

# **BATHING WATER QUALITY MONITORING PROGRAMME 2004**

**Report on physicochemical monitoring**



**Environment Protection Directorate**  
Malta Environment and Planning Authority

## **Executive Summary**

As a member of the European Union, Malta is required to carry out bathing water quality monitoring as part of obligations under L.N.380 of 2003 which transposes EU Directive 76/160/EEC. Monitoring is carried out jointly by MEPA, which carries out physicochemical monitoring, and the Department of Health, which carries out microbiological monitoring.

Environment Inspectors from the Pollution Prevention and Control Unit within the Environment Protection Directorate of MEPA gather samples throughout the designated bathing season (3<sup>rd</sup> week of May till the 3<sup>rd</sup> week of October) from various sites divided into 4 main coastal zones. The latter are Malta South, Malta Central (Sliema Area), Malta North and Gozo.

Samples are gathered every Monday and Wednesday according to coastal zone, thereby resulting in a two-week rotation of sample collection from each zone. The exact routine is discussed in detail further on in the report.

While on-site, inspectors carry out some analysis on the samples which includes pH, percentage dissolved oxygen and temperature using portable instruments while the rest of the analysis takes place at an accredited laboratory. Other sample-related records include weather conditions and rainfall occurrences.

This report includes the results obtained for physicochemical parameters of the bathing water season 2004 and their compliance to the bathing water legislation.

## **1.0 INTRODUCTION:**

Following Accession into the EU, Malta is bound to implement and comply with several directives that have been transposed and have come into force. The Bathing Water Directive (CD 76/160/EEC) has been transposed as L.N. 380 of 2003. This legislation lists a set of parameters of a microbiological and physicochemical nature to be monitored. Malta is also as a contracting party to the Barcelona Convention, and is thus obliged to carry out testing of bathing waters during the legally designated bathing season between mid-May to mid-October annually.

The monitoring of bathing waters is carried out jointly between the Department of Public Health within the Ministry of Health that carries out microbiological analysis and the Environment Protection Directorate within the Malta Environment and Planning Authority that carries out monitoring of physicochemical parameters in-situ and ex-situ.

This report contains results of physicochemical analysis that have been carried out on samples gathered from designated bathing sites around the coast of Malta during the official bathing season.

## **2.0 FREQUENCY AND METHODOLOGY OF SAMPLE COLLECTION**

### 2.1 Selection of monitored sites

The site selection and grouping of the different coastal areas is harmonized with that of the Public Health Department, whereby Malta is divided into 4 main coastal zones:

<b>Coastal Zone A</b>	<b>Malta South</b>
<b>Coastal Zone B</b>	<b>Sliema Area</b>
<b>Coastal Zone C</b>	<b>Malta North</b>
<b>Coastal Zone D</b>	<b>Gozo and Comino</b>

The total number of bathing sites with a corresponding code according to the location of the coastal zone is 87, as designated by the Department of Health, out of which 43 had been selected as sampling points for physicochemical monitoring by MEPA.

Coastal Zone A	Coastal Zone B	Coastal Zone C	Coastal Zone D
A3	B1A	C1	D2
A5	B3	C3	D6
A7	B4	C5	D7
A8	B5	C6	D9
A9	B6	C7	D10
A11	B9	C9	D13
A12	B11	C13	D15
A13	B12	C17	D17
A15	B13	C19	
A16		C20A	
A17		C23	
		C26	
		C28	
		C30	
		C32	

Sites selected by MEPA for physicochemical monitoring 2004.

Refer to Appendix for site description.

## 2.2 Frequency of monitoring

Sampling was carried out twice weekly on Mondays and Wednesdays. Sampling took place in the early morning, generally between the hours of 6am and 9am. The exact dates when sampling took place were between the 24<sup>th</sup> May and the 20<sup>th</sup> October.

The samples were collected from the shoreline, at a depth of approximately 0.3m, and placed within sample bottles provided by the assigned laboratory. Samples were kept in a cooler and transported back to MEPA premises until collection by staff from the designated laboratory.

### 2.3 Analysis of Samples Collected

The samples collected from the 43 selected sites were analysed both in-situ (on-site) by MEPA Environment Inspectors and ex-situ (off-site) at a designated laboratory (CEFIT, Italy) according to the physicochemical parameter being analysed.

The table below indicates which parameters were analysed in-situ (I) and ex-situ (E).

