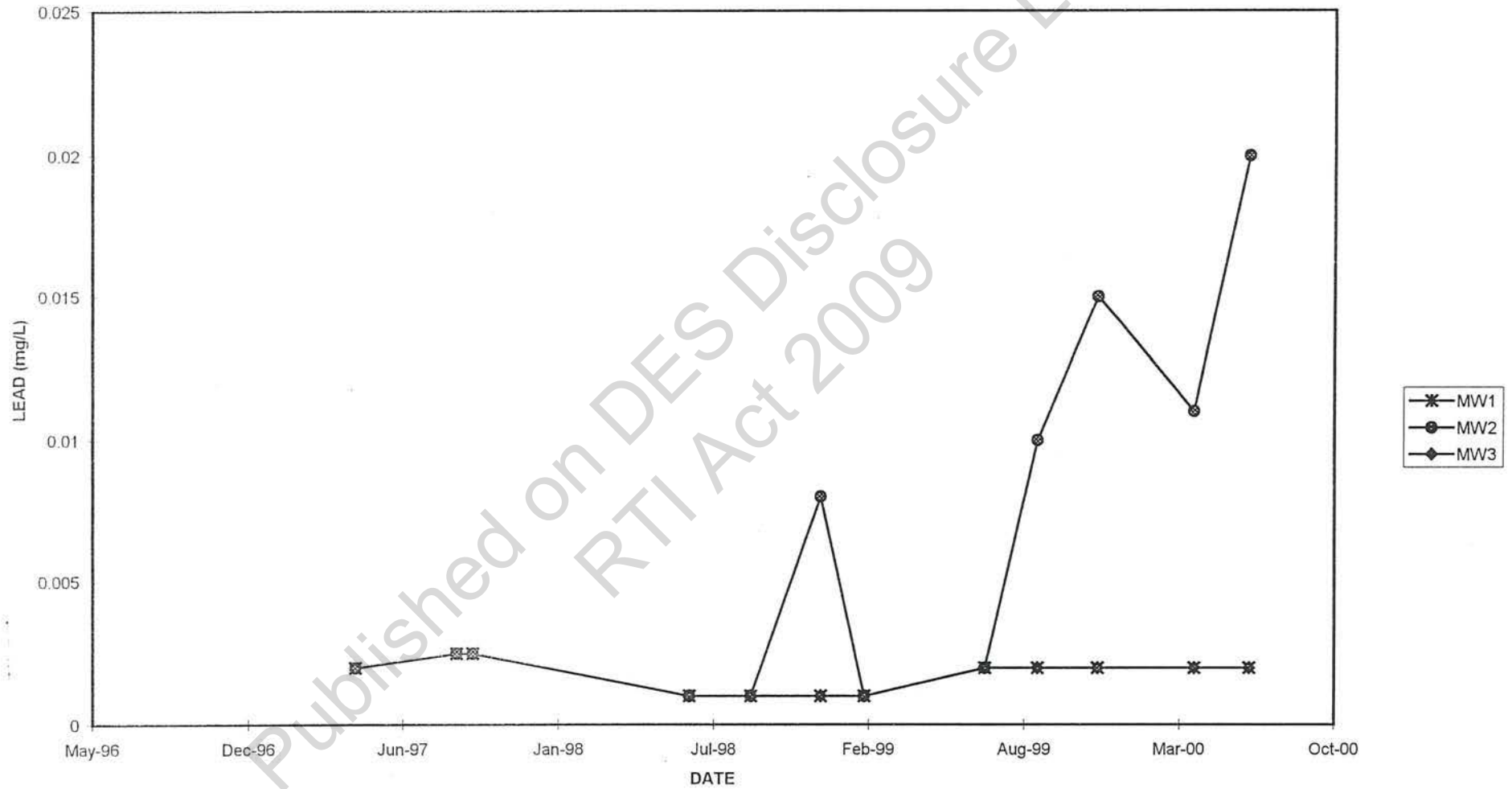
File A

MEDALFIELD LANDFILL GROUNDWATER ZINC LEVELS



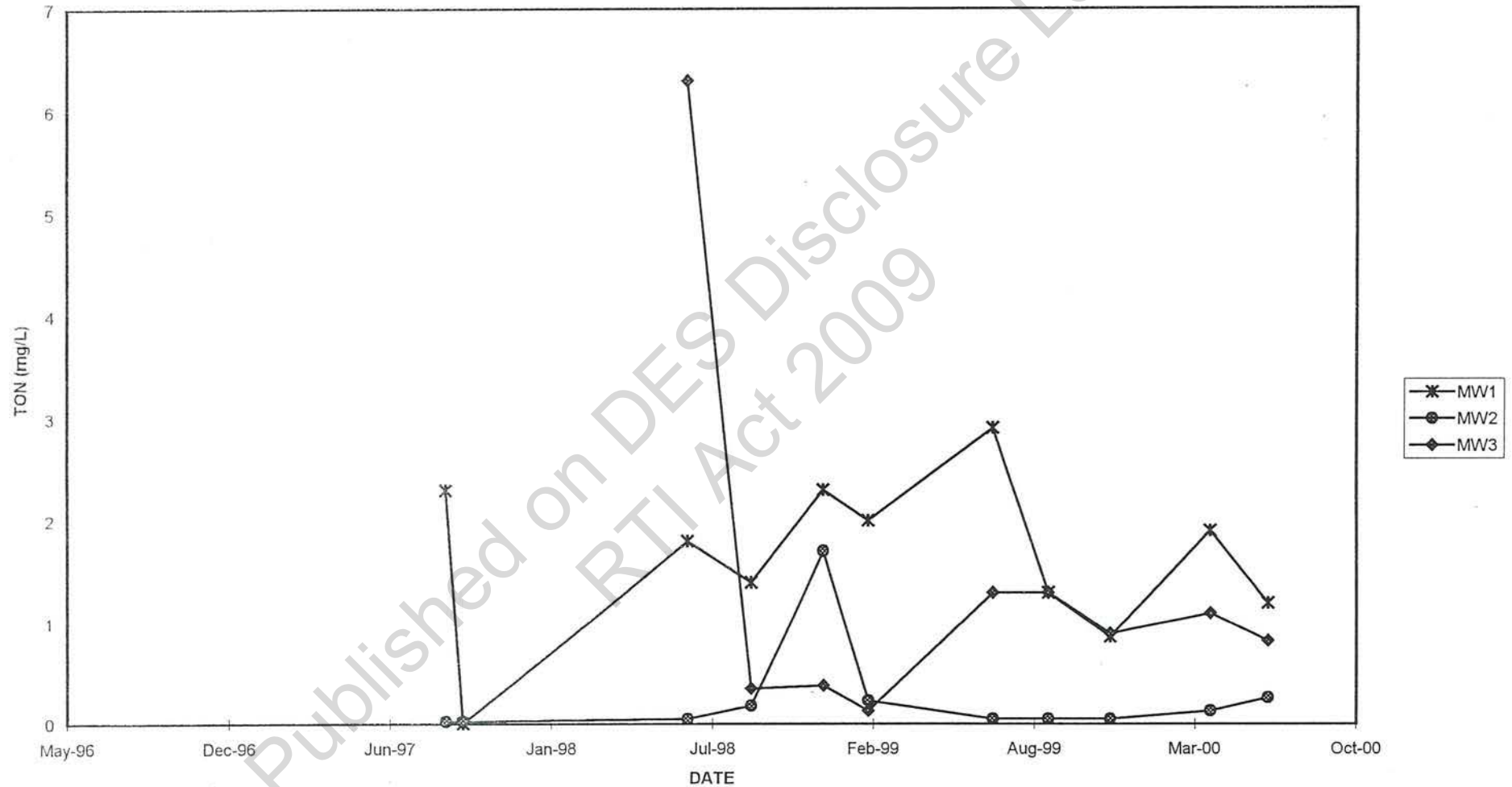
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DATE 14.11.00
18-541

MEDALFIELD LANDFILL GROUNDWATER LEAD LEVELS



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DATE: 14/11/2000
CHECKED BY: sch4p4(6)
DATE: 14/11/00

MEDALFIELD LANDFILL GROUNDWATER TOTAL OXIDISED NITROGEN LEVELS



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DATE: 14.11.00
18-541

Appendix C

“Important Information About Your Environmental Site Assessment”

Golder Associates

Important Information About Your

Environmental Site Assessment

These notes have been prepared by Golder Associates Pty Ltd using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences, of which Golder Associates Pty Ltd is a member. They are offered to help you in the interpretation of your Environmental Site Assessment (ESA) report.

Reasons For Conducting An ESA

ESA's are typically, though not exclusively carried out in the following circumstances :

- as pre-acquisition assessments, on behalf of either purchaser or vendor, when a property is to be sold;
- as pre-development assessments, when a property or area of land is to be redeveloped or have its use changed, for example, from a factory to a residential subdivision;
- as pre-development assessments of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrogeological constraints to the development of, for example, a landfill; and
- as audits of the environmental effects of an ongoing operation.

Each of these circumstances requires a specific approach to the assessment of soil and groundwater contamination. In all cases, however, the objective is to identify and if possible quantify the risks which unrecognised contamination poses to the proposed activity. Such risks may be both financial, for example, clean-up costs or limitations on site use, and physical, for example, health risks to site users or the public.

The Limitations of An ESA

Although the information provided by an ESA can reduce exposure to such risks, no ESA, however diligently carried out, can eliminate them. Even a rigorous professional assessment may fail to detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled.

An ESA Report Is Based On A Unique Set of Project Specific Factors

Your environmental report should not be used :

- When the nature of the proposed development is changed, for example, if a residential development is proposed instead of a commercial one;

- When the size or configuration of the proposed development is altered;
- when the location or orientation of the proposed structure is modified;
- When there is a change of ownership; or
- For the application to an adjacent site.

To help avoid costly problems, refer to your consultant to determine how any factors which have changed subsequent to the date of the report may affect its recommendations.

ESA "Findings" Are Professional Estimates

Site assessment identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise its impact. For this reason, owners should retain the services of their consultants through the development stage, to identify variations, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Subsurface Conditions Can Change

Subsurface conditions are changed by natural processes and the activity of man. Because an ESA report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on an ESA report whose adequacy may have been affected by time. Speak with the consultant to learn if additional tests are advisable.



Annual Monitoring Report
For
Environmental Authority
5010000159

Reporting period:
25 June 2001 to 24 June 2002



Cairns Water

⁵ Median must be based on results of at least five samples with individual samples. For the monitoring report the median is calculated on the basis of 12 months consecutive results.

*High maximum result due to repair on oxidation ditch No. 2. All effluent was directed to the smaller (No. 1) ditch during repair, effectively reducing capacity of system to oxidise the ammonia.

Sludge Monitoring Results

Date	Aluminium (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
9/07/2001	3100	4	240	350
6/08/2001	2800	3	270	450
3/09/2001	3200	3	260	410
1/10/2001	4300	4	300	510
29/10/2001	5700	4	400	750
26/11/2001	5600	5	360	480
17/12/2001	8700	4	340	310
2/01/2002	6000	2	350	420
18/02/2002	7300	5	380	660
18/03/2002	5300	4	330	570
15/04/2002	7300	4	320	530
13/05/2002	4700	10	280	520
11/06/2002	4200	4	330	510

All sludge samples analysed for total organochlorine pesticides showed levels below detection limits.

2.2 Northern Water Pollution Control Plant

2.2.1 Quantity characteristics

Quantity characteristic	Maximum Release Limit (m ³ /day)	Maximum Actual Discharge (m ³ /day)	Date
Dry Weather Flow	26,000	15,670	16 August 2001
Wet Weather Flow- Prior to 14 Nov. 2001	39,000	14,940	18 September 2001
Wet Weather Flow- After 14 Nov. 2001	130,000	19,659	20 February 2002

2.2.2 Quality characteristics

Quality Characteristic	Release Limit	Actual Discharge	Limit Type
BOD ₅ (mg/L)	20	16.722	80 th percentile (long term) ¹
	25	34.0*	80 th percentile (short term) ²
	60	38.0	Maximum
Suspended Solids (mg/L)	30	14.798	80 th percentile (long term)
	60	21.8	80 th percentile (short term)
	90	25.0	Maximum
pH (pH units)	6.5 – 8.5	7.1 – 7.8	Range
Dissolved Oxygen (mg/L)	2	4.8	Minimum
Free residual Chlorine (mg/L)	0.7	1.80*	Maximum
Ammonia (N) (mg/L)	15	6.94	80 th percentile (short term)
	20	12	Maximum
Oil and Grease	10	2.4	80 th percentile ⁴
Faecal Coliforms (CFU/100ml)	10000	100	Median ⁵
	40000	121600*	80 th percentile (short term)

Notes:

¹ The 80th percentile (long term) is calculated on the basis of a log normal distribution, using 12 months consecutive results for the characteristic in question.

² The 80th percentile (short term) is calculated based on a normal distribution, using consecutive results from the regular weekly monitoring program. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

³ 50th percentile means that the measured values of the quality characteristic must not be greater than the stated release limit for any more than three out of six consecutive samples. For the monitoring report, the 50th percentile is calculated based on a normal distribution. The value reported is the maximum value for the 50th percentile for any 6 consecutive results for the year.

⁴ The 80th percentile means that the quality characteristic measured must not be greater than the stated release limit for any more than one out of five consecutive samples. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

⁵ Median must be based on results of at least five samples with individual samples. For the monitoring report the median is calculated on the basis of 12 months consecutive results

*Exceedances were noted for BOD₅ (short term percentile), Free Chlorine Residual (Maximum), and Faecal Coliforms (short term Percentile). Refer correspondence dated 15 November and reported non-compliances (above), for October/November 2001.

2.2.3 Sludge Monitoring Results

Date	Aluminium (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
9/07/2001	10000	4	450	470
6/08/2001	7300	3	480	620
3/09/2001	9700	4	390	460
1/10/2001	8800	4	440	490
29/10/2001	12000	4	490	630
26/11/2001	17000	10	510	520
17/12/2001	17000	3	530	610
2/01/2002	16000	3	560	470
18/02/2002	13000	4	530	780
18/03/2002	13000	4	540	700
15/04/2002	12000	4	560	640
13/05/2002	5100	9	520	670
11/06/2002	8900	5	470	520

All sludge samples analysed for total organochlorine pesticides showed levels below detection limits.

2.3 Southern Water Pollution Control Plant

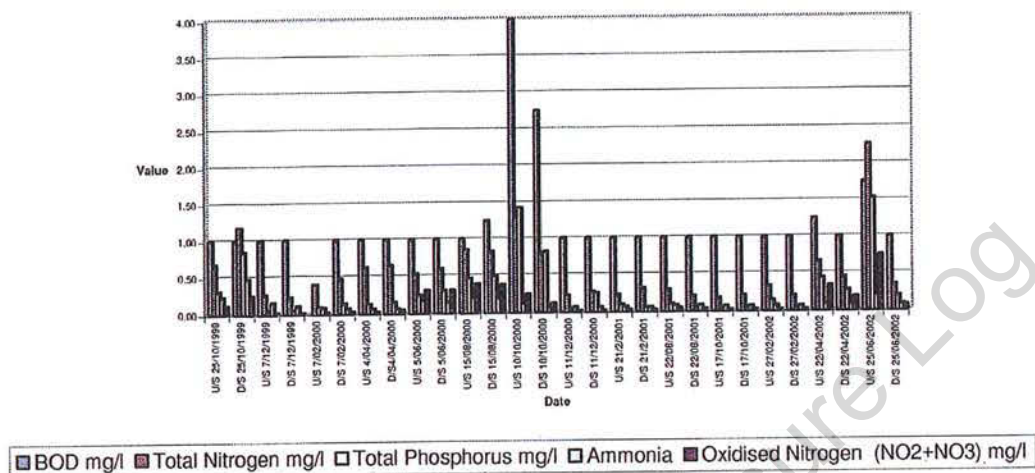
2.3.1 Quantity characteristics

Quantity characteristic	Maximum Release Limit (m ³ /day)	Maximum Actual Discharge (m ³ /day)	Date
Dry Weather Flow	32,000	15,781	29 April 2002
Wet Weather Flow- Prior to 14 November 2001	48,000	15,107	22 October 2001
Wet Weather Flow- After to 14 November 2001	140,000	17,410	20 February 2002
Total effluent supplied for re-use		48.0	Period 26/06/01 to 1/7/2002

2.3.2 Quality characteristics

Quality Characteristic	Release Limit	Actual Discharge	Limit Type
BOD ₅ (mg/L)	20	16.156	80 th percentile (long term) ¹
	25	37.0	80 th percentile (short term) ²
	60	89*	Maximum
Suspended Solids (mg/L)	30	15.980	80 th percentile (long term)
	60	27.0	80 th percentile (short term)
	90	79	Maximum
pH (pH units)	6.5 – 8.5	7.2 – 7.8	Range
Dissolved Oxygen (mg/L)	2	1.4*	Minimum
Ammonia (N) (mg/L)	15	17.2*	80 th percentile (short term)
	20	18	Maximum
Oil and Grease	10	2.0	80 th percentile ⁴

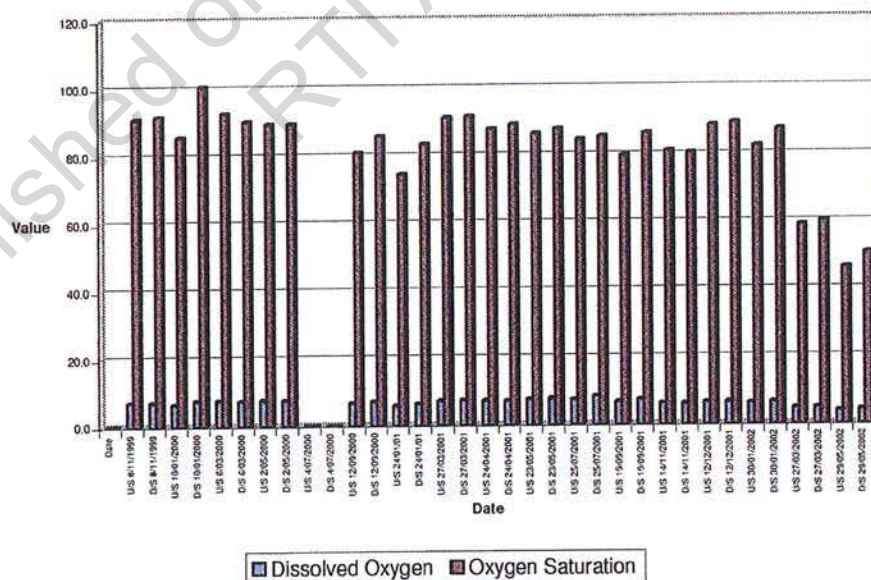
Marlin Coast Nutrient Comparison Upstream and Downstream of Discharge



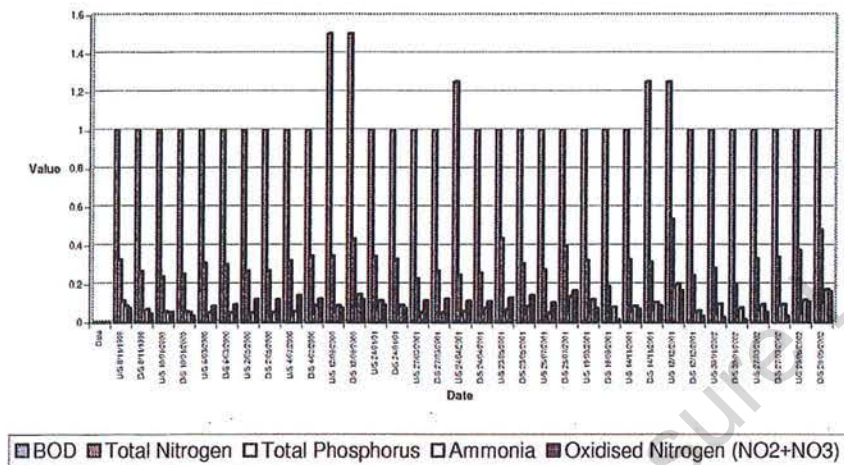
3.1.2 Results Barron River

The following table summarises the results for the first 32 months of the program.

Barron River Oxygen Comparison Upstream and Downstream of Discharge



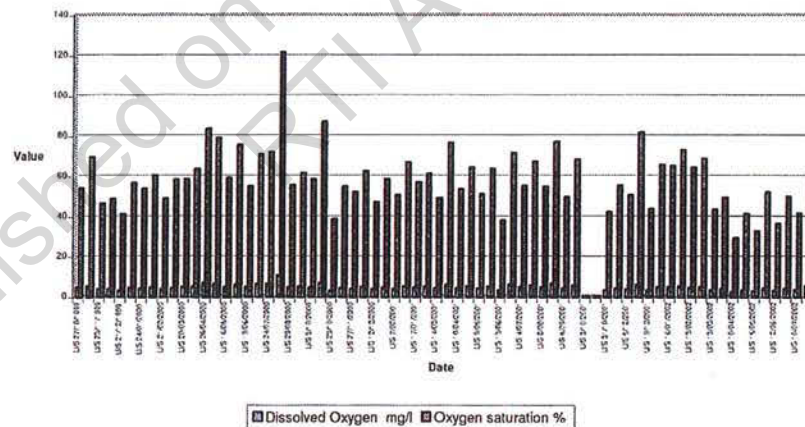
Barron River Nutrient Comparison Upstream and Downstream of Discharge



3.1.3 Results Trinity Inlet

The following table summarises the results for the first 32 months of the program.

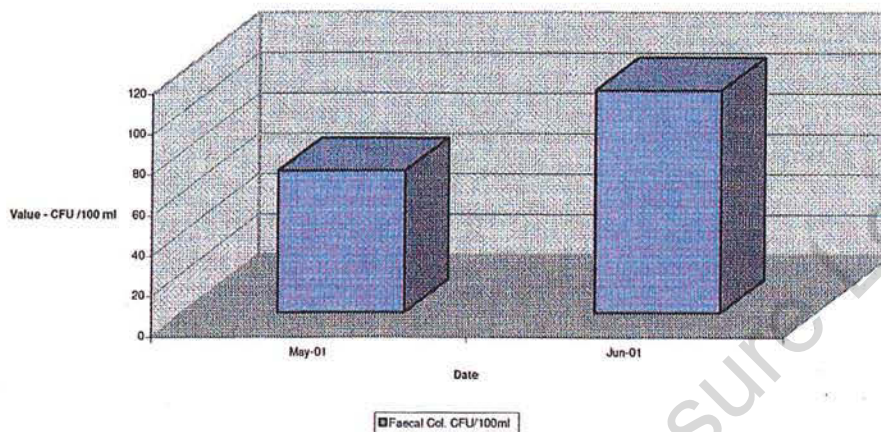
Trinity Inlet Dissolved Oxygen Comparison Upstream and Downstream of Discharges



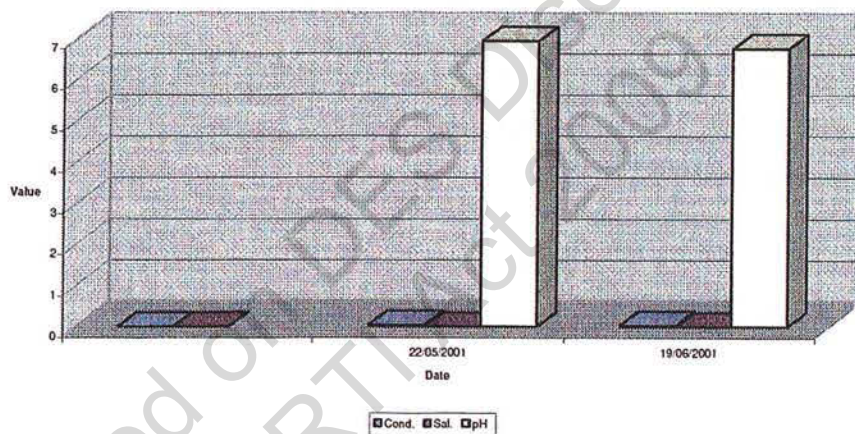
4.1.2 Northern

4.1.2.1 Northern Site 1

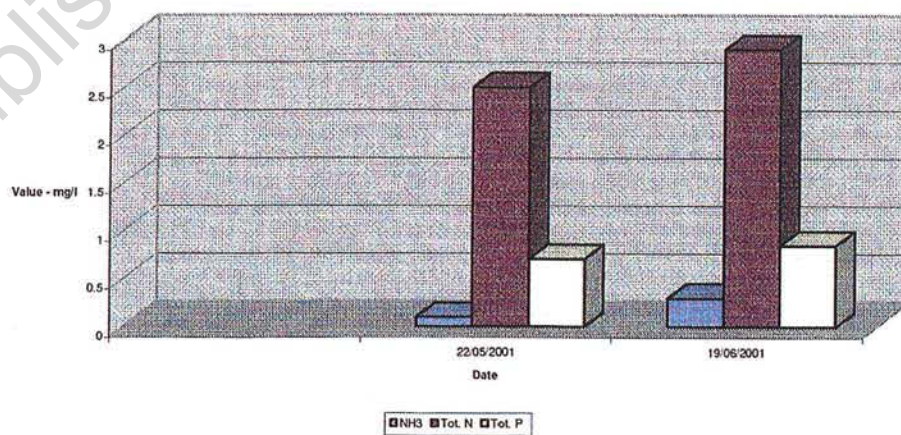
Northern Site 1 - Faecal Coliform bacteria



