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- EMERGENCY OVERFLOW
- EXCESS FLOW TO/FROM STORM TANK
- FOUL LINE
- RECIRCULATING FOUL LINE
- COMBINED TREATED EFFLUENT + STORM

N

Rev.	Date	By	Description

CORK COUNTY COUNCIL
SOUTHERN DIVISION

Noel O Keeffe, B.E. C.Eng., Eur.Ing F.I.E.I.I.M.I.E.I. — A/County Engineer, County Hall, Cork.
Patricia Power, Director of Services, Area Operations South

Project: LADYSBRIDGE
WWTP WASTE WATER
DISCHARGE LICENCE APPLICATION

Title: APPLICATION FORM
ATTACHMENT C1_Dwg 01
OPERATION INFORMATION REQUIREMENTS

Designed:	Checked:	Scales:	Drawing No:
ER	MH	1:250 @ A3	C1_Dwg 01
Drawn: SD	Approved: MH	Date: NOV '08	
File Path:		Status: _	Rev: A

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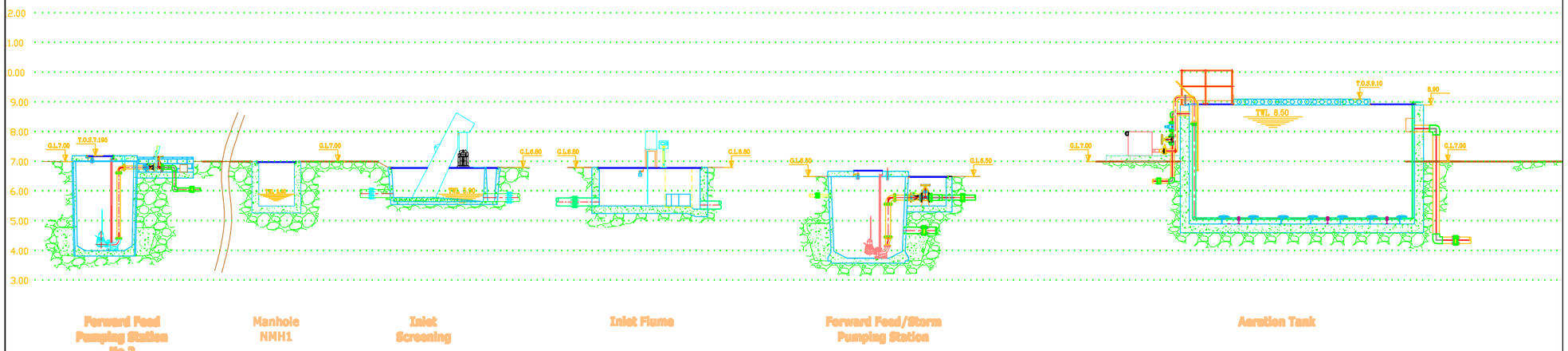

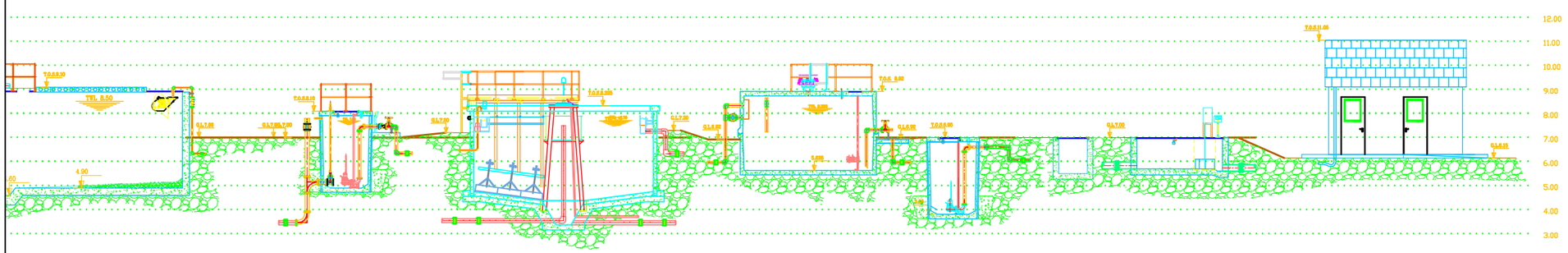

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Rev.	Date	By	Description

CORK COUNTY COUNCIL
SOUTHERN DIVISION

Ned O Keeffe, B.E. C.Eng. Ba.Eng F.I.E.I.I.M.I.C.E
A/County Engineer
County Hall, Cork.

