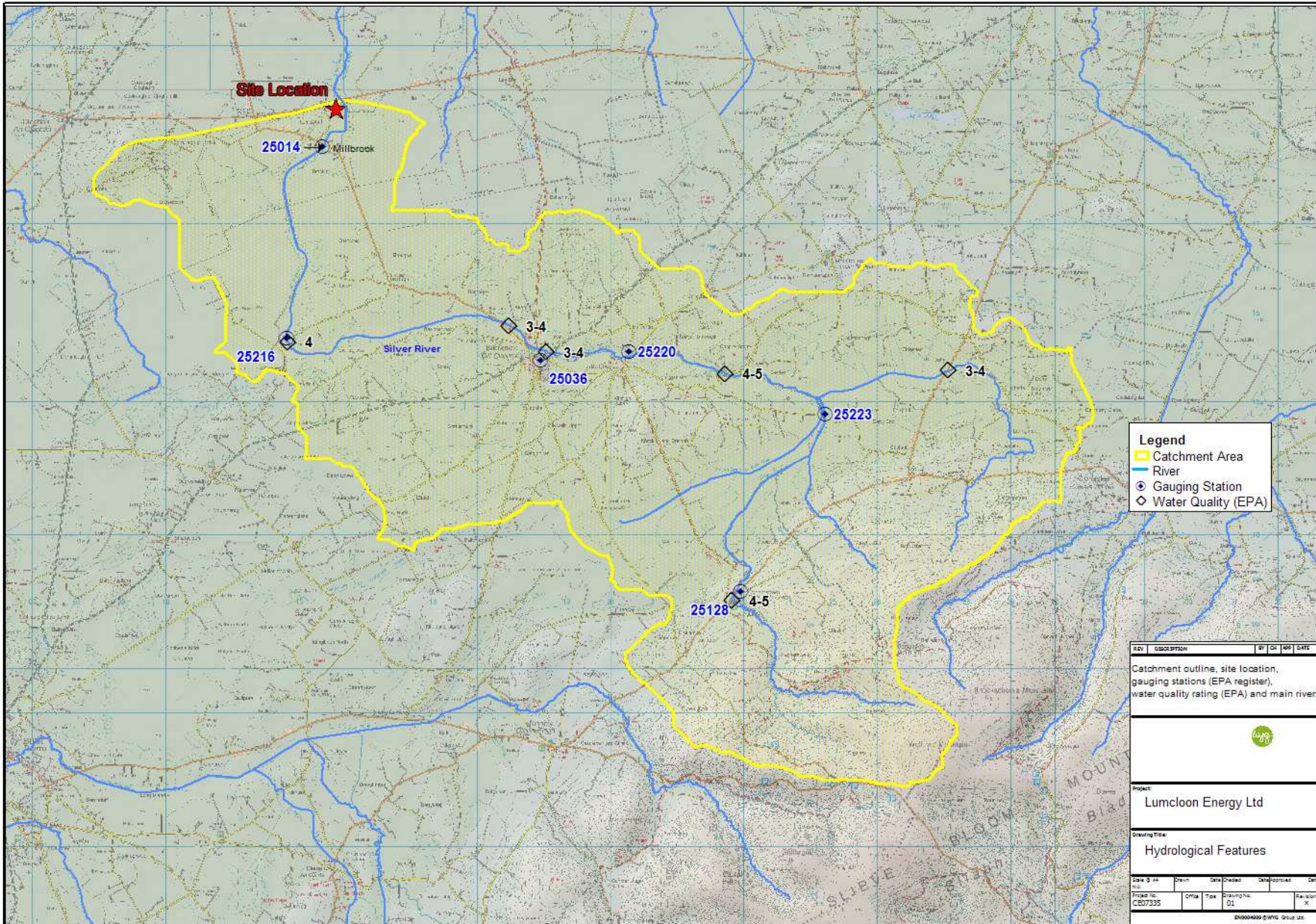


Appendix 9.1



Legend

- ▭ Catchment Area
- River
- ◆ Gauging Station
- ◆ Water Quality (EPA)

REV DESCRIPTION BY OR APP DATE

Catchment outline, site location, gauging stations (EPA register), water quality rating (EPA) and main rivers



Project:
Lumclon Energy Ltd

Drawing Title:
Hydrological Features

REV	DESCRIPTION	BY	OR	APP	DATE
01	Issue for Design				

Scale	Drawn	Date/Drawn	Date/Approved	Date
1:1				
Project No.	Office	Title	Drawn/No.	Revision
CE07335			01	X

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Appendix 9.2



Flood Assessment

Introduction

Information provided by the Office of Public Work (OPW) including gauging station records, drainage scheme drawings and benefitting land records indicate that the site is located in the floodplain of the Silver River.

To ensure that the proposed development meets current best practice, and as an integral part of planning approval for the proposed development, a flood impact assessment is required to be undertaken to determine both:

- The impact of the development on flood levels and;
- Appropriate mitigation strategies to ameliorate any adverse impact.