Northern Site 1 - Conductivity, Salinity & pH



Northern Site 1 - Nutrient



A-2 Northern Sewage Treatment Plant

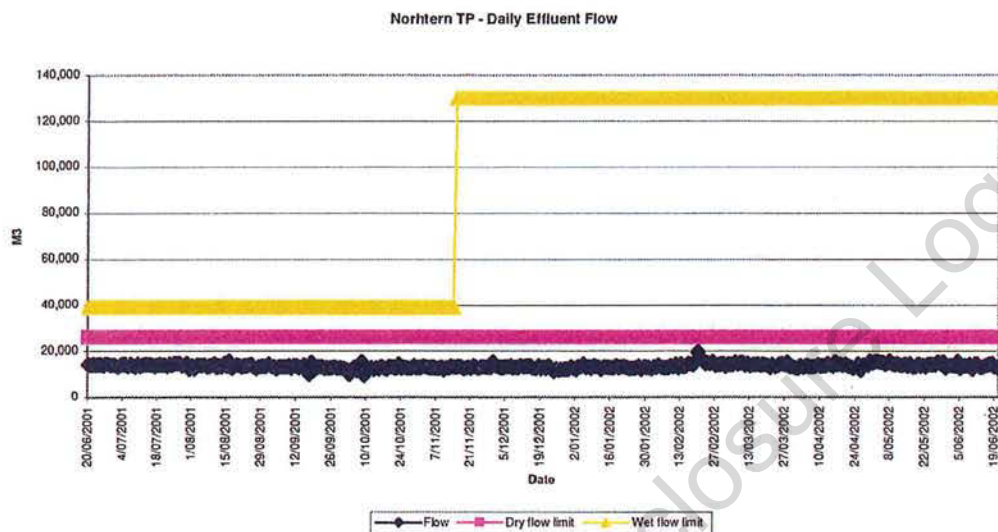


Figure A-2.1 Daily effluent Flow for reporting period

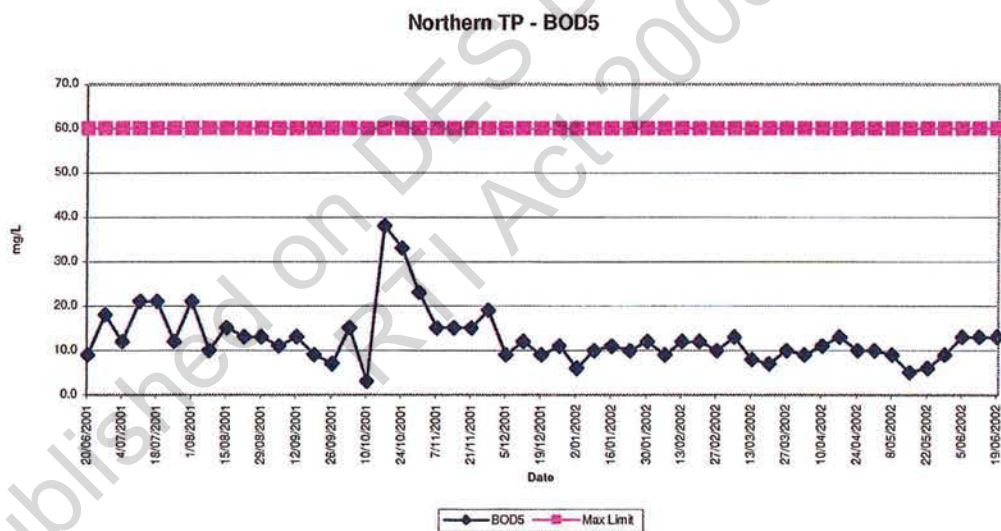


Figure A-2.2 BOD₅ concentration for reporting period

Northern TP - Dissolved Oxygen

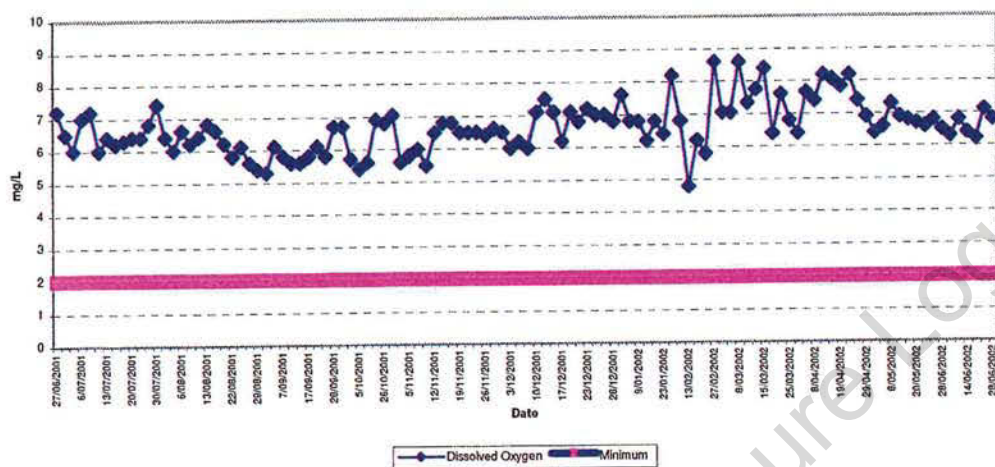


Figure A-2.5 Dissolved Oxygen Concentration for reporting period

Northern STP - Nutrients

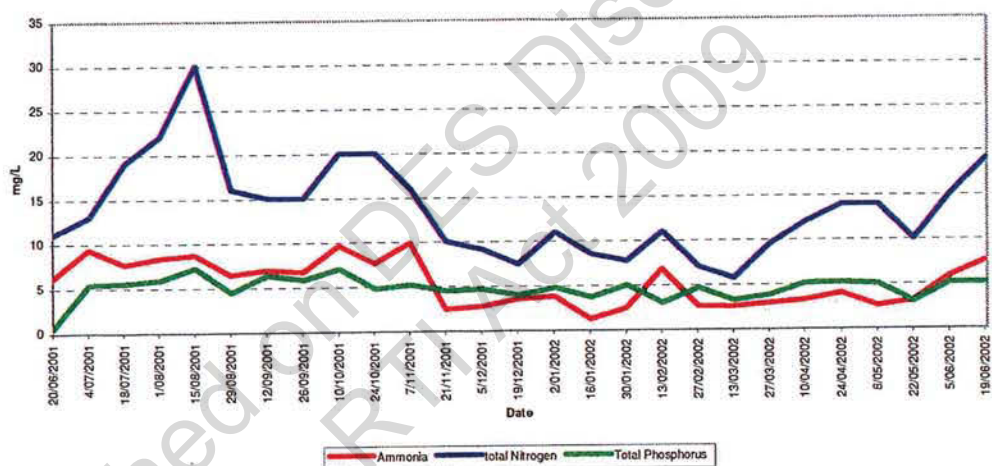


Figure A-2.6 Nutrient concentration for reporting period

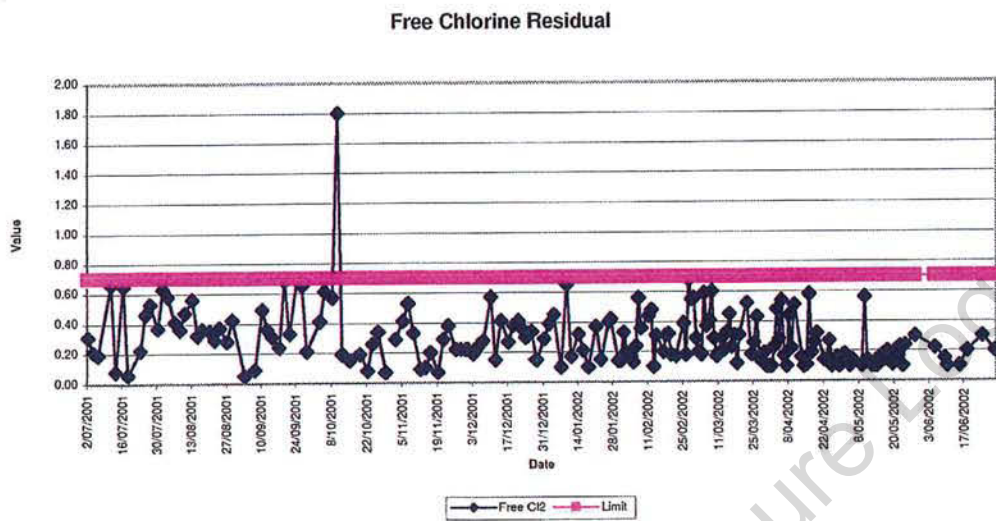
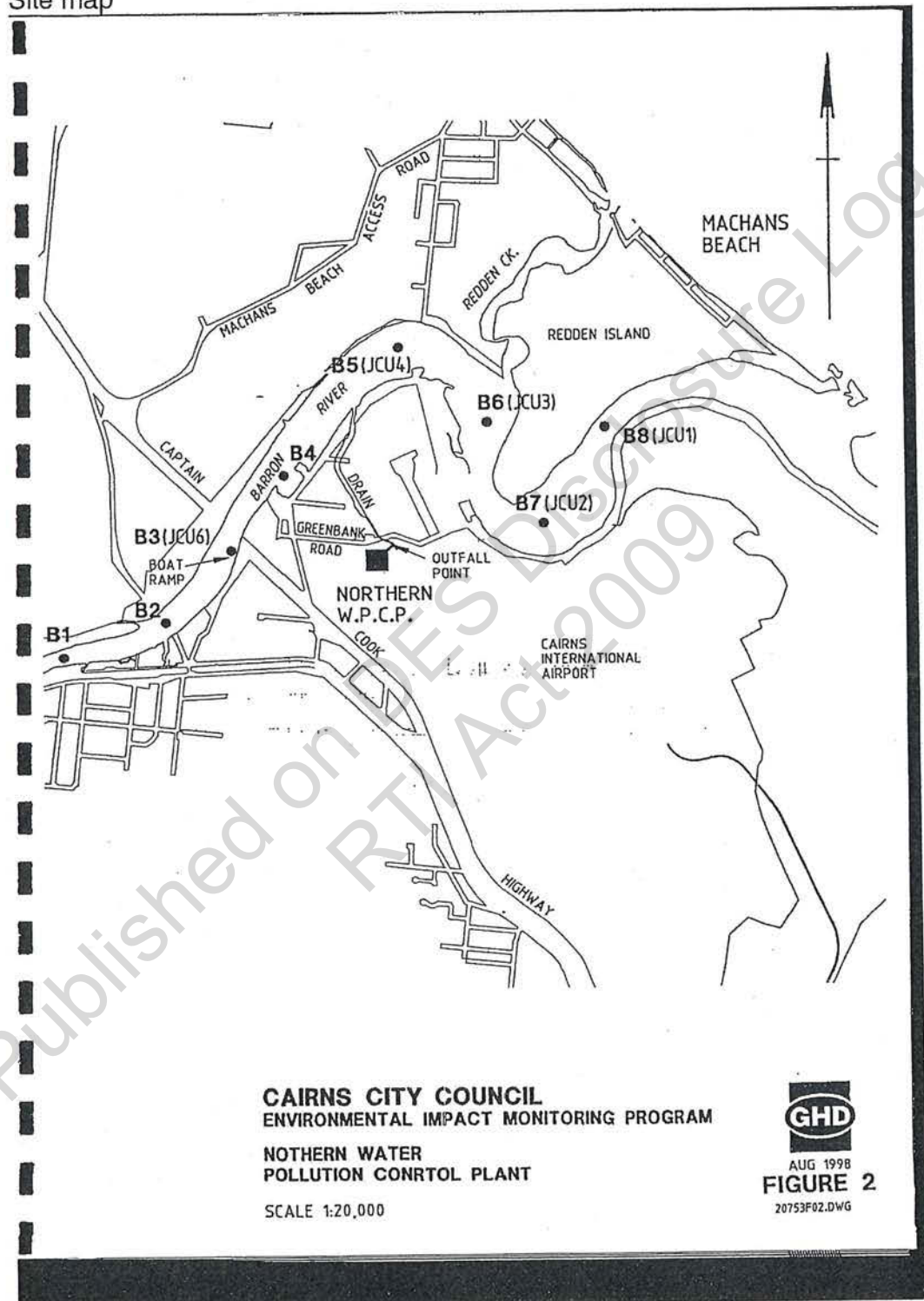


Figure A-2.9 Free Chlorine Residual for reporting period

* Free chlorine residual of 1.8 on 10 October 2001 coincides with an exceedance of faecal coliform bacteria. This would not be expected to occur. The evidence would suggest that the free chlorine residual analysis was incorrect.

B-2 Northern STP Receiving Waters - Baron River (BR1 to BR8)

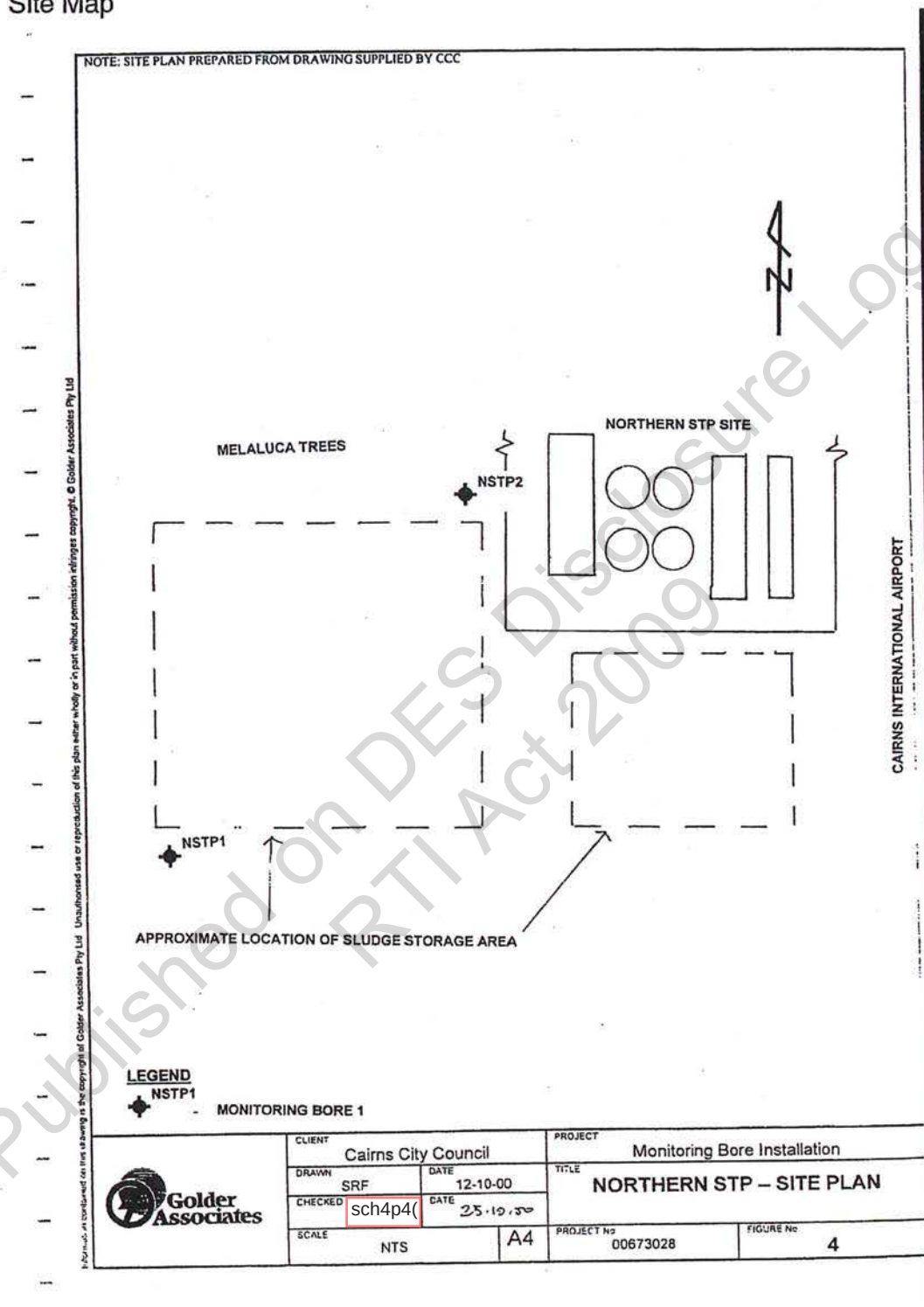
Site map



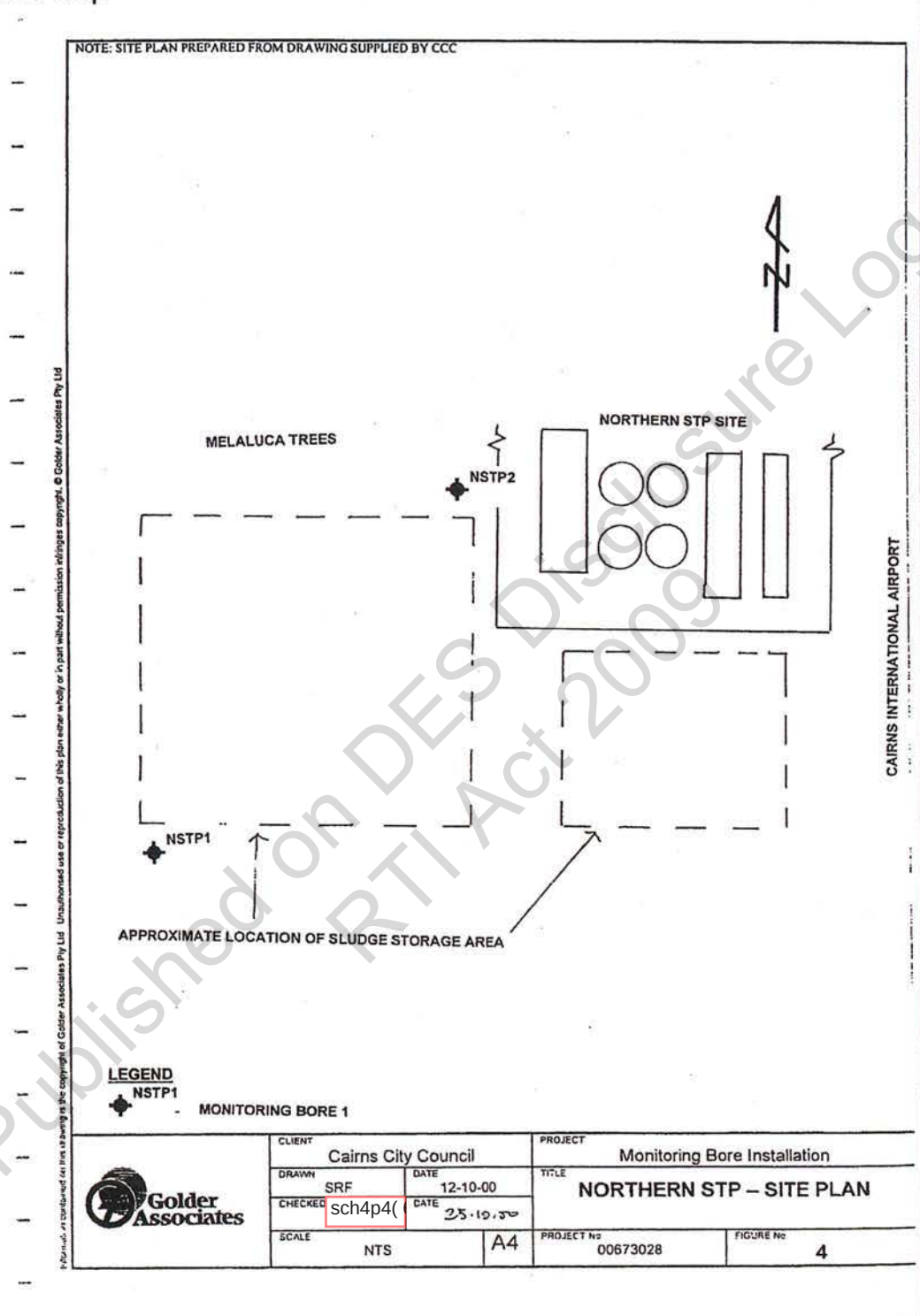
BR1	29/05/2002	9:15	3.7	45	29.6	20.6	6.3	25.9
BR2	29/05/2002	9:35	3.7	46	32.4	20.5	6.9	26.1
BR3	29/05/2002	9:50	3.9	47	27.5	17.3	7.0	26.1
BR4	29/05/2002	10:15	3.7	47	27.5	18.2	7.2	26.1
BR5	29/05/2002	10:35	4.1	49	27.2	16.7	7.2	25.5
BR6	29/05/2002	10:50	4.1	50	40.6	25.2	7.4	26.0
BR7	29/05/2002	11:15	4.1	50	42.7	27.5	7.6	26.1
BR8	29/05/2002	11:35	4.4	53	42.4	27.2	7.7	26.1

Site ID	Date	Time Sampled	Faecal Coliforms > CFU/100ml	BOD < mg/l	Total Nitrogen mg/l	Total Phosphorus mg/l	Ammonia mg/l	Oxidised Nitrogen (NO2+NO3)mg/l
BR1	25/07/2001	9:40	42.0<	1.0	0.3<	0.02<	0.05	0.098
BR2	25/07/2001	9:55	30.0<	1.0	0.25<	0.02<	0.05	0.098
BR3	25/07/2001	10:10	26.0<	1.0	0.25<	0.02<	0.05	0.1
BR4	25/07/2001	10:30	28.0<	1.0	0.29<	0.02<	0.05	0.11
BR5	25/07/2001	10:45	29.0<	1.0	0.39	0.04	0.094	0.16
BR6	25/07/2001	11:00	31.0<	1.0	0.4	0.08	0.13	0.16
BR7	25/07/2001	11:20	19.0<	1.0	0.4	0.07	0.15	0.17
BR8	25/07/2001	11:45	7.0<	1.0	0.39	0.04	0.17	0.16
BR1	19/09/2001	9:10	18.0	1.0	0.36	0.03	0.12	0.093
BR2	19/09/2001	9:35	14.0<	1.0	0.37	0.05	0.14	0.09
BR3	19/09/2001	9:55	25.0<	1.0	0.34	0.05	0.14	0.077
BR4	19/09/2001	10:10	7.0<	1.0	0.21<	0.02	0.077	0.02
BR5	19/09/2001	10:30	7.0<	1.0	0.21<	0.02	0.084	0.017
BR6	19/09/2001	10:45	6.0<	1.0	0.18<	0.02	0.088	0.011
BR7	19/09/2001	11:00	4.0<	1.0	0.18<	0.02	0.076<	0.01
BR8	19/09/2001	11:25	6.0<	1.0	0.18<	0.02	0.068	0.011
BR1	14/11/2001	9:50	15.0<	1.0	0.34	0.06	0.081	0.067
BR2	14/11/2001	10:15	13.0	1.0	0.33	0.05	0.07	0.066
BR3	14/11/2001	10:30	8.0	1.0	0.29	0.05	0.086	0.067
BR4	14/11/2001	10:45	12.0<	1.0	0.34	0.06	0.091	0.067
BR5	14/11/2001	11:00	15.0<	1.0	0.32	0.07	0.11	0.1
BR6	14/11/2001	11:15	18.0	2.0	0.32	0.06	0.11	0.096
BR7	14/11/2001	11:30	15.0<	1.0	0.31	0.06	0.096	0.079
BR8	14/11/2001	11:45	20.0<	1.0	0.3	0.06	0.093	0.075
BR1	12/12/2001	9:30	24.0	2.0	0.29	0.05<	0.05	0.042
BR2	12/12/2001	9:45	32.0<	1.0	0.29	0.06<	0.05	0.028
BR3	12/12/2001	9:55	25.0	1.0	0.28	0.05	0.075	0.043
BR4	12/12/2001	10:15>	8000.0	1.0	1.28	0.57	0.62	0.54
BR5	12/12/2001	10:30	17.0<	1.0	0.26	0.06	0.07	0.039
BR6	12/12/2001	10:48	9.0<	1.0	0.25	0.05	0.06	0.033
BR7	12/12/2001	11:10	90.0<	1.0	0.24	0.05	0.053	0.032
BR8	12/12/2001	11:35	23.0<	1.0	0.22	0.04<	0.05	0.018
BR1	30/01/2002	10:55	18.0<	1.0	0.33	0.06	0.11	0.039
BR2	30/01/2002	11:10	9.0<	1.0	0.32	0.06	0.093	0.028
BR3	30/01/2002	11:25	24.0<	1.0	0.26	0.04	0.087	0.02
BR4	30/01/2002	10:40	4.0<	1.0	0.2	0.02	0.092<	0.01
BR5	30/01/2002	10:25	9.0<	1.0	0.19	0.02	0.074<	0.01
BR6	30/01/2002	10:15	3.0<	1.0	0.17<	0.02	0.076<	0.01
BR7	30/01/2002	9:50	5.0<	1.0	0.24	0.03	0.075<	0.01
BR8	30/01/2002	9:30	5.0<	1.0	0.18<	0.02	0.08<	0.01
BR1	27/03/2002	9:40	6.0	1.0	0.34	0.07	0.098	0.066

C-2 Northern STP Groundwaters – NSTP1 to NSTP2 Site Map



C-2 Northern STP Groundwaters – NSTP1 to NSTP2 Site Map





**Annual Monitoring Report
For
Environmental Authority
5010000159**

**Reporting period:
25 June 2002 to 24 June 2003**



Cairns Water

2.2 Northern Water Pollution Control Plant

2.2.1 Quantity characteristics

Quantity characteristic	Maximum Release Limit (m ³ /day)	Maximum Actual Discharge (m ³ /day)	Date
Dry Weather Flow	26,000	18,004	27 April 2003
Wet Weather Flow	130,000	23,668	13 March 2003

2.2.2 Quality characteristics

Quality Characteristic	Release Limit	Actual Discharge	Limit Type
BOD ₅ (mg/L)	20	17.82	80 th percentile (long term) ¹
	25	22.4	80 th percentile (short term) ²
	60	36.0	Maximum
Suspended Solids (mg/L)	30	14.41	80 th percentile (long term)
	60	20.0	80 th percentile (short term)
	90	20.0	Maximum
pH (pH units)	6.5 – 8.5	7.2 – 7.9	Range
Dissolved Oxygen (mg/L)	2	6.1	Minimum
Free residual Chlorine (mg/L)	0.7	0.66	Maximum
Ammonia (N) (mg/L)	15	7.98	80 th percentile (short term)
	20	12	Maximum
Oil and Grease	10	2.0	80 th percentile ⁴
Faecal Coliforms (CFU/100ml)	10000	80000*	Median ⁵
	40000	80400*	80 th percentile (short term)

Notes:

¹ The 80th percentile (long term) is calculated on the basis of a log normal distribution, using 12 months consecutive results for the characteristic in question.

² The 80th percentile (short term) is calculated based on a normal distribution, using consecutive results from the regular weekly monitoring program. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

³ 50th percentile means that the measured values of the quality characteristic must not be greater than the stated release limit for any more than three out of six consecutive samples. For the monitoring report, the 50th percentile is calculated based on a normal distribution. The value reported is the maximum value for the 50th percentile for any 6 consecutive results for the year.

⁴ The 80th percentile means that the quality characteristic measured must not be greater than the stated release limit for any more than one out of five consecutive samples. The value reported is the maximum value for the 80th percentile for any 5 consecutive results for the year.

⁵ Median must be based on results of at least five samples with individual samples. For the monitoring report the median is calculated on the basis of 12 months consecutive results

*Exceedance was noted for Faecal Coliform (short term percentile and Median). Problems associated with the chlorine delivery system were highlighted in several reports to EPA throughout the year.

2.2.3 Bio-Solids Monitoring Results

Date	Aluminium (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
8/07/2002	11000	8	480	130
5/08/2002	24000	4	260	460
2/09/2002	11000	5	450	480
7/10/2002	17000	4	490	440
28/10/2002	8000	2	450	480
25/11/2002	16000	4	530	570
16/12/2002	15000	3	590	690
20/01/2003	10000	4	550	680
17/02/2003	13000	5	470	650
17/03/2003	9000	3	620	660
14/04/2003	12000	1	530	670
12/05/2003	9300	1	530	660
10/06/2003	6300	2	510	640

All sludge samples analysed for total organochlorine pesticides showed levels below detection limits.