Patrick Power,
Director of Services,
Area Operations South

Project: LADYSBRIDGE
WWTP WASTE WATER
DISCHARGE LICENCE APPLICATION

Title: APPLICATION FORM
ATTACHMENT C1_Dwg 02
OPERATION INFORMATION - SECTION

Designed:	ER	Checked:	MH	Scale: NOT TO SCALE @ A3	Drawing No: C1_Dwg 02
Drawn:	SD	Approved:	MH	Date: NOV '08	
File Path:				Status: _	Rev: A

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PT_CD	PT_TYPE	LA_NAME	RWB_TYPE	RWB_NAME	DESIGNATION	EASTING	NORTHING	VERIFIED
SW01LADY	Primary	Cork County Council	River	Womanagh River	NHA	E 197057	N 071972	N

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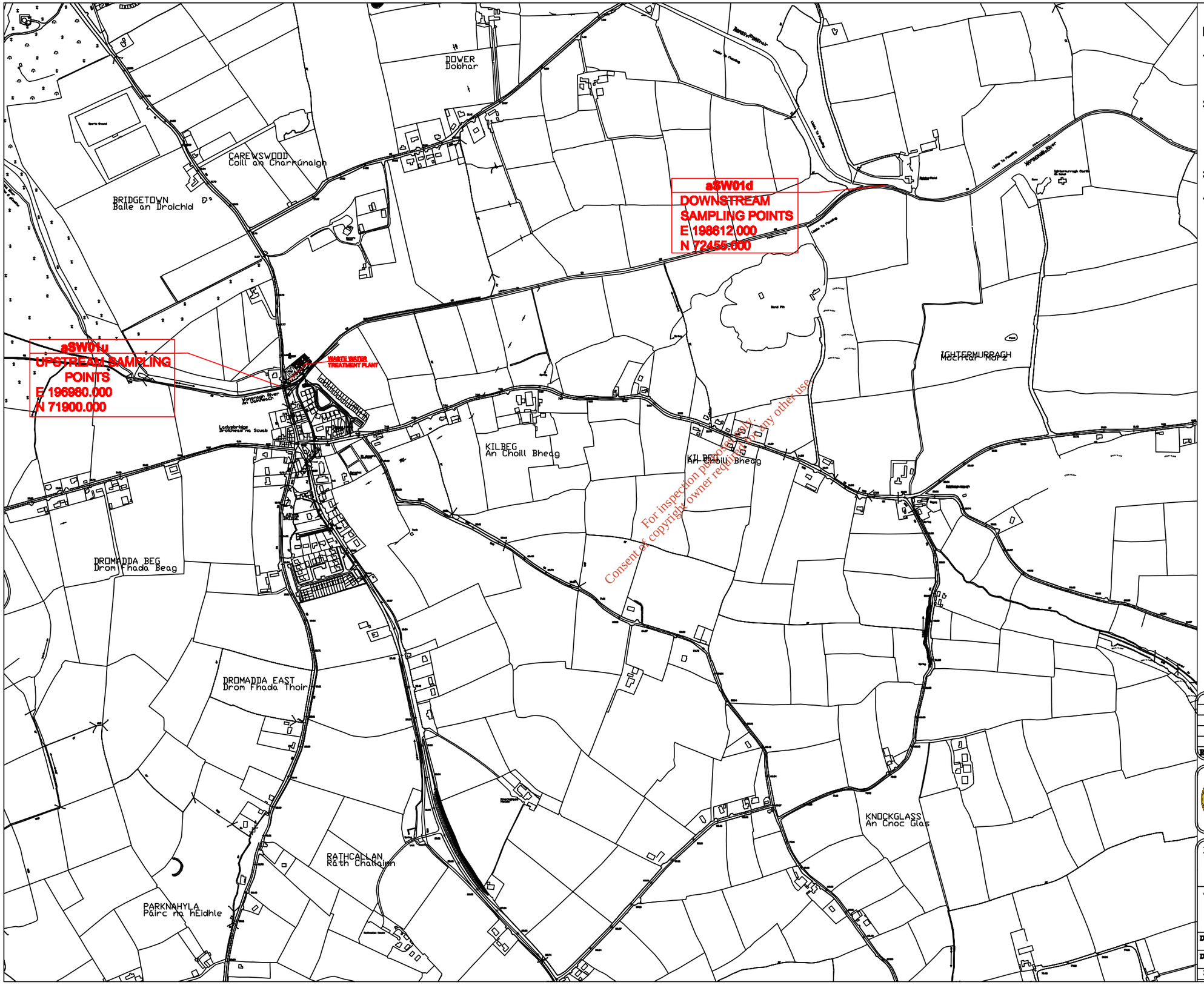

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Rev.	Date	By	Description

CORK COUNTY COUNCIL
SOUTHERN DIVISION

Noel O Keeffe, B.E. C.Eng. Eur.Ing F.I.E.I.I.M.I.C.E. A/County Engineer, County Hall, Cork.
Patricia Power, Director of Services, Area Operations South.

