



ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

BELINSTOWN TO ST. STEPHEN'S GREEN

ANNEXES

VOLUME 3 – BOOK 2 OF 2

ANNEX F

Annex F

Metro North EIS

Information supporting the surface water chapters

- Results of chemical water sampling of surface water bodies
- Emission limit values for surface water discharges
- Relevant surface water legislation

1 Information that supports surface water chapters

1.1 Results of chemical water sampling

Table 1.1 Results of Chemical Water Sampling

Chemical Sampling Parameter	Units	River							
		Liffey	Royal Canal	Tolka	Santry	Mayne	Sluice	Ward	Broad Meadow
Temperature	°C	9.7	10.6	9.9	11.1	13.5	14.0	10.2	9.8
pH	pH units	7.55	7.63	7.48	7.6	7.72	6.78	7.31	7.22
Oxygen Saturation	%	89.3	74.7	80.0	86.4	92.3	78.6	82.2	87.5
Dissolved Oxygen	mg/l	5.2	5.5	5.4	5.1	4.7	5.4	5.8	5.9
Conductivity	µS/cm	564	568	561	686	565	566	527	524
Biological Oxygen Demand	mg/l	2	2	2	<2	2	<2	5	<2
Total Suspended Solids	mg/l	<10	<10	<10	11	<10	<10	<10	<10
Total Phosphorous	mg/l	0.16	0.09	0.28	0.13	0.06	0.24	0.16	0.19
Orthophosphate as PO ₄	mg/l	0.19	0.17	0.19	0.17	0.12	0.43	0.08	0.34
Orthophosphate as P	µg/l	70	55	70	55	39	140	26	111
Nitrate as NO ₃	mg/l	10.4	0.8	7.2	9.0	6.0	7.1	7.2	13.2
Nitrite as NO ₂	mg/l	0.09	0.21	0.18	0.14	0.13	0.13	0.27	0.18
Total Nitrogen as N	mg/l	4	1	3	3	3	5	4	4
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Kjeldahl Nitrogen	mg/l	2	<1	<1	1	2	3	2	<1
Water classification	-	A2	A1	A1	A1	A2	A3	A2	A1

* Water classification as per the water categories in S.I. No. 295/1989 – European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989

1.2 Emission Limit Values

All terminology, abbreviations and acronyms used in Table 1.2 are explained in Section 1.3.

Table 1.2 Emission Limit Values

Chemical Sampling Parameter	Units	Proposed Water Quality Standards for Surface Water Classification (EPA, 2007)	Surface Water Regulations 1989	Bathing Water Regulations 1989 - 1998	Freshwater Fish Directive (78/659/EEC)		Salmonid Waters Regulations 1988	Shellfish Directive 79/923/EEC		Drinking Water Directive 98/83/EC
			I/PV value	I/PV value	G value	I/PV value	I/PV value	G value	I/PV value	I/PV value
Temperature	°C	TAV maximum temperature (90% ile) <21.5°C EQS: rise above ambient temperature of <1.5°C	A1 waters: 25 A2 waters: 25 A3 waters 25	-	-	-	-	-	-	-
	Notes	-	-	=	-	Notes 1 and 2	Note 3	Note 4	-	-
pH	pH units	-	A1 waters: 5.5 - 8.5 A2 waters: 5.5 - 9.0 A3 waters: 5.5 - 9.0	≥ 6 and ≤ 9	-	(S) 6 - 9 (C) 6 - 9	≥ 6 and ≤ 9	-	7.0 - 9.0	> 6.5 and ≤ 9.5
Conductivity	Notes S/cm	-	1000 at 20°C	Note 5	Notes 6 and 7	-	Note 8	-	-	Note 9 2500 at 20°C