The primary objective of this assessment is to satisfy Offaly County Council as planning authority that the proposed development will not adversely impact existing flood levels and this will be achieved through the following:

- Establish existing flood levels and extent for the Silver River in the vicinity of the development site;
- Determine minimum floor levels for the proposed development;
- Determine the potential impact of the proposed development on existing flood conditions;
- Develop a mitigation strategy that can be implemented at the site to offset potential flood impacts.



Gauging Station Data

Gauging station data was accessed from the OPW website for station

Table 9.2.1: Overview of Gauging Station Data

GENERAL STATION DETAILS			
Station Name: Millbrook	Station No: 25014	Watercourse: Silver	NGR: N 135 187
Catchment Area (km ²): 165	Catchment: Brosna	Gauge Type: AR	Datum: Poolbeg

SUMMARY HYDROMETRIC STATISTICS
Annual Average Rainfall (mm) ¹ : 992
Est'd Annual Losses (mm) ¹ : 456
Mean Annual Flow (m ³ /s): 2.3652 (Data derived for the period 1972 to 2001)

STATION HISTORY
Period of Continuous Hardcopy Records: 1951 to 2005
Period of Digitised Record: 1972 to 2004

Note 1 : Data extracted from the Environmental Protection Agency publication 'Hydrological Data', July 1997

DURATION PERCENTILES							
Flows equalled or exceeded for the given percentage of time (m ³ /s) (Data derived for the period 1972 to 2001)							
1%	5%	10%	50%	80%	90%	95%	99%
11.2	6.25	4.64	1.79	0.85	0.62	0.49	0.33
Levels equalled or exceeded for the given percentage of time (mAOD Poolbeg) (Data derived for the period 1972 to 2004)							
1%	5%	10%	50%	80%	90%	95%	99%
48.80	48.32	48.14	47.76	47.63	47.59	47.56	47.51

The annual maximum series provides flow and water level data for a period of 56 years at the Millbrook Station (25014), which is located approximately 1.5km upstream from the site and duration percentiles and flow are also available for this station.

Design Flows

A design flood may be determined by either of two broad categories of methods, namely:

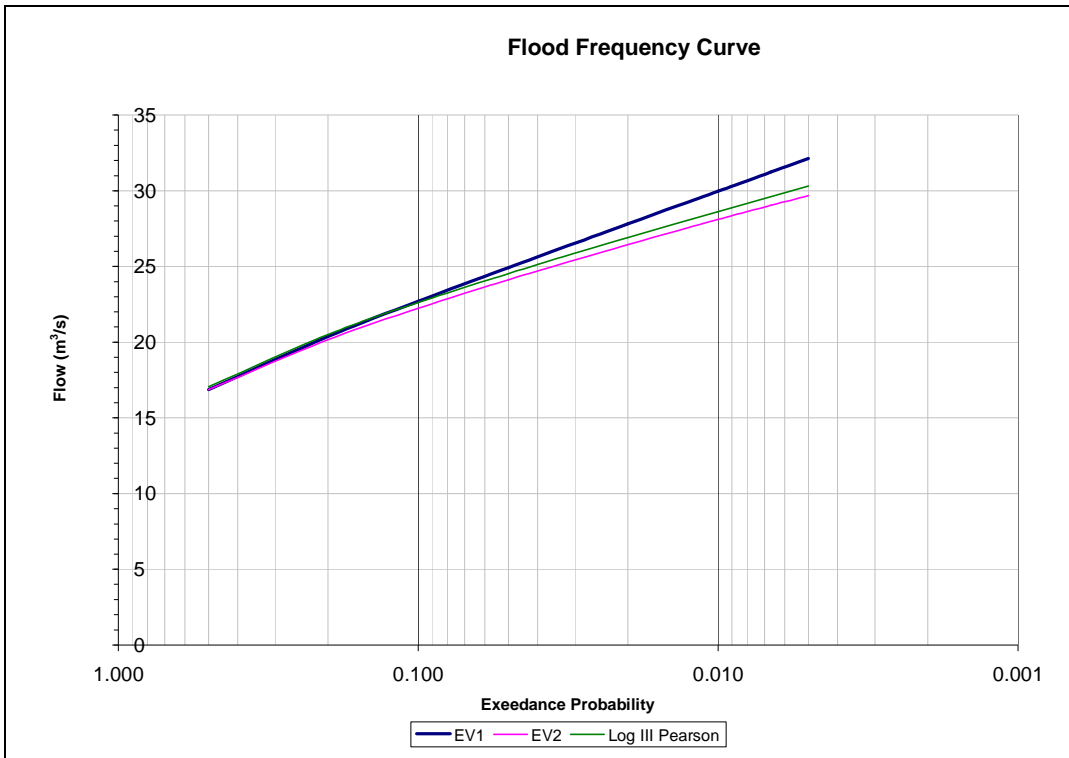
- Methods based on statistical analysis of flood peak data; and,
- Methods based on a design rainstorm and a rainfall-runoff model which converts the design rainstorm into a design flood.