3 Environmental Impact Monitoring Program for Receiving Waters

3.1 Water quality Monitoring Program for Receiving Waters

The current water quality monitoring of receiving waters is summarised in the following table:

STP	Receiving water	Frequency	Number of sampling sites	Analytes
Marlin Coast STP	Avondale Creek (AV) on River (M)	Every two months	8 sites Unimpacted sites: AV1 to AV4 Impacted sites : AV5, M1 M2 M3	Total Nitrogen, Total Oxidised Nitrogen, Ammonia, Total Phosphorus, Biological Oxygen Demand (BOD), Faecal Coliform In situ measurements: pH, Oxygen (% and mg/l), Conductivity, salinity, Temperature
Northern STP	Barron River (BR)	Every two months	8 sites Unimpacted sites: BR1 to BR 4 Impacted sites : BR5 to BR8	Total Nitrogen, Total Oxidised Nitrogen, Ammonia, Total Phosphorus, Biological Oxygen Demand (BOD), Faecal Coliform In situ measurements: pH, Oxygen (% and mg/l), Conductivity, salinity, Temperature
Southern STP & Edmonton STP	Trinity Inlet: Smith Creek (SMT) Skeleton Creek (SKC) Chinaman Creek (CNC)	Every month	8 sites SKC1.6, SKC3.4 SMT9.5 , SMT11.3, SMT12.9, SMT14.6 CNC1.8, CNC3.2	Total Nitrogen, Total Oxidised Nitrogen, Ammonia, Total Phosphorus, Biological Oxygen Demand (BOD), Faecal Coliform In situ measurements: pH, Oxygen (% and mg/l), Conductivity, salinity, Temperature
Gordonvale STP	Mulgrave River	Quarterly	8 sites Unimpacted sites: MR1 to MR 4 Impacted sites : MR5 to MR8	Total Nitrogen, Total Oxidised Nitrogen, Ammonia, Total Phosphorus, Biological Oxygen Demand (BOD), Faecal Coliform In situ measurements: pH, Oxygen (% and mg/l), Conductivity, salinity, Temperature
Babinda STP	Babinda Creek	Quarterly	8 sites Unimpacted sites: BC1 to BC4 Impacted sites : BC5 to BC8	Total Nitrogen, Total Oxidised Nitrogen, Ammonia, Total Phosphorus, Biological Oxygen Demand (BOD), Faecal Coliform In situ measurements: pH, Oxygen (% and mg/l), Conductivity, salinity, Temperature

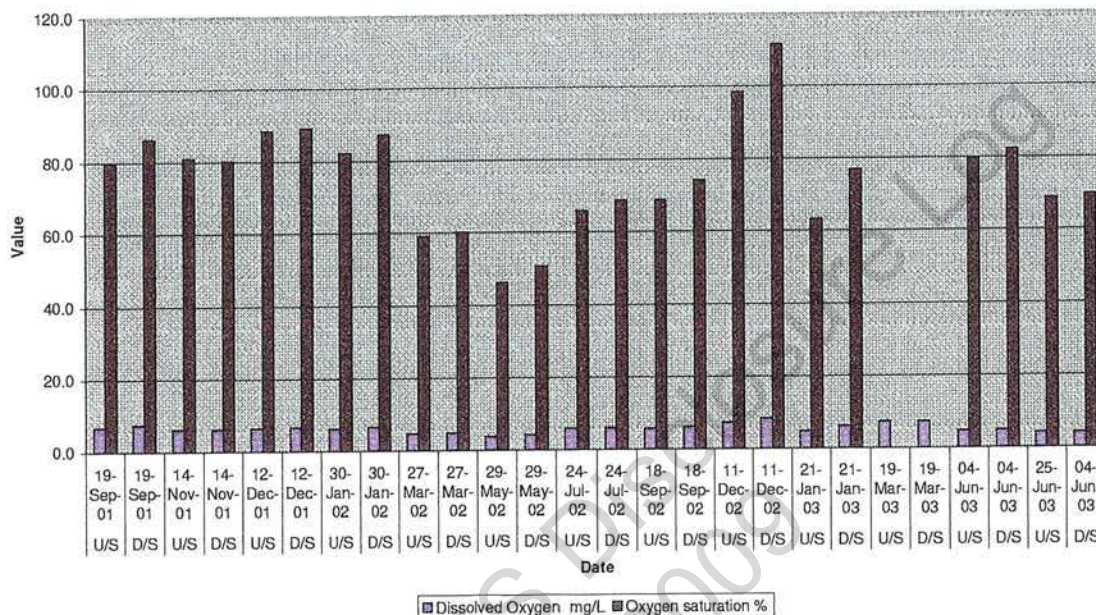
The program commenced in October 1999 and is conducted by trained staff members of the Cairns City Council.

Sampling Locations for this program are included in Appendix B.

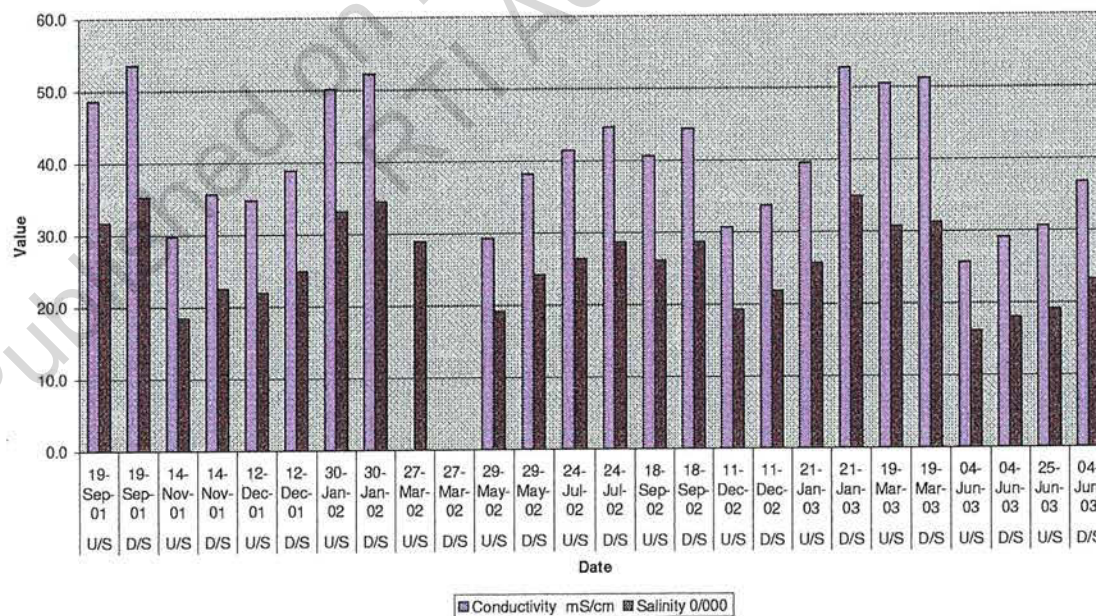
3.1.2 Results Barron River

The following graphs summarise the results for the last 20 months of the program.

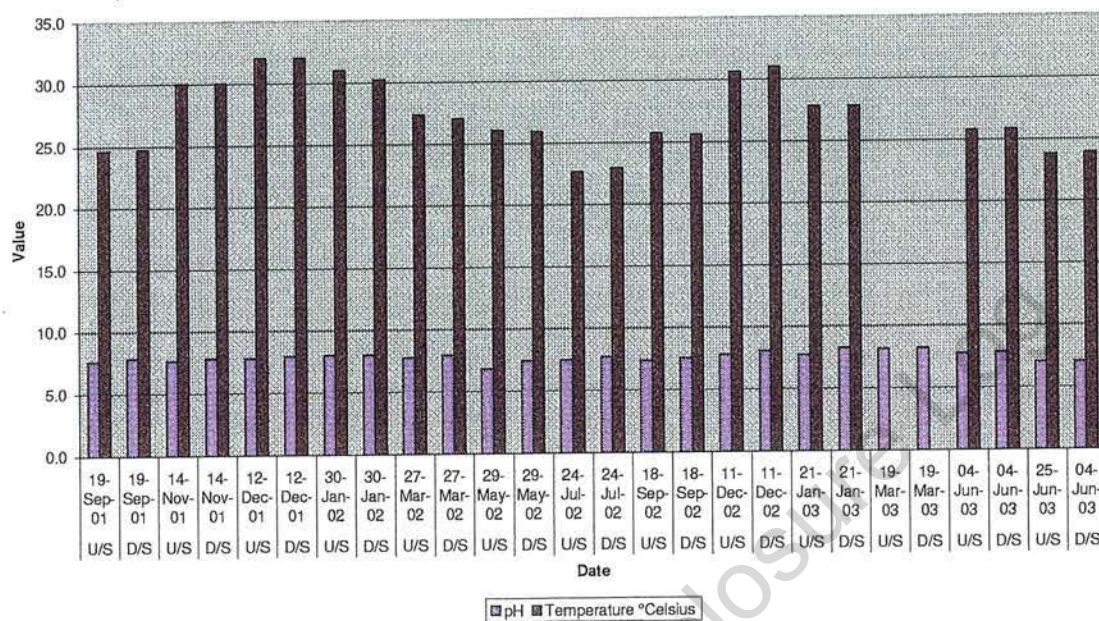
Barron River Oxygen Comparison Upstream and Downstream of Discharge



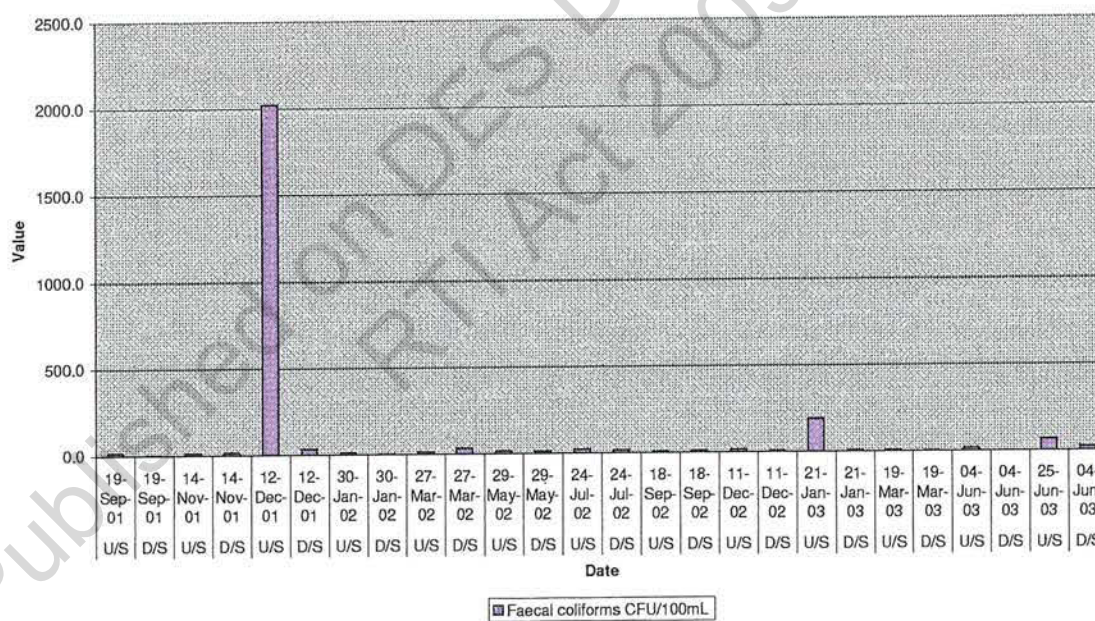
Barron River Conductivity and Salinity Comparison Upstream and Downstream of Discharge



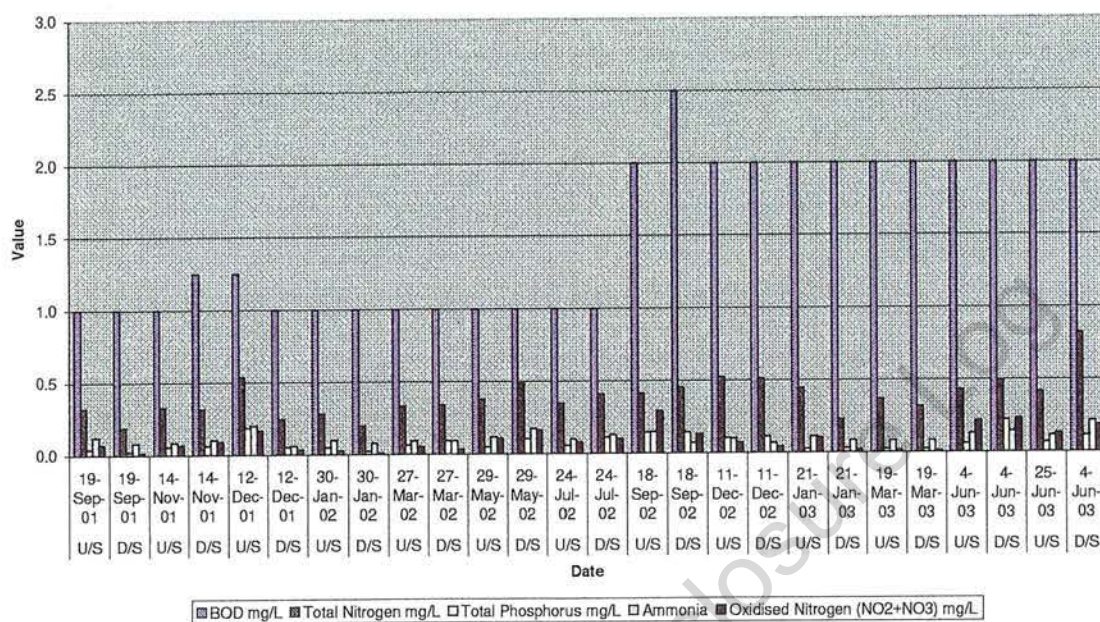
Barron River pH and Temperature Comparison Upstream and Downstream of Discharge



Barron River Faecal Coliform Levels Upstream and Downstream of Discharge



Barron River Nutrient Comparison Upstream and Downstream of Discharge



The following graphs summarise the results for the last 20 months of the program.

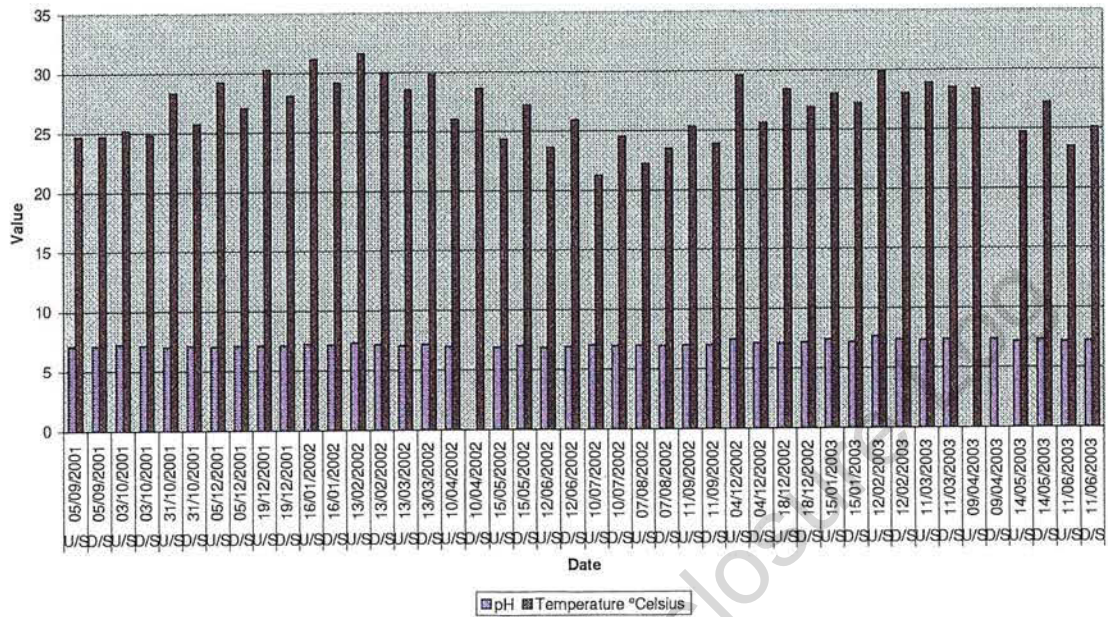
The bar chart displays two data series over time from May 2001 to November 2003. The Y-axis represents 'Value' from 0 to 70. The X-axis represents 'Date' with labels every two months. The legend indicates that light blue bars represent Dissolved Oxygen (mg/L) and dark blue bars represent Oxygen Saturation (%).

Date	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)
05/09/2001	49	4
05/10/2001	49	4
03/10/2001	4	4
03/11/2001	42	4
31/10/2001	46	4
31/12/2001	51	4
05/12/2001	46	4
19/12/2001	44	4
19/12/2001	47	4
16/01/2002	65	5
16/01/2002	51	4
13/02/2002	64	5
13/02/2002	57	4
13/03/2002	44	4
13/03/2002	54	5
10/04/2002	30	3
10/04/2002	46	4
15/05/2002	34	3
15/05/2002	41	4
12/06/2002	37	4
12/06/2002	40	4
10/07/2002	42	4
10/07/2002	40	4
07/08/2002	39	4
07/08/2002	40	4
11/09/2002	43	4
11/09/2002	41	4
04/12/2002	4	4
04/12/2002	4	4
18/12/2002	46	4
18/12/2002	44	4
15/01/2003	48	4
15/01/2003	46	4
12/02/2003	31	4
12/02/2003	42	4
11/03/2003	6	4
11/03/2003	40	4
09/04/2003	43	4
09/04/2003	42	4
14/05/2003	6	4
14/05/2003	42	4
11/06/2003	51	4
11/06/2003	45	4

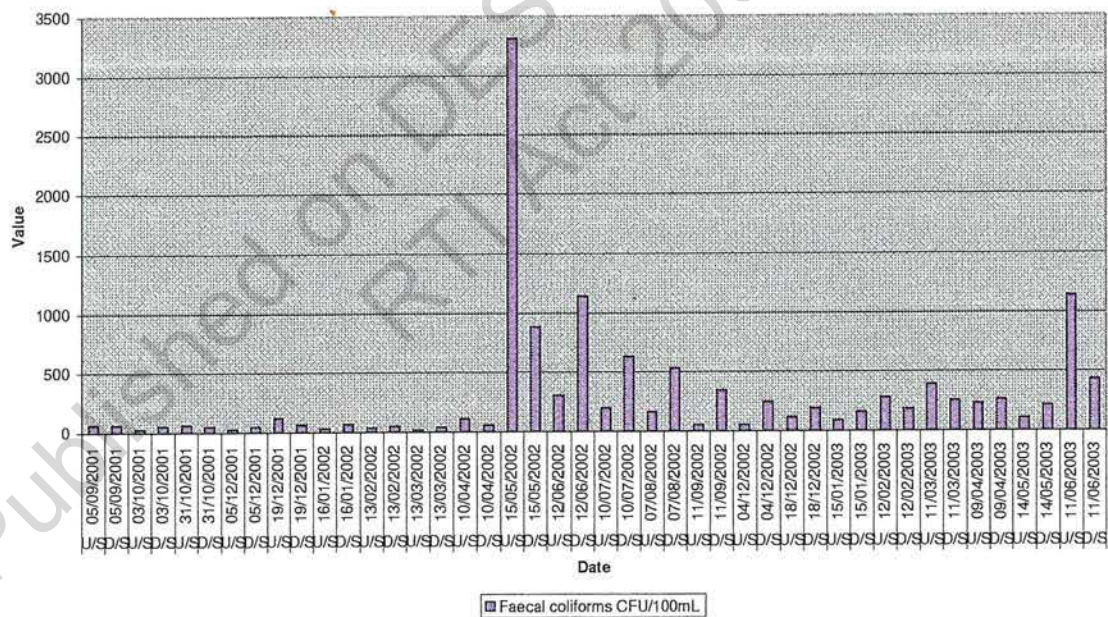
The chart displays two data series: Conductivity (purple bars) and Salinity (dark brown bars). The Y-axis represents the 'Value' ranging from 0 to 60. The X-axis represents the 'Date' in YYYY/MM format, spanning from May 2001 to November 2003. Conductivity values are generally higher than Salinity values, with both showing seasonal fluctuations. Conductivity peaks around 55 in early 2002 and 2003, while Salinity peaks around 38 in early 2002 and 2003.

Date	Conductivity	Salinity
05/09/2001	49	32
05/09/2001	49	32
03/10/2001	51	33
03/10/2001	48	32
31/10/2001	48	31
31/10/2001	49	32
05/12/2001	48	31
05/12/2001	49	32
19/12/2001	48	31
19/12/2001	49	32
16/01/2002	51	33
16/01/2002	49	31
16/01/2002	51	33
13/02/2002	51	33
13/02/2002	49	31
13/02/2002	51	33
13/03/2002	46	30
13/03/2002	49	32
10/04/2002	48	31
10/04/2002	45	30
15/05/2002	48	31
15/05/2002	48	31
12/06/2002	49	31
12/06/2002	47	31
10/07/2002	51	33
10/07/2002	49	31
07/08/2002	51	33
07/08/2002	50	32
07/08/2002	53	35
11/09/2002	51	33
11/09/2002	55	38
04/12/2002	55	35
04/12/2002	54	36
18/12/2002	54	35
18/12/2002	53	35
15/01/2003	54	35
15/01/2003	54	35
12/02/2003	52	34
12/02/2003	52	34
11/03/2003	45	30
11/03/2003	45	33
09/04/2003	48	31
09/04/2003	48	32
14/05/2003	47	31
14/05/2003	47	32
11/06/2003	44	29
11/06/2003	47	31

Trinity Inlet pH and Temperature Comparison Upstream and Downstream of Discharge



Trinity Inlet Faecal Coliform Comparison Upstream and Downstream of Discharge

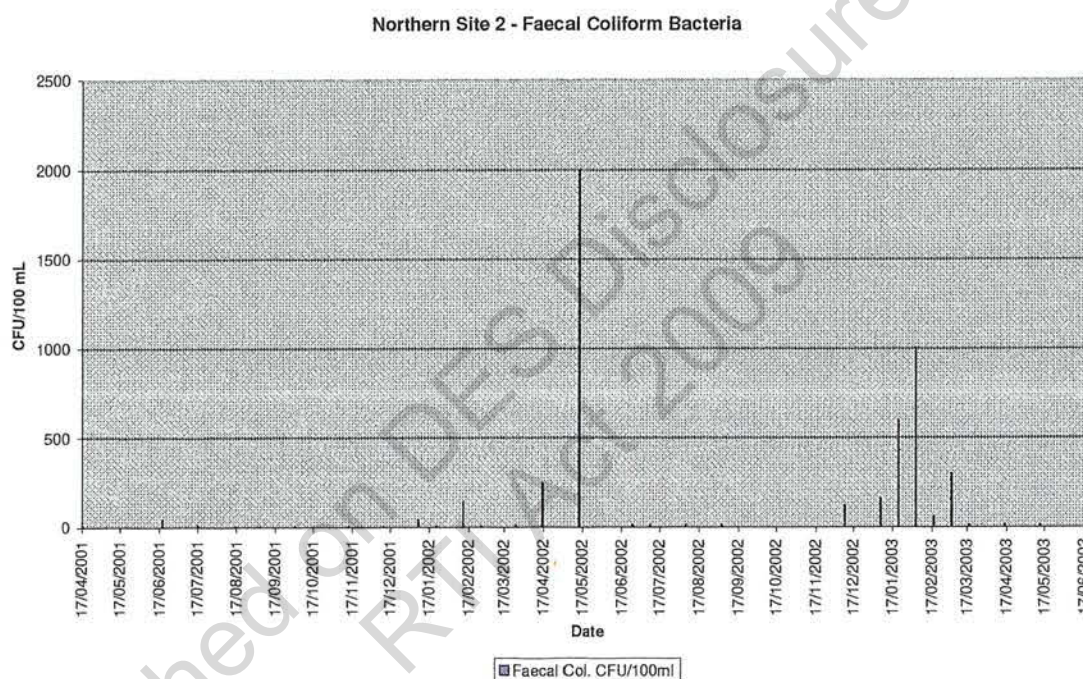


4.1.2 Northern

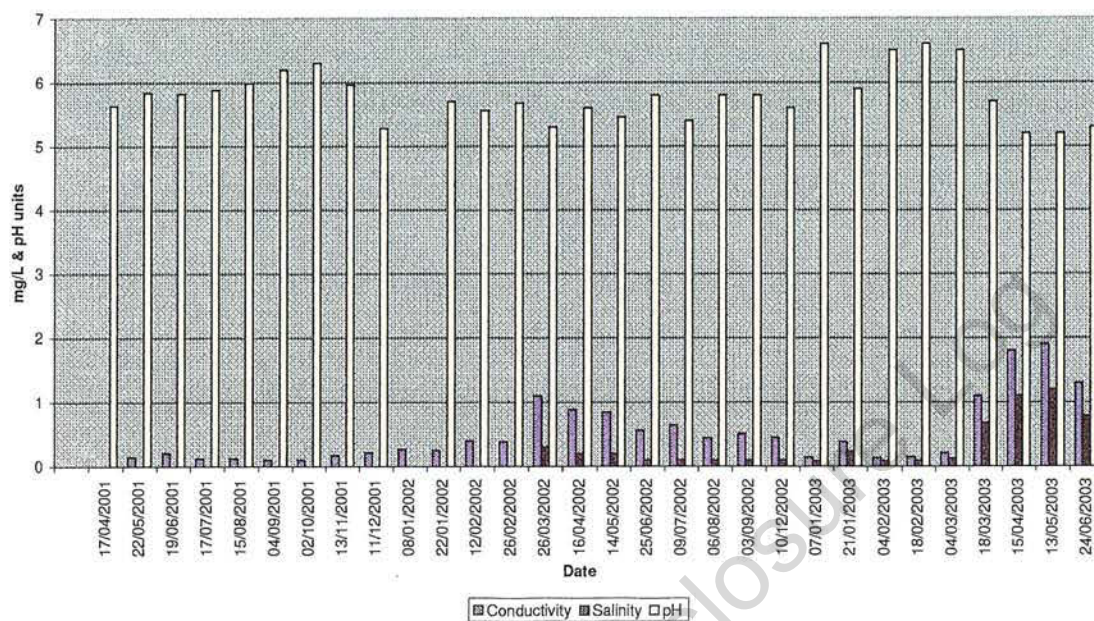
4.1.2.1 Northern Site 1

As a result of insufficient rainfall during the past two years the groundwater level at this site has fallen below the base of the weir. An Environmental Protection Order issued during January 1998, prevented further bio-solids storage at this site, and redevelopment, including landscaping has been undertaken.