<b>Parameters (As indicated in L.N. 380 of 2003)</b>	<b>Analysis: Insitu = I Exsitu = E</b>	<b>Unit of Measurement</b>	<b>Method</b>	<b>Detection Limits (mg/l) CEFIT Laboratory (Siracusa, Italy)</b>
PH	I	-	PH Probe	-
Colour	E	-	Pt/Co Scale	
Odour	I/E	-	Olfactory	-
Mineral Oils/ Grease	I/E	mg/l	Gravimetry	0.500
Surface-active substances	E	mg/l	Spectrophotometry	0.020
Phenols	E	microg/l	Gas-Chromatography	5.000
Dissolved Oxygen	I	% Saturation	DO Meter	-
Ammonia	E	mg/l	Spectrophotometry	0.300
Nitrogen Kjeldahl	E	mg/l	Spectrophotometry	1.000
Heavy Metals - Arsenic	E	microg/l	Atomic Absorption	1.000
Heavy Metals - Cadmium	E	microg/l	Atomic Absorption	0.030
Heavy Metals - Chromium	E	microg/l	Atomic Absorption	0.200
Heavy Metals - Lead	E	microg/l	Atomic Absorption	1.000
Heavy Metals - Mercury	E	microg/l	Atomic Absorption	0.500
Cyanides	E	microg/l	??	0.010
Nitrate N	E	mg/l	Ion Chromatography	0.050
Phosphate P	E	mg/l	Spectrophotometry	0.050

*Table 2: Analysis of parameters in-situ (I) and ex-situ (E). Detection Limit Values per parameter analysed at CEFIT Laboratories*

### 2.3.1 Onsite (Insitu) Analysis

Instruments used were calibrated shortly before the bathing season and included:

- Oxyguard Handy pH
- Oxyguard Handy MkIII (Dissolved Oxygen)

The parameters analysed in-situ are indicated in previous table. Results obtained are included in section 3 and Appendix I

### 2.3.2 Laboratory Analysis (Exsitu)

Laboratory analysis was carried out by CEFIT Laboratories (Siracusa)

- All samples were tested for Kjeldahl N, ammonia N, nitrate N and phosphate P in the 43 sites as well as salinity, colour and odour.
- Further to this oil and grease, anionic surfactants, phenols, heavy metals (namely arsenic, cadmium, chromium, lead, and mercury) and cyanides, these parameters were analysed in the 10 sites highlighted in the table below.

<b>Coastal Zone A</b>	A3	A5	A7	A8	A9	A11	A12	A13	A15	A16	A17				
<b>Coastal Zone B</b>	B1A	B3	B4	B5	B6	B9	B11	B12	B13						
<b>Coastal Zone C</b>	C1	C3	C5	C6	C7	C9	C13	C17	C19	C20A	C23	C26	C28	C30	C32
<b>Coastal Zone D</b>	D2	D6	D7	D9	D10	D13	D15	D17							

Table: Samples Tested for Physicochemical Parameters.

The highlighted cells indicate the 10 sites where analysis for all parameters was carried out.

### 2.4 Statistics

- A total of 471 samples were collected over a span of 11 weeks out of a possible 473
- 2 samples were **not collected** due to very rough weather
- Out of 471 samples
  - 363 were tested for 8 parameters

- 108 were tested for 17 parameters

### **3.0 RESULTS**

#### 3.1 Compliance with 76/160/EEC transposed as L.N. 380 of 2003 (Physicochemical Parameters)

The aim of bathing water monitoring, apart from providing data for environment monitoring and evaluation, is to seek compliance with the above-mentioned legislation as a reflection of good or excellent bathing water quality. For some parameters, the legal notice sets both guideline and mandatory values. Guideline values (G) are stricter than mandatory (I) and are represented either as specific values or limits of variation. Compliance required with at least the mandatory values to satisfy bathing water criteria.

The table overleaf illustrates the mandatory (I) and guideline (G) values assigned to the different physicochemical parameters required for testing.

The next table presents compliance with L.N. 380 of 2003 and EU mandatory and guideline values according to the results received.