A further distinction arises between gauged and ungauged catchment methods. The latter use formulae which relate some key component of the method, such as the mean annual flood or unit hydrograph time to peak, to catchment descriptors such as area, slope, and mean annual rainfall among others. If catchments are gauged and there is a sufficiently long flow record (typically more than 20 years) then a relationship between peak flood flow and return period can be established by applying an Extreme Value

distribution to the data series of "Annual Maximum" flow series. The theory of extreme values states that if Z is the maximum of a number of other random variables X1, X2,XN then the distribution of Z converges towards one of the 3 types of Extreme Value distribution (EV1, EV2 or EV3) as N becomes infinitely large.

An Extreme Value analysis for the Gumbel distribution (EV1), the Weibull distribution (EV2) and the Log III Pearson distribution was used to predict design flows and results are presented in Figure 9.2.1. . Generally in Ireland the EV1 (2 parameter) distribution is applied for the majority of gauged rivers and findings show that this also provides the most conservative flood prediction at Millbrook.

Figure 9.2.1 Flood Frequency Curve



Hydraulic Model

A hydraulic model was developed of the Silver River in the vicinity of the site using HEC-RAS. Unfortunately, the topographical survey data supplied by the OPW was outdated and was not suitable for this assessment. In order to provide an indication of the flood level predictions, onsite measurements were undertaken of the Lumcloon Bridge (Figure 9.2.2), the local railway access bridge (Figure 9.2.3) as well as typical river sections of the Silver River and this data was utilised to develop the hydraulic model.

HEC-RAS implements a 1-dimensional model of river flow (depth and width averaged) and can solve for water elevation under steady conditions and in the most recent version gradually varying unsteady flows solving the full Saint Venant equations. HEC RAS is an integrated software solution for simulating flows in rivers, channels and floodplains. It is designed by the US Army Corps of Engineers and performs one-dimensional hydraulic calculations for a full network of natural and constructed channels. The software includes full solution modelling of open channels, floodplains, embankments and hydraulic structures.

The model requires the following information:

- topographic survey data of river channel and flood plain (cross-section station, bed elevation and channel and overbank reach lengths);
- dimensions and elevation of relevant structures;
- upstream and internal flow boundary conditions;
- downstream water elevation boundary condition, and in the case of supercritical flow regime (Froude No. > 1) the upstream water elevation boundary condition;
- channel and flood plain roughness coefficients; and,
- local expansion and contraction loss coefficients.

Figure 9.2.2 Lumcloon Bridge



Figure 9.2.3 Local Access Railway access bridge ~32m upstream of Lumcloon Br.





The OPW have produced draft guidelines in respect to design considerations of possible climate change for flood risk management practice. The recommended design allowances to be used for increases in flood flows during the sensitivity and / or design process are given by region in Table 9.2.2.

Table 9.2.2 - Regional Flood Peak Allowances (OPW, 2005)

Region	Allowances (% increase) in Flood Flows	
	Summer (and Autumn) Floods	Winter (and Spring) Floods
North	10	20
North West	10	15
West	25	10
South West	10	15
South	15	25
South East	15	20
East	10	20
Midlands	25	20

Adopted Design Flows

Design peak flows using the EV1 distribution were developed and factored up by 20% to incorporate for climate change as well as a factorial standard error (FSE), which depends on the return period and length of data record. These design flows were then input into the hydraulic model as upstream boundary. The downstream boundary was set as Normal Depth with a relatively flat slope of 0.00097m/m.

Table 9.2.3 provides details of the adopted design flows.

Table 9.2.3 – EV1 peak flows

Return Period	Design Flow	Design Flow including FSE	Design Flow with SFE & CC
2	16.9	16.9	20.2
10	22.7	25.2	30.2
20	24.9	34.9	41.9
50	27.8	49.8	59.7
100	30.0	62.3	74.8



Our hydraulic analysis showed that the for the 100 year design flows the Lumcloon Bridge and the local access bridge are surcharge. However, no flooding of the site occurs for any of the design flows investigated.

A freeboard of 500mm is adopted in addition to the 100 year flood level to estimate the proposed floor levels for the site and this will be set at minimum to 46.85mOD (Malin).

The results from this assessment should be regarded as guidance values and should be confirmed following a more detailed bathymetric survey of the Silver River.