Chemical Sampling Parameter	Units	Proposed Water Quality Standards for Surface Water Classification (EPA, 2007)	Surface Water Regulations 1989	Bathing Water Regulations 1989 - 1998	Freshwater Fish Directive (78/659/EEC)		Salmonid Waters Regulations 1988	Shellfish Directive 79/923/EEC		Drinking Water Directive 98/83/EC
			I/PV value	I/PV value	G value	I/PV value	I/PV value	G value	I/PV value	I/PV value
Oxygen Saturation	Notes	-	-	-	-	-	-	-	-	Note 10
	%	-	A1 waters: > 60% A2 waters: > 50% A3 waters: > 30%	> 70 or ≤ 120	-	-	-	≥ 80 %	≥ 70 %	-
Dissolved Oxygen	Notes	-	Note 11	Note 12	-	-	-	Notes 13 and 14		-
	mg/l	Lower Limit: TAV Daytime minimum (Grab Sample) >9 EQS 24 hour minimum >7 Upper Limit: TAV Daytime maximum <11 mg/l	-	-	(S) 50% ≥ 9 (S) 100% ≥ 7 (C) 50% ≥ 8 (C) 100% ≥ 5	50% ≥ 9 - 50% ≥ 7 -	50% ≥ 9	-	-	-
Biochemical Oxygen Demand	Notes	-	-	-	Notes 15 and 16		Note 17	-	-	-
	mg/l	TAV <2 mg/l annual median EQS <5 mg/l	A1 waters: 5 A2 waters: 5 A3 waters: 7	-	(S) ≤ 3 (C) ≤ 6	-	< 5	-	-	-

Chemical Sampling Parameter	Units	Proposed Water Quality Standards for Surface Water Classification (EPA, 2007)	Surface Water Regulations 1989	Bathing Water Regulations 1989 - 1998	Freshwater Fish Directive (78/659/EEC)		Salmonid Waters Regulations 1988	Shellfish Directive 79/923/EEC		Drinking Water Directive 98/83/EC
			I/PV value	I/PV value	G value	I/PV value	I/PV value	G value	I/PV value	I/PV value
		P/I EQS High/Good Boundary <34 µg P/I EQS Good/Moderate Boundary <50 µg P/I (Median)								
Nitrate as NO ₃	Notes	-	-	-	-	-	-	-	-	-
	mg/l	-	A1 waters: 50 A2 waters: 50 A3 waters: 50							50
Nitrite as NO ₂	Notes	-	Note 27	Note 28	-	-	=	-	-	Note 29
	mg/l	-	-	-	(S) ≤ 0.01 (C) ≤ 0.03	-	≤ 0.05	-	-	0.5
Total Nitrogen as N (as Nitrogen, Kjeldahl)	Notes	-	-	-	-	-	Note 8	-	-	Notes 29 and 30
	mg/l	-	-	-	-	-	-	-	-	-
	Notes	-	-	-	-	=	-	-	-	-

Chemical Sampling Parameter	Units	Proposed Water Quality Standards for Surface Water Classification (EPA, 2007)	Surface Water Regulations 1989	Bathing Water Regulations 1989 - 1998	Freshwater Fish Directive (78/659/EEC)		Salmonid Waters Regulations 1988	Shellfish Directive 79/923/EEC		Drinking Water Directive 98/83/EC
			I/PV value	I/PV value	G value	I/PV value	I/PV value	G value	I/PV value	I/PV value
Kjeldahl Nitrogen	mg/l	-	A1: 1 A2: 2 A3: 3	-	-	-	-	-	-	-
	Notes	-	Note 31	Note 32	-	-	-	-	-	-
Ammonium as NH ₄	mg/l	-	A1: 0.2 (Ammonia) A2: 1.5 (Ammonia) A3: 4 (Ammonia)	-	(S) ≤ 0.04 (C) ≤ 0.2	≤ 1 ≤ 1	-	-	-	0.5
	Notes	-	Note 7	Note 33	total ammonium	-	-	-	-	ammonium
Ammonia as NH ₃	mg/l	-	-	-	(S) ≤ 0.005 (C) ≤ 0.005	≤ 0.025 ≤ 0.025	≤ 0.02 non-ionised ammonia ≤ 1 total ammonia	-	-	-
	Notes	-	-	-	non-ionised ammonia	-	Note 34 and Note 35	-	-	-
Ammoniacal Nitrogen as N (calculated)	mg/l	-	A1 waters: 0.16 A2 waters: 1.24	-	(S) ≤ 0.03 (C) ≤ 0.16	≤ 0.82 ≤ 0.82	-	-	-	0.41 ammonium as N

Chemical Sampling Parameter	Units	Proposed Water Quality Standards for Surface Water Classification (EPA, 2007)	Surface Water Regulations 1989	Bathing Water Regulations 1989 - 1998	Freshwater Fish Directive (78/659/EEC)		Salmonid Waters Regulations 1988	Shellfish Directive 79/923/EEC		Drinking Water Directive 98/83/EC
			I/PV value	I/PV value	G value	I/PV value	I/PV value	G value	I/PV value	I/PV value

A3 waters:
3.29

total ammonium as N

* I [value]: Mandatory (imperative) value in EU Directives

* G [value]: Guide (advisory) value in EU Directives

* TAV: Trigger Action Value - A TAV is a numerical value proposed in some cases for certain parameters (e.g. phosphorus), usually in parallel with an environmental quality standard (EQS), and which provides in these cases a more stringent non-binding target than the EQS, e.g. in the case of a water body thought to be especially sensitive to that parameter. TAVs are also used in other situations such as in the case of the parameter 'dissolved oxygen' where 24-hour continuous monitoring is required to establish compliance or otherwise with the EQS in the event that the TAV value based on 'grab-sampling' is breached.