**Physicochemical Parameters listed in L.N. 380 of 2003 and 76/160/EEC**

**Method of Analysis is indicated as carried out by MEPA**

<b>Parameters (as listed in L.N. 380 of 2001)</b>	<b>Insitu = I (On-site Analysis) Exsitu = E (Lab Analysis)</b>	<b>Guideline Values (G)</b>	<b>Mandatory Values (I)</b>
PH	I	-	6-9
Colour	E	-	No abnormal change in colour (0)
Mineral Oils	I/E	<0.3mg/l	No film visible on surface of the water and no odour
Surface-active substances	E	<0.3mg/l	No lasting foam
Phenols mg/l	E	<0.005mg/l	-
Transparency	NOT REQUIRED	2	1
Dissolved Oxygen % Saturation of O2	I	80-120	-
Tarry residues and floating materials such as wood, plastic articles, bottles, containers of glass, plastic, rubber or any other substance.	I	Absence	-
Ammonia mg/l NH4	E	-	-
Nitrogen Kjeldahl mg/l N	E	-	-
Pesticides mg/l (parathion, HCH, dieldrin)	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED
HM* - Arsenic	E	-	-
HM* - Cadmium	E	-	-
HM* - Chromium	E	-	-
HM* - Lead	E	-	-
HM* - Mercury	E	-	-
Cyanides	E	-	-
Nitrate N mg/l NO3	E	-	-
Phosphate PO4	E	-	-



**Compliance with L.N. 380 of 2003 corresponding to  
EU Guideline (G) and Mandatory (I) Values in 76/160/EEC**

Physicochemical Parameters (as listed in L.N. 380 of 2001)	COASTAL ZONE A (% Compliance)		COASTAL ZONE B (% Compliance)		COASTAL ZONE C (% Compliance)		COASTAL ZONE D (% Compliance)	
	G	I	G	I	G	I	G	I
PH	-	100	-	100	-	100	-	100
Colour	-	100	-	100	-	100	-	100
Mineral Oils	0	100	0	100	0	100	0	100
Surface-active substances	97.7	-	100	-	100	-	100	-
Phenols mg/l	100	-	100	-	100	-	100	-
Transparency	NA* <sup>1</sup>	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen % Saturation of O2	43.8	-	54.6	-	66.6	-	61.4	-
Tarry residues and floating materials	96.7	-	96.9	-	96.0	-	98.9	-
Ammonia mg/l NH4	-	-	-	-	-	-	-	-
Nitrogen Kjeldahl mg/l N	-	-	-	-	-	-	-	-
Pesticides mg/l (parathion, HCH, dieldrin)	NA* <sup>2</sup>	NA	NA	NA	NA	NA	NA	NA
HM* - Arsenic	-	-	-	-	-	-	-	-
HM* - Cadmium	-	-	-	-	-	-	-	-
HM* - Chromium	-	-	-	-	-	-	-	-
HM* - Lead	-	-	-	-	-	-	-	-
HM* - Mercury	-	-	-	-	-	-	-	-
Cyanides	-	-	-	-	-	-	-	-
Nitrate N mg/l NO3	-	-	-	-	-	-	-	-
Phosphate PO4	-	-	-	-	-	-	-	-

NA\* = No Analysis

<sup>1</sup> Transparency was 100% due to bottom always visible

<sup>2</sup> There was no suspect that the substance may be present or that the quality of the water had deteriorated, according to Provision (2) of Annex of 76/160/EEC

## 3.2 Results Obtained

### *3.2.1 pH*

pH values were well within the range of 6 – 9 during the entire bathing season.

### *3.2.2 Colour*

All samples were colour-free during the entire bathing season.

### *3.2.3 Olfactory*

No samples had any particular odour for the entire bathing season.

### *3.2.4 Mineral & Oils (Oil & Grease) – Detection Limit: 0.5mg/l*

Compliance for this directive requires adhering to the mandatory (I) condition of no visible film being present at the surface. While oil films were never detected throughout the bathing season, the values for oil and grease were always greater than the recommended guideline value of 0.3mg/l. Complete results are included in Appendix I.

### *3.2.5 Surface-Active Substances – Detection Limit: 0.02mg/l*

The values for SASs were mostly below the detection limit for the entire bathing season. The levels adhered to the guideline criteria for most part of the season except for 24<sup>th</sup> May where values were analysed between 0.05mg/l and 2mg/l in sites A5, A9, A11, A13 and B1A.

### *3.2.6 Phenols –Detection Limit: 0.005mg/l*

The phenol values were all below detection limit and complied with Guideline Values.

### *3.2.7 Dissolved Oxygen - % Sat. Dissolved Oxygen*

The levels of dissolved oxygen varied largely in all coastal zones. There are no mandatory values indicated for oxygen levels. Complete values are included in Appendix I.