Appendix 9.3





SampleDate	Ammonia (N)	BOD	Chloride	Colour	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Hardness	Nitrates (N)	Nitrites (N)	Ortho-Phosphate (P)	pH	Suspended Solids	Temp	Total Oxidised Nitrogen	Total Phosphorus	Un-ionised Ammonia
16Apr/98	0.096	0.95		32	655	97.8				0.013	8.04	7.7	9.7	4.657		0.0023
05May/98	0.077	0.3		29	657	90.3			0.005		8.04	6	11.5	3.925		0.0021
12May/98	0.07			96	498	90.4			0.028	0.006	7.93	12.7	10.8	2.703		0.0014
18May/98	0.043			38	662	111.1			0.037	0.003	8.17	17.3	14.5	3.973		0.002
26May/98	0.063			30	695	113			0.04	0.003	8.21	14.3	12.8	4.567		0.0028
25Jun/98	0.089			108	568	108.2			0.029	0.018	7.97	9.7	15.7	3.066		0.0028
30Jun/98	0.08			58	640	110.4			0.026	0.018	8.02	7	13.6	3.342	0.032	0.0024
06Jul/98	0.042			40	673	107.3			0.02	0.012	8.07	5	14.4	4.211	0.024	0.0015
13Jul/98	0.068			104	491	111.4			0.019	0.01	8.01	7.7	14.1	2.56	0.06	0.0021
20Jul/98	0.117			151	368	100.9			0.023	0.007	7.87	10.7	15.8	1.678	0.042	0.003
28Jul/98	0.112	1.4		91	596	102			0.028	0.016	7.95	4.7	14.7	2.901	0.035	0.0032
04Aug/98	0.091			151	441	102			0.024	0.013	7.85	11	15.1	1.987	0.049	0.0021
10Aug/98	0.069			30	669	110.5			0.033	0.015	8.09	1.3	17.4	3.782	0.025	0.0032
18Aug/98	0.061			28	663	129.3			0.026	0.009	8.23	3.3	16.3	3.765	0.026	0.0036
25Aug/98	0.076	1		82	555	95.4			0.026	0.013	7.98	4.33	15.2	3.175	0.033	0.0024
01Sep/98	0.09	2.8		177	277.1	91.1			0.033	0.018	7.91	16.66	15.3	1.182		0.0024
10Sep/98	0.142				330	89			0.033	0.02	8.03		13.9	2.288	0.153	0.0045
30Sep/98	0.132				444	75.4			0.044	0.017	7.97	3.7	12.5	2.93	0.032	0.0033
06Oct/98	0.128				409	77.7			0.028	0.014	7.93		11.1	2.422		0.0026
13Oct/98	0.101			41	615	88.7			0.03	0.016	8	4.3	12.3	3.135		0.0027
20Oct/98	0.13	1.1			626	88.2			0.023	0.022	7.93	4	9.3	2.946	0.043	0.0023
29Oct/98	0.264				520	86.5			0.027	0.021	7.59	12.3	8.4	2.377		0.002
03Nov/98	0.205	2			456	86			0.026	0.025	7.59	20	7.9	2.448	0.061	0.0015
12Nov/98	0.164			133	361	89.9			0.02	0.022	7.6	31.3	9	1.606		0.0014
19Nov/98	0.176				598	89.7			0.027	0.019	7.78	15.4	8.7	3.15		0.0021
26Nov/98	0.143				627				0.029	0.017	7.8	8.7		3.439		
30Nov/98	0.122				641	92.8			0.025	0.016	7.84	6.6	7.9	3.388		0.0016
15Dec/98	0.2	1.9		124	523	91			0.031	0.025	7.74	18.3	8.7	2.659	0.053	0.0022
14Jan/99	0.159				595	74.9			0.025	0.021	7.82	13.3	6.6	3.52		0.0018
20Jan/99	0.163	1.6			582	73.3			0.023	0.026	7.78	25	7	3.536	0.062	0.0017
02Feb/99	0.13				658	75.6			0.033	0.023	7.96	15.7	7.8	4.134		0.0022
09Feb/99	0.133			83	601	74.8			0.028	0.019	7.91	11.7	4.8	3.355		
15Feb/99	0.111				643	76.7			0.034	0.017	8.05	46.7	8.5	3.891		
23Feb/99	0.128				631	76.4			0.034	0.015	8.04	8.7	6.6	3.721	0.037	
02Mar/99	0.304				376	74.2			0.032	0.034	7.73	77.4	10.1	1.606		
11Mar/99	0.124	1.7		44	667	75.3			0.027	0.014	7.94	8.7	7.1	4.037		0.0019
15Mar/99	0.114				670	76.7			0.031	0.015	8.01	9.3	9.3	3.989	0.028	