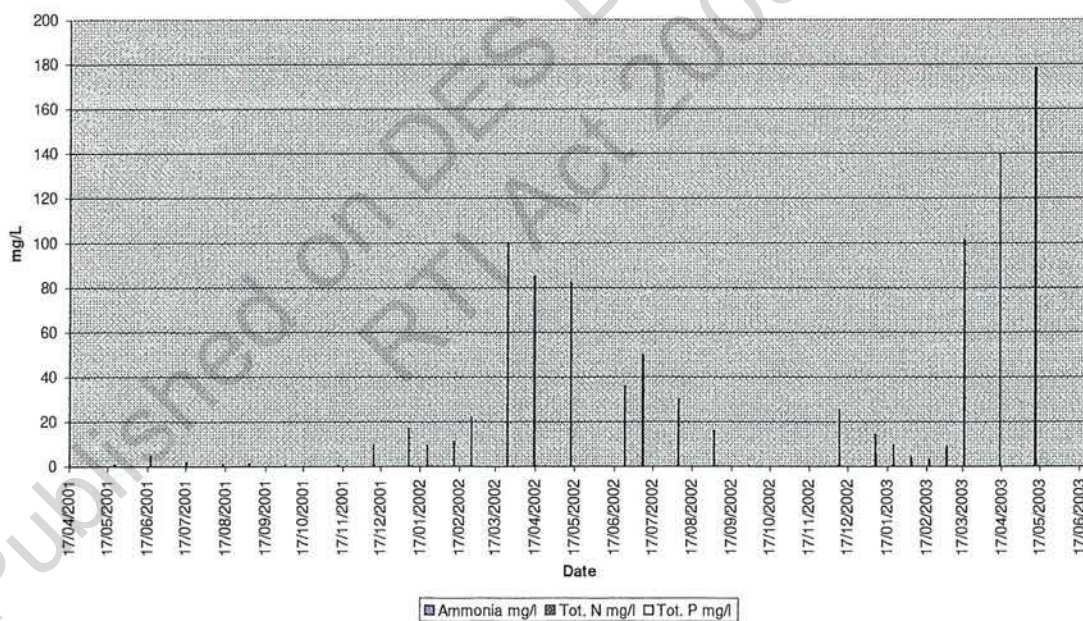
4.1.2.2 Northern Site 2



Northern Site 2 - Conductivity, Salinity & pH



Northern Site 2 - Nutrient



A-2 Northern Sewage Treatment Plant

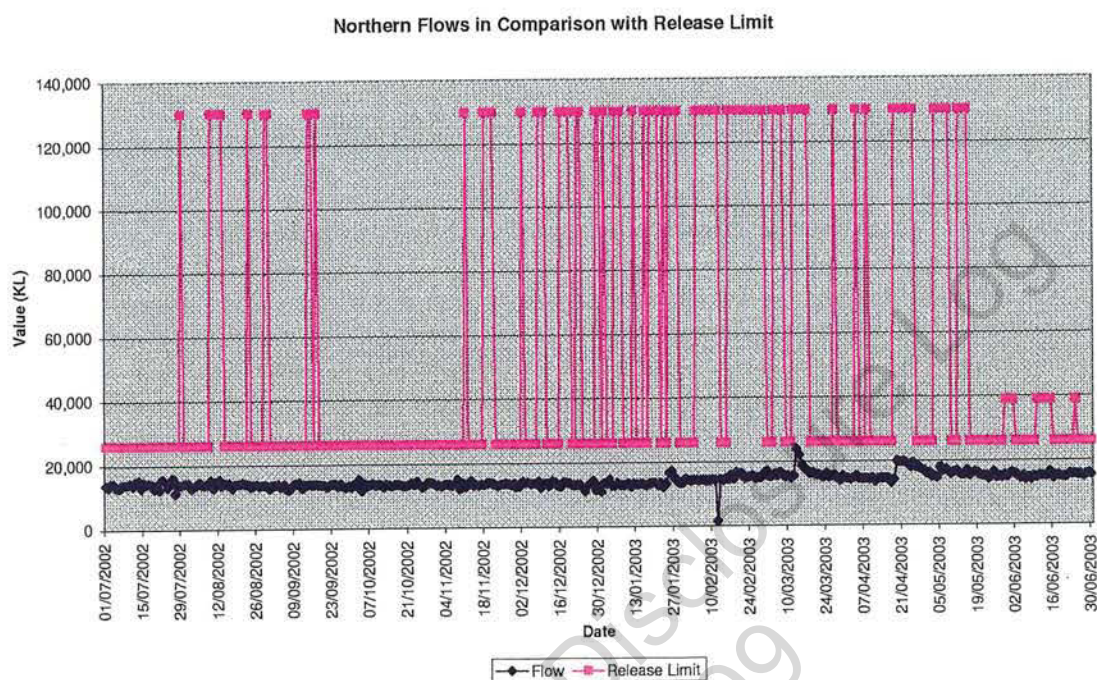


Figure A-2.1 Daily effluent Flow for reporting period

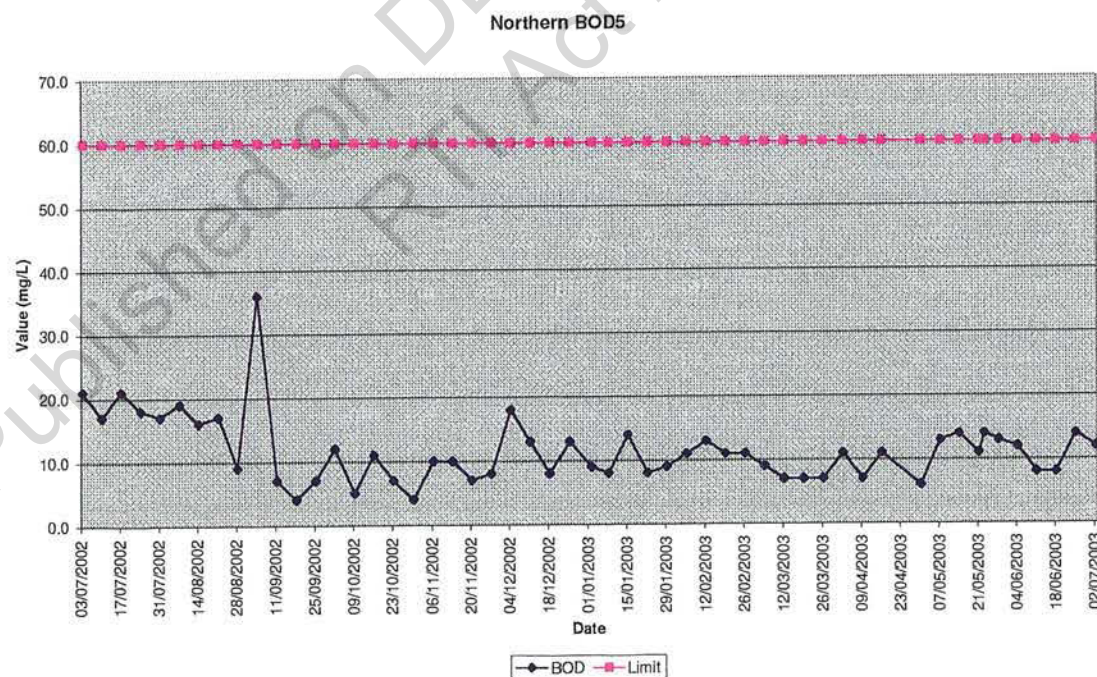


Figure A-2.2 BOD₅ concentration for reporting period

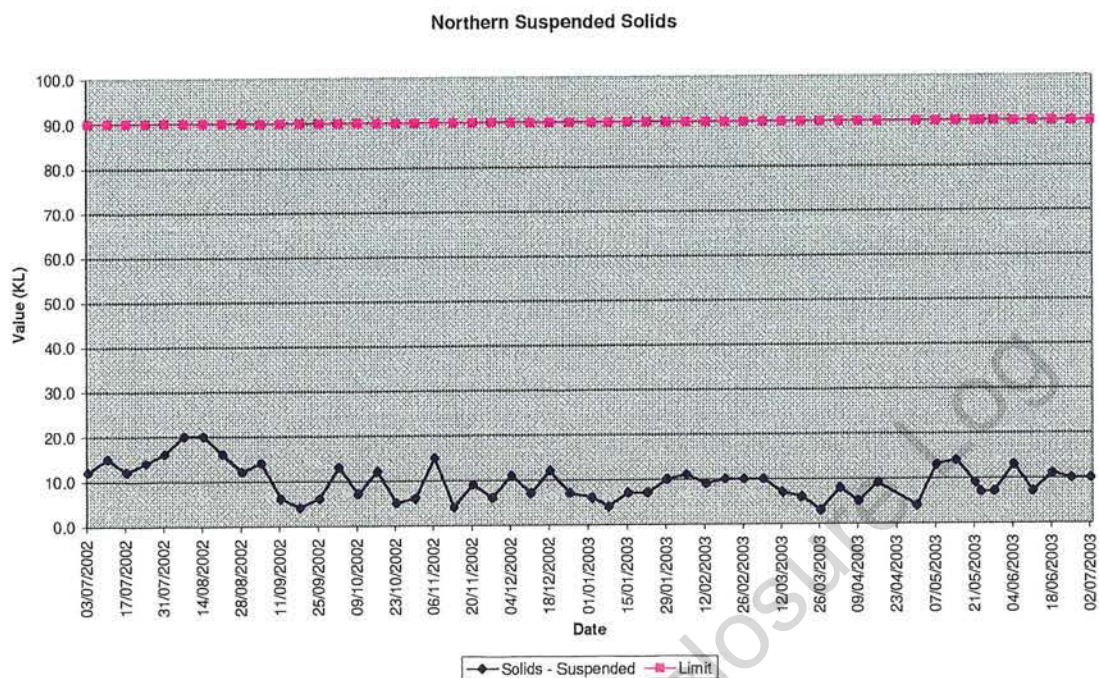


Figure A-2.3 Total Suspended Solid concentration for reporting period

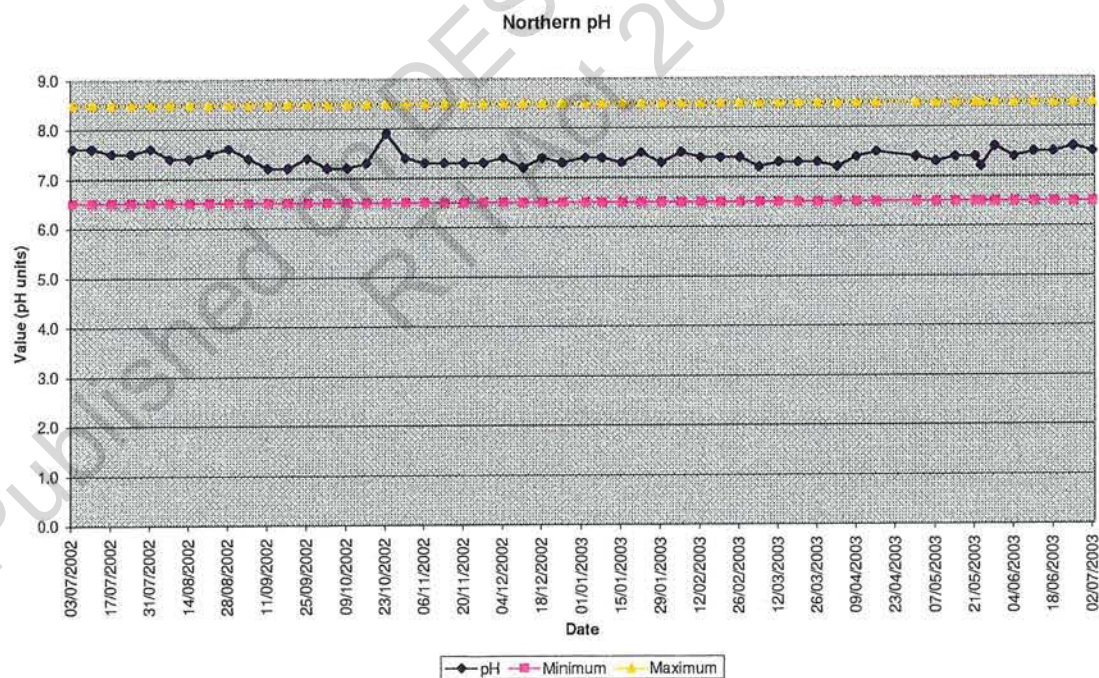


Figure A-2.4 pH readings for reporting period

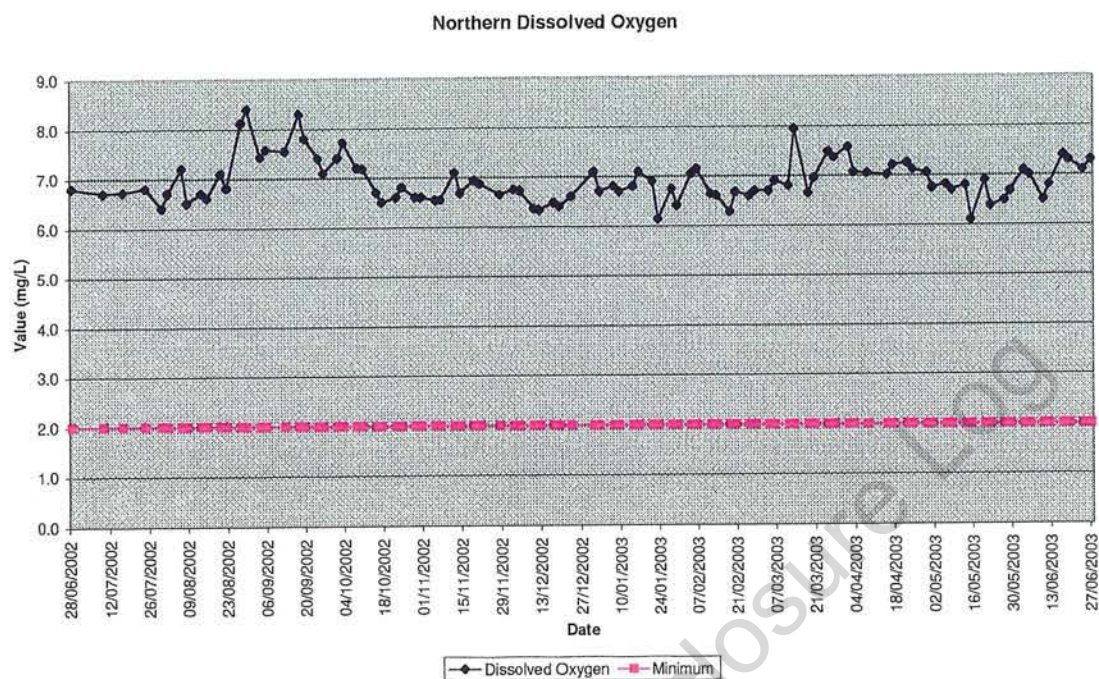


Figure A-2.5 Dissolved Oxygen Concentration for reporting period

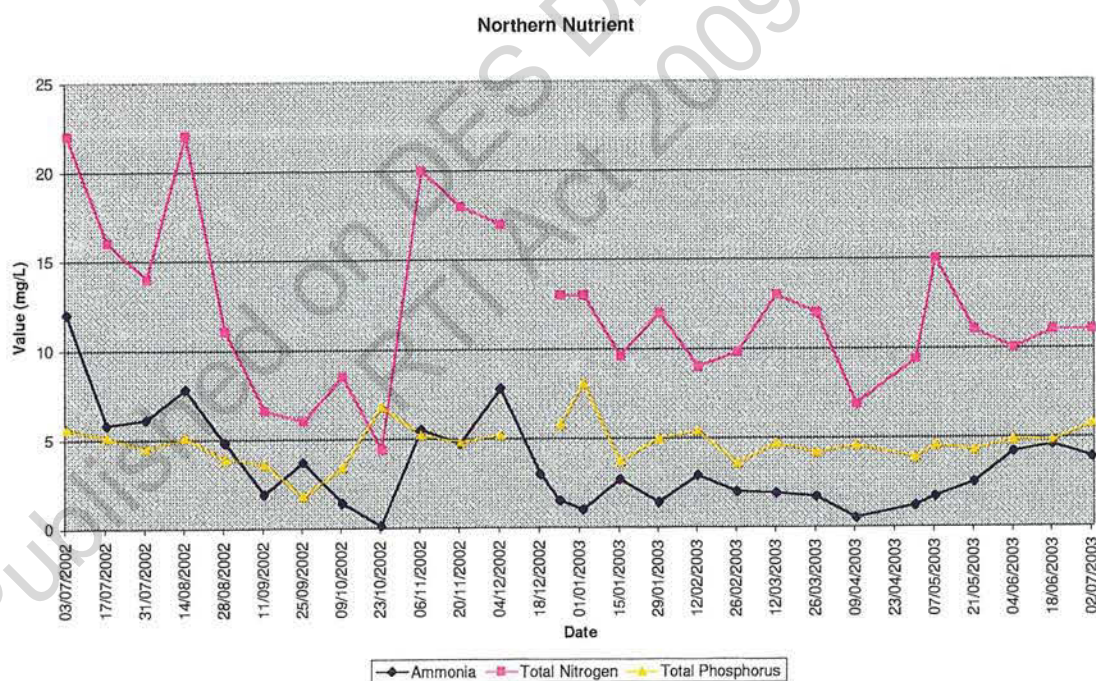


Figure A-2.6 Nutrient concentration for reporting period

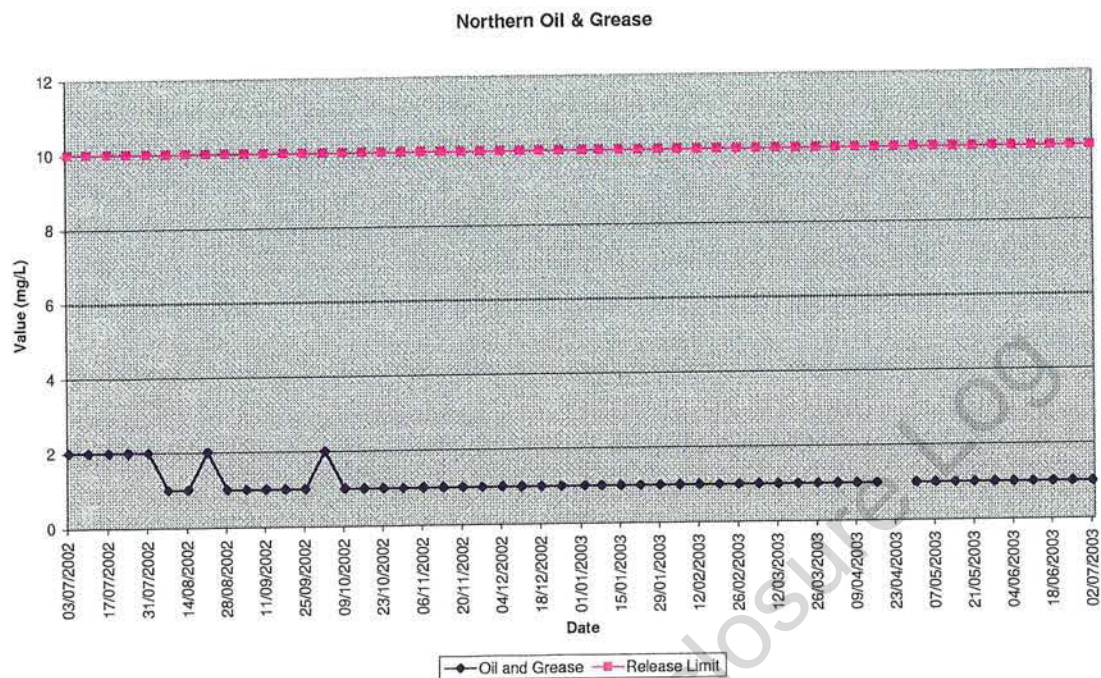


Figure A-2.7 Oil and Grease concentration for reporting period

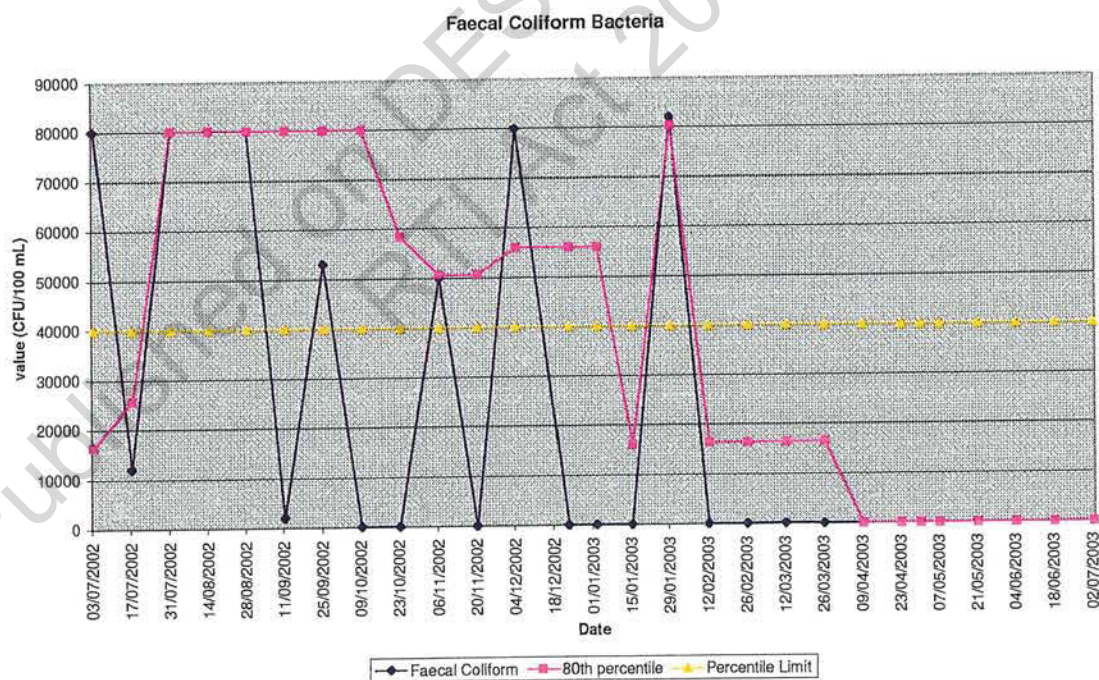


Figure A-2.8 Faecal Coliform concentration for reporting period

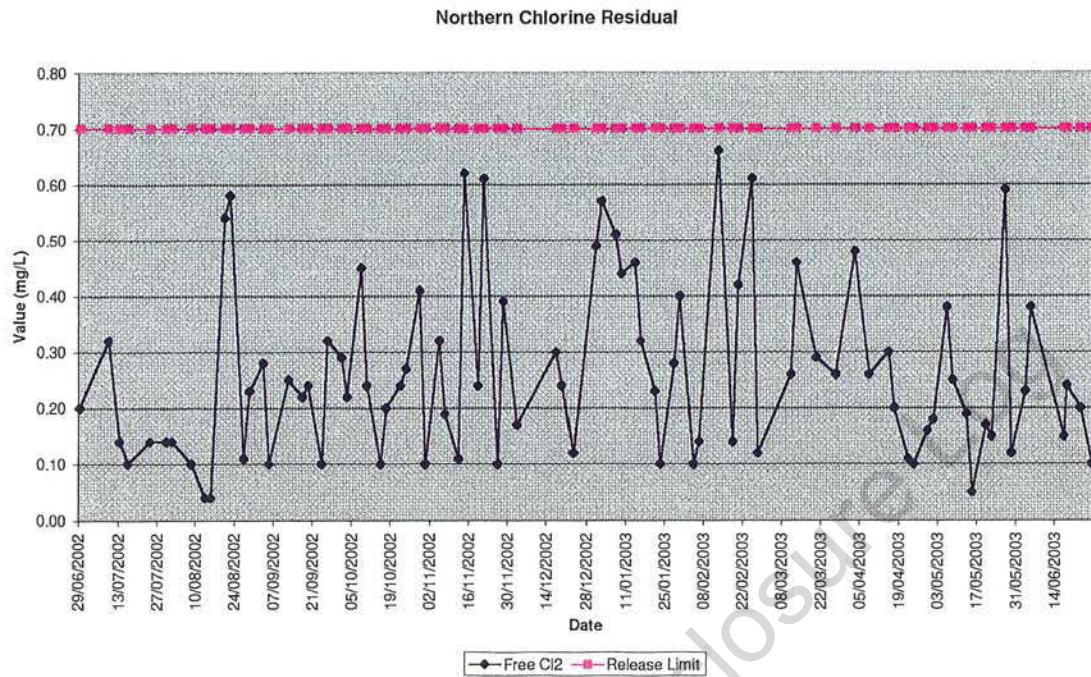
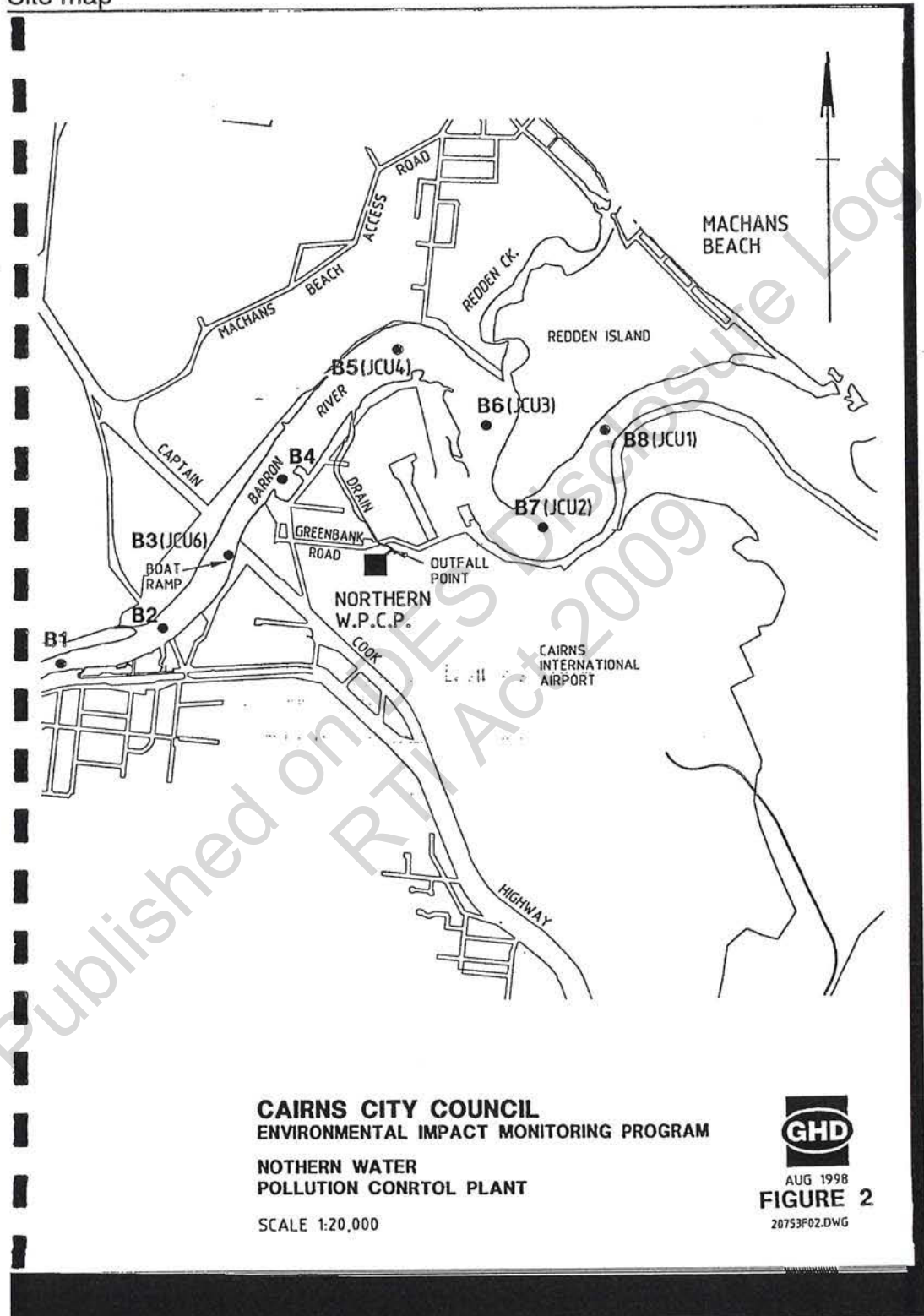


Figure A-2.9 Free Chlorine Residual for reporting period

B-2 Northern STP Receiving Waters - Baron River (BR1 to BR8)