### *3.2.8 Ammonia N – Detection Limit: 0.3 mg/l*

The values of ammonia N were mostly below detection limit for the whole season.

### *3.2.9 Kjeldahl N – Detection Limits 0.04mg/l and 1.00mg/l*

The values for Kjeldahl N fluctuated for all sites and were often above the detection limit. Values were generally below 10mg/l, but there were instances where this concentration was surpassed. 11 samples were taken from each site in each coastal zone over a period of 22 weeks (samples gathered from one site, once a fortnight). It resulted that values above detection limit occurred with the following frequency in the following sites:

- Coastal Zone A: A5 (4), A9 (8), A13(9) and A16(2)
- Coastal Zone B: B01A (9), B9 (5), B11 (2) and B13 (3)
- Coastal Zone C: C3 (5), C5 (3), C7 (1), C9 (3), C19 (5), C23 (1), C28 (7) and C30 (7)
- Coastal Zone D: D7 (1), D9 (1), D10 (1), D13 (7) and D20 (4)

Complete Values are included in Appendix 1

### *3.2.10 Phosphates – Detection Limit 0.05 mg/l*

Generally phosphates were below detection limit in all sites except for some instances.

- Coastal Zone A – A3 (0.1mg/l)
- Coastal Zone B – No occurrences
- Coastal Zone C – No occurrences
- Coastal Zone D – D2 (0.20mg/l) and D20 (0.10 and 0.11mg/l)

### *3.2.11 Nitrates – Detection Limit 0.05mg/l*

The values for Kjeldahl N fluctuated for all sites and were often above the detection limit.

- Coastal Zone A: A3 (6), A5 (4), A9 (8), A13(9) and A16(2)
- Coastal Zone B: B01A (9), B9 (5), B11 (2) and B13 (3)
- Coastal Zone C: C3 (5), C5 (3), C7 (1), C9 (3), C19 (5), C23 (1), C28 (7) and C30 (7)
- Coastal Zone D: D7 (1), D9 (1), D10 (1), D13 (7) and D20 (4)

Complete results are included in Appendix I.

### 3.2.12 Heavy Metals

Analysis for heavy metals generally revealed that values were mostly below detection limit.

#### *Arsenic (Detection Limit 1 microg/l)*

- All values below detection limit for entire bathing season

#### *Cadmium (Detection Limit 0.03 microg/l)*

- All below detection limit except on:
  - 24<sup>th</sup> May for sites A5, A9, A11, A13 and B01A were values varied between 0.08 – 0.15 microg/l

#### *Chromium (Detection Limit 0.03 microg/l)*

- All below detection limit except on:
  - 24<sup>th</sup> May for sites A5, A9, A11, A13 and B01A were values varied between 0.08 – 0.15 microg/l
  - 26<sup>th</sup> May for site B01A with a values of 0.6 microg/l
  - 31<sup>st</sup> May for sites 1.9 – 2.6 microg/l
  - 2<sup>nd</sup> June
  - 10<sup>th</sup> June
  - 16<sup>th</sup> June
  - 21<sup>st</sup> June

#### *Lead (Detection Limit 0.03 microg/l)*

- All values below detection limit for entire bathing season

#### *Mercury (Detection Limit 0.03 microg/l)*

- All values below detection limit for entire bathing season

### 3.2.13 Cyanides

All values below detection limit for entire bathing season

## **DISCUSSION AND CONCLUSIONS**

Bathing water monitoring is an on-going programme that MEPA (also as the former Environment Department) and the Department of Health have been carrying out since 1996. Apart from assessing that the bathing waters as being of sufficient quality for bathers, monitoring also provides a means to collect data of environmental significance over a period of time.

The pressures on bathing areas are large during the bathing season, considering the size of tourist influx during the season. An overall increased activity in the islands during this period including sewage disposal and marine-related leisure activities, such as water sports and ferry cruises, causes significant stress on the bathing waters and non-bathing waters alike

In contrast with microbiological results, physicochemical results are not published immediately due to the fact that the interpretation of these results may only be taken over a longer period of time (as contrasted with microbiological results over 24-48hrs that if unfavourable lead to bathing prohibition). The accumulation of the results obtained and an analysis of the latter over a few years could lead to reliable information reflecting marine ecotoxicological changes that could be accounted as natural or possibly anthropogenic.