22Mar/99	0.104				678	77.7			0.026	0.012	8.05	6.3	9.1	4.035		
20Apr/99	0.116	2.45		25	652	96.7			0.024	0.008	8.05	100	9.8	3.748	0.189	0.0028
28Apr/99	0.058				599	94.5			0.017	0.012	8.06	5	12.4	2.908		0.0018
20May/99	0.049	0.78		41	656	99.6			0.02	0.007	8.17	3.3	12.7	3.369	0.032	0.002
24May/99	0.044				652	111.4			0.015	0	8.28	2.7	12.9	3.466		0.0023
03Jun/99	0.082	3.17			428	84.7			0.022	0.007	7.99	14	13	2.046		0.0022
09Jun/99	0.047				654	96.3			0.019	0.003	8.19		11.7	3.559	0.016	0.0018
15Jul/99	0.067	2.62		106	562	70.5			0.038	0.014	7.81	4.3	15.1	3.823	0.026	0.0014
19Jul/99	0.14			45	403	86.2			0.038	0.021	8.04	8.3	15.9	2.136	0.05	0.0053
27Jul/99	0.055	1.64				111.4			0.039	0.012	8.23		17.5	3.756	0.03	0.0035
04Aug/99	0.056			27	669	108.1			0.036	0.002	8.19		17.8	3.741	0.02	0.0034
10Aug/99	0.086	0.93			650	103.2			0.055	0.014	8.18		15.9	3.531		0.0044
19Aug/99	0.162				566	87.9			0.034	0.042	8.04		14.1	2.87	0.093	
26Aug/99	0.085				240	80.3			0.022	0.036	7.78		16.1	0.779	0.125	
31Aug/99	0.072	1.46		34	625	98			0.024	0.02	8.11	6.3	15	3.338	0.044	
08Sep/99	0.134				475	89.5			0.037	0.017	7.97		15.7	2.191		
13Sep/99	0.141				301	88.1			0.021	0.022	7.82	6	11.9	1.051		
20Sep/99	0.082				466	86.5			0.023	0.018	7.94	4.7	13.6	1.798		
25Nov/99	0.156	1.7		143	544	94.3			0.021	0.014	7.87	12.3	9.2	2.277	0.037	0.0024
29Nov/99	0.227				492	90.5			0.023	0.023	7.68		6.9	2.246		0.0019
13Dec/99	0.163			86	604	91.8			0.023	0.019	7.81	10	6.2	3.504	0.044	0.0017
05Jan/00	0.137	1.7			596				0.02	0.019	7.8			3.532		
06Jan/00	0.098	2.5		37	379				0.018	0.015	8.31	6.7		3.781	0.047	
12Jan/00	0.166				361				0.019	0.034	7.6	37.3		1.688		
19Jan/00	0.12			54	660	92.5			0.02	0.017	7.91		7.3	3.851	0.034	0.0018
25Jan/00	0.133				696	94.8			0.02	0.014	7.96	10.3	6.3	3.99		0.002
23Feb/00	0.106	1.3		71	578	92			0.018	0.016	7.9	1.3	9.1	3.43	0.03	0.0018
29Feb/00	0.155	1.9			565	90.2			0.018	0.021	7.75	10	7.3	2.749		0.0016
07Mar/00	0.107				640	98.3			0.019	0.013	7.92		10.5	3.635		0.0021
14Mar/00	0.093			48	651	93.2			0.021	0.018	8	11.6	9.9	3.641	0.036	0.002
21Mar/00	0.091				658	93.9			0.018	0.012	7.96		9.8	3.808		0.0018
29Mar/00	0.09				669				0.012	0.01	8.03	3	8.4	3.851		0.0019
03Apr/00	0.081				664	101.2			0.013	0.01	8.07	5.7	6.8	3.785		0.0016
12Apr/00	0.083	1.2			654	99			0.009	0.007	8.04	2.3	7.7	3.828	0.017	0.0017
18Apr/00	0.06				561	104.3			0.008	0.005	8.04	3.3	10.3	3.048		0.0015
26Apr/00	0.106				486	98.6			0.012	0.005	7.97	4.7	8.5	2.53		0.002
02May/00	0.066	0.9			634	107.2			0.013	0.009	8.08	4.3	13.6	3.267		0.0023
11May/00	0.038				667	119			0.014	0.002	8.24	5.3	15.1	3.734		0.0021
18May/00	0.074				497	103.2			0.012	0.005	8.02	4	11.6	2.512	0.028	0.0019
24May/00	0.031			32	616	128.4			0.011	0.001	8.3	3	12.7	3.262		0.0017
31May/00	0.039	1.3			647	123.8			0.015	0.002	8.26	2.3	13	3.605		0.0019
06Jun/00	0.058				629	132.3			0.022	0.001	8.2		14.8	3.485	0.02	0.0029