Site map



Site ID	Date	Time sample	Dissolved Oxygen mg/L	Oxygen saturation %	Conductivity mS/cm	Salinity 0/00	pH	Temperature °Celsius
BR1	24/07/2002	9:30	5.5	63	41.8	26.7	7.29	22.5
BR2	24/07/2002	9:45	5.7	66	40.4	25.6	7.37	22.6
BR3	24/07/2002	10:05	6.0	68	41.2	26	7.56	22.7
BR4	24/07/2002	10:25	5.8	67	42.3	27.3	7.7	22.8
BR5	24/07/2002	10:40	5.8	67	43.3	27.8	7.73	22.9
BR6	24/07/2002	11:05	6.0	68	41.9	26.9	7.35	23.2
BR7	24/07/2002	11:20	6.0	70	45.6	29.4	7.89	22.9
BR8	24/07/2002	11:40	6.1	70	47.6	30.7	7.89	22.9
BR1	18/09/2002	9:30	5.4	66	39.7	25.4	7.41	25.9
BR2	18/09/2002	9:45	5.5	65	40.3	25.9	7.39	25.8
BR3	18/09/2002	10:05	5.7	70	41	26.4	7.36	25.6
BR4	18/09/2002	10:30	6.1	74	41.6	26.7	7.45	25.8
BR5	18/09/2002	10:40	6.1	74	42.5	27.3	7.43	25.8
BR6	18/09/2002	10:55	6.2	75	43.3	27.8	7.52	25.8
BR7	18/09/2002	11:15	6.1	74	45.1	29.1	7.63	25.5
BR8	18/09/2002	11:35	6.1	74	46.7	30.4	7.68	25.3
BR1	11/12/2002	9:05	6.7	90	30.8	19.2	7.87	30.7
BR2	11/12/2002	9:30	7.4	99	30.7	19.2	7.68	30.6
BR3	11/12/2002	9:45	7.5	100	30.5	19.3	7.76	30.6
BR4	11/12/2002	10:05	7.7	105	30.6	19.4	7.99	30.7
BR5	11/12/2002	10:25	7.8	105	32.4	20.3	8.07	30.8
BR6	11/12/2002	10:40	7.7	105	33.4	23.7	7.94	31.1
BR7	11/12/2002	10:55	8.5	114	34.2	21.6	8.16	31.1
BR8	11/12/2002	11:15	9.1	123	34.7	21.9	8.24	31.1
BR1	21/01/2003	9:35	4.7	64	31	21	7.26	27.9
BR2	21/01/2003	9:40	4.6	61	39	24.5	7.71	27.9
BR3	21/01/2003	9:50	4.9	62	41.1	26.4	7.85	27.8
BR4	21/01/2003	9:55	5.2	66	47.2	30.7	8.07	27.7
BR5	21/01/2003	10:00	5.7	71	51.2	33.8	8.2	27.6
BR6	21/01/2003	10:05	6.2	80	53.1	35.2	8.33	27.8
BR7	21/01/2003	10:10	6.3	80	53.2	35.2	8.29	27.9
BR8	21/01/2003	10:15	6.1	77	53.3	35.3	8.37	27.9
BR1	19/03/2003	8:55	7.3		49.0	30.0	8.10	
BR2	19/03/2003	8:59	7.4		51.0	31.0	8.20	
BR3	19/03/2003	9:03	7.3		51.0	31.0	8.20	
BR4	19/03/2003	9:07	7.4		51.0	31.0	8.20	
BR5	19/03/2003	9:13	7.3		52.0	32.0	8.20	
BR6	19/03/2003	9:17	7.4		51.0	31.0	8.20	
BR7	19/03/2003	9:26	7.3		51.0	31.0	8.20	
BR8	19/03/2003	9:33	7.3		51.0	31.0	8.20	
BR1	04/06/2003	9:30	4.4	78	34.9	22.3	7.79	25.9
BR2	04/06/2003	9:45	4.4	74	23.0	14.2	7.73	25.8
BR3	04/06/2003	10:15	4.7	82	21.8	13.2	7.80	25.7
BR4	04/06/2003	10:35	4.9	85	23.0	14.9	7.79	25.8
BR5	04/06/2003	11:00	4.7	81	26.8	16.4	7.82	25.8
BR6	04/06/2003	11:25	4.8	83	25.2	15.5	7.85	25.9
BR7	04/06/2003	11:40	4.7	82	29.7	18.4	7.87	25.9
BR8	04/06/2003	11:55	4.7	83	34.9	21.9	7.97	25.8
BR1	25/06/2003	9:55	4.0	68	28.0	17.4	7.07	23.7
BR2	25/06/2003	10:15	4.1	68	28.6	17.6	7.06	23.7
BR3	25/06/2003	10:30	4.1	69	31.1	19.6	7.04	23.8
BR4	25/06/2003	10:40	4.2	70	34.9	22.0	7.07	24.0
BR5	25/06/2003	10:55	4.0	68	35.6	22.4	7.07	24.0
BR6	25/06/2003	11:15	4.2	71	35.7	22.5	7.05	23.9
BR7	25/06/2003	11:30	4.1	69	37.1	23.5	7.07	23.9
BR8	25/06/2003	11:45	4.2	71	38.7	24.6	7.07	23.9

Site ID	Date	Time sample	Total coliforms < CFU/100ml	BOD mg/L	Total Nitrogen mg/L	Total Phosphorus mg/L	Ammonia mg/L	Nitrogen (N) mg/L
BR1	24/07/2002	9:30	15.0	1.0	0.35	0.03	0.1	0.075
BR2	24/07/2002	9:45	21.0	1.0	0.36	0.08	0.098	0.074
BR3	24/07/2002	10:05	34.0	1.0	0.34	0.03	0.11	0.078
BR4	24/07/2002	10:25	17.0	1.0	0.33	0.08	0.082	0.069
BR5	24/07/2002	10:40	40.0	1.0	0.5	0.13	0.18	0.14
BR6	24/07/2002	11:05	16.0	1.0	0.43	0.11	0.13	0.099
BR7	24/07/2002	11:20	6.0	1.0	0.38	0.11	0.12	0.091
BR8	24/07/2002	11:40	3.0	1.0	0.32	0.08	0.075	0.059
BR1	18/09/2002	9:30	8.0	2.0	0.4	0.17	0.053	0.068
BR2	18/09/2002	9:45	6.0	2.0	0.38	0.05	0.056	0.063
BR3	18/09/2002	10:05	5.0	2.0	0.37	0.12	0.05	0.067
BR4	18/09/2002	10:30	14.0	2.0	0.49	0.22	0.43	0.96
BR5	18/09/2002	10:40	15.0	2.0	0.43	0.17	0.086	0.16
BR6	18/09/2002	10:55	15.0	3.0	0.51	0.18	0.071	0.13
BR7	18/09/2002	11:15	7.0	2.0	0.42	0.14	0.061	0.12
BR8	18/09/2002	11:35	1.0	3.0	0.44	0.07	0.064	0.1
BR1	11/12/2002	9:05	19	2	0.41	0.06	0.073	0.01
BR2	11/12/2002	9:30	16	2	0.42	0.06	0.066	0.01
BR3	11/12/2002	9:45	19	2	0.37	0.05	0.077	0.01
BR4	11/12/2002	10:05	11	2	0.88	0.24	0.18	0.25
BR5	11/12/2002	10:25	18	2	0.52	0.1	0.069	0.061
BR6	11/12/2002	10:40	2	2	0.51	0.11	0.058	0.03
BR7	11/12/2002	10:55	6	2	0.53	0.12	0.08	0.057
BR8	11/12/2002	11:15	3	2	0.47	0.1	0.051	0.01
BR1	21/01/2003	9:35	330	2	0.48	0.02	0.12	0.099
BR2	21/01/2003	9:40	140	2	0.47	0.02	0.12	0.097
BR3	21/01/2003	9:50	250	2	0.46	0.04	0.12	0.12
BR4	21/01/2003	9:55	46	2	0.36	0.02	0.075	0.091
BR5	21/01/2003	10:00	21	2	0.29	0.03	0.08	0.038
BR6	21/01/2003	10:05	1	2	0.22	0.04	0.085	0.01
BR7	21/01/2003	10:10	1	2	0.21	0.02	0.091	0.01
BR8	21/01/2003	10:15	1	2	0.18	0.02	0.081	0.01
BR1	19/03/2003	8:55	7	2	0.39	0.02	0.083	0.018
BR2	19/03/2003	8:59	7	2	0.34	0.02	0.079	0.014
BR3	19/03/2003	9:03	16	2	0.35	0.02	0.075	0.013
BR4	19/03/2003	9:07	4	2	0.38	0.02	0.079	0.011
BR5	19/03/2003	9:13	9	2	0.32	0.02	0.082	0.011
BR6	19/03/2003	9:17	7	2	0.31	0.02	0.077	0.011
BR7	19/03/2003	9:26	3	2	0.32	0.02	0.084	0.01
BR8	19/03/2003	9:33	4	2	0.31	0.02	0.073	0.01
BR1	04/06/2003	9:30	27	2	0.39	0.07	0.12	0.12
BR2	04/06/2003	9:45	20	2	0.37	0.04	0.11	0.14
BR3	04/06/2003	10:15	17	2	0.33	0.02	0.095	0.11
BR4	04/06/2003	10:35	1	2	0.63	0.1	0.18	0.49
BR5	04/06/2003	11:00	1	2	0.55	0.32	0.14	0.28
BR6	04/06/2003	11:25	1	2	0.51	0.31	0.13	0.24
BR7	04/06/2003	11:40	5	2	0.46	0.03	0.15	0.2
BR8	04/06/2003	11:55	3	2	0.46	0.22	0.14	0.2
BR1	25/06/2003	9:55	140	2	0.38	0.06	0.1	0.11
BR2	25/06/2003	10:15	90	2	0.41	0.06	0.1	0.13
BR3	25/06/2003	10:30	30	2	0.4	0.07	0.13	0.14
BR4	25/06/2003	10:40	16	2	0.46	0.07	0.12	0.13
BR5	25/06/2003	10:55	15	2	0.64	0.1	0.2	0.2
BR6	25/06/2003	11:15	19	2	0.52	0.11	0.17	0.16
BR7	25/06/2003	11:30	19	2	0.62	0.12	0.23	0.19
BR8	25/06/2003	11:45	42	2	1.5	0.11	0.24	0.17

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REPORT ON

**GROUNDWATER
ENVIRONMENTAL IMPACT ANALYSIS
INERT LANDFILL
LOWER FRESHWATER ROAD
KAMERUNGA, QUEENSLAND**

Submitted to:

Medalfield Pty Ltd
PO Box 64
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November, 2003

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Appendix A	Results of Laboratory Testing
Appendix B	Graphical Plots
Appendix C	“Important Information About Your Geo-Environmental Report”

1.0 INTRODUCTION

Golder Associates was commissioned by Medalfeld Pty Ltd to conduct an Environmental Impact Analysis of the results of groundwater monitoring conducted at the inert landfill site on Lower Freshwater Road during the past twelve months.

Background information in relation to the site's hydrogeological setting, location and construction of monitoring wells are contained in our previous report 96670123(H) dated November 1997. An evaluation of potential environmental impacts for the preceding 12 months is contained in our report 96670123(AQ) dated September 2002. These previous reports should be read in conjunction with this report.

2.0 GROUNDWATER MONITORING WELLS

2.1 Water Levels

Water levels have been monitored in the wells since installation. Graphical plots of recorded water levels are presented in Appendix B.

2.2 Sampling Procedures & Field Measurements

Prior to collection of water samples, five well volumes were bailed from each well or the well was bailed dry. Once the water level had equalised to pre-bailing levels a water sample was collected from each well. Water samples were collected in laboratory supplied jars and bottles, and then immediately placed in a chilled insulated container for transport to the analytical laboratory.

Golder Associates standard sampling, handling, and decontamination procedures were followed during this work.

Fieldwork measurements of pH and electrical conductivity were conducted on recovered samples from each well.

3.0 LABORATORY ANALYSES

In addition to field measurements, the groundwater samples were analysed for the following parameters as required under the site's Environmental Authority:

- dissolved oxygen;
- total dissolved solids;
- iron;
- zinc;
- lead;
- copper; and
- total oxidised nitrogen (ie. nitrate as N).

Laboratory analyses were conducted by SGS Environmental Services Pty Ltd (SGS) in Cairns. SGS is NATA accredited for the tests conducted. Laboratory certificates of analysis are presented in Appendix A.

4.0 SUMMARY OF FIELD TESTING AND LABORATORY ANALYSES

Field and Laboratory test results for this monitoring period are summarised in Table 1. Graphical plots of monitoring since commencement in 1997 are presented in Appendix B.

Table 1 - Summary Of Field and Analytical Test Results

PARAMETER										AWQG		NWQMS
	MW1 6/12/02	MW1 28/02/03	MW1 20/06/03	MW2 6/12/02	MW2 28/02/03	MW2 20/06/03	MW3 6/12/02	MW3 28/02/03	MW3 20/06/03	FRESHWATER ECOSYSTEM PROTECTION*	AGRICULTURE (LTV)**	DRINKING WATER
pH	5.1	6.1	5.1	5.6	6.2	6.5	5.7	5.6	5.7	-	6.0-9.0	6.5-8.5
Electrical Conductivity mS/cm	97	105	85	72	94	97	183	184	176	-	-	-
Total Dissolved Solids mg/L	100	70	97	160	200	100	190	140	160	-	-	500
Dissolved Oxygen mg/L	1.7	6	4.4	8.3	7.4	0.1	4.6	4.2	5.8	-	-	>85%
Iron (Fe) mg/L (filtered)	<0.05	<0.05	<0.05	1.9	2.8	0.12	0.07	<0.05	<0.05	-	0.2	0.3
Total Iron mg/L (unfiltered)	0.08	<0.05	12	86	340	260	0.21	0.13	<0.05	-	-	-
Copper mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0014	0.2	1
Zinc mg/L	0.008	<0.005	0.26	0.049	0.033	0.021	0.008	<0.005	<0.005	0.008	2.0	3
Lead (Pb) mg/L	<0.002	<0.002	<0.002	0.003	0.005	<0.002	<0.002	<0.002	<0.002	0.0034	2	0.01
Total Oxidised Nitrogen (Nitrate as N plus Nitrite as N) mg/L	0.44	0.59	0.83	0.1	0.06	0.05	0.41	0.25	0.22	0.7	5	50 [#]

Note: * ANZECC Water Quality Guidelines - Trigger Values for Freshwater (95% Protection)

** Long Term Value

Nitrate as N

5.0 IMPACT ASSESSMENT GUIDELINES

The Environmental Protection (Water) Policy, 1997 has been used as the basis for determining assessment criteria for this site. This policy indicates that the expected range of environmental values to be protected are:

- (i) biological integrity of a modified aquatic ecosystem;
- (ii) suitability for recreational use;
- (iii) suitability for minimal treatment before supply as a drinking water;
- (iv) suitability for agricultural use; and
- (v) suitability for industrial use.

The above environmental values (i) and (ii) refer more to surface waters but are relevant at this site given the close proximity of the Barron River.

Indicators (ie. the parameters listed in Table 1) of environmental values were stated in the Environmental Authority for this site. These indicators are compared to water quality guidelines in order to assess the potential impact of site processes on ground and surface waters. The Environmental Protection (Water) Policy states that the following documents are to be used to decide the water quality guidelines for an environmental value for a water:

- (i) site specific documents;
- (ii) the Australian New Zealand Water Quality Guidelines (AWQG - Reference 1);
- (iii) documents published by a recognised entity.

No site specific documents or guidelines published by a recognised entity are known to exist for this site or the Barron River. The following guidelines have therefore been adopted for this assessment:

Aquatic Ecosystem	AWQG – Trigger values for freshwater system, 95% protection
Drinking Water Supply	NWQMS (Reference 2) - drinking water guidelines
Agricultural Use	AWQG - irrigation and stockwater guidelines

The protection of water for industrial purposes has not been considered as the above guideline levels are typically lower than those to be protected for industrial use.

Guideline values are listed in Table 1 along with the monitoring results.

6.0 INTERPRETATION OF RESULTS

Measured groundwater levels of the last twelve months monitoring period have fluctuated seasonally in a similar manner to that shown by previous monitoring. The fluctuations are within the bounds of previously recorded groundwater levels.

Test results over the current monitoring period indicated continued acidic groundwater conditions ranging from pH 5.1 to pH 6.5 (similar to the previous monitoring period). The indicated acidity is generally lower than assessment guidelines for the environmental values under consideration. However, our experience with groundwater quality in the Cairns region suggests that acidic groundwater within the indicated range is not uncommon and therefore the pH levels are not considered to represent a potential environmental impact. Levels of pH since commencement of monitoring have ranged between 5.0 and 6.5 (see Appendix B).

Electrical conductivities (EC) in MW1 had an average level of approximately 95 $\mu\text{S}/\text{cm}$. This conductivity measurement is similar to previous measured levels. EC levels in MW2 were generally around 90 $\mu\text{S}/\text{cm}$. This level is slightly lower than previous levels which were around 120 $\mu\text{S}/\text{cm}$. EC levels in MW3 were generally around 180 $\mu\text{S}/\text{cm}$. These levels are again slightly lower than the previous years levels of 220 $\mu\text{S}/\text{cm}$. No assessment guideline levels are given for the 95% freshwater trigger value or agricultural water use in the AWQG 2000. However, our experience with groundwater quality in the Cairns region indicates that the EC levels recorded at the landfill are similar to EC levels found in the surrounding Cairns region.

Total dissolved solids (TDS) levels in all boreholes show similar trends to levels recorded prior to September 2002. TDS concentrations in all three monitoring wells are considered to provide a reasonable approximation of groundwater quality in this region of Cairns.

Lead concentrations in MW1 and MW3 have remained below laboratory detection limits over the current monitoring period. Lead concentrations slightly above detection levels were initially detected in MW2 (December and February results). However, by June 2003, the lead concentration was again below laboratory detection levels. The average result at MW2 during the monitoring period is below the 95% freshwater trigger value and agricultural water use LTV (AWQG 2000).

Concentrations of copper were below the laboratory detection limits in all monitoring wells and are not considered to be a source of potential impact to the environmental values of the groundwater or Barron River.

Zinc concentrations in all groundwater samples from MW2 and the June 2003 sample from MW1 exceeded impact assessment guideline levels for ecosystem protection but remained below agriculture and drinking water levels. Zinc concentrations in the remaining groundwater samples from MW1 and MW3 were below all impact assessment criteria. Zinc levels at MW2 and MW3 over the current monitoring period have decreased significantly compared with previous results. Previous trends (see Appendix B) suggest seasonal variations in zinc concentrations. As the zinc concentrations were measured in groundwater and not in a river or stream (which ecosystem protection levels refer to) and as significant dilution and dispersion are likely to occur prior to this groundwater discharging into the Barron River, the present zinc levels at MW1 are not considered to be a source of potential impact to the environmental values of the Barron River, although continued monitoring is recommended.

Iron (filtered) concentrations in monitoring wells MW1 and MW3 over the current monitoring period have remained below the impact assessment guideline levels for agricultural and drinking water use (Note no trigger level has been specified for freshwater ecosystems in AWQG 2000). The concentrations in MW2 were above impact assessment guideline levels in December 2002 and February 2003. The concentration has then decreased in June 2003 (see Appendix B). This trend for iron (filtered) has been repeated seasonally at MW2 for the past three years. The iron concentrations are within the range of concentrations in the Barron River near the Captain Cook Highway measured by the Cairns Port Authority between 1995 and 1997. They are therefore not considered to represent a source of impact to the environmental values of the Barron River.

Total (unfiltered) iron concentrations in all monitoring well groundwater samples remained relatively constant when compared to previous years results. No assessment guideline levels are given for the 95% freshwater trigger value or agricultural water use in the AWQG 2000. However, our experience with groundwater quality in the Cairns region indicates that the Total (unfiltered) iron levels recorded at the landfill are similar to Total (unfiltered) iron found in the surrounding Cairns region. Graphs summarising total iron concentrations since 1999 are presented in Appendix B.

Nitrate (TON) concentrations in the June 2003 water sample from MW1 exceeded impact assessment guideline levels for ecosystem protection but were well below assessment levels for agriculture and drinking water use. Nitrate (TON) concentrations in remaining water samples from MW1, MW2 and MW3 were equal to or below assessment levels for ecosystem protection, agriculture and drinking water use. Given that the nitrate concentrations measured were in the groundwater and not in a river or stream (which ecosystem protection levels refer to) and that significant dilution and dispersion are likely to occur prior to this groundwater discharging into the Barron River, the present nitrate concentration in MW1 are not considered to represent a source of serious impact to the environmental values of the Barron River.

7.0 CONCLUSIONS & RECOMMENDATIONS

The results for the monitoring period September 2002 to September 2003 indicate generally good water quality for all monitoring bores. The results during the current monitoring period indicate concentrations of various analytes within previously recorded fluctuations. The current concentrations are not considered to represent a source of serious impact to the environmental values of the Barron River but continued monitoring and implementation of corrective measures should be continued.

8.0 LIMITATIONS OF THIS REPORT

This report has been prepared in accordance with the agreement between Medalfeld Pty Ltd and Golder Associates Pty Ltd (Golder Associates). The services performed by Golder Associates have been conducted in a manner consistent with the level of quality and skill generally exercised by members of its profession and consulting practice. No warranty or guarantee of site conditions is intended.

This report is solely for the use of Medalfeld Pty Ltd and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Golder Associates.

The information in this report is considered to be accurate at the date of issue in accordance to the current conditions of the site. Subsurface conditions can vary across a particular site which cannot be explicitly defined by investigation. Therefore, it is unlikely that the results and estimations expressed in this report will represent the extremes of conditions within the site. Subsurface conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used after a significant delay in time.

Attached as Appendix C is a document entitled "Important Information About Your Geo-Environmental Report" which should be read in conjunction with this report. We would be pleased to answer any questions about this important information.

GOLDER ASSOCIATES PTY LTD

sch4p4(6) Personal Information

Associate

PKS/MSK/cps
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9.0 REFERENCES

1. National Water Quality Management Strategy, "Australian and New Zealand Guidelines for Fresh & Marine Water Quality", October 2000, Australia.
2. National Health and Medical Research Council & Agriculture and Resource Management Council of Australia and New Zealand "National Water Quality Management Strategy - Australian Drinking Water Guidelines", 1996

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APPENDIX A
RESULTS OF LABORATORY TESTING



Australian
Environmental
Laboratories

CERTIFICATE OF ANALYSIS

23 December, 2002

sch4p4(6) Persona

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

GOLDER ASSOCIATES PTY LTD	
PROJECT No.: 96670123	
6 JAN 2003	

Your Order No: - CQ-2351
Your Project No: - 96670123
Laboratory Report No: 44785

Date Received: 6 December 2002

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following table. Please find the results in the attached report.

Yours faithfully,

AUSTRALIAN ENVIRONMENTAL LABORATORIES

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



NATA Accredited Laboratory No: 2562
NATA Endorsed Test Report
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Page 1 of 2

ACN 004 591 664 (Analabs Pty. Ltd.) ABN 91 004 591 664
2/58 Comport Street, PORTSMITH. NQ 4870 Australia
Telephone: (07) 4035 5111 Facsimile: (07) 4035 5122

RESULTS

AEL Reference		44785-01	44785-02	44785-03		
Your Reference		MW1	MW2	MW3	Limit of	Analytical
Parameter	Units				Reporting	Method*
Dissolved Oxygen [†]	mg/L	1.7	8.3	4.6	0.1	CEI-021
Total Dissolved Solids	mg/L	100	160	190	10	CEI-017
Total Oxidised Nitrogen	mg/L as N	0.44	0.10	0.41	0.05	CEA-001
Total Iron (Fe) [‡]	mg/L	0.08	86	0.21	0.05	CEI-200
Iron (Fe)	mg/L	0.05	1.9	0.07	0.05	"
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01	"
Zinc (Zn)	mg/L	0.008	0.049	0.008	0.005	"
Lead (Pb)	mg/L	<0.002	0.003	<0.002	0.002	CEI-201

* Methods are In-house, unless otherwise stated.

[†] NATA accreditation does not cover the performance of this analysis.

[‡] Analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



NATA Accredited Laboratory No: 2562

NATA Endorsed Test Report

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CERTIFICATE OF ANALYSIS

18 March, 2003

sch4p4(6) Personal Info

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870

GOLDER ASSOCIATES PTY LTD	
PROJECT No.:	96670123
27 MAR 2003	

Your Order No: - CQ-2430
Your Project No: - 96670123
Laboratory Report No: 45074

Date Received: 28 February 2003

Dear Sir

Three water samples (six bottles) were received and analysed for the parameters as listed in the following table. Please find the results in the attached report.

Yours faithfully,

SGS Environmental Services

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



NATA Accredited Laboratory No: 2562

NATA Endorsed Test Report

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Page 1 of 2

RESULTS

SGS Reference		45074-01	45074-02	45074-03		
Your Reference		MW1	MW2	MW3	Limit of Reporting	Analytical Method*
Parameter	Units					
Dissolved Oxygen [†]	mg/L	6.0	7.4	4.2	0.1	CEI-021
Total Dissolved Solids	mg/L	70	200	140	10	CEI-017
Total Oxidised Nitrogen	mg/L as N	0.59	0.06	0.25	0.05	CEA-001
Total Iron (Fe) [‡]	mg/L	0.05	340	0.13	0.05	CEI-200
Iron (Fe)	mg/L	<0.05	2.8	<0.05	0.05	"
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01	"
Zinc (Zn)	mg/L	<0.005	0.033	<0.005	0.005	"
Lead (Pb)	mg/L	<0.002	0.005	<0.002	0.002	CEI-201

* Methods are In-house, unless otherwise stated.

[†] NATA accreditation does not cover the performance of this analysis.

[‡] Analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



NATA Accredited Laboratory No: 2562

NATA Endorsed Test Report

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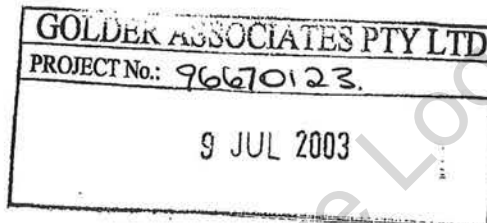


CERTIFICATE OF ANALYSIS

1 July, 2003

sch4p4(6) Personal

Golder Associates Pty Ltd
PO Box 5823
CAIRNS QLD 4870



Your Order No: - CQ-2523
Your Project No: - 96670123
Laboratory Report No: 45531

Date Received: 20 June 2003

Dear Sir

Three water samples (nine bottles) were received and analysed for the parameters as listed in the following table. Please find the results in the attached report.

Yours faithfully,

SGS Environmental Services

sch4p4(6) Personal Information

Operations Manager
CAIRNS

sch4p4(6) Personal Information

Inorganic Chemist
CAIRNS



NATA Accredited Laboratory No: 2562

NATA Endorsed Test Report

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Page 1 of 2

RESULTS

SGS Reference		45531-01	45531-02	45531-03		
Your Reference		MW1	MW2	MW3	Limit of Reporting	Analytical Method*
Parameter	Units					
Dissolved Oxygen [†]	mg/L	4.4	<0.1	5.8	0.1	CEI-021
Total Dissolved Solids	mg/L	97	100	160	5	CEI-017
Total Oxidised Nitrogen	mg/L as N	0.83	0.05	0.22	0.05	CEA-001
Total Iron (Fe) [‡]	mg/L	12	260	<0.05	0.05	CEI-200
Iron (Fe)	mg/L	<0.05	0.12	<0.05	0.05	"
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01	"
Zinc (Zn)	mg/L	0.26	0.021	<0.005	0.005	"
Lead (Pb)	mg/L	<0.002	<0.002	<0.002	0.002	CEI-201

* Methods are In-house, unless otherwise stated.

[†] NATA accreditation does not cover the performance of this analysis.

[‡] Analysis determined on digested sample. Please note that NATA accreditation does not cover the digestion.