### Improvements over Bathing Water Quality Monitoring Report 2003

Following suggestions in the Bathing Water Quality Monitoring Report 2003, some improvements were carried out in monitoring during 2004 including:

- Record of daily weather to be kept in conjunction with results, with special reference to rainfall, wind strength and wind direction.
- Lower detection limits

A pending improvement is:

- Selection of a few (perhaps three) sites that are clean but are not bathing sites for monitoring of some physicochemical parameters for comparison to the results obtained for the bathing sites, in the absence of formal guidance through the bathing water regulations.



**APPENDIX I – Complete Results for Some Parameters**

**Results of Analysis for Concentration of Dissolved Oxygen (%)**

	<b>24-May-04</b>	<b>10-Jun-04</b>	<b>21-Jun-04</b>	<b>5-Jul-04</b>	<b>20-Jul-04</b>	<b>2-Aug-04</b>	<b>16-Aug-04</b>	<b>30-Aug-04</b>	<b>13-Sep-04</b>	<b>28-Sep-04</b>	<b>12-Oct-04</b>
A03	82	76	78	70	79	68	89	66	63	77	84
A05	86	86	93	85	91	82	93	61	76	84	79
A07	72	72	98	81	81	58	90	70	69	90	68
A08	84	77	97	90	85	74	85	78	58	83	67
A09	72	84	88	82	88	83	88	80	70	90	80
A11	88	74	75	73	84	64	78	70	76	93	71
A12	87	81	77	47	71	71	76	49	59	85	78
A13	89	94	94	85	85	76	83	80	79	94	77
A15	86	87	87	92	95	104	86	89	80	91	81
A16	85	95	97	95	92	94	91	82	78	98	79
A17	92	56	66	38	67	68	81	67	76	95	63
Average	84	80	86	76	83	77	85	72	71	89	75
	<b>26-May-04</b>	<b>11-Jun-04</b>	<b>23-Jun-04</b>	<b>7-Jul-04</b>	<b>21-Jul-04</b>	<b>4-Aug-04</b>	<b>18-Aug-04</b>	<b>2-Sep-04</b>	<b>15-Sep-04</b>	<b>29-Sep-04</b>	<b>13-Oct-04</b>
B01A	81	71	80	81	82	64	70	89	70	84	74
B03	78	72	76	81	81	30	42	78	68	76	71
B04	77	41	63	74	56	55	58	76	73	78	66
B05	79	53	66	54	59	35	38	83	24	64	68
B06	80	87	95	91	93	94	85	84	82	95	86
B09	77	82	84	85	83	84	80	83	74	82	77
B11	N/A	85	90	95	90	84	83	76	81	80	79
B12	N/A	93	91	89	91	78	88	86	58	82	84
B13	84	84	94	87	85	80	78	80	76	92	81
Average	79	74	82	82	80	67	69	82	67	81	76

	31-May-04	14-Jun-04	28-Jun-04	12-Jul-04	27-Jul-04	9-Aug-04	23-Aug-04	6-Sep-04	20-Sep-04	4-Oct-04	19-Oct-04
C01	89	80	81	69	83	N/A	84	73	88	76	86
C03	80	94	64	71	83	N/A	91	77	89	88	74
C05	82	87	74	69	85	N/A	90	79	89	90	84
C06	83	74	77	60	71	N/A	83	71	74	84	84
C07	79	84	88	87	79	N/A	87	80	89	97	85
C09	88	91	89	83	88	N/A	94	80	94	94	74
C13	100	93	96	92	80	N/A	92	94	96	92	88
C17	68	85	75	56	75	N/A	76	64	74	73	65
C19	63	95	76	73	68	N/A	83	81	77	75	80
C20A	96	93	93	87	83	N/A	72	80	80	82	70
C23	74	85	74	57	68	N/A	88	64	90	87	59
C26	95	90	98	78	96	N/A	91	82	84	90	82
C28	86	99	108	88	93	N/A	96	84	92	79	91
C30	88	94	106	94	95	N/A	89	86	90	80	94
C32	102	78	76	79	77	N/A	91	77	82	75	81
Average	85	88	85	76	82	N/A	87	78	86	84	80
	2-Jun-04	16-Jun-04	30-Jun-04	14-Jul-04	28-Jul-04	11-Aug-04	25-Aug-04	7-Sep-04	23-Sep-04	6-Oct-04	20-Oct-04
D02	74	77	108	77	82	89	63	74	81	85	80
D06	91	79	82	93	74	78	82	76	82	92	87
D07	82	86	81	85	66	78	74	78	82	85	75
D09	67	65	68	77	82	79	55	65	95	94	85
D10	85	78	78	83	79	77	71	87	81	99	79
D13	85	76	82	87	84	85	80	83	89	94	81
D15	88	91	85	77	76	89	86	88	86	97	86
D20	82	82	82	94	64	87	81	73	73	92	82
Average	82	79	83	84	76	83	74	78	84	92	82



