

7.4 Ringsend Effluent

Up until late November/December 2002 primary treatment was the process in operation at Ringsend Sewage Treatment Works. The Sequential Batch Reactors (SBRs) gradually came on line in December 2002. Although the plant was officially opened on 30th June 2003 the commissioning trials only commenced during December 2003. In order to comply with the Urban Waste Water Treatment Directive (91/271/EEC), the effluent water quality must to meet with the following requirements:

BOD	25 mg/l O ₂ (on a 95 percentile basis)
COD	125 mg/l O ₂ (on a 95 percentile basis)
Total Suspended Solids	35 mg/l (on a 95 percentile basis).

The Liffey Estuary is now considered under the Urban Waste Water Treatment Regulations, 2001 (S.I. No 254 of 2001) to be a 'sensitive' area and therefore the work in progress at Ringsend must be extended to include nutrient (nitrogen) reduction facilities. The additional requirement is as follows:

Total Nitrogen ²	10 mg/l N ¹
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Note 1: the annual mean of the samples shall conform to the relevant parametric values.

Note 2: Total nitrogen means the sum of total Kjeldahl-nitrogen (organic N plus ammonia), nitrate nitrogen and nitrite nitrogen.

The effluent data for the fourth year of the monitoring programme (July 2003 to end of June 2004) are summarised alongside the values obtained for the first, second and third years of the monitoring programme (2000/1, 2001/2 2002/3) in Tables 24a, b & c below. The mean BOD values recorded for 2000/1, 2001/2 and the first half of the third year of the monitoring programme may be underestimated as values greater than 388, 377 and 373 mgO₂/l were taken as 389, 378 and 374 mgO₂/l respectively

Table 24 - Comparison of Results for Ringsend Effluent 2000/1, 2001/2, 2002/3 & 2003/4

Table 25 (a)

	BOD				
	2000/1	2001/2	07/02 to 12/02	11/02 to 06/03	2003/4
Max	>388	>377	>373	95	82
Min	43	112	10	<2	3
Mean	210*	237*	200*	32 [^]	20
count	79	80	28	41	129

[^] The sample taken on 25/06/03 had a BOD of >8 mgO₂/l. This value was not included in calculating the mean.

* BOD mean may be underestimated (see text).

Table 24(b)

	COD mgO ₂ /l				
	2000/1	2001/2	07/02 to 12/02	11/02 to 06/03	2003/4
Max	1115	1053	1140	404	634
Min	60	194	36	18	25
Mean	428	462	356	116	94
count	135	139	75	103	259

Table 24(c)

	Suspended Solids mg/l				
	2000/1	2001/2	07/02 – 12/02	11/02 – 06/03	2003/4
Max	2,400	712	606	300	236
Min	37	75	10	<10	<10
Mean	211	188	144	71	44
count	135	140	80	104	259

There has been a significant improvement in the effluent quality since the commencement of the secondary treatment process. However the effluent quality is not consistently complying with limits specified in the Urban Waste Water Directive (UWWD) yet. The percent compliance of the effluent sample results with limits specified in the UWWD are tabulated in Table 25 below

Table 25 - Percent Compliance of Effluent Sample Results with Limits Specified in UWWD

	BOD			COD			Suspended Solids		
	No. samp	No. < 25mgO ₂ /l	% Comp	No. samp	No. < 125mgO ₂ /l	% Comp	No. samp	No. < 35mgO ₂ /l	% Comp
11/02 – 06/03	41	24	59	103	74	72	104	42	40
2003/4	129	95	74	259	233	90	259	131	51

The BOD and COD results are generally satisfactory, however, there are problems with the removal of suspended solids. During the fourth year of the monitoring just over half of the suspended solids results complied with the UWWD limit of 35 mg/l.

As stated in the First Annual Report (November 2001), a thorough investigation was carried out into the nutrient content of the Ringsend effluent during 1993 for the Stride Report. The effluent nutrient results for the fourth year of the monitoring are tabulated alongside the results for the first three years as well as the 1993 results in

Table 26 a, b, c, d, & e below. The results for the third year of the programme have been split into two as the SBRs were not fully operations during the first half of the third year.