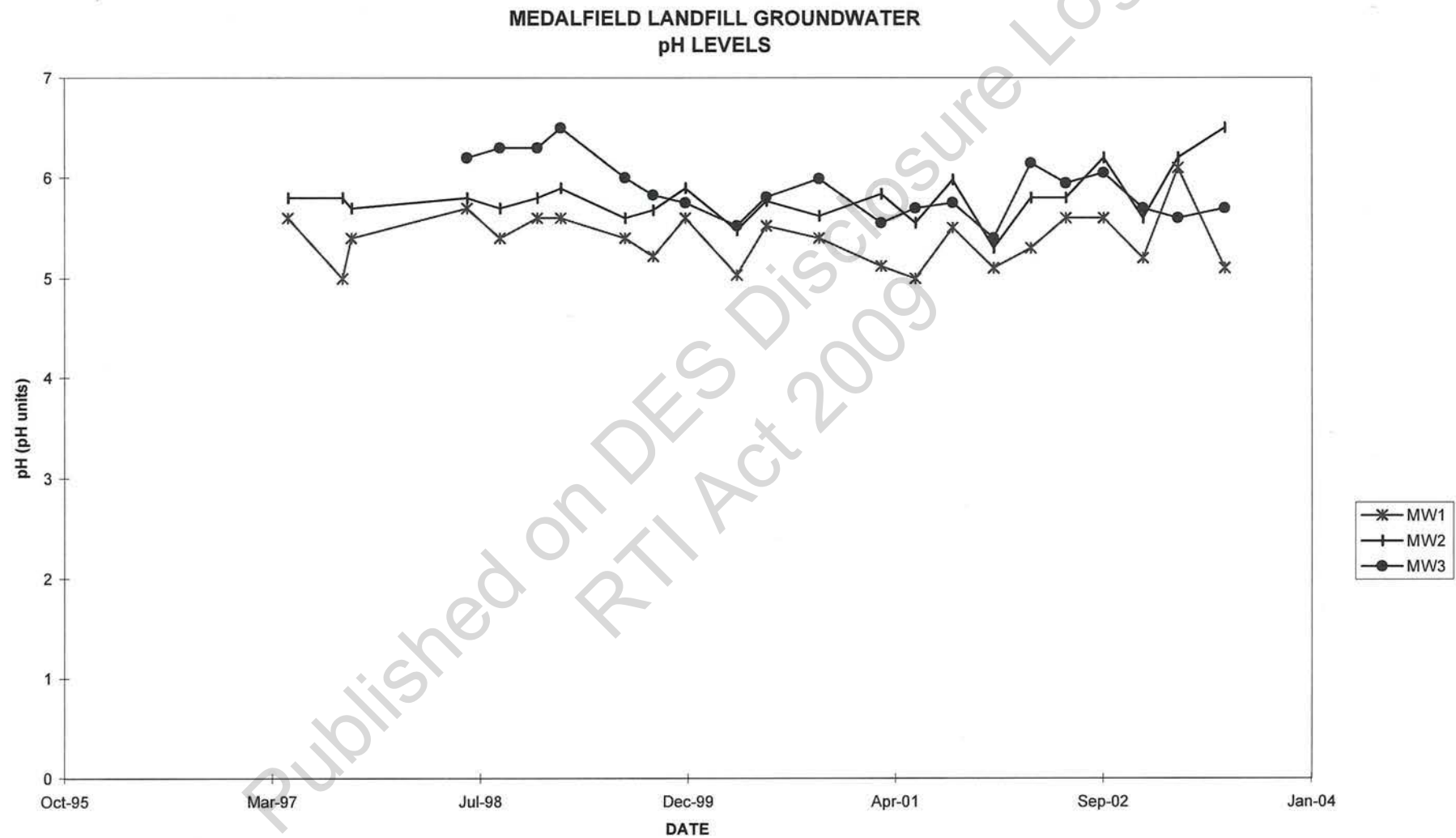
NATA Accredited Laboratory No: 2562

NATA Endorsed Test Report

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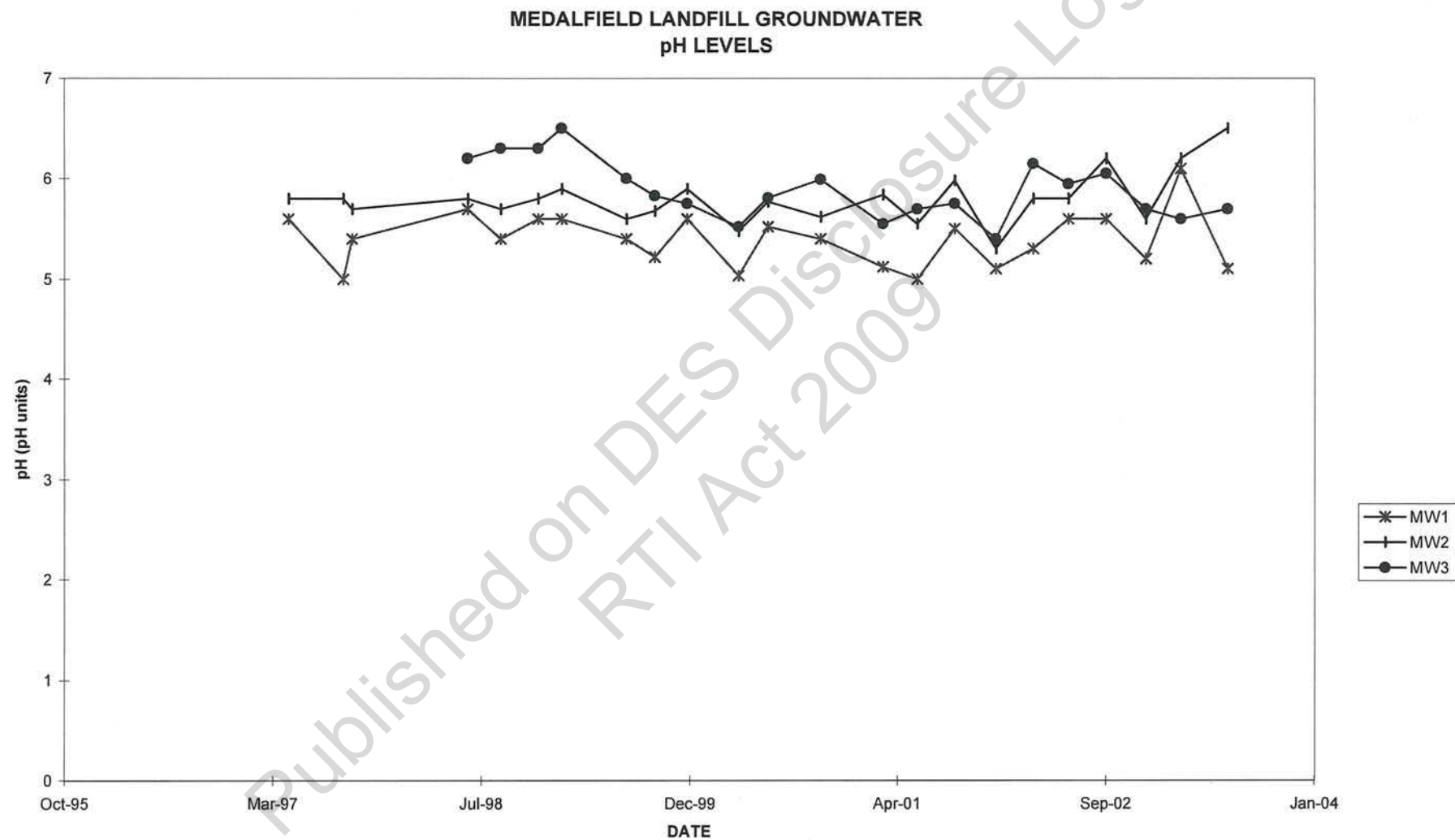
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RTI Act 2009

APPENDIX B
GRAPHICAL PLOTS



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 DATE: 13/11/03

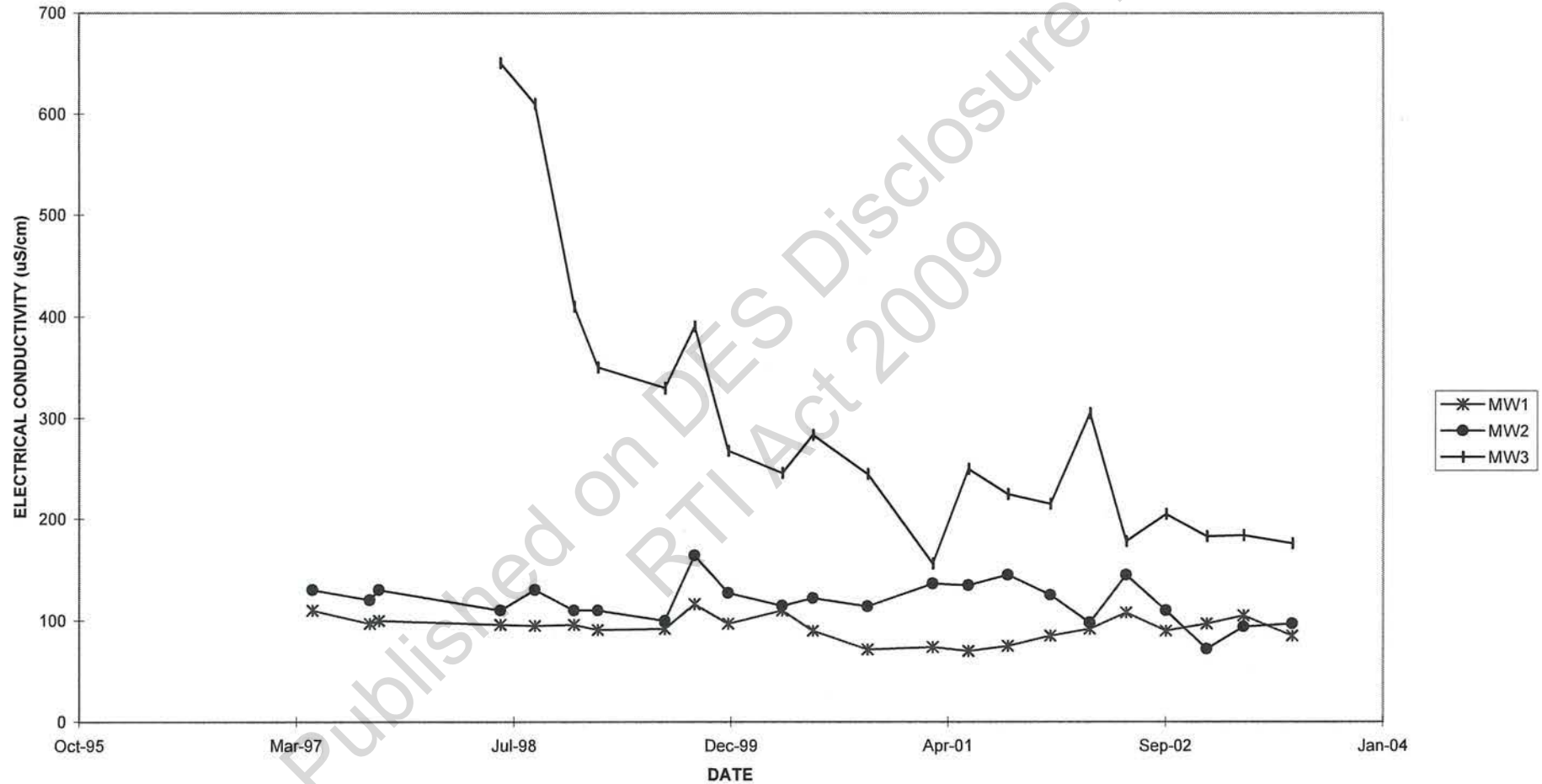
J:\96670123\ONGOINGMONITORINGpH Chart 1
 Page 1 of 1



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 DATE: 13/11/03

J:\96670123\ONGOINGMONITORINGpH Chart 1
 Page 1 of 1

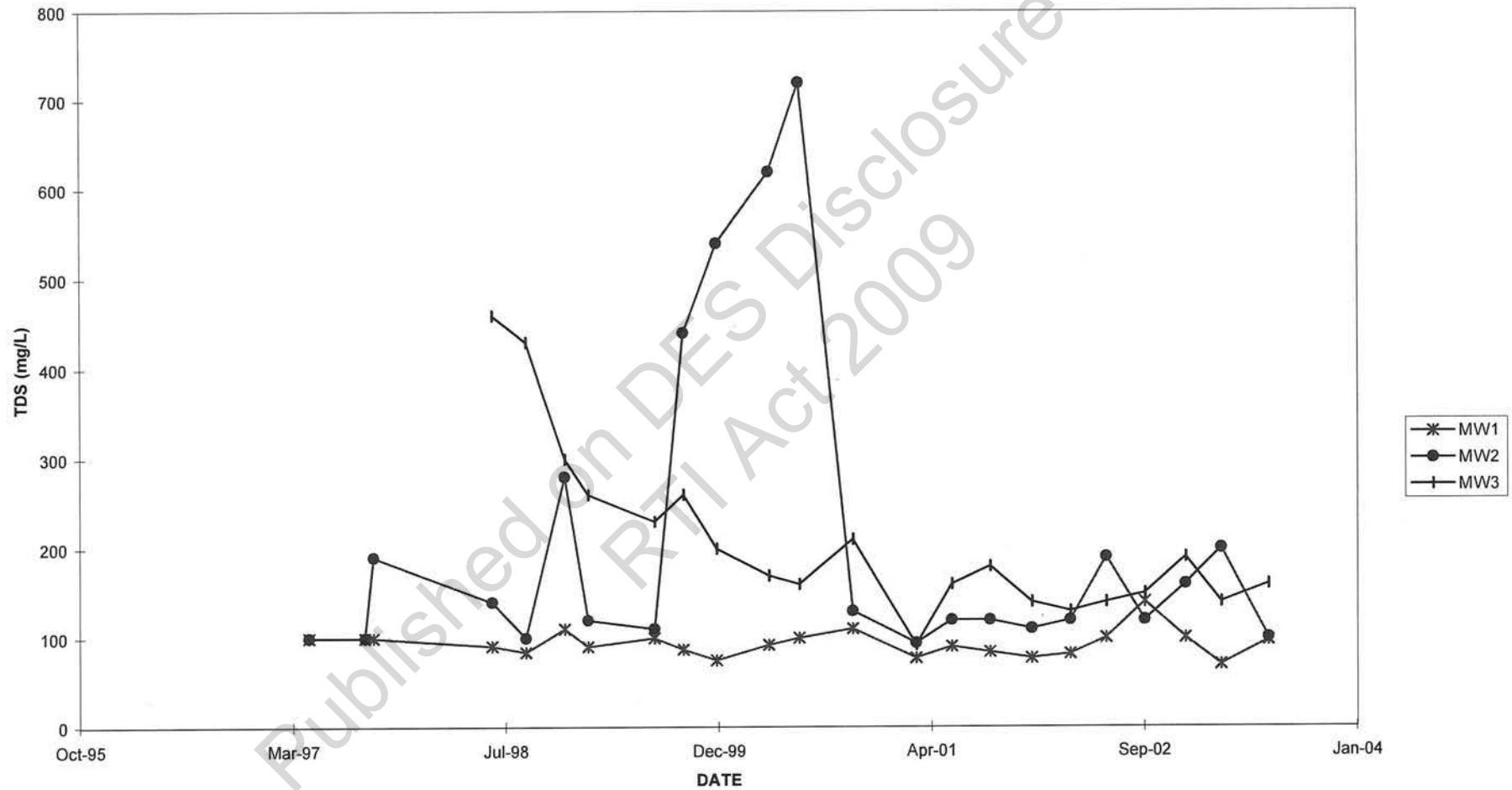
MEDALFIELD LANDFILL GROUNDWATER ELECTRICAL CONDUCTIVITY LEVELS



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DATE: 13/11/03

J:\96670123\ONGOINGMONITORING\EC Chart 1
Page 1 of 1

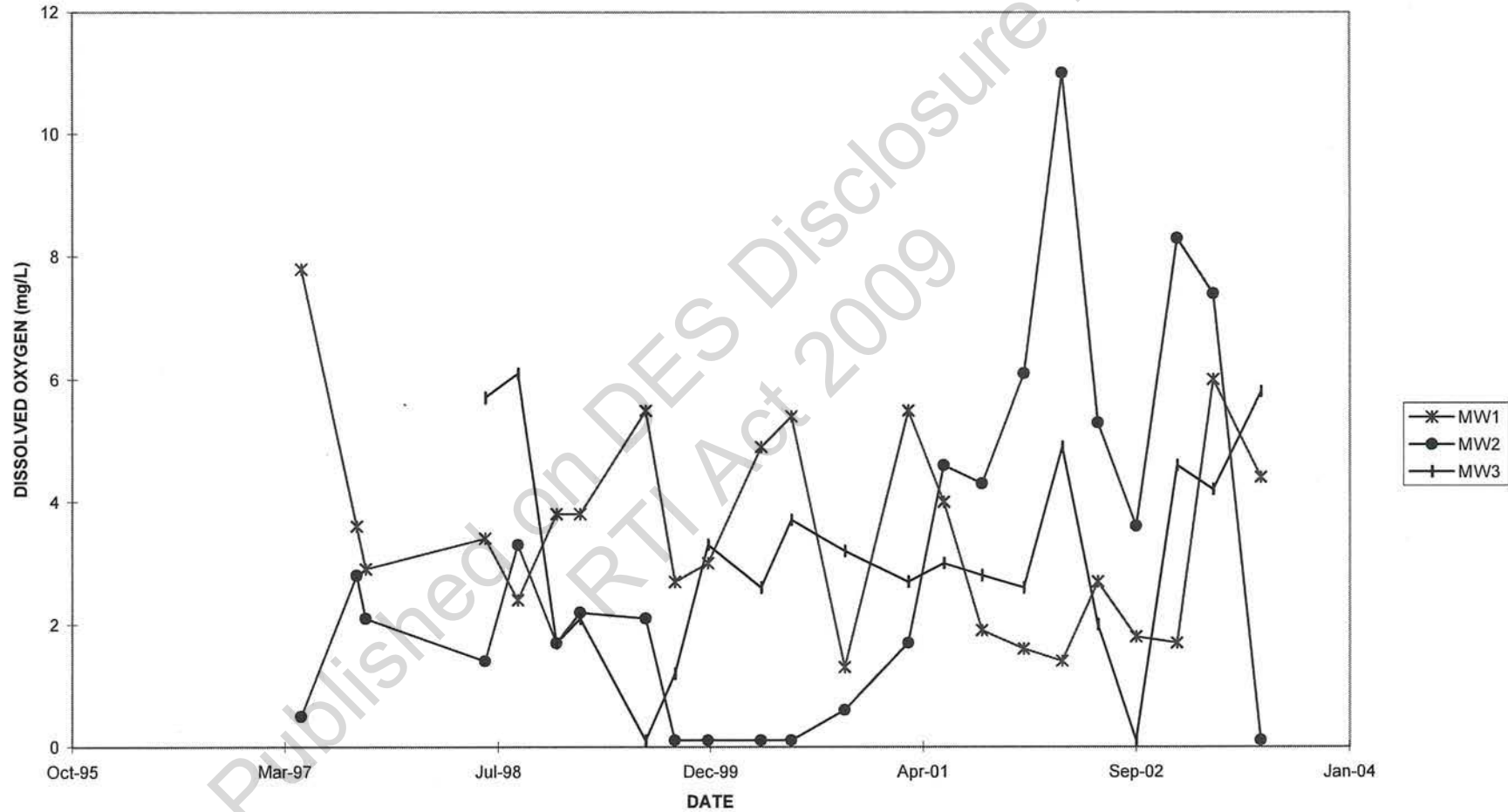
MEDALFIELD LANDFILL GROUNDWATER TOTAL DISSOLVED SOLIDS (TDS) LEVELS



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J:\96670123\ONGOINGMONITORING\TDS Chart 1
Page 1 of 1

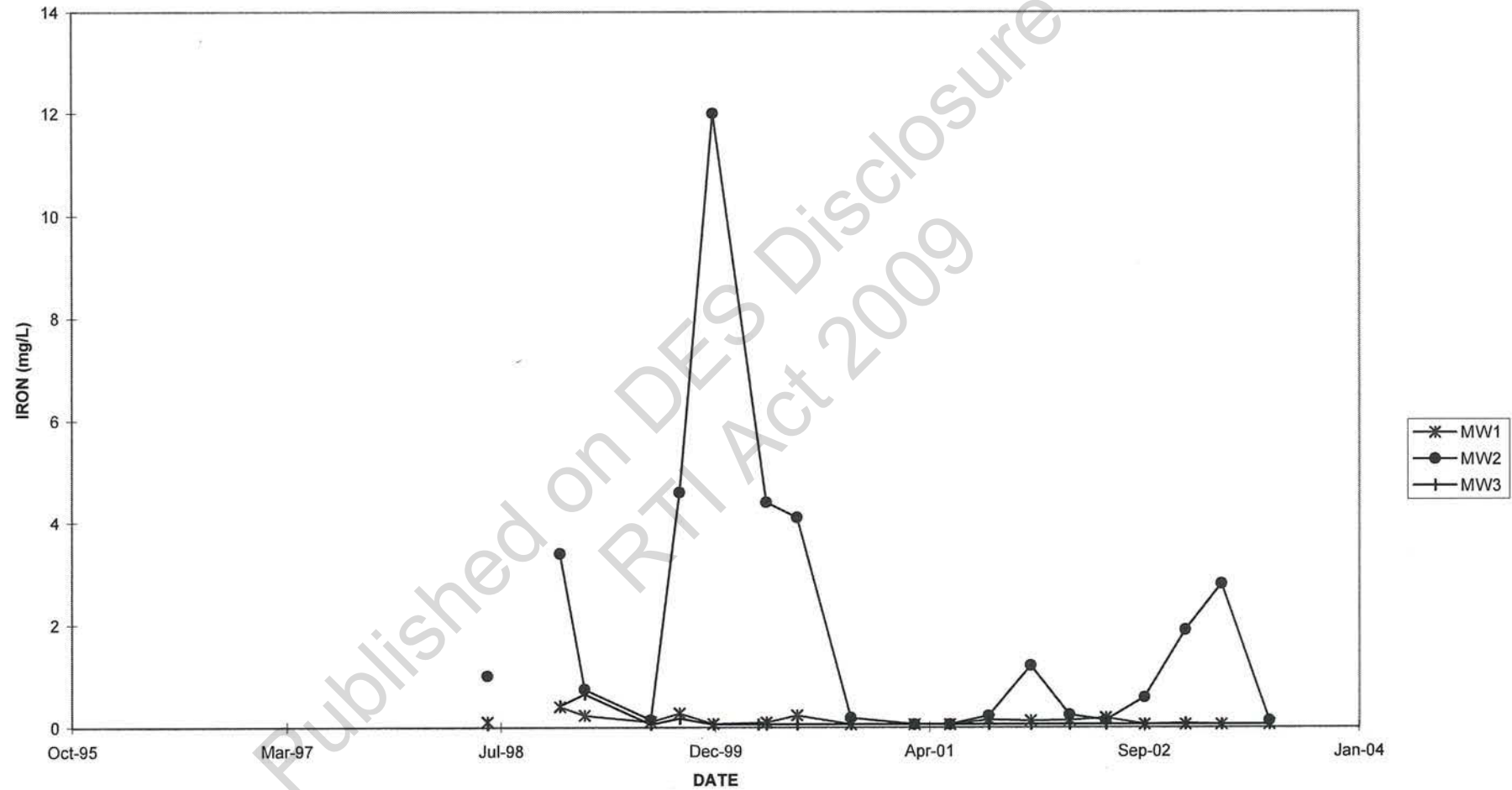
MEDALFIELD LANDFILL GROUNDWATER DISSOLVED OXYGEN LEVELS



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 DATE: 13/11/03

J:\96670123\ONGOINGMONITORING\DO Chart 1
 Page 1 of 1

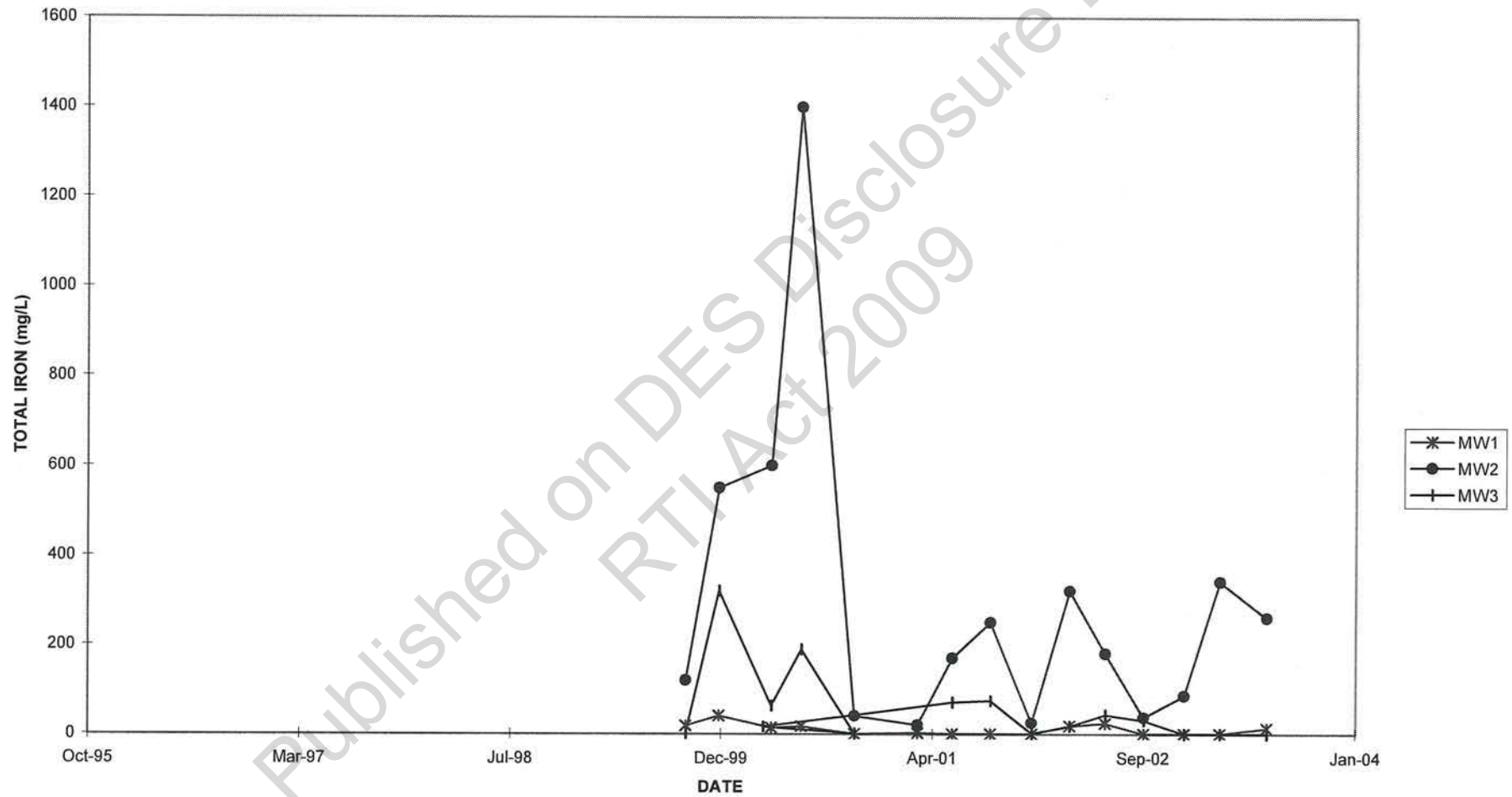
MEDALFIELD LANDFILL GROUNDWATER IRON LEVELS



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Page 1 of 1

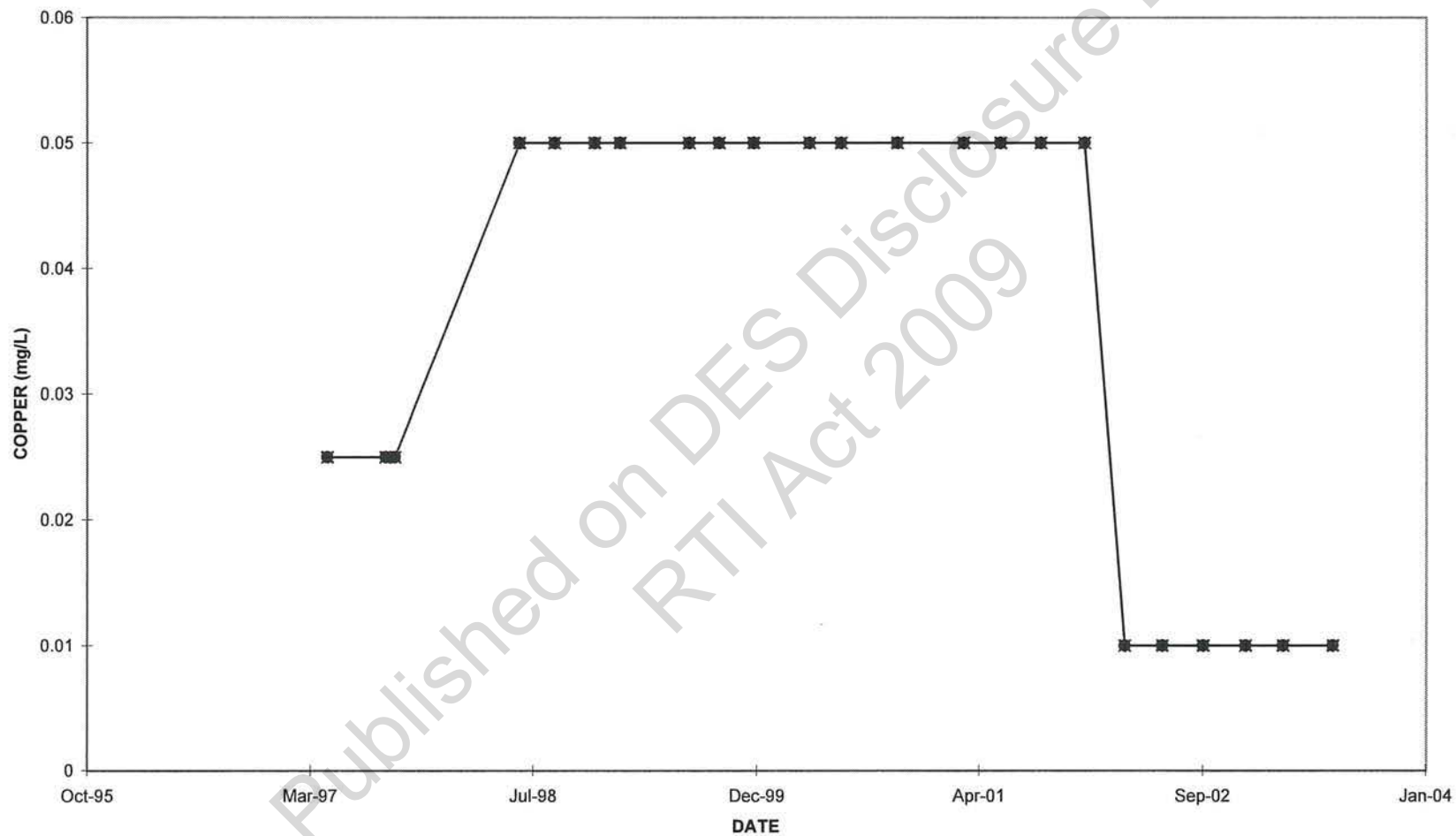
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Page 1 of 1