* EQS: Ecological Quality Ratio (EQR) - The relationship between the values of the biological parameters observed for a given body of surface water and the values for those parameters in the reference conditions applicable to that body. The ratio is to be expressed as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero

* A1 waters, A2 waters, A3 waters – The water categories in the 1975 Surface Water Directive/1989 Regulations

* (S) Salmonid waters – Freshwater Fish Directive/Salmonid Water Regulations (waters of a quality sufficient to support game fish)

* (C) Cyprinid waters – Freshwater Fish Directive (waters of a quality sufficient to support coarse but not game fish)

* This precisely-defined unit is broadly equivalent to 'ortho-phosphate' as determined using the ascorbic acid/molybdate colorimetric procedure.

1.3 Relevant Legislation

1.3.1 S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended For The Abstraction of Drinking Water) Regulations, 1989

Schedule Part I

Definition of the standard methods of treatment for transforming surface water of categories A1, A2 and A3 into drinking water.

Category A1

Simple physical treatment and disinfection, e.g. rapid filtration and disinfection.

Category A2

Normal physical treatment, chemical treatment and disinfection, e.g. prechlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination).

Category A3

Intensive physical and chemical treatment, extended treatment and disinfection, e.g. chlorination to break-point, coagulation, flocculation, decantation, filtration, adsorption (activated carbon), disinfection (ozone, final chlorination).

PART II

Table 1.3 Surface water quality standards

Parameters		Unit of measurement	Standards for Categories		
1	pH	pH Unit	A1	A2	A3
2	Colouration (after simple filtration)	mg/1 Pt scale	5.5-8.5	5.5-9.0	5.5-9.0
3	Total suspended solids	mg/1 SS	20 (o)	100 (o)	150 (o)
4	Temperature	°C	50		
5	Conductivity	µs/cm-1 at 20 °C	25 (o)	25 (o)	25 (o)
6	Odour	(dilution factor at 25°C)	1000	1000	1000
7	Nitrates	mg/1 NO ₃	5	10	20
8	Fluorides	mg/1 F	50 (o)	50 (o)	50 (o)
9	Dissolved iron	mg/1 Fe	1	1.7	1.7
10	Manganese	mg/1 Mn	0.2	2	2
11	Copper	mg/1 Cu	0.05	0.3	1
12	Zinc	mg/1 Zn	0.05 (o)	0.1 (o)	1 (o)
13	Boron	mg/1 B	3	5	5

Parameters		Unit of measurement	Standards for Categories		
14	Arsenic	mg/1 As	2	2	2
15	Cadmium	mg/1 Cd	0.05	0.05	0.1
16	Total chromium	mg/1 Cr	0.005	0.005	0.005
17	Lead	mg/1 Pb	0.05	0.05	0.05
18	Selenium	mg/1 Se	0.05	0.05	0.05
19	Mercury	mg/1 Hg	0.01	0.01	0.01
20	Barium	mg/1 Ba	0.001	0.001	0.001
21	Cyanide	mg/1 CN	0.1	1	1
22	Sulphates	mg/1 SO ₄	0.05	0.05	0.05
23	Chlorides	mg/1 Cl	200	200 (o)	200 (o)
24	Surfactants (reacting with methylene blue)	mg/1 (laurylsulphate)	250	250	250
25	Phosphates	mg/1 P ₂ O ₅	0.2	0.2	0.2
26	Phenols (phenol index) paranitraniline 4-aminoantipyrine	mg/1 C ₆ H ₅ CH	0.5	0.7	0.7
27	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether)	mg/1	0.0005	0.005	0.1
28	Polycyclic aromatic hydrocarbons	mg/1	0.01	0.2	1
29	Total pesticides (parathion, BHC, dieldrin)	mg/1	0.0002	0.0002	0.001
30	Chemical oxygen demand (COD)	mg/1 O ₂	0.0005	0.0025	0.005
31	Dissolved oxygen saturation rate	% O ₂			40
32	Biochemical oxygen demand (BOD ₅) (at 20 °C without nitrification)	mg/1 O ₂	>60%	>50%	>30%
33	Nitrogen by Kjeldahl method (except in NO ₂ and NO ₃)	mg/1 N	5	5	7
34	Ammonium	mg/1 NH ₄	1	2	3
335	Substances extractable with chloroform	mg/1 SEC	0.2	1.5	4 (o)
36	Total coliforms 37°C	/100 ml	0.2	0.4	1
37	Faecal coliforms	/100 ml	5,000	25,000	100,000
38	Faecal streptococci	/100 ml	1,000	5,000	40,000
39	Salmonella		200	2,000	10,000
			Not present in 500 ml	Not present in 100 ml	