Table 26 - Comparison of Results for Ringsend Effluent 1993 (Stride Report), 2000/1, 2001/2, 2002/3 & 2003/4

Table 26a

	Total Oxidisable Nitrogen					
	1993	2000/1	2001/2	mgN/l		2003/4
				07/02 – 12/02	11/02 – 06/03	
Max	3.02	5.83	0.52	7.07	9.81	15.55
Min	0	<0.11	<0.11	<0.11	<0.11	<0.37
Mean	0.25	*0.32	*0.11	*1.14	3.69	7.77
count	90	87	90	64	74	197

*TON mean value may be overestimated (see text)

Table 26b

	Ammoniacal Nitrogen					
	1993	2000/1	2001/2	mgN/l		2003/4
				07/02 – 12/02	11/02 – 06/03	
Max	26.44	39.62	26.99	30.92	17.96	17.91
Min	3.99	1.53	1.16	1.94	0.18	0.12
Mean	16.46	15.94	18.12	15.5	9.29	4.2
count	90	96	97	63	75	197

Table 26c

	Reactive Phosphate					
	1993	2000/1	2001/2	mgP/l		2003/4
				07/02 – 12/02	11/02 – 06/03	
Max	6.88	5.82	5.65	4.39	4.4	4.37
Min	0.64	0.44	0.82	0.21	0.16	0.03
Mean	3.53	3.15	2.96	1.99	2.1	2.35
count	90	94	96	63	71	193

Table 26d

	Total Phosphorus mgP/l					
	1993	2000/1	2001/2	07/02 – 12/02	11/02 – 06/03	2003/4
Max	9.95	9.49	8.37	10.27	5.11	7.00
Min	1.31	0.64	1.86	0.62	0.58	1.04
Mean	5.4	5.71	5.09	4.61	3.26	3.30
count	90	60	130	63	37	187

Table 26e

	Total Kjeldahl Nitrogen mgN/l					
	1993	2000/1	2001/2	07/02 – 12/02	11/02 – 06/03	2003/4
Max	39.92	70.3	55.3	48.46	43.1	18.6
Min	6.71	4.5	14.4	3.91	1.8	<1
Mean	24.84	26.8	32.4	25.66	11.4	5.89
count	90	58	94	68	46	185

There has been a marked reduction in the concentration of ammoniacal nitrogen with a corresponding increase in the TON levels, due to nitrification since the commencement of the secondary treatment process. All of the ammoniacal nitrogen values were less than 18.8mgN/l. There was also a significant reduction in the kjeldahl nitrogen values due to the lower ammoniacal nitrogen values and the reduction in the suspended solids levels with a corresponding reduction in the particulate nitrogen concentrations. The reactive phosphate values were similar to those obtained previously. The total phosphorus values were similar to those recorded for the first six months of the secondary treatment process. These values were slightly lower than the values recorded prior to the secondary treatment and are probably associated with the removal of suspended solids.

Figures 31 to 37 below are scatter plots of the effluent BOD, COD suspended solids ammoniacal nitrogen, TON, kjeldahl nitrogen and total nitrogen results during the fourth year of the monitoring programme. The total nitrogen values are the sum of the TON and kjeldahl nitrogen values. The mean TN value for the fourth year of the monitoring programme was 13.6 mgN/l and the maximum value recorded was 23.2mgN/l. The effluent TN concentration must comply with the limit of 10mgN/l for discharge into sensitive waters by 31st May 2008.