SampleDate	Ammonia (N)	BOD	Chloride	Colour	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Hardness	Nitrates (N)	Nitrites (N)	Ortho-Phosphate (P)	pH	Suspended Solids	Temp	Total Oxidised Nitrogen	Total Phosphorus	Un-ionised Ammonia
22Jun/00	0.045			35	600	119		0.028	0.009	8.17	33.3	15.6	3.091		0.0022	
28Jun/00	0.048				657	127.2		0.028	0.005	8.25	1.3	17.8	3.906		0.0033	
04Jul/00	0.07				585	98.3		0.029	0.016	8.05	1	16.2	2.956		0.0028	
13Jul/00	0.083	1.3		48	617	99.8		0.028	0.021	8.05	2	15	3.397		0.003	
19Jul/00	0.046				647	118.2		0.026	0.013	8.2	1.7	18.1	3.69	0.032	0.0029	
27Jul/00	0.037				655	121.1		0.017	0.003	8.21	6.7	17.4	3.769		0.0023	
03Aug/00	0.095	3.1			319	106.7		0.019	0.013	7.87	11.3	16	1.287	0.06	0.0025	
08Aug/00	0.055			30	619			0.03	0.018	8.09			3.078			
17Aug/00	0.028				634	126.2		0.015	0.003	8.19		18.3	3.527		0.0018	
21Aug/00	0.05				618	111.1		0.011	0.001	8.14		14.7	3.281		0.0022	
30Aug/00	0.054				649	111.2		0.012	0.001	8.14		14.7	3.689		0.0023	
21Sep/00	0.119	1.1		59	563			0.031	0.019	8.02	4.4		3.159	0.037		
03Oct/00	0.162	1.7		141	417	90.9		0.033	0.019	7.79	8.3	13.1	1.792	0.048	0.0028	
16Oct/00	0.346				540	90.7		0.045	0.014	7.83	28.3	10.9	2.372		0.0056	
31Oct/00	0.275			171	433	88.3		0.029	0.025	7.59	25	8.7	2.867	0.082	0.0022	
15Nov/00	0.126	1.4		66	606	96.3		0.02	0.013	7.86	11.3	7.2	3.368		0.0016	
02Jan/01	0.145	1.7		102	524			0.021	0.019	7.71	13.3		2.778	0.036		
09Jan/01	0.098				619	94.8		0.018	0.015	7.93	2.5	5.5	3.781		0.0013	
18Jan/01	0.123				631	96.6		0.018	0.012	8	3	5.3	4.055		0.0019	
25Jan/01	0.11				544	97.1		0.014	0.014	7.9	8	4.8	3.012		0.0013	
29Jan/01	0.109				595	96.1		0.014	0.012	7.91		4.6	3.428		0.0013	
07Feb/01	0.171	2.2		129	451	94.3		0.019	0.02	7.66	15.5	7.2	2.471	0.043	0.0014	
21Feb/01	0.095				624	93.3	110	0.02	0.016	7.94	10.3	7.9	3.815		0.0016	
28Feb/01	0.114				625	97.3		0.013	0.009	7.97		3.4	3.719		0.0014	
05Apr/01	0.121				601	96.7		0.013	0.008	7.83	10.7	8.5	3.134		0.0016	
19Apr/01	0.073	1.3			601	98.9		0.01	0.007	8.01	4.3	7.8	3.3	0.018	0.0014	
25Apr/01	0.072			90	507	94.9		0.012	0.007	7.88	7.7	10.3	2.292		0.0012	
03May/01	0.064	1.2		53	616	100.7		0.011	0.007	7.98		11.9	3.133		0.0016	
16May/01	0.071				645	98.8		0.019	0.005	7.95	11.3	11.6	3.414	0.03	0.0016	
22May/01	0.043				647	115.2		0.014	0.001	8.07	4	14.7	3.648		0.0016	
06Jun/01	0.052				656	99.2		0.019	0.001	7.99	9	13.3	3.956	0.012	0.0015	
11Jun/01	0.042			32	655	97.2		0.019	0.002	8.07	3	13.3	3.747		0.0014	
19Jun/01	0.121	1.4			549	96.2		0.025	0.019	8	7	15	2.628		0.0039	
27Jun/01	0.109				662	113.5		0.029	0.023	8.13	3.3	15.6	3.911		0.0049	
03Jul/01	0.077				627	98.1		0.03	0.024	8.09	5.7	18	3.644		0.0038	
10Jul/01	0.073				654	102.6		0.037	0.043	8.07	83.6	15.4	3.976		0.0028	
18Jul/01	0.041			107	638	100.1		0.015	0.016	8.09	1.7	13.5	4.048		0.0015	
26Jul/01	0.032				637	104.7		0.015	0.004	8.12		16.7	3.57	0.058	0.0015	