### Results of Analysis for Kjeldahl N (mg/l)

	24-May-04	10-Jun-04	21-Jun-04	5-Jul-04	20-Jul-04	2-Aug-04	16-Aug-04	30-Aug-04	13-Sep-04	28-Sep-04	12-Oct-04
A03	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A05	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	1.60	1.10	3.50	3.00	<1.00
A07	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A08	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A09	<0.04	<0.04	<0.04	16.80	19.50	2.80	1<1.00	8.40	6.80	6.80	7.20
A11	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A12	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A13	<0.04	<0.04	0.12	19.60	29.00	2.60	2.00	3.50	5.60	4.80	5.40
A15	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A16	<0.04	<0.04	<0.04	8.40	12.40	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
A17	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Average	<0.04	<0.04	0.05	4.10	6.26	1.31	2.05	1.91	2.17	2.05	1.96
	26-May-04	11-Jun-04	23-Jun-04	07-Jul-04	21-Jul-04	04-Aug-04	18-Aug-04	02-Sep-04	15-Sep-04	29-Sep-04	13-Oct-04
B01A	10.00	<0.04	<0.04	14.00	2<1.00	5.60	9.00	5.60	6.00	7.20	6.80
B03	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B04	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B05	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B06	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B09	<0.04	<0.04	<0.04	<0.04	<1.00	2.80	3.20	4.80	2.00	2.00	<1.00
B11	<0.04	<0.04	<0.04	11.20	14.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B12	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
B13	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	5.20	3.00	2.00	<1.00
Average	1.15	<0.04	<0.04	2.83	4.67	1.71	2.13	2.40	1.89	1.91	1.64

	<b>31-May-04</b>	<b>14-Jun-04</b>	<b>28-Jun-04</b>	<b>12-Jul-04</b>	<b>27-Jul-04</b>	<b>9-Aug-04</b>	<b>23-Aug-04</b>	<b>6-Sep-04</b>	<b>20-Sep-04</b>	<b>4-Oct-04</b>	<b>19-Oct-04</b>
C01	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C03	<0.04	<0.04	<0.04	5.60	2.80	11.20	8.40	<1.00	<1.00	<1.00	<1.00
C05	<0.04	<0.04	<0.04	<0.04	<1.00	2.60	2.80	<1.00	<1.00	<1.00	<1.00
C06	<0.04	<0.04	<0.04	2.80	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C07	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C09	<0.04	<0.04	<0.04	11.20	8.40	14.00	8.00	<1.00	<1.00	<1.00	<1.00
C13	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C17	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C19	14.00	<0.04	<0.04	<0.04	<1.00	2.80	<1.00	<1.00	<1.00	8.40	8.40
C20A	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C23	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C26	<0.04	<0.04	<0.04	2.80	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
C28	11.20	<0.04	<0.04	<0.04	<1.00	3.10	5.60	<1.00	5.00	2.80	<1.00
C30	<0.04	<0.04	<0.04	8.40	5.60	15.00	9.00	<1.00	6.80	5.60	4.20
C32	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Average	1.71	<0.04	<0.04	2.08	1.92	3.85	2.92	<1.00	1.65	1.92	1.71
	<b>02-Jun-04</b>	<b>16-Jun-04</b>	<b>30-Jun-04</b>	<b>14-Jul-04</b>	<b>28-Jul-04</b>	<b>11-Aug-04</b>	<b>25-Aug-04</b>	<b>07-Sep-04</b>	<b>23-Sep-04</b>	<b>06-Oct-04</b>	<b>20-Oct-04</b>
D02	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
D06	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
D07	22.40	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
D09	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
D10	<0.04	<0.04	<0.04	<0.04	<1.00	2.00	<1.00	<1.00	<1.00	<1.00	<1.00
D13	<0.04	<0.04	<0.04	<0.04	<1.00	3.00	4.00	<1.00	6.00	5.60	5.10
D15	<0.04	<0.04	<0.04	<0.04	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
D20	11.20	<0.04	<0.04	<0.04	<1.00	3.00	6.50	<1.00	<1.00	2.80	<1.00
Average	4.23	<0.04	<0.04	<0.04	<1.00	1.63	2.06	<1.00	1.63	1.80	1.51