(o) = See article 5 (1) (b). * = See article 5 (1) (d).

1.3.2 S.I. No. 294/1989 - Article 5

5. (1) A departure from the quality standards referred to in article 3 (1) may be granted by the Minister to a sanitary authority:

(a) in the case of floods or other natural disasters,

(b) in the case of the quality standards marked ' (o) ' where exceptional meteorological or geographical conditions have arisen,

(c) where the quality standards applicable to categories A1, A2 and A3 are exceeded because the surface water concerned has undergone natural enrichment from the soil, without human intervention;

(d) in respect of parameters marked with an asterisk in Part II of the Schedule in the case of surface water in shallow lakes or virtually stagnant surface water.

1.3.3 S.I. No. 258/1998 — Local Government (Water Pollution) Act, 1977, (Water Quality Standards For Phosphorus) Regulations, 1998

THIRD SCHEDULE PART I

Table 1.4 Quality standards for rivers

Column 1	Column 2	Column 3
Existing Biological Quality (Q) Rating/Q Index	Minimum Target Biological Quality (Q) Rating/Q Index	Molybdate-Reactive Phosphate Median Concentration*(ugP/L)
Unpolluted		
5	5	15
4-5	4-5	20
4	4	30
Slightly Polluted		
3-4	4	30
Moderately Polluted		
3	3 - 4	50
2-3	3	70
Seriously Polluted		
≤2	3	70

*Median concentration to be determined using as a minimum ten samples taken at inter-vals of four weeks or longer in any twelve consecutive month period. Where the requisite number of samples has not been taken within such period, the median concentration shall be determined from sampling conducted over such period, being a period not exceeding twenty four months, as required to obtain a minimum of fifteen samples taken at intervals of four weeks or longer.

1.4

Explanatory notes

1. value is 'Temperature measured downstream of a point of thermal discharge (at the edge of the mixing zone) must not exceed the unaffected temperature by more than 1.5°C in salmonid waters and 3.00°C in cyprinid waters. Derogations limited in geographical scope may be decided by Member States in particular conditions if the competent authority can prove that there are no harmful consequences for the balanced development of the fish population.'

2. Thermal discharges must not cause the temperature downstream of the point of discharge (at the edge of the mixing zone) to exceed the following: 21.5°C/10°C in salmonid waters and 28°C/10°C in cyprinid waters. The 10°C temperature limit applies only to breeding periods of species which need cold water for reproduction and only to waters which may contain such species.' Temperature limits may, however be exceeded for 2% of the time.

3. Standard laid down in Regulations is: 'Temperature measured downstream of a point of thermal discharge (at the edge of the mixing zone as determined by the local authority) must not -

exceed the unaffected temperature by more than 1.5°C

exceed (i) 21.5 °C or (ii) 10°C during the period from 1 November to 30 April where species which need cold water for reproduction are present.

A thermal discharge must not cause sudden variations in temperatures. ' (Temperature limits to be conformed with for 98% of the time.)

4. G value is: 'A discharge affecting shellfish waters must not cause the temperature of the waters to exceed by more than 2°C the temperature of water not so affected.'

5. Sampling to be carried out 'where an investigation... shows, or there are other grounds for believing, that there has been deterioration in the quality of waters...' No two consecutive samples to fall outside the range.

6. Standard to be conformed by 95% of samples over a period of 12 months where sampling is carried out at least once per month; where sampling is less frequent the standard shall be conformed with by all samples.

7. Parameter is designated 'Hydrogen ion concentration' with the comments 'The water should not be aggressive' and 'For still water put into bottles or containers, the minimum value may be reduced to 4.5 pH units. For water put into bottles or containers which is naturally rich in or artificially enriched with carbon dioxide, the minimum value may be lower.'

8. 'Artificial pH variations with respect to the unaffected values shall not exceed ± 0.5 of a pH unit within the limits 6 and 9 provided that these variations do not increase the harmfulness of other substances present in the water.'