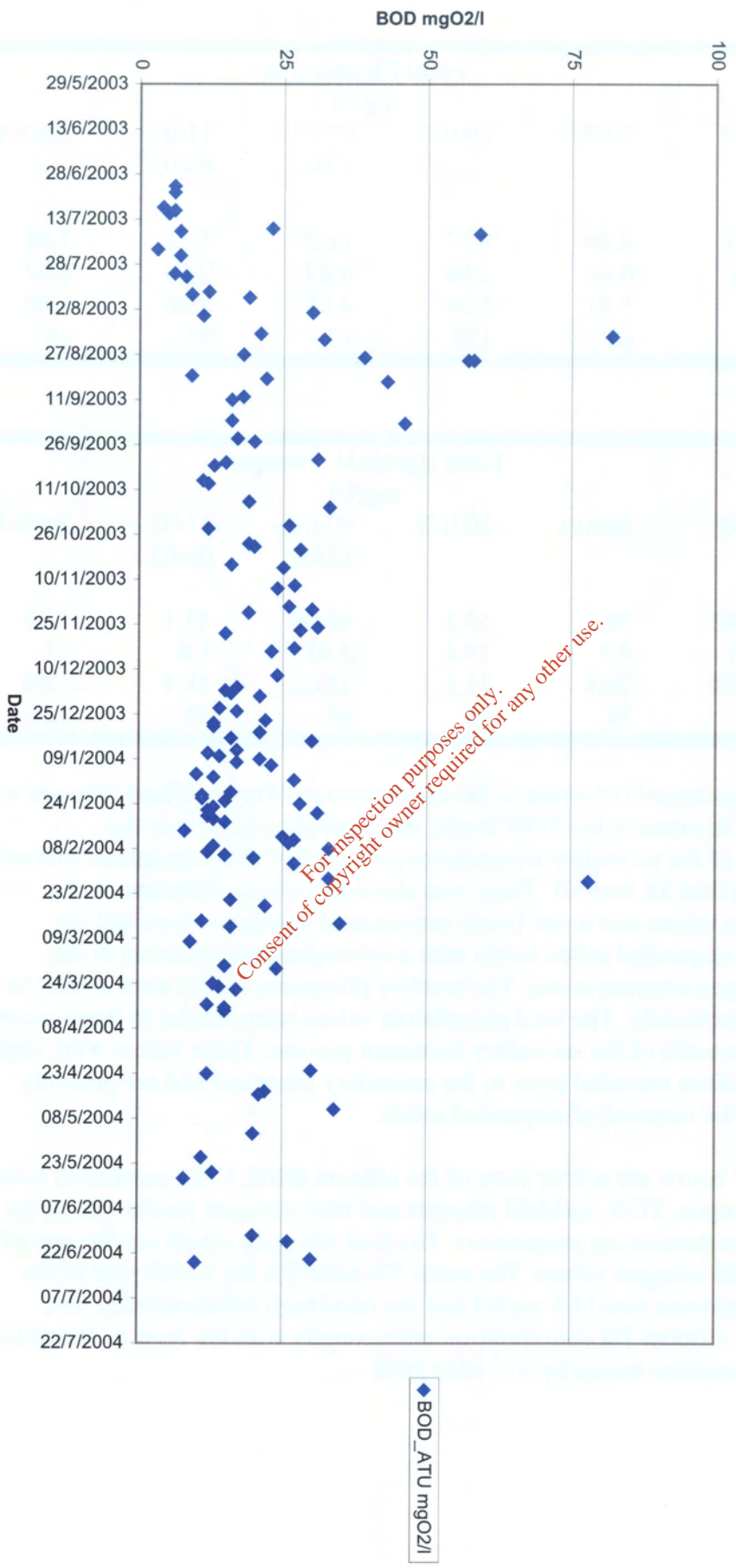