### Results of Analysis for Nitrate N (mg/l)

	<b>24-May-04</b>	<b>10-Jun-04</b>	<b>21-Jun-04</b>	<b>5-Jul-04</b>	<b>20-Jul-04</b>	<b>2-Aug-04</b>	<b>16-Aug-04</b>	<b>30-Aug-04</b>	<b>13-Sep-04</b>	<b>28-Sep-04</b>	<b>12-Oct-04</b>
A03	<0.05	<0.05	<0.05	<0.05	0.40	<0.05	0.70	0.80	0.90	0.70	0.70
A05	<0.05	<0.05	0.44	1.60	0.80	<0.05	<0.05	0.80	1.00	0.70	0.60
A07	<0.05	<0.05	<0.05	<0.05	0.40	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
A08	<0.05	<0.05	<0.05	<0.05	0.80	<0.05	0.60	0.70	0.54	0.80	0.70
A09	<0.05	<0.05	0.85	<0.05	<0.05	2.80	<0.05	0.60	0.55	0.50	<0.05
A11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
A12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.20	1.00
A13	<0.05	<0.05	<0.05	<0.05	<0.05	2.60	<0.05	<0.05	<0.05	<0.05	<0.05
A15	<0.05	<0.05	<0.05	<0.05	0.70	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
A16	<0.05	<0.05	<0.05	<0.05	0.60	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
A17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Average	<0.05	<0.05	0.16	0.19	0.36	0.53	0.16	0.30	0.30	0.38	0.30
	<b>26-May-04</b>	<b>11-Jun-04</b>	<b>23-Jun-04</b>	<b>7-Jul-04</b>	<b>21-Jul-04</b>	<b>4-Aug-04</b>	<b>18-Aug-04</b>	<b>2-Sep-04</b>	<b>15-Sep-04</b>	<b>29-Sep-04</b>	<b>13-Oct-04</b>
B01A	<0.05	1.18	1.30	6.10	3.60	5.60	1.40	1.60	<0.05	<0.05	<0.05
B03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.80	0.70
B04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.80	<0.05	<0.05
B06	<0.05	<0.05	<0.05	<0.05	0.50	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B09	<0.05	<0.05	<0.05	<0.05	0.70	2.80	<0.05	<0.05	<0.05	<0.05	<0.05
B11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.70	<0.05	<0.05	<0.05
Average	<0.05	0.18	0.19	0.72	0.57	0.97	0.20	0.41	0.13	0.13	0.12

	<b>31-May-04</b>	<b>14-Jun-04</b>	<b>28-Jun-04</b>	<b>12-Jul-04</b>	<b>27-Jul-04</b>	<b>9-Aug-04</b>	<b>23-Aug-04</b>	<b>6-Sep-04</b>	<b>20-Sep-04</b>	<b>4-Oct-04</b>	<b>19-Oct-04</b>
C01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C05	<0.05	<0.05	<0.05	<0.05	<0.05	0.60	<0.05	<0.05	<0.05	<0.05	<0.05
C06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C07	<0.05	<0.05	<0.05	<0.05	<0.05	0.60	<0.05	<0.05	<0.05	<0.05	<0.05
C09	<0.05	<0.05	<0.05	<0.05	<0.05	0.95	<0.05	<0.05	<0.05	<0.05	<0.05
C13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C19	0.75	<0.05	0.70	4.60	0.50	0.60	0.97	<0.05	0.60	1.70	<0.05
C20A	<0.05	<0.05	<0.05	<0.05	<0.05	0.50	<0.05	<0.05	0.50	<0.05	<0.05
C23	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C26	<0.05	<0.05	<0.05	<0.05	<0.05	0.50	0.70	<0.05	0.60	0.80	<0.05
C28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C30	<0.05	<0.05	0.43	<0.05	<0.05	0.60	0.60	<0.05	<0.05	<0.05	<0.05
C32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.75	<0.05	<0.05	<0.05	<0.05
Average	0.10	<0.05	0.12	0.35	0.08	0.32	0.24	<0.05	0.15	0.21	<0.05
	<b>2-Jun-04</b>	<b>16-Jun-04</b>	<b>30-Jun-04</b>	<b>14-Jul-04</b>	<b>28-Jul-04</b>	<b>11-Aug-04</b>	<b>25-Aug-04</b>	<b>7-Sep-04</b>	<b>23-Sep-04</b>	<b>6-Oct-04</b>	<b>20-Oct-04</b>
D02	<0.05	<0.05	<0.05	<0.05	0.30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
D06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
D07	1.95	<0.05	<0.05	<0.05	<0.05	<0.05	0.90	<0.05	<0.05	<0.05	<0.05
D09	<0.05	<0.05	<0.05	<0.05	0.40	0.50	0.60	<0.05	<0.05	<0.05	<0.05
D10	<0.05	<0.05	<0.05	<0.05	<0.05	0.80	0.70	<0.05	<0.05	<0.05	<0.05
D13	<0.05	<0.05	0.42	<0.05	<0.05	0.80	0.60	<0.05	<0.05	<0.05	<0.05
D15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
D20	<0.05	<0.05	<0.05	<0.05	0.26	0.65	<0.05	<0.05	<0.05	<0.05	<0.05
Average	0.29	<0.05	0.10	<0.05	0.15	0.37	0.38	<0.05	<0.05	<0.05	<0.05