31Jul/01	0.05				661	94.1		0.019	0.003	8.09	3.3	16.8	3.804		0.0023	
07Aug/01	0.046	0.9		17	639	96.3		0.014	0.006	8.01	2	14.9	3.719	0.026	0.0015	
14Aug/01	0.067				534	94.2		0.025	0.017	8.03	30.3	17.1	2.775		0.0027	
23Aug/01	0.078				562	95.3		0.025	0.019	8.01	4.7	16.1	2.769		0.0028	
29Aug/01	0.053				648	96.9		0.025	0.012	8.11		15.4	3.416		0.0023	
06Sep/01	0.049				642	96.6		0.012	0.002	8.09		14.4	3.381		0.0019	
10Sep/01	0.033			39	625	101.9		0.012	0.002	8.16	1.7	12.4	3.325	0.017	0.0013	
19Sep/01	0.041	1.1			648	98.8		0.01	0.002	8.02		11.5	3.755		0.0011	
26Sep/01	0.024				656	89.2		0.017	0.003	8.01	2	12.4	3.818			
09Oct/01	0.11	1.8		130	398	91.1		0.017	0.018	7.86	2.7	11	1.708		0.0019	
18Oct/01	0.049	1.7			391	90.4		0.012	0.016	7.85		13.1	1.437		0.001	
01Nov/01	0.065	1.3		89	512	90.2		0.014	0.015	7.9	1.6	10.1	2.168		0.0012	
08Nov/01	0.105				346	92.4		0.016	0.019	7.79		8.4	1.098	0.048	0.0013	
15Nov/01	0.066				560	92.1		0.013	0.015	7.64	2.6	7.8	2.491		0.0005	
19Nov/01	0.07				612	82.5		0.014	0.017	7.99	1.3	8.1	2.839		0.0013	
27Nov/01	0.167				560	94.2		0.019	0.015	8.01		7.2	2.484	0.029	0.0031	
06Dec/01	0.216	1.4		132	477	89.9		0.024	0.016	7.71	4	7.7	2.267		0.0021	
18Dec/01	0.102				653	92.2		0.017	0.013	7.81	0.3	5	3.207		0.001	
07Jan/02	0.139			53	582	94.4		0.018	0.018	7.2	1	7.4	2.663	0.033	0.0004	
16Jan/02	0.086	2.1			540	92.1		0.014	0.018	7.61	2.6	7.2	2.36		0.0006	
23Jan/02	0.143				210	96.1		0.018	0.033	7.62	133	8.2	0.755		0.0012	
31Jan/02	0.194				549	90.2		0.023	0.02	7.39		8.1	3.756		0.0009	
14Feb/02	0.116			88	607	97.1		0.022	0.017	7.92	10.6	6.9	4.914		0.0017	
27Feb/02	0.15	2.1			530			0.019	0.024	7.94	6	5	4.077	0.052	0.002	
14Mar/02	0.091	1.1		44	651	91.1		0.015	0.011	7.82	7.3	6.5	4.303	0.022	0.001	
02Apr/02	0.066			46	618	96.3		0.012	0.009	8.2	1.3	9.6	3.681	0.015	0.0022	
23Apr/02	0.038	0.8			590	102.1		0.009	0.007	8.02	5.3	14.1	3.428		0.0012	
30Apr/02	0.12				521	100.4		0.015	0.018	8.06	9	9.7	2.785		0.003	
07May/02	0.026	1.1		41	425	95.9		0.012	0.003	7.89	3.3	12.6	3.775	0.037	0.0005	
16May/02	0.057				561	96.4		0.019	0.001	7.89	0.3	14.8	2.101		0.0014	
29May/02	0.114				367	94.1		0.02	0.028	7.61	23.3	12.1	1.609		0.0012	
04Jun/02	0.012	1			90.4			0.005	0.003	7.64	0.3	13.2	4.96		0.0002	
11Jun/02	0.069			130	461	100.4		0.017	0.017	7.94	1.6	12.4	2.005	0.044	0.0016	
20Jun/02	0.062				642	96.1		0.019	0.015	8.07	6.6	13.8	3.239		0.0021	
26Jun/02	0.048				621	92.9		0.025	0.011	7.63	1.3	13.4	2.602		0.0006	
02Jul/02	0.02	1.7		28	599	101.1		0.011	0.004	7.96	1.3	12.7	4.045		0.0005	
08Jul/02	0.073				642	98.6		0.017	0.021	7.99	3	13.3	3.259	0.033	0.002	
15Jul/02	0.027				671	94.1		0.016	0.014	7.96	5	15.1	3.61		0.0008	
08Aug/02	0.057	2.3		275	472	94.4		0.017	0.016	8.01	5	14.1	2	0.041	0.0018	
15Aug/02	0.046				596	89.1		0.015	0.019	7.81	2.3	14.6	2.938	0.033	0.0009	
22Aug/02	0.113				644	89.1		0.042	0.003	8.11	2.6	15.4	1.886		0.0048	