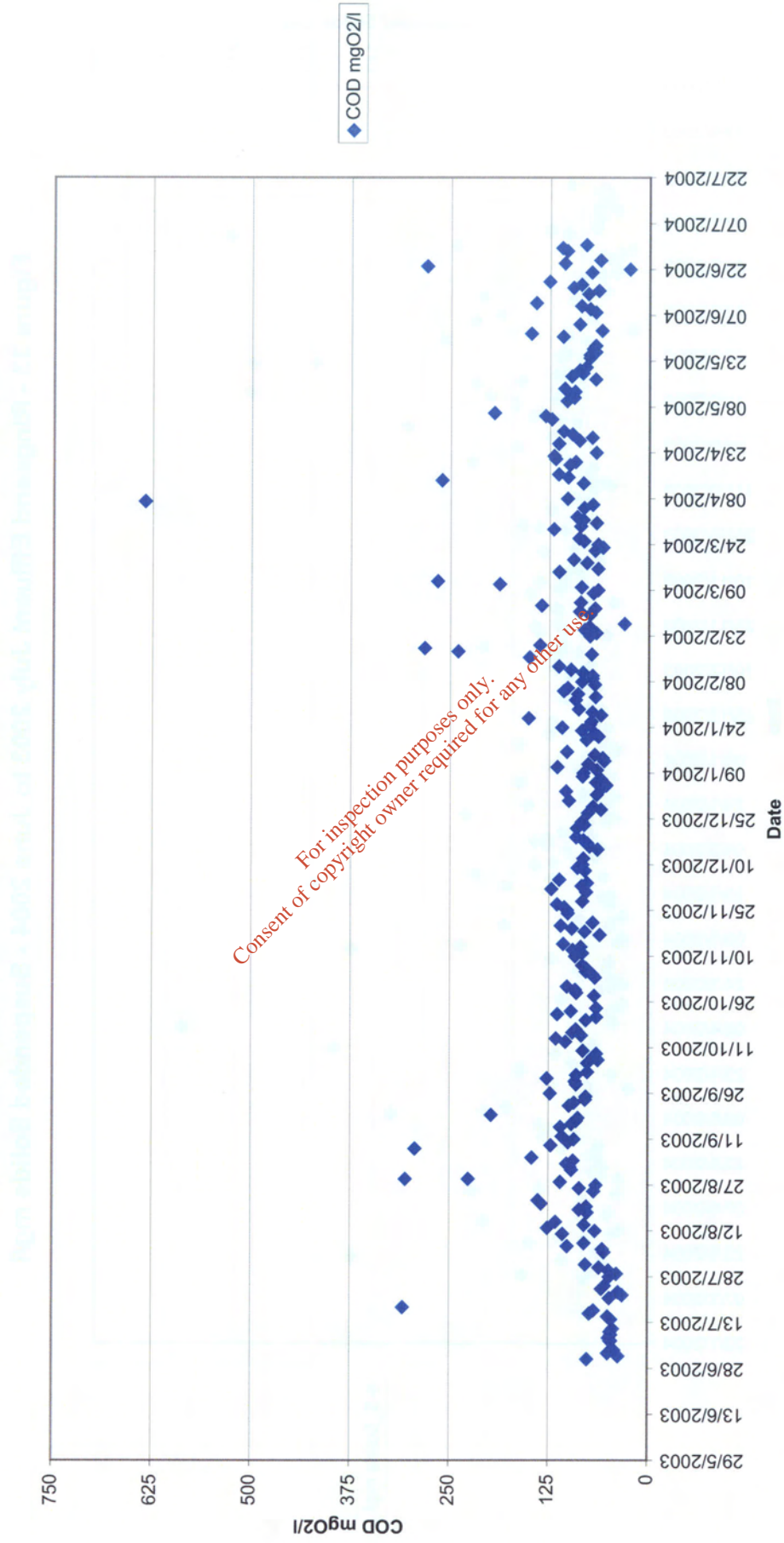