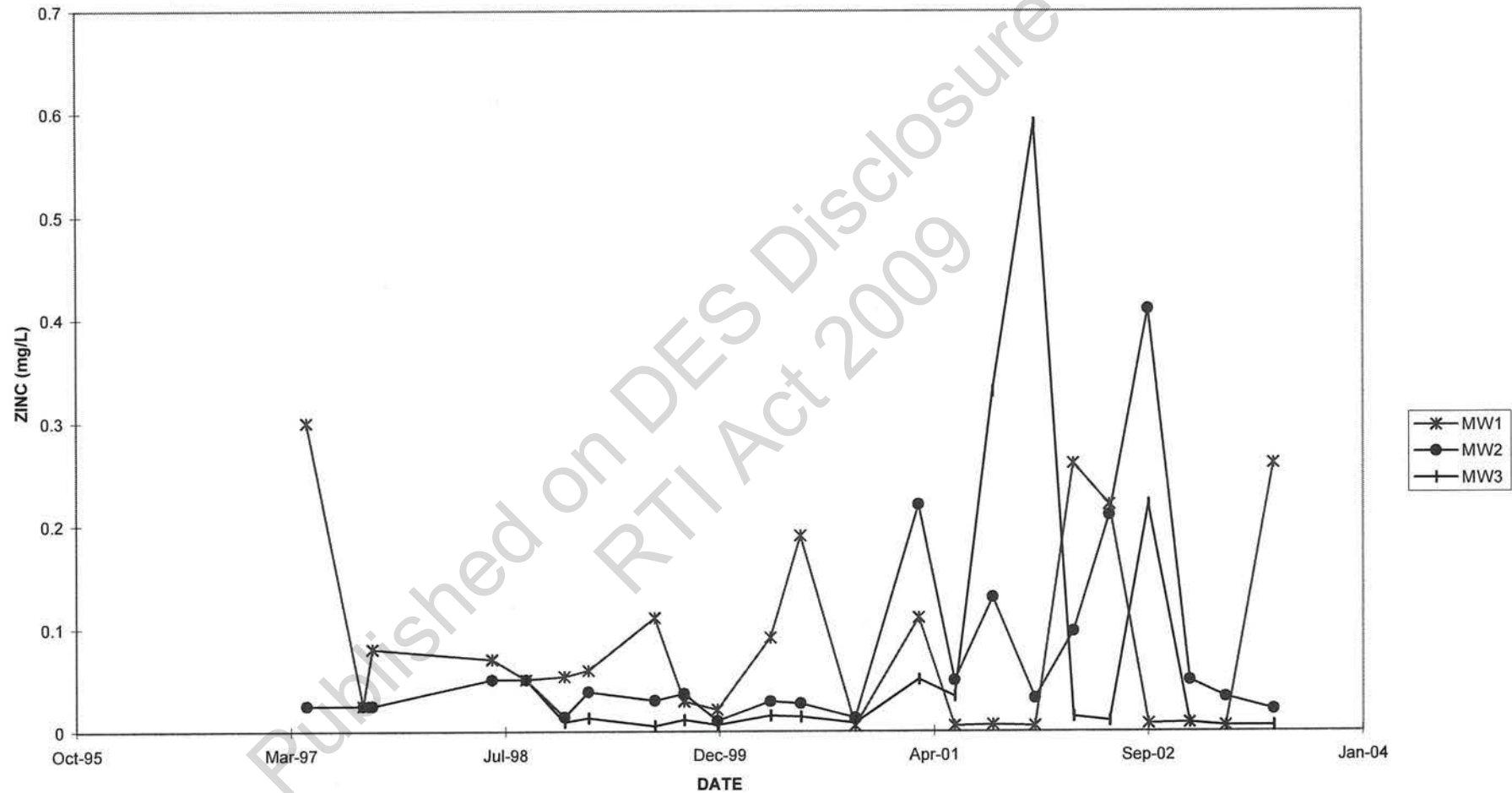
MEDALFIELD LANDFILL GROUNDWATER COPPER CONCENTRATIONS



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Page 1 of 1

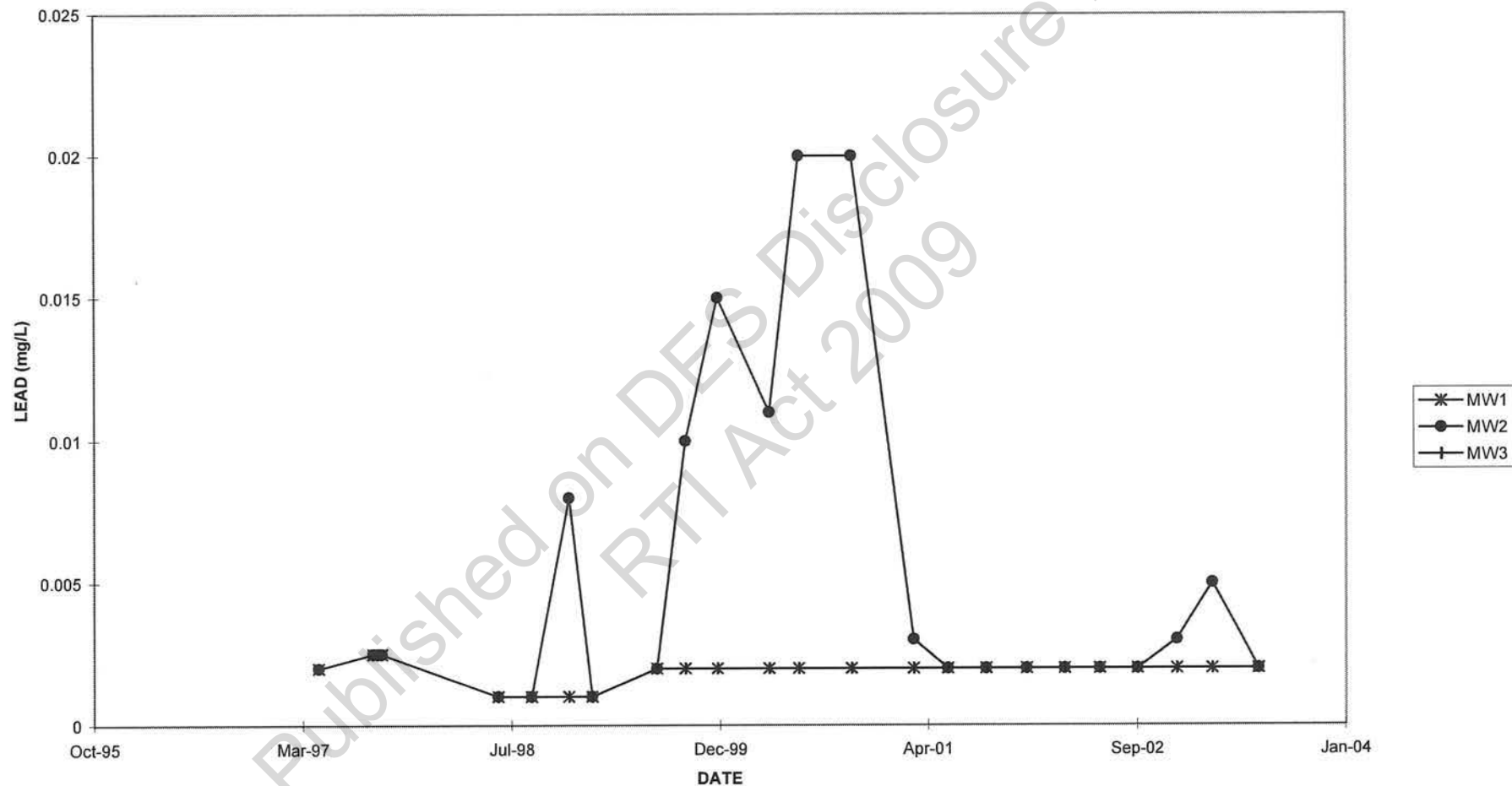
MEDALFIELD LANDFILL GROUNDWATER ZINC LEVELS



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DATE: 13/11/03

J:\96670123\ONGOINGMONITORING\zn Chart 1
Page 1 of 1

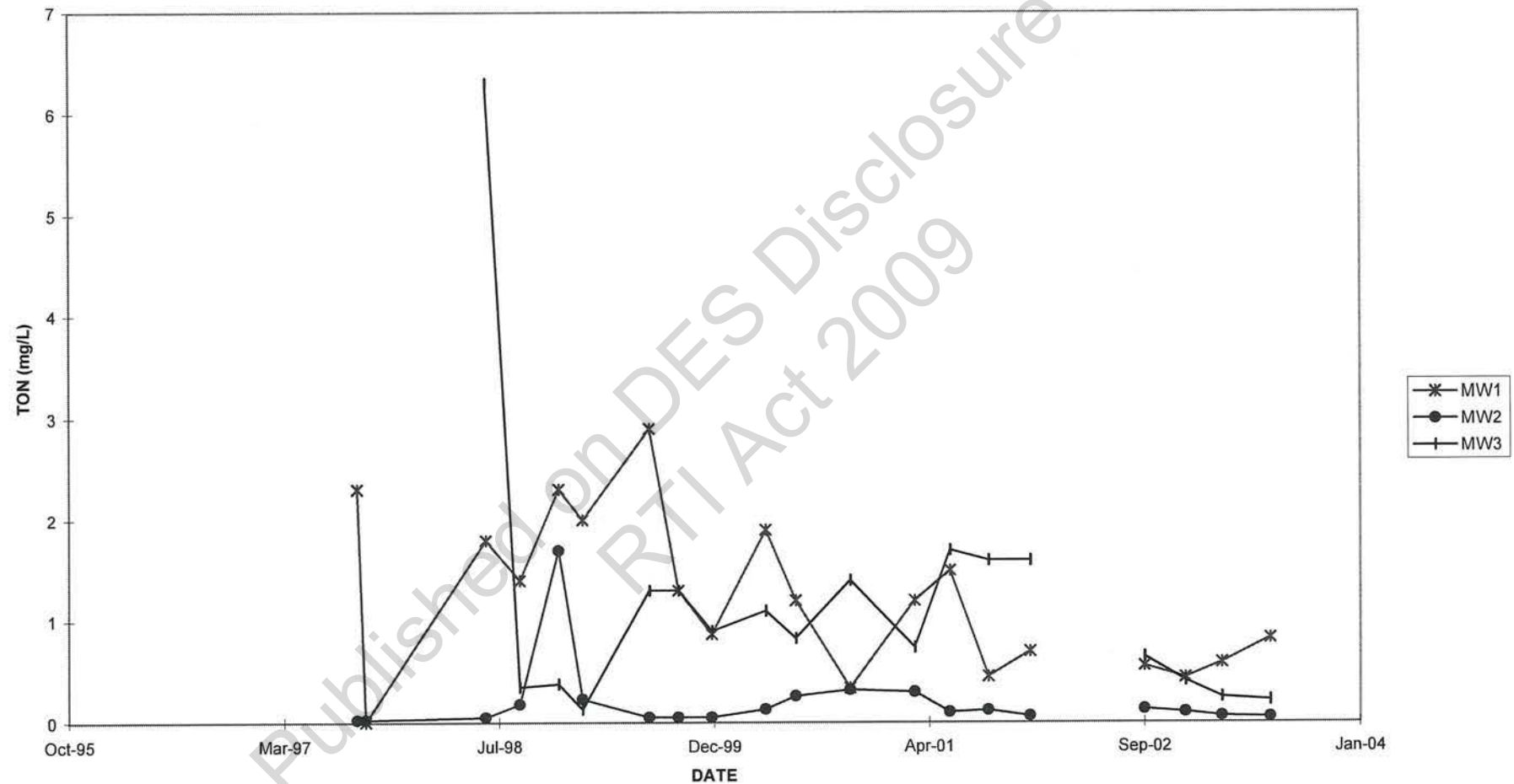
MEDALFIELD LANDFILL GROUNDWATER LEAD LEVELS



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Page 1 of 1

MEDALFIELD LANDFILL GROUNDWATER TOTAL OXIDISED NITROGEN LEVELS



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Page 1 of 1

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APPENDIX C
**“IMPORTANT INFORMATION ABOUT YOUR
GEO-ENVIRONMENTAL REPORT”**

Important Information About Your Geo-environmental Report

These notes have been prepared by Golder Associates Pty Ltd using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences, of which Golder Associates Pty Ltd is a member. They are offered to help you in the interpretation of your Geo-environmental Report.

Geo-environmental studies are commissioned to gain information about environmental conditions on and beneath the surface of a site. The more comprehensive the study, the more reliable the assessment is likely to be. But remember, any such assessment is to a greater or lesser extent based on professional opinions about conditions that cannot be seen or tested. Accordingly, no matter how much data is accumulated, risks created by unanticipated conditions will always remain. *Have realistic expectations.* Work with your Geo-environmental consultant to manage known and unknown risks. Part of that process should already have been accomplished, through the risk allocation provisions you and your Geo-environmental professional discussed and included in your contract's general terms and conditions. This document is intended to explain some of the concepts that may be included in your agreement, and to pass along information and suggestions to help you manage your risk.

Beware of Change; Keep Your Geo-environmental Professional Advised

The design of a Geo-environmental study considers a variety of factors that are subject to change. Changes can undermine the applicability of a report's findings, conclusions, and recommendations. *Advise your Geo-environmental professional about any changes you become aware of them.* Geo-environmental professionals cannot accept responsibility or liability for problems that occur because a report fails to consider conditions that did not exist when the study was designed. Ask your Geo-environmental professional about the types of changes you should be particularly alert to. Some of the most common include:

- modification of the proposed development or ownership group,
- sale or other property transfer,
- replacement of or additions to the financing entity,
- amendment of existing regulations or introduction of new ones, or
- changes in the use or condition of adjacent property

Should you become aware of any change, *do not rely on an existing Geo-environmental report.* Advise your Geo-environmental professional immediately; follow the professional's advice.

Recognize the Impact of Time

A Geo-environmental professional's findings, recommendations, and conclusions cannot remain valid indefinitely. The more time that passes, the more likely it is that important latent changes may occur. *Do not rely on a Geo-environmental report if too much time has elapsed since it was completed.* Ask your environmental professional to define "too much time." In the case of Phase I Environmental Site Assessments (ESAs), for example, more than 180 days after submission is generally considered "too much."

Prepare To Deal with Unanticipated Conditions

The findings, recommendations, and conclusions of a Phase I ESA report typically are based on a review of historical information, interviews, a site "walkover," and other forms of noninvasive research. When site subsurface conditions are not sampled in any way, the risk of unanticipated conditions is higher than it would otherwise be.

While borings, installation of monitoring wells, and similar invasive test methods can help reduce the risk of unanticipated conditions, *do not overvalue the effectiveness of testing.* Testing provides information about actual conditions only at the precise locations where samples are taken, and only when they are taken. Your Geo-environmental professional has applied that specific information to develop a general opinion about environmental conditions. *Actual conditions in areas not sampled may differ (sometimes sharply) from those predicted in a report.* For example, a site may contain an unregistered underground storage tank that shows no surface trace of its existence. *Even conditions in areas that were tested can change,* sometimes suddenly, due to any number of events, not the least of which include occurrences at adjacent sites. Recognize, too, that *even some conditions in tested areas may go undiscovered,* because the tests or analytical methods used were designed to detect only those conditions assumed to exist.

Manage your risks by retaining your Geo-environmental professional to work with you as the project proceeds. Establish a contingency fund or other means to enable your Geo-environmental professional to respond rapidly, in order to limit the impact of unforeseen conditions. To

help prevent any misunderstanding, identify those empowered to authorize changes and the administrative procedures that should be followed.

Do Not Permit Any Other Party To Rely on the Report

Geo-environmental professionals design their studies and prepare their reports to meet the specific needs of the clients who retain them, in light of the risk management methods that the client and Geo-environmental professional agree to, and the statutory, regulatory, or other requirements that apply. The study designed for a developer may differ sharply from one designed for a lender, insurer, public agency ... or even another developer. *Unless the report specifically states otherwise, it was developed for you and only you.* Do not unilaterally permit any other party to rely on it. The report and the study underlying it may not be adequate for another party's needs, and you could be held liable for shortcomings your Geo-environmental professional was powerless to prevent or anticipate. Inform your Geo-environmental professional when you know or expect that someone else - a third-party will want to use or rely on the report. *Do not permit third-party use or reliance until you first confer with the Geo-environmental professional who prepared the report.* Additional testing, analysis, or study may be required and, in any event, appropriate terms and conditions should be agreed to so both you and your Geo-environmental professional are protected from third-party risks. *Any party who relies on a Geo-environmental report without the express written permission of the professional who prepared it and the client for whom it was prepared may be solely liable for any problems that arise.*

Avoid Misinterpretation of the Report

Design professionals and other parties may want to rely on the report in developing plans and specifications. They need to be advised, in writing, that their needs may not have been considered when the study's scope was developed, and, even if their needs were considered, they might misinterpret Geo-environmental findings, conclusions, and recommendations. *Commission your Geo-environmental professional to explain pertinent elements of the report to others who are permitted to rely on it, and to review any plans, specifications or other instruments of professional service that incorporate any of the report's findings, conclusions, or recommendations.* Your Geo-environmental professional has the best understanding of the issues involved, including the fundamental assumptions that determined the study's scope.

Give Contractors Access to the Report

Reduce the risk of delays, claims, and disputes by giving contractors access to the full report, *providing that it is accompanied by a letter of transmittal that can protect you* by making it unquestionably clear that: 1) the study was not conducted and the report was not prepared for purposes of bid development, and 2) the findings, conclusions, and recommendations included in the report

are based on a variety of opinions, inferences, and assumptions and are subject to interpretation. Use the letter to also advise contractors to consult with your Geo-environmental professional to obtain clarifications, interpretations, and guidance (a fee may be required for this service), and that-in any event-they should conduct additional studies to obtain the specific type and extent of information each prefers for preparing a bid or cost estimate. Providing access to the full report, with the appropriate caveats, helps prevent formation of adversarial attitudes and claims of concealed or differing conditions. If a contractor elects to ignore the warnings and advice in the letter of transmittal, it would do so at its own risk. Your Geo-environmental professional should be able to help you prepare an effective letter.

Do Not Separate Documentation from the Report

Geo-environmental reports often include supplementary documentation, such as maps and copies of regulatory files, permits, registrations, citations, and correspondence with regulatory agencies. If subsurface explorations were performed, the report may contain final boring logs and copies of laboratory data. If remediation activities occurred on site, the report may include: copies of daily field reports, waste manifests, and information about the disturbance of subsurface materials, the type and thickness of any fill placed on site, and fill placement practices, among other types of documentation. *Do not separate supplementary documentation from the report. Do not, and do not permit any other party to redraw or modify any of the supplementary documentation for incorporation into other professionals' instruments of service.*

Understand the Role of Standards

Unless they are incorporated into statutes or regulations, standard practices and standard guides developed by the American Society for Testing and Materials (ASTM) and other recognized standards-developing organizations (SDOs) are little more than aspirational methods agreed to by a consensus of a committee. The committees that develop standards may not comprise those best qualified to establish methods and, no matter what, no standard method can possibly consider the infinite client and project-specific variables that fly in the face of the theoretical "standard conditions" to which standard practices and standard guides apply. In fact, these variables can be so pronounced that Geo-environmental professionals who comply with every directive of an ASTM or other standard procedure could run foul of local custom and practice, thus violating the standard of care.

Accordingly, when Geo-environmental professionals indicate in their reports that they have performed a service "in general compliance" with one standard or another, it means they have applied professional judgement in creating and implementing a scope of service designed for the specific client and project involved, and which follows some of the general precepts

laid out in the referenced standard. To the extent that a report indicates "general compliance" with a standard, you may wish to speak with your Geo-environmental professional to learn more about what was and was not done. *Do not assume a given standard was followed to the letter.* Research indicates that that seldom is the case.

Realize That Recommendations May Not Be Final

The technical recommendations included in a Geo-environmental report are based on assumptions about actual conditions, and so are preliminary or tentative. Final recommendations can be prepared only by observing actual conditions as they are exposed. For that reason, you should retain your Geo-environmental professional to observe construction and/or remediation activities on site, to permit rapid response to unanticipated conditions. *The Geo-environmental professional who prepared the report cannot assume responsibility or liability for the report's recommendations if that professional is not retained to observe relevant site operations.*

Understand That Geotechnical Issues Have Not Been Addressed

Unless geotechnical engineering was specifically included in the scope of professional service, a report is not likely to relate any findings, conclusions, or recommendations about the suitability of subsurface materials for construction purposes, especially when site remediation has been accomplished through the removal, replacement, encapsulation, or chemical treatment of on-site soils. The equipment, techniques, and testing used by geotechnical engineers differ markedly from those used by Geo-environmental professionals; their education, training, and experience are also significantly different. If you plan to build on the subject site, but have not yet had a geotechnical engineering study conducted, your Geo-environmental professional should be able to provide guidance about the next steps you should take. The same firm may provide the services you need.

Read Responsibility Provisions Closely

Geo-environmental studies cannot be exact; they are based on professional judgement and opinion. Nonetheless, some clients, contractors, and others assume Geo-environmental reports are or certainly should be unerringly precise. Such assumptions have created unrealistic expectations that have led to wholly unwarranted claims and disputes. To help prevent such problems, Geo-environmental professionals have developed a number of report provisions and contract terms that explain who is responsible for what, and how risks are to be allocated. Some people mistake these for "exculpatory clauses," that is, provisions whose purpose is to transfer one party's rightful responsibilities and liabilities to someone else. Read the responsibility provisions included in a report and in the contract you

and your Geo-environmental professional agreed to. They are important.

Rely on Your Geo-environmental Professional for Additional Assistance

Membership in ASFE exposes Geo-environmental professionals to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a Geo-environmental project. Confer with your ASFE-member Geo-environmental professional for more information.

INCIDENT REPORT

Medalfield Waste Dump Facility
Lower Freshwater Rd
Kamerunga QLD

3 Jan 2003	One battery dumped, taken back out with customer
22 Jan 2003	2 tyres dumped on tip, removed and taken to tyre company
25 Jan 2003	2 batteries put on a pallet at tip
27 March 2003	Paint tins containing paint taken back out with customer
14 April 2003	1 battery dumped, moved to pallet near shed 2 tyres dumped, taken to tyre company
7 May 2003	2 x 20 litre drums half full of oil, taken back out with customer
16 July 2003	1 tyre taken back out with customer
25 July 2003	2 tyres taken back out with customer
3 August 2003	1 battery, 2 x 20lt drums of oil taken back out with customer
20 August 2003	2 full paint tins taken to shed
19 September 2003	2 tyres taken back out by customer
6 October 2003	4 tyres taken back out by customer 1 battery put on pallet by shed
11 November	1 battery put on pallet by shed

Groundwater Sampling

(Please refer to table 1 –Summary of field and analytical test results (page 3 of report)).

pH

The pH levels included in the report range from 5.1 to 6.2 indicating the groundwater is acidic. Of the samples analysed only one reading meets drinking water guidelines (i.e. 6.5-8.5). When compared against the agricultural standards only some of the samples are within agriculture levels. The report includes previous data for pH levels. This information indicates that the landfill site has been acidic since 1997. According to the report pH levels have been acidic since the landfill had begun operation. Therefore, although the pH levels are acidic, it does not seem as if the landfills presence has contributed to this. Refer to appendix B.

The acidity of the groundwater would most likely be due to the geology of the Landfill site. This is because the pH readings have been acidic since the landfill's commencement. The geology of bedrock is generally influential on the base-flow. However, this is assuming that the landfill has not largely influenced the pH of the groundwater.

Electrical Conductivity

No guideline values were included in this report for electrical conductivity. Therefore, guidelines will be used from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000. The electrical conductivity guidelines have been used from Table 3.3.5 page 3.3-13 for ecosystems in tropical Australia. The recommended guideline value for lakes, reservoirs and wetlands is 90-900 uS/cm salinity.

The results submitted in the report are in mS/cm and range from 72-184mS/cm. Therefore, the results range from 0.072 to 0.184 uS/cm. This is well below the recommended levels.

Total Dissolved Solids (TDS)

All readings of TDS are below the recommended drinking water value of 500mg/L. The readings range from 70-200 mg/L.