SampleDate	Ammonia (N)	BOD	Chloride	Colour	Conductivity @ 25°C	Dissolved Oxygen % Saturation	Hardness	Nitrates (N)	Nitrites (N)	Ortho-Phosphate (P)	pH	Suspended Solids	Temp	Total Oxidised Nitrogen	Total Phosphorus	Un-ionised Ammonia
28Aug/02	0.029				682	92.1			0.012	0.009	7.99	1	15.5	3.986		0.001
04Sep/02	0.021	1.4				96.1			0.013	0.006		3.3	15	4.051		
12Sep/02	0.015					91.2			0.011	0.004		2.3	15.4	3.812	0.027	
18Sep/02	0.023					92.6			0.014	0.005		2	15.1	4.184		
03Oct/02	0.047	1.4		32	661	93.7			0.019	0.004	7.92	4	12.8	3.862	0.018	0.0011
07Oct/02	0.044				659	92.2			0.02	0.005	7.52	3.3	14.1	4.003		0.0004
17Oct/02	0.08				566	97.2			0.015	0.016	7.29	21	7.6	2.887		0.0003
24Oct/02	0.206				462	100.2			0.021	0.016	6.49	6.7	9.9	2.178		0.0001
06Nov/02	0.352				471	94.3			0.042	0.004	7.04	2.3	10.1	2.214	0.035	0.0009
12Nov/02	0.12	1.8		146	526	94.2			0.023	0.016	7.44		8.5	2.674		0.0007
04Dec/02	0.076	1.9		86	546	92.5			0.022	0.018	7.02	10.7	8.5	2.967	0.043	0.0002
10Dec/02	0.059				651	94.2			0.019	0.014	7.82	4	5.8	3.814		0.0006
13Jan/03	0.113				659				0.022	0.014	7.58	8.3	7.9	4.044		0.0008
21Jan/03	0.088	3.2		121	522	94.7			0.018	0.021	7.23		6.4	2.701		0.0003
10Feb/03	0.067			51	630	94.3			0.016	0.012	7.92	8	7.9	3.847	0.026	0.0011
20Feb/03	0.082	1.5			662	90.6			0.014	0.011	8.15	5	4.9	4.363	0.026	0.0017
25Feb/03	0.064				677	92.5			0.014	0.011	7.88		7.6	4.331		0.0009
03Mar/03	0.082				582	92.4			0.014	0.013	8.03	5.6	7.3	3.238		0.0016
13Mar/03	0.091	1.4		77	640	94.3			0.014	0.012	7.85	7	6.7	3.301	0.024	0.0011
23Jun/03	0.049	1.2		33	679	92.4			0.016	0.001	7.49	1.3	14.2	3.82	0.0158	0.0005
08Jul/03	0.081	1.5		39	654	92.1			0.024	0.01	7.98	4	15.7	3.329	0.02	0.0026
26Aug/03	0.034	1.2		26	690	90.4			0.016	0.001	7.82	4.3	15.5	4.07		0.0008
29Oct/03	0.075	1.5		23	661	92.9			0.025	0.012	7.89	1.3	8.7	4.183	0.022	0.0012
27Jan/04	0.106	2		46	650	99.1			0.018	0.009	7.96	10.3	3.9	3.927	0.026	0.0013
10Feb/04	0.08	1.39		53	627	99.9	NT		0.02	0.009	7.15	5.7	8.1	4.081		0.023
24Mar/04	0.119	1.63		78	570	85.5			0.019	0.009	7.89	5.3	7	3.383		0.029
28Apr/04	0.071	2.32		32	661	98.1	NT		0.009	0.005	7.89	4.7	11.8	3.472		0.018
01Jul/04	0.015	1.4		65	540	82.1	NT		0.006	0.01	8.33	2	16.4	1.43		0.02
20Jul/04	0.023	1.58		26	646	98.1	NT		0.015	0.001	7.92	3.3	15.2	3.926		0.01
25Aug/04	0.088	1.42		131	435	86.2	NT		0.021	0.013	7.8	3.3	14.8	1.876		0.036
29Sep/04	0.059	1.93		176	289	98.1	NT		0.015	0.034	6.49	10.3	14.2	0.9		0.071
26Oct/04	0.14	1.67		120	572	86.2	NT		0.027	0.018	7.25	4	11.5	3.21		NT
24Nov/04	0.101	1.25		94	625	86.2	NT		0.027	0.004	7.82	11.3	10.8	4.214		0.022
26Jan/05	0.086	1.45		57	640	88.2	NT		0.028	0.009	7.92	4.3	9	5.387		0.024
23Feb/05	0.067	1.19		44	640	92.5	NT		0.014	0.008	8.11	9.3	5.5	4.63		0.011
29Mar/05	0.07	1.1		54	660		NT		0.012	0.001	8.11	19	9.9	4.16		0.039
26Apr/05	0.059	1		46	659	82.1	NT		0.012	0.007	8.12	6.7	12.1	4.292		NT
24May/05	0.135	1.4		48	627	99.2	NT		0.016	0.001	8.15	5.3	13.1	3.902		0.018
19Jul/05	0.028	1.6		20	689	91.2	NT		0.017	0.003	8.16	0.5	15.5	4.662		0.02
29Aug/05	0.024	1.3		31	618	98.3	NT		0.02	0.004	8.18	1	16.5	3.85		NT
26Sep/05	0.084	2.1		143	404	87.8	NT		0.016	0.015	7.98	4.7	12.7	2.157		0.045
24Oct/05	0.261	4.4		284	209	85.2	NT		0.026	0.029	7.77	37	12.6	1.028		0.08
21Nov/05	0.083	1.4		45	645	89.6	NT		0.014	0.013	8.08	6.3	6.1	4.224		0.022
19Dec/05	0.093	1.5		47	632		NT		0.016	0.011	8.02	7.3	7.3	3.361		0.028
09Jan/06	0.09	1.5		39	640	96.7	NT		0.017	0.012	8.1	0.7	4.6	3.93		0.024
28Mar/06	0.094	1.7		135	397	92.5	NT		0.019	0.019	7.71	24.3	10.3	2.09		0.07
23May/06	0.11	1.4		158	548	90.8	NT		0.034	0.023	7.69	17.7	10.2	4.422		0.048
20Jun/06	0.04	1.2		89	698	96.9	NT		0.013	0.005	8	1.3	13.3	4.576		0.013
18Jul/06	0.031	1.2		18	673	96.9	NT		0.027	0.004	7.95	2	17.9	5.236		0.02
15Aug/06	0.029	NT		13	695	94.1	NT		0.022	0.001	8.08	2	14	4.748		0.013
19Sep/06	0.005	1.5		35	603	82.2	NT		0.012	0.006	8.01	6	13.3	2.725		0.02
17Oct/06	0.055	1.3		59	643	87.2	NT		0.024	0.015	7.94	2.3	11.8	3.083		0.018
14Nov/06	0.076	1.4		70	615	88.3	NT		0.02	0.013	7.92	5.7	9.8	2.958		NT
13Dec/06	0.105	1.5		106	576	87.7	NT		NT	0.026	7.84	9.7	10.1	5.204		0.032
09Jan/07	0.12	1.5	18.4	141	496	86.1	250	3.358	0.031	0.03	7.67		9.5	3.39		
06Feb/07	0.092	1.5	23.7	41	685	85.4	340	5.934	0.022	0.015	8		5.4	5.956		
06Mar/07	0.087	1.9	17.7	123	437	91.2	216	2.731	0.023	0.017	7.3		7.8	2.754		