Figure 31 - Ringsend Effluent July 2003 to June 2004 - BOD mgO₂/l

Figure 32 - Ringsend Effluent July 2003 to June 2004 - COD mgO2/l



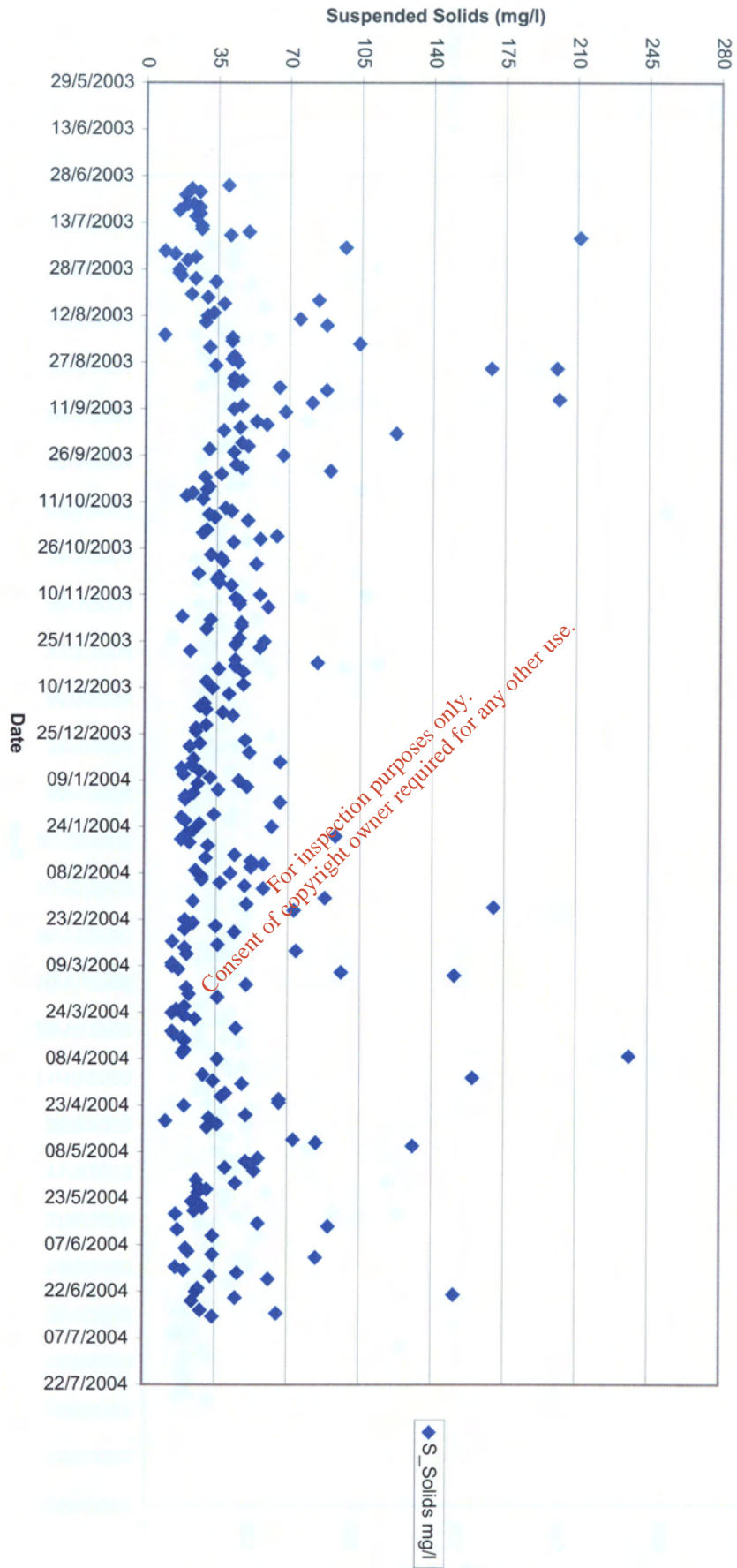
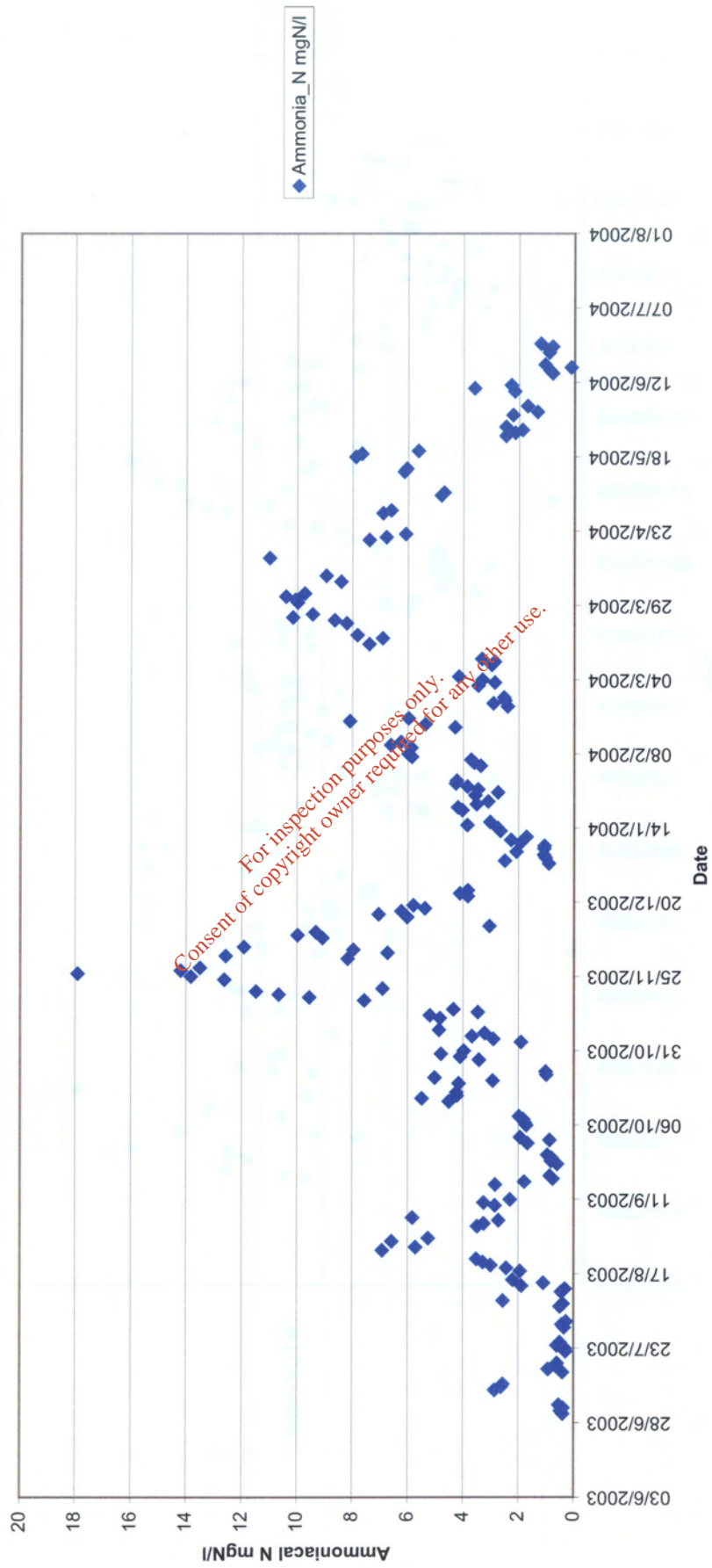