### Results of Analysis for Oil and Grease (mg/l)

	<b>24-May-04</b>	<b>10-Jun-04</b>	<b>21-Jun-04</b>	<b>5-Jul-04</b>	<b>20-Jul-04</b>	<b>2-Aug-04</b>	<b>16-Aug-04</b>	<b>30-Aug-04</b>	<b>13-Sep-04</b>	<b>28-Sep-04</b>	<b>12-Oct-04</b>
A05	0.99	2.00	1.90	2.00	11.90	11.90	9.90	5.90	10.70	4.00	4.70
A09	2.00	1.90	1.10	1.00	10.00	10.00	8.96	6.00	8.90	6.96	6.10
A11	2.00	2.00	2.00	3.00	5.00	5.00	15.90	10.90	13.50	6.90	6.60
A13	1.00	1.00	1.00	1.90	6.00	6.00	11.90	6.00	10.80	1.00	1.10
Average	1.50	1.73	1.50	1.98	8.23	8.23	11.67	7.20	10.98	4.72	4.63
	<b>26-May-04</b>	<b>11-Jun-04</b>	<b>23-Jun-04</b>	<b>7-Jul-04</b>	<b>21-Jul-04</b>	<b>4-Aug-04</b>	<b>18-Aug-04</b>	<b>2-Sep-04</b>	<b>15-Sep-04</b>	<b>29-Sep-04</b>	<b>13-Oct-04</b>
B01A	5.95	1.95	1.00	1.00	1.00	1.00	15.90	12.90	10.70	8.90	0.70
	<b>31-May-04</b>	<b>14-Jun-04</b>	<b>28-Jun-04</b>	<b>12-Jul-04</b>	<b>27-Jul-04</b>	<b>9-Aug-04</b>	<b>23-Aug-04</b>	<b>6-Sep-04</b>	<b>20-Sep-04</b>	<b>4-Oct-04</b>	<b>19-Oct-04</b>
C19	1.00	2.00	4.90	2.10	2.00	1.90	2.10	3.90	4.82	3.92	4.00
C28	2.00	3.00	2.00	2.00	3.00	2.90	3.00	1.96	7.85	7.91	7.89
C30	3.00	1.90	7.80	1.10	1.00	1.00	1.00	1.00	7.98	6.94	5.96
Average	2.00	2.30	4.90	1.73	2.00	1.93	2.03	2.29	6.88	6.26	5.95
	<b>2-Jun-04</b>	<b>1-Jan-00</b>	<b>30-Jun-04</b>	<b>14-Jul-04</b>	<b>28-Jul-04</b>	<b>11-Aug-04</b>	<b>25-Aug-04</b>	<b>7-Sep-04</b>	<b>23-Sep-04</b>	<b>6-Oct-04</b>	<b>20-Oct-04</b>
D13	1.00	1.00	1.00	2.20	2.10	2.00	2.00	2.98	14.50	11.78	12.00
D20	2.00	3.00	1.00	1.10	1.90	2.00	2.80	2.94	4.92	3.90	3.04
Average	1.50	2.00	1.00	1.65	2.00	2.00	2.40	2.96	9.71	7.84	7.52