9. Derogations possible 'because of exceptional weather or special geographical conditions.'

10. The water should not be aggressive

11. Parameter is 'Dissolved oxygen saturation rate'. Departure from the standard may be granted by the Minister 'in the case of surface water in shallow lakes or virtually stagnant surface water.'

12. Sampling to be carried out 'where an investigation... shows, or there are other grounds for believing, that there has been deterioration in the quality of waters...' Standard to be conformed by 95% of samples. No two consecutive samples to fall outside the range.

13. The I value quoted is an average value; there are also the following provisions: 'Should an individual measurement indicate a value lower than 70%, measurements shall be repeated. An individual measurement may not indicate a value of less than 60% unless there are no harmful consequences for the development of shell-fish colonies.'

14. The sampling frequency is given as 'monthly, with a minimum of one sample representative of low oxygen conditions on the day of sampling... Where major daily variations are suspected, a minimum of two samples in one day shall be taken.'

15. The I value for cyprinid water contains the provision: 'When the oxygen concentration falls below 4mg/l, Member States shall implement the provisions of Article 7(3) (of the Directive). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population'

16. The regulations specify: $50\% \geq 9 \text{ mg/l O}_2$. 'When the oxygen concentration falls below 6mg/l the local authority must prove that there will be no harmful consequences for the balanced development of fish population.'

17. The I value for salmonid water contains the provision: 'When the oxygen concentration falls below 6mg/l, Member States shall implement the provisions of Article 7(3) (of the Directive). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population'

18. Parameter is described as 'Biochemical oxygen demand (BOD₅) (at 20°C without nitrification).' A nitrification inhibitor should therefore be used in the analytical procedure.

19. Departure may be granted by the Minister 'in the case of surface water in shallow lakes or virtually stagnant surface water.'

20. Nitrification (cf. Note 18 immediately above) should not be inhibited.

21. 'Where weed or sewage fungus growths are excessive appropriate measures for control should be taken. Standard to be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once per month; where sampling is less frequent the standard shall be conformed with by all samples.'

22. 'The values shown are average concentrations and do not apply to suspended solids with harmful chemical properties. Floods are liable to cause particularly high concentrations.' Departures are possible 'because of exceptional weather or special geographical conditions.'

23. 'The standard is expressed as an average concentration over a period of 12 months and does not apply to suspended solids with harmful chemical properties.'

24. The I value quoted is : 'A discharge affecting shellfish waters must not cause the suspended solid content of the waters to exceed by more than 30% the content of waters not so affected.'

25. Directive gives a formula for phosphorous loading in lakes

26. Parameter is designated 'Phosphates'. Sampling to be carried out 'where an investigation... Shows, or there are other grounds for believing, that there has been a deterioration in the quality of waters...'

27. Departure may be granted by the Minister 'in the case of surface water in shallow lakes or virtually stagnant surface water' or 'where exceptional meteorological or geographical conditions have arisen.'

28. Sampling to be carried out 'where an investigation... shows, or there are other grounds for believing, that there has been deterioration in the quality of waters...'

29. The Directive specifies that 'Member States must ensure that the condition that $\frac{[\text{nitrate}]/50 + [\text{nitrite}]/3 \leq 1$, the square brackets signifying the concentrations in mg/l for nitrate (NO_3) and nitrite (NO_2), is complied with and that the value of 0.10 mg/l for nitrites is complied ex water treatment works.'

30. The latter requirement in note (29) appears inconsistent with the parametric value of 0.5 mg/l NO_2 .

31. Parameter listed as 'Nitrogen by Kjeldahl method (except NO_2 and NO_3).'

32. Parameter designated as: 'Nitrogen Kjeldahl.' Sampling to be carried out 'where an investigation... shows, or there are other grounds for believing, that there has been a deterioration in the quality of waters ... or, in the case of Nitrogen Kjeldahl..., that there is a tendency towards eutrophication.'

33. Sampling to be carried out 'where an investigation... shows, or there are other grounds for believing, that there has been deterioration in the quality of waters... Or, in the case of ... Ammonia, that there is a tendency towards eutrophication.'

34. Standard may be exceeded in the form of minor peaks in daytime and, subject to this, be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once per month; where sampling is less frequent the standard shall be conformed with by all samples.

35. Standard is ≤ 1 'subject to conforming with the standard for non-ionised ammonia.' Standard to be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once per month; where sampling is less frequent the standard shall be conformed with by all samples.