Figure 33 - Ringsend Effluent July 2003 to June 2004 - Suspended Solids mg/l

Figure 34 - Ringsend Effluent July 2003 to June 2004 - Ammoniacal Nitrogen



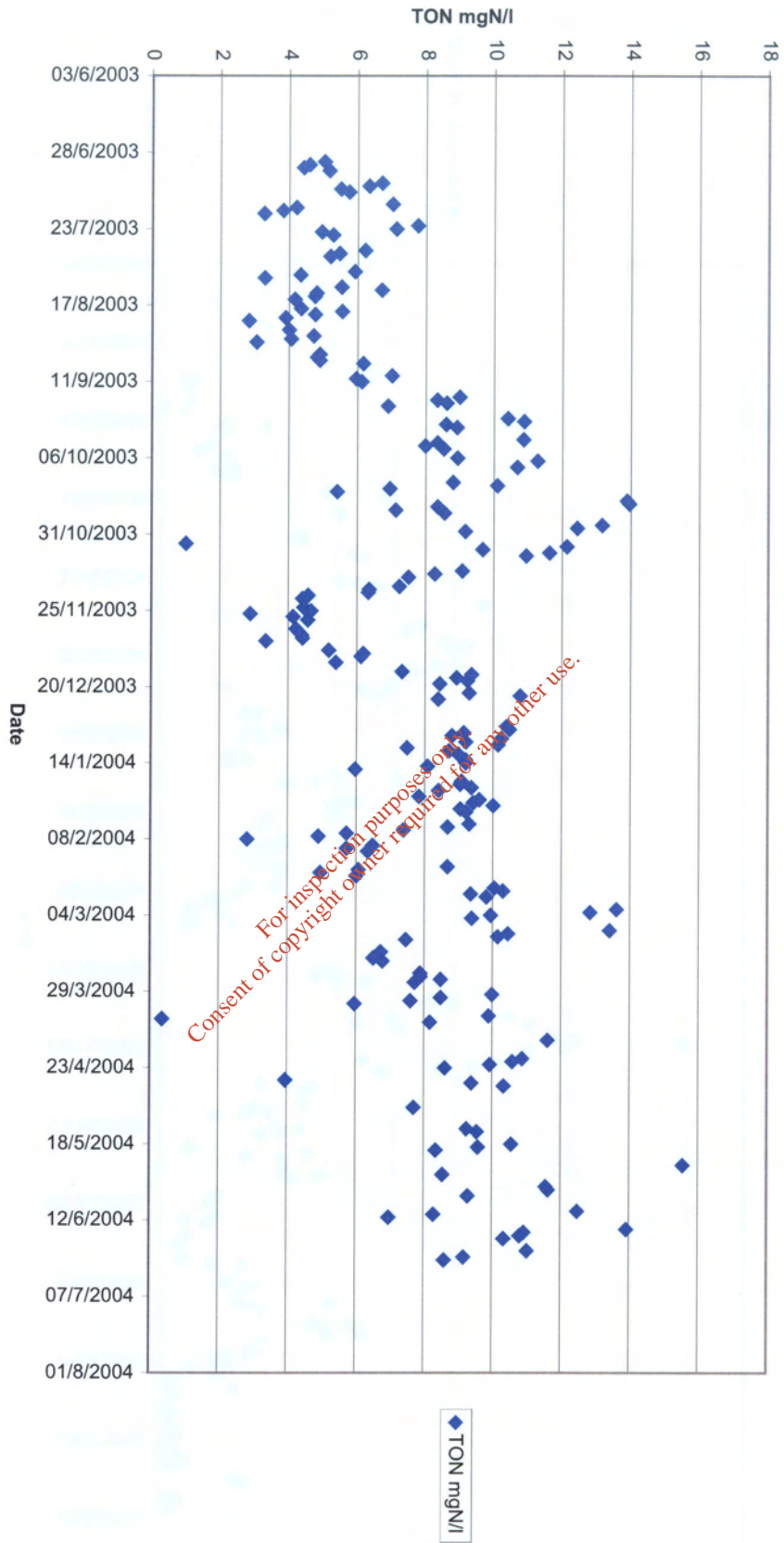
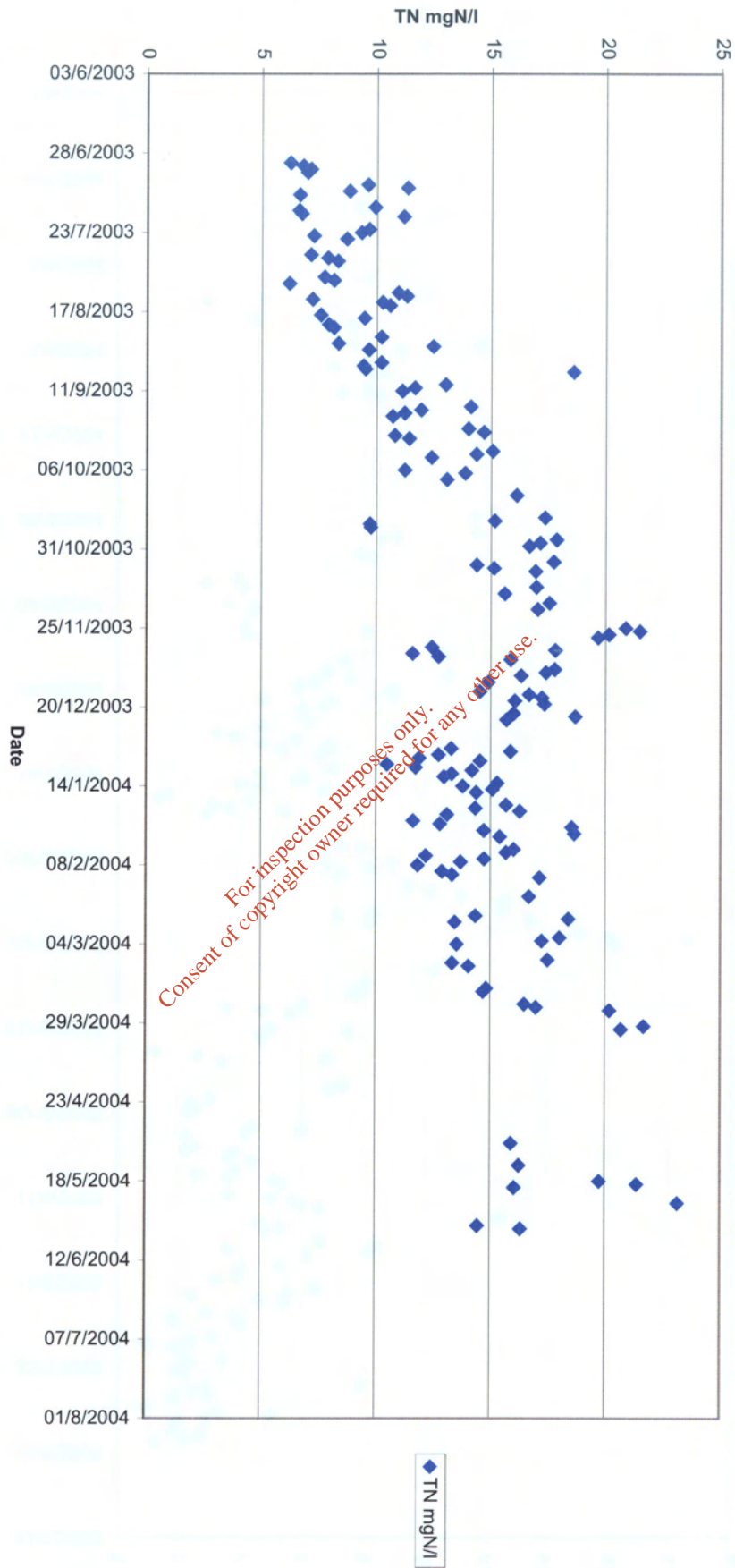


Figure 35 - Ringsend Effluent July 2003 to June 2004 - TON

Figure 36 - Ringsend Effluent July 2003 to June 2004 - Total Kjeldahl Nitrogen





8. Conclusion

The first and second years of the five-year monitoring programme involved gathering baseline information on the water quality of the Liffey Estuary, Dublin Bay offshore waters, the Ringsend effluent. The third year of the programme includes data acquired prior to and subsequent to the upgrading of the Ringsend Sewage Treatment Works. During the fourth year all of the sequential batch reactors (SBRs) were in operation and therefore this was the first full year of monitoring subsequent to the upgrading of the Ringsend Treatment Works. There were, however, a significant number of discharges from the Treatment Works on many of the survey dates and therefore it is difficult to accurately assess the impact of the upgraded Plant on the water quality in the Liffey estuary and the offshore waters. The discharges ceased in May 2004 and therefore did not occur during the bathing season.