Dissolved Oxygen

Dissolved oxygen is in % saturation for guideline values. The readings provided by Golder Associates is in mg/L. The results range from 0.1 to 8.3 mg/L. Current ANZECC guidelines state that for Tropical Australia, dissolved oxygen levels should be from 85 to 120% saturation. However, there are no guideline values in mg/L. The previous ANZECC Guidelines outlined that the level of dissolved oxygen should not fall below 6 mg/L or 80-90% saturation. Assuming that 6 mg/L is still an appropriate trigger value, the level was below this in 6 out of the 9 measurements taken.

Iron

The NWQMS has outlined that the level of iron in drinking water should be 0.3 mg/L. However, table 1 has indicated that this level has been exceeded twice (1.9mg/L, 2.8 mg/L). This has also exceeded the agriculture standard of 0.2. In the past, other exceedences have also occurred (refer appendix B).

Copper

All copper readings taken from the samples were below the recommended drinking, agriculture and freshwater ecosystem protection standards.

Zinc

The levels outlined in table 1 show that levels are below the recommended drinking water standards. One measurement exceeds the agriculture standard and some measurements exceed the freshwater ecosystem protection levels.

Lead

All readings from the samples are below the recommended drinking water standard and the agriculture standard. However, some readings exceed the freshwater ecosystem protection levels.

Nitrogen

All samples are below the recommended agriculture level. One reading (taken 20/06/03) is above freshwater ecosystem protection level. The level outlined by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 for No_x (oxides of Nitrogen) is 10 ug/L for lowland rivers. All the measurements are below the recommended agricultural standards.

Discussion

The iron levels (filtered) were above guideline values in MW2. The samples indicated that the iron levels exceeded the agriculture and drinking water guidelines on two instances. However, the most recent water testing results indicated that the iron level was back below the guidelines for both agriculture and drinking water. Iron levels have fluctuated over the past few years as is shown in appendix B. However, the level of iron present has increased.

The pH values were below the recommended drinking water levels in all but one case. The pH results indicated that the only instance that a reading met both the agriculture and drinking standard was on 20.06.03 in MW2. This was the only time for the yearly period that a pH reading met the drinking standards. All other readings were more acidic. However, it is outlined in the report by Golder Associates that their experience with groundwater monitoring in the Cairns region suggested that the samples acidity was not uncommon. The results complied for the year does not suggest that there has been any change in pH readings since the commencement of the landfill although levels have fluctuated over time.

Therefore it is recommended that the bores are monitored to ensure no further decrease in pH or increase in iron levels occur. It should be noted that there are no guidelines for groundwater although the Australian and New Zealand Guidelines for Fresh and Marine Water Quality indicate in box 1.2 of the manual that the guidelines can be applied to groundwater as it is stated that the groundwater should be the quality of surface water when it comes to the surface. Metalfield should take measures to ensure that levels are within guidelines.

Metalfield should also ensure that they are taking the required amount of samples as outlined in condition H7(e) that the groundwater samples are required to be taken 'on at least one occasion in each of the months of December, March, June and September each year. This report indicates that the samples have been taken in December, February and June. The samples taken in February occurred later in the month (28.02) therefore this should suffice for March. However, this leaves the samples that are required to be taken for the month of September missing from the document.

After going through the contents of the file for Metalfield it was noted that in previous reports the groundwater levels were included as outlined in licence condition H7(d).

H7(d) standing water levels in metres must be measured and recorded on each occasion that samples are obtained. Such measurement must be undertaken prior to any disturbance by

sampling and must be reported as the depth in metres from the top edge of the casing collar to the water surface within the bore;

The groundwater levels for the year September 2002-September 2003 have not been included in the report.

After reviewing the file CNS1372 it is noted that there has been concern in the past (2001) as to the results of the Groundwater Environmental Impact Analysis Report. The iron level is noticeably higher than previously recorded. For the year 2000-2001 the iron levels range from 0.05-0.22 mg/L the higher level being from MW2. In the year 2002-2003 (this report) the level was <0.05 – 2.8 mg/L in MW2. Furthermore, the highest recorded total iron level for the year 2000-2001 was 250 mg/L in MW2 and for this report (2002-2003) it was 340 mg/L in MW2. This shows a dramatic increase in iron levels.

Other parameters were also compared and it was concluded that:

Parameter		2000-2001	2002-2003	Comment
pH		5-5.99	5.1-6.5	Recent results are less acidic
Electrical Conductivity	mS/cm	70-250	72-184	Recent results have less EC
TDS	mg/L	77-210	70-200	Approximately the same
DO	mg/L	0.6-5.5	0.1-8.3	Recent levels show lower min value and higher max value
Iron (Fe)	mg/L (filtered)	0.05-0.22	<0.05-2.8	Recent results are much higher
Total Iron	mg/L (unfiltered)	0.05-250	<0.05-340	Recent results are higher
Copper	mg/L	<0.05	<0.01	Recent results are lower
Zinc	mg/L	0.005-0.33	<0.005-0.26	Recent results are lower
Lead	mg/L	<0.002-0.02	<0.002-0.005	Recent results are lower
Total Oxidised Nitrogen	mg/L	0.1-1.7	0.05-0.83	Recent results are lower

Perhaps action should be taken to identify the cause of these iron levels - especially to determine if there is a cause for concern due to these higher levels.

sch4p4(6) Personal Information

1-APR-01 WED 13:38

* P. 101. CHRISTINA

CNS815.



Certificate of Analysis

CAIRNS WATER
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 Cairns 4870

Laboratory Contact:

sch4p4(6) Pe

Cairns

direct phone: (07) 4044 8344

direct fax: (07) 4044 8333

P138 Lemura Sand Co P/L
 PO Box 190
 Smithfield
 Qld 4878

Attn: sch4p4(6) Pers
Phone: (07) 4058 1187
Faxes: (07) 4058 1357

re noted 6/4/01

Client Reference:

Lemura Sands - Pit 2

Sampled: 03/04/2001 07:30:00 Depth (m): 0
 Received at Lab: 03/04/2001 08:00:00

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
pH	<u>101/03583</u> 7.5		TPP140	Yes
Dissolved Oxygen	<u>101/03584</u> 1.3 mg/L O ₂		TFP100	Yes

Client Reference:

Lemura Sands - Pit 3

Sampled: 03/04/2001 07:30:00 Depth (m): 0
 Received at Lab: 03/04/2001 08:00:00

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
pH	<u>101/03585</u> 8.1		TPP140	Yes

Explanatory Notes for this Report

Responsibility for sampling lies with the client

sch4p4(6) Personal Informa

A number in parentheses () indicates a presumptive result.

Chemical Signatory

Biological Signatory

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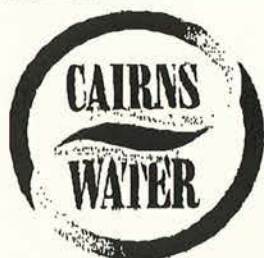
Page 1 of 1

Report issued: 04/04/2001

1-MAY-01 FRI 12:22

* ATTN:

sch4p4(6) Personal Inform



Certificate of Analysis

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CNS 815
CNS 200 1/6416

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Chemist

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P138 Lemura Sand Co P/L
Box 190
Smithfield
Qld

4878

CARMS

Attn: sch4p4(6) Pers

Phone: (07) 4058 1187

Faxes: (07) 4058 1357

Client Reference:

Lemura Sands - Pit 2

Sampled: 09/05/2001 09:30:00 Depth (m):

Received at Lab: 09/05/2001 10:08:00

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
pH	101/05017 7.5		TPP140	Yes
Dissolved Oxygen	101/05018 2.6 mg/L O2		TPP100	Yes

Client Reference:

Lemura Sands - Pit 3

Sampled: 09/05/2001 09:30:00 Depth (m):

Received at Lab: 09/05/2001 10:08:00

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
pH	101/05019 8.0		TPP140	Yes

Explanatory Notes for this Report

Responsibility for sampling lies with the client

sch4p4(6) Personal Information

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Chemical Signatory

Biological Signatory

Sighted
sch4p4(6)
sch4p4(6) Personal Information
sch4p4(6)

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Report issued: 11/05/2001



C&B GROUP

FACSIMILE TRANSMISSION

Attention:	sch4p4(6) Personal Information		
Company:	EPA		
Fax No:	4046 6606		
Cc:	[redacted] (Fax: 40581357)		
Sender:	sch4p4(6) Personal Info	Date:	16 February 2001
Job No:	5770	Pages:	5
Subject:	Lemura Sands Draft Licence		

This message is intended for the use of the person or entity names above and may contain information that is private, confidential or privileged. If you have received this communication in error or have not received all pages stated above, please contact the writer immediately on phone (07) 4031 1336 or fax (07) 4031 2942.

Dear [redacted]

Following our review of the draft licence and consultation with sch4p4(6) Person
sch4p4(6) Personal I we provide the following comment.

YORKEYS KNOB WASTE DISPOSAL PITS

- **Condition (1.C3) A collection sump must be provided in the bunded area to capture stormwater run-off that has been in contact with any contaminants at the site.**

As discussed in our meeting at C&B Group on Wednesday 7 February 2001, we consider that the collection sump is onerous and unnecessary requirement. Waste disposal pits, waste inspection areas, waste storage areas and temporary storage areas are bunded to maintain flood immunity from at least a 1 in 50 year flood event. Waste inspection areas, waste storage areas and temporary storage areas are profiled such that any rainfall runoff is directed towards the waste disposal pit.

We also note that spill contingency procedures are in place, which may be implemented immediately in the event of spillage of any contaminants. These spill contingency procedures relate to the clean up of spillage via dry methods.

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- **Condition (2.E3) Only one waste disposal pit must be operational at anytime and should cease operation prior to the commencement of operation at another waste disposal pit.**

We advise that in the future the need may arise to operate more than one waste disposal pit. For example, this need may arise in the event that backfilling operations in Pit 1 sufficiently fill the pit to a level greater than the permanent groundwater level. In such a circumstance, Lemura Sands would need to commence waste disposal operations in a second waste disposal pit so that PASS could be disposed below the permanent groundwater level. We therefore request that this condition be deleted or amended to allow for operation of two pits at any time.

- **Condition (2.E9) Representative pH tests of each incoming load of PASS material must be carried out prior to acceptance of each load.**

During our recent meeting Lemura Sands advised that arrangements relating to the suitability of the PASS material for acceptance are made in advance of the material being received on site. Under these arrangements, Lemura Sands notify each potential PASS material waste generator/disposer that they require laboratory test results in advance of the waste being received on site. Upon the receipt and consideration of the test results, Lemura Sands then decide whether to accept or reject the PASS material.

Under this process the suitability of the PASS material for disposal is assessed prior to receipt of the material at the site thereby eliminating the need to carry out testing of each incoming load prior to acceptance.

BARRON SANDS WASTE DISPOSAL PITS

- **Condition (3.E3) Only one waste disposal pit must be operational at anytime and should cease operation prior to commencement of operation at another waste disposal pit.**

We advise that it is necessary to operate two disposal sites at the Barron Sands Waste Disposal Pits. One disposal site is required for general inert waste, which may be buried above or below the groundwater level, while another disposal site is required for mixed loads of green waste, which is buried at least 2 m above the highest seasonal groundwater level. Attached **Drawing 5770-6** shows the location of the operational disposal pit and the vegetation backfill area (mixed loads only).

- **Schedule 3.E – Table 1 – Waste Acceptance Criteria (refer p17 of Draft Environmental Licence)**

Schedule 3.E – Table 1 designates green waste (generated by construction and demolition activities and delivered to the site as part of a mixed load of materials) as a waste acceptable for temporary storage.

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As detailed in the Integrated Environmental Management System (IEMS) submitted to the Environmental Protection Agency, it is proposed that mixed loads of green waste be permitted for disposal. The following control measures were proposed to minimise the potential for biodegradation and leaching of phosphorus and nitrogen to the groundwater:

- The waste shall be disposed at an elevation at least 2 m above the highest seasonal groundwater table;
- The waste shall be covered at the end of each day with low permeability material to minimise exposure to oxygen and moisture and therefore minimise the rate of biodegradation of the green waste; and
- Covering of locations where mixed loads of green waste have been disposed with a 0.3 m thick layer of compacted low permeability material (eg. high clay content material).

Given the above control measures, it is considered that there is a very low risk that nitrogen or phosphorus pollution of groundwater would occur consequent to the acceptance and disposal of mixed loads of green waste. Groundwater monitoring data for the site is enclosed, the data suggests that burial of mixed loads of green waste does not appear to impact the quality of the receiving groundwater.

Should you have any queries in regard to this matter, please call to discuss.

Yours faithfully
C&B GROUP

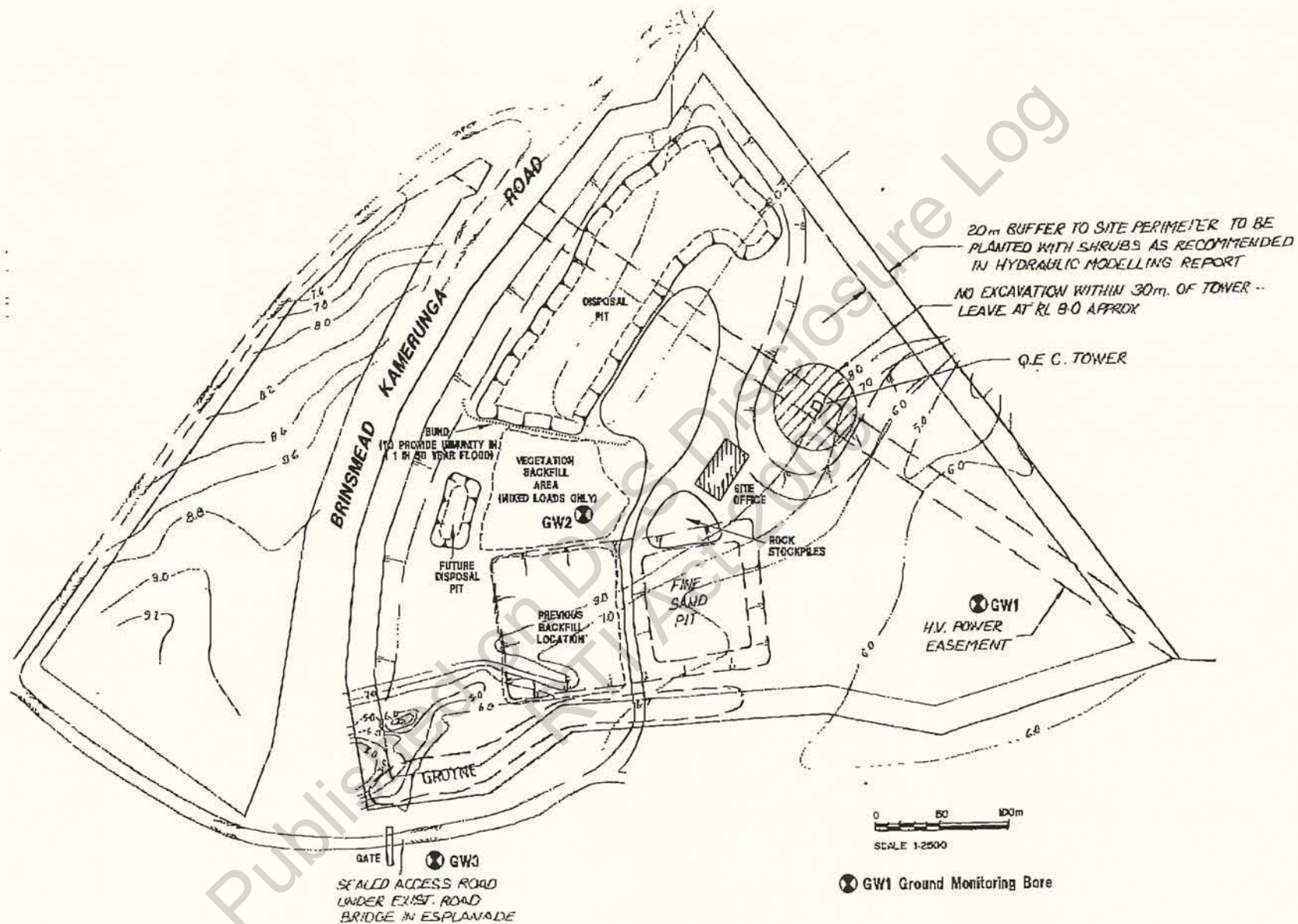
sch4p4(6) Personal Information

MANAGER - ENVIRONMENTAL SERVICES

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LAYOUT IS NOT SURVEYED.
APPROXIMATE POSITION ONLY.

18-541

AMENDMENT A:

HS 16/02/01

File A

KAMERUNGA SAND PIT WASTE DISPOSAL SITE LAYOUT

5770-6A

29-9-00

C&B GROUP

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Rel

Kamerunga Sands Groundwater Monitoring Database

Site	Date	pH	EC (uS/cm)	Ammonia (mg/L)	TON (mg/L)	TKN (mg/L)	TN (mg/L)	TP (mg/L)	G.W. Level (m from top of bore)
GW1 (Background)	2-Mar-99	6.3	130	0.014	1.6	<0.05	1.6	<0.05	
GW1 (Background)	18-May-99	5.9	130	<0.05	1.3	<0.05	1.3	<0.05	
GW1 (Background)	7-Sep-99	6.8	99	<0.05	0.64	0.08	0.72	<0.05	
GW1 (Background)	8-Jun-00	5.6	120	<0.05	1.2	0.15	1.4	<0.05	
GW1 (Background)	28-Sep-00	6.3	98	<0.05	0.66	<0.05	0.66	<0.05	4.6
GW2 (Oldest Backfill Pit)	2-Mar-99	6.2	580	0.026	1.4	0.13	1.5	<0.05	
GW2 (Oldest Backfill Pit)	18-May-99	6.4	320	<0.05	1.1	<0.05	1.1	<0.05	
GW2 (Oldest Backfill Pit)	7-Sep-99	*	*	*	*	*	*	*	
GW2 (Oldest Backfill Pit)	8-Jun-00	*	*	*	*	*	*	*	*
GW2 (Oldest Backfill Pit)	28-Sep-00	*	*	*	*	*	*	*	
GW3 (Downgradient of Backfill Site)	2-Mar-99	6.4	380	0.059	1	0.12	1.1	<0.05	
GW3 (Downgradient of Backfill Site)	18-May-99	6.4	520	0.1	0.45	0.14	0.59	<0.05	
GW3 (Downgradient of Backfill Site)	7-Sep-99	7.1	280	<0.05	0.34	<0.05	0.34	<0.05	
GW3 (Downgradient of Backfill Site)	8-Jun-00	*	*	*	*	*	*	*	*
GW3 (Downgradient of Backfill Site)	28-Sep-00	*	*	*	*	*	*	*	
ANZECC Guidelines for Fresh Waters		6.5-9.0	<1500	-	-	-	0.01-0.75	0.01-0.1	-

Note - * indicates that the groundwater well was dry and hence no sample was collected.

- Bold format indicates noncompliance with ANZECC Guidelines for Fresh Waters.
- Groundwater level measured as depth in metres below top of bore.

GW1

Notes for Nov 00
Jan 01



C&B GROUP

Our Ref: 5770/PL/L33664

15 September 2000

Environmental Protection Agency
2nd Floor 2-4 McLeod Street
Cairns QLD 4870

Attention: sch4p4(6) Personal Information

Dear sch4p4(6) Perso

Re: **Odours Problems at Lemura Sands**

We advise that we act on behalf of Lemura Sand Company for this matter.

We refer your correspondence dated 25 August 2000 regarding odour problems at the Lemura Sands and we offer the following information.

Since initial identification of the odour problem, Lemura Sands have undertaken action to alleviate the odour problem by way of mechanical aeration. Early control measures included the use of a water pump to spray water into the air over the pit. More recently Lemura Sands have installed 2 mechanical aerators and an artificial waterfall, in addition to the water pump. These control measures are illustrated on the enclosed Plates.

Lemura Sands have carried out water quality monitoring in accordance with the conditions of the Environmental Authority. Recent water quality monitoring results are presented in Table 1 below for your reference.

Table 1 Water Quality Monitoring Results

Date	Pit Number	pH	Dissolved Oxygen (mg/L)
4/9/2000	Pit 1	3.8 ¹	-
4/9/2000	Pit 2	7.5 ¹	2.0 ¹
4/9/2000	Pit 3	7.4 ¹	-
12/9/2000	Pit 1	6.3 ²	-
12/9/2000	Pit 2	-	5.3 ¹

Note: 1 - indicates sample collected by Lemura Sands and analysed by Cairns City Council Water Quality Laboratory (Analysis Certificates are attached for your reference).

2 - indicates sample measurement taken by C&B Group using a portable pH meter.

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The water quality monitoring results recorded dissolved oxygen levels in Pit 2 at 2.0 mg/L, which comply with the minimum limit of 2.0 mg/L. However, following the recent installation of the 2 mechanical aerators and the waterfall (in addition the water pump), recent water quality monitoring has demonstrated that dissolved oxygen levels have increased dramatically to 5.3 mg/L.

The Lemura Sand Company has advised that they will continue to carry out dissolved oxygen testing at weekly intervals over the next 5 weeks, after which, Lemura Sands will carry out dissolved oxygen testing at monthly intervals in accordance with the Condition (H7) of the Environmental Authority.

Monthly pit pH monitoring recorded a reading of pH 3.8 at Pit 1, which is below the pH range 5.5 – 8.5. This depression in pH is expected to be a consequence of extraction operations, which were completed the day before the water samples were collected. As the extraction of material may temporarily decrease pH, it is standard operational practice at Lemura Sands to monitor pit waters both during and after extraction and then amend pH with lime as necessary. Monitoring carried out by C&B Group on the 12 September 2000 recorded a reading of pH 6.3 in Pit 1, which is compliant with pH range 5.5 – 8.5.

We understand that Condition (H8) of Environmental Authority No. 5010000188 (Amended) requires that Lemura Sands submit a Water Quality monitoring program to the administering authority by 30 August 2000. We advise that Lemura Sands are currently preparing an Integrated Environmental Management System (IEMS) to cover disposal activities carried out the Yorkeys Knob Road site. We confirm that a Water Quality monitoring program will be included in the IEMS and that submission of this IEMS to the Environmental Protection Agency is imminent. We therefore request that you relax the date upon which the Water Quality monitoring program was to have been received from the 30 August 2000 to the date upon which the IEMS is received by the Environmental Protection Agency.



We trust that this information meets with your requirements. Should you require any additional information in regard to this matter, please contact Peter Lander or the undersigned.

Yours faithfully
C&B GROUP

sch4p4(6) Personal Information

MANAGER ENVIRONMENTAL SERVICES

enc.

cc. Attn: sch4p4(6) Person
Lemura Sand Company
PO Box 190
Smithfield QLD 4878





Plate 1 – Illustration showing the artificial waterfall being used to aerate pit waters.



Plate 2 – Illustration showing the water pump spraying water into the air over the pit and the artificial waterfall.



Plate 3 – Illustration showing the mechanical aerators.



Certificate of Analysis

Calms City Council
Water Quality Laboratory

38 MacNamara Street

P.O. Box 359

Calms 4870

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Qld

4878

Laboratory Contact:

sch4p4(6) Pers

Chemist

direct phone: (07) 4051 0755

direct fax: (07) 4051 0331

Attn: sch4p4(6) Person
Phone: (07) 4058 1187
Faxes: (07) 4058 1357

Client Reference:

Lemura Sands - Pit 1

Sampled: 04/08/2000 08:30:00

Depth (m):

Received at Lab: 04/09/2000 08:45:00

0

Analysis Result	Guideline	Analysis Method	NATA Endorsed
100/09004			
pH	3.8	TPP140	Yes

Client Reference:

Lemura Sands - Pit 2

Sampled: 04/09/2000 08:30:00

Depth (m):

Received at Lab: 04/09/2000 08:45:00

0

Analysis Result	Guideline	Analysis Method	NATA Endorsed
100/09005			
pH	7.5	TPP140	Yes
100/09007			
Dissolved Oxygen	2.0 mg/L O2	TPP100	Yes

Client Reference:

Lemura Sands - Pit 3

Sampled: 04/09/2000 08:30:00

Depth (m):

Received at Lab: 04/09/2000 08:45:00

0

Analysis Result	Guideline	Analysis Method	NATA Endorsed
100/09008			
pH	7.4	TPP140	Yes

Explanatory Notes for this Report

Responsibility for sampling lies with the client

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Report Issued: 04/09/2000

P. 01/01

*ATTN:

sch4p4(6) Personal Information



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sch4p4(6) Per

Chemist

direct phone: (07) 4051 0755

direct fax: (07) 4051 0331

Attn: sch4p4(6) Person

Phone: (07) 4058 1187

Fax: (07) 4058 1357

Client Reference:

Lemura - Dam
(Pit 2)

Sampled: 12/09/2000 13:30:00

Depth (m):

0

Received at Lab: 12/09/2000 14:25:00

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
Dissolved Oxygen	100/08431 5.3 mg/L O2		TPP100	Yes

Explanatory Notes for this Report

Responsibility for sampling lies with the client.

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Report issued: 12/09/2000

10/10/01

18-541

12 SEP 2001 10:11

File A

85:91 Page 128 of 130
12 SEP 2001 15:58

Subject: Yorkeys Knob Site (Lemura Sands)

Date: Thu, 22 Feb 2001 17:44:04 +1000

From: sch4p4(6) Personal Informa@cbgroup.com.au>

To: sch4p4(6) Personal Information@env.qld.gov.au>

Hi sch4p4(6) Pers

I enclose some salinity and electrical conductivity data for your information for the Lemura Sands Yorkeys Knob site.

Pit 3 - 19/2/2001

pH = 7.57

EC = 1082uS/cm

Salinity = 595 ppm (or mg/L)

Pit 1 - November 1999

Salinity = 210 ppm (or mg/L)

Pit 2 - November 1999

Salinity = 890 ppm (or mg/L)

Pit 3 - November 1999

Salinity = 650 ppm (or mg/L)

As would be expected Pit 2 and 3 show higher values than Pit 1 owing to their location nearer Richters Creek. This reach of Richters Creek nearby Pits 2 & 3 frequently experiences some tidal influence during high tides.

Regards

sch4p4(6) Personal Inform



Certificate of Analysis

CAIRNS WATER
Laboratory Services
 38 MacNamara Street
 P.O. Box 359
 Cairns 4870

P138 Lemura Sand Co P/L
 PO Box 190
 Smithfield
 Qld 4878

Laboratory Contact :

sch4p4(6) Personal

Chemist

direct phone: (07) 4044 8344
 direct fax: (07) 4044 8333

Attn : sch4p4(6) Personal
Phone : (07) 4058 1187
Faxes : (07) 4058 1357

FIXED
 7-2-01

Client Reference :

Lemura Sands - Pit 2

Sampled : 05/02/2001 11:00:00 Depth (m):

Received at Lab : 05/02/2001 11:55:00 0

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
	<u>101/01346</u>			
Dissolved Oxygen	4.0 mg/L O2		TPP100	Yes
	<u>101/01347</u>			
pH	7.5		TPP140	Yes

Client Reference :

Lemura Sands - Pit 3

Sampled : 05/02/2001 11:00:00 Depth (m):

Received at Lab : 05/02/2001 11:55:00 0

	Analysis Result	Guideline	Analysis Method	NATA Endorsed
	<u>101/01348</u>			
pH	7.8		TPP140	Yes

Explanatory Notes for this Report

Responsibility for sampling lies with the client
 sch4p4(6) Personal Information

A number in parentheses () indicates a presumptive result.

Chemical Signatory

Biological Signatory

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Report Number : 12092

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