During the 2004 bathing season all of the samples taken from the offshore waters complied with the blue flag limits for total and faecal coliforms and there was also an improvement in the bacteriological quality of the water in the Liffey estuary in the vicinity of the Ringsend Treatment Works outfall. UV sterilisation of the Ringsend effluent occurred during the bathing season. Outside of the bathing season there were a number of elevated coliform counts for samples taken from the Offshore waters – 5.9% of total coliform results and 10% of faecal coliform results exceeded the EU mandatory limit values. In the Liffey estuary, total and faecal coliform results for samples taken in the vicinity of the Ringsend outfall were in excess of 20,000 cfu per 100ml on a number of occasions. These elevated bacteriological counts were probably associated with discharges from Ringsend.

The BOD results for samples taken from the Liffey Estuary indicated that there was an improvement in the water quality in the vicinity of the Ringsend Treatment Works outfall. In this region of the estuary only 2.7% of the BOD results exceeded 4mgO₂/l compared with 24.3% and 21.8% in the first and second years of the programme. The ammoniacal nitrogen values were generally lower than in the previous years of the monitoring programme, however, there were a number of elevated results i.e. greater than 0.8mgN/l on a number of occasions throughout the year. These were probably related to the discharges. While the ammoniacal nitrogen values decreased there was an increase in the TON values due to nitrification of the sewage. The total phosphorus and phosphate results were similar to those recorded during the first three years of the programme.

In the Offshore waters there are indications that the levels of ammoniacal nitrogen and total nitrogen are decreasing and there is a slight increase in the TON values during the summer months. However, more surveys are required of both the Liffey estuary and the offshore waters to accurately assess the impact of the secondary treatment process on the levels of nutrients in both water bodies.

During the 2004 bathing season the bacteriological quality of the water at Seapoint, Killiney, Blackrock, Dollymount North and Dollymount South complied with the blue flag limit values. Samples taken from Dollymount Middle/Bathing Zone complied with the blue flag limit values for total and faecal coliforms but not faecal streptococci. Three faecal streptococci results out of 21 i.e. 14% exceeded the limit of 100cfu/100ml. Two of these samples were taken after very heavy rain which had a

negative impact on the water quality due to combined sewer overflows discharging into the river Liffey, runoff from the land in addition to overflows from Ringsend. As in 2003 there was a significant improvement in the bacteriological quality of samples taken from the Bull Wall and Dollymount South during the 2004 bathing season when compared with the bacteriological quality prior to the upgrading of the Ringsend Treatment Works. However during 2004, three of the eighteen samples taken from the Bull Wall exceeded the mandatory limit value for total coliforms. Two of these elevated results were recorded after heavy rainfall. The reasons for the third failure are not clear. Although there was an improvement in the water quality in the Liffey estuary at the Poolbeg lighthouse the results were not as good as those recorded during the 2003 bathing season even though the discharges from Ringsend discontinued in May 2004. The bathing water at Merrion and Sandymount complied with the EU mandatory limit values but not the blue flag limit values. There are a number of potential sources of pollution in the Sandymount/Merrion area including the Saint Alban's overflow pipe, the Elm Park Stream which flows onto the beach at Merrion, gullies on the road in the Sandymount area discharge onto the beach after rain. There is also a problem with faecal matter from dogs on the beach at Sandymount. Investigations are still underway to try to identify and eliminate sources of pollution in the Sandymount/Merrion area. It should be noted that Dollymount South, Dollymount North and Blackrock were not sampled on 23/06/04 or 18/08/04 (after the heavy rain referred to above). Samples were taken from Seapoint and Killiney on 23/06/04 but not 18/08/04 and the bacteriological results at either location did not comply with the blue flag limits on 23/06/04.

The Sequential Batch Reactors gradually came on line in December 2002 and there has been a significant improvement in the effluent quality since the commencement of the secondary treatment process. However the effluent water quality is not yet consistently complying with limits specified in the Urban Waste Water Directive (UWWD). Between July 2003 and June 2004 74%, 90% and 51% of the BOD, COD and Suspended Solids results respectively complied the UWWD limits.

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