Project: LADYSBRIDGE
WWTP WASTE WATER
DISCHARGE LICENCE APPLICATION

Title: APPLICATION FORM
ATTACHMENT E2_Map11
LOCATION OF UPSTREAM & DOWNSTREAM
MONITORING POINTS

Designed: ER	Checked: MH	Scales: 1:10,000 @ A3	Drawing No: E2_Map11	
Drawn: SD	Approved: MH	Date: NOV '08		
File Path:			Status: _	Rev: A

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PT_CD	PT_TYPE	MON_TYPE	EASTING	NORTHING	VERIFIED
SW01	Primary Discharge	S	E 197062	N 071965	N
aSW01u	Primary Discharge	S	E 196980	N 071900	N
aSW01d	Primary Discharge	S	E 198612	N 072455	N

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Attachment E4 Ladysbridge Inlet Table E4

Sample Date	27/11/2008				
Sample	Influent	Average	Kg/day	kg/year	
Sample Code	GS1284				
Flow M^3/Day	*	675		Maximum Flow	
pH	7.5	7.5			
Temperature ℃	*	*			
Cond 20℃	601	601			
SS mg/L	131	131	88.425	32275.125	
NH_3 mg/L	12.6	12.6	8.505	3104.325	
BOD mg/L	65	65	43.875	16014.375	
COD mg/L	291	291	196.425	71695.125	
TN mg/L	27	27	18.225	6652.125	
Nitrite mg/L	0.892	0.892	0.6021	219.7665	
Nitrate mg/L	5.77	5.77	3.89475	1421.58375	
TP mg/L	3.9	3.9	2.6325	960.8625	
O-PO4-P mg/L	1.87	1.87	1.26225	460.72125	
SO4 mg/L	39.5	39.5	26.6625	9731.8125	
Phenols µg/L	<0.10	<0.0001	<0.0000675	<0.0246375	
Atrazine µg/L	<0.01	<0.00001	<0.00000675	<0.00246375	
Dichloromethane µg/L	<1	<0.001	<0.000675	<0.246375	
Simazine µg/L	<0.01	<0.00001	<0.00000675	<0.00246375	
Toluene µg/L	<1	<0.001	<0.000675	<0.246375	
Tributyltin µg/L	*	*	*	*	
Xylenes µg/L	<1	<0.001	<0.000675	<0.246375	
Arsenic µg/L	<0.96	<0.00096	<0.000648	<0.23652	
Chromium mg/L	<0.02	<0.02	<0.0135	<4.9275	
Copper mg/L	0.064	0.064	0.0432	15.768	
Cyanide µg/L	<5	<0.005	<0.003375	<1.231875	
Fluoride µg/L	70	0.07	0.04725	17.24625	
Lead mg/L	<0.02	<0.02	<0.0135	<4.9275	
Nickel mg/L	<0.02	<0.02	<0.0135	<4.9275	
Zinc mg/L	0.045	0.045	0.030375	11.086875	
Boron mg/L	<0.02	<0.02	<0.0135	<4.9275	
Cadmium mg/L	<0.02	<0.02	<0.0135	<4.9275	
Mercury µg/L	<0.2	<0.0002	<0.000135	<0.049275	
Selenium µg/L	2.4	0.0024	0.00162	0.5913	
Barium mg/L	0.024	0.024	0.0162	5.913	

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Attachment E4 Ladysbridge Discharge Outlet Table E4

Sample Date	17/01/2007	30/05/2007	04/07/2007	08/08/2007	17/10/2007	22/11/2007	03/04/2008	22/05/2008	10/07/2008	03/09/2008	09/10/2008	27/11/2008			
Sample	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Average	Kg/Day	Kg/year
Sample Code							GS273	GS441	GS646	GS831	GS1016	GS1283			
Flow M^3/Day	*	*	*	*	*	*	*	*	*	*	*	*	675		
pH	7.3	7.4	7.4	7.5	7.6	7.2	*	7.5	*	7.9	7.6	7.4	7.6		
Temperature ℃	*	*	*	*	*	*	*	*	*	*	*	*			
Cond 20℃	*	*	*	*	*	*	508	539	472	516	*	570	521		
SS mg/L	25	31	11	20	18	10	5	10	20	26	23	24	18	12.15	4434.75
NH_3 mg/L	*	*	<0.1	0.2	4	<0.1	<0.1	<0.1	<0.1	1.4	<0.1	0.1	0.582	0.39285	143.39025
BOD mg/L	45	22	1.1	5.3	4.86	2.54	1.32	3.34	5.55	4.34	2.41	3.3	3.3766667	2.27925	831.92625
COD mg/L	70	67	<21	<21	30	<21	<21	28	35	<21	<21	33	24.5	16.5375	6036.1875
TN mg/L	12	16.5	*	17.5	19.3	24.5	12.9	19.7	12.9	14	19	26	17.416667	11.75625	4291.03125
Nitrite mg/L	*	*	*	*	*	*	*	*	*	*	*	0.0201	0.021	0.014175	5.173875
Nitrate mg/L	*	*	*	*	*	*	*	*	*	*	*	*		0	0
TP mg/L	1.54	1.84	<0.2	0.73	*	0.38	0.26	0.53	0.73	0.9	4.3	1.1	1.3033333	0.87975	321.10875
O-PO4-P mg/L	*	*	<0.05	0.4	0.56	0.13	<0.05	0.19	0.08	0.11	0.22	0.37	0.211	0.142425	51.985125
SO4 mg/L	*	*	98.1	<30	35.8	87.3	*	*	*	*	<30	67.5	53.12	35.856	13087.44
Phenols µg/L	*	*	*	*	*	*	*	*	*	*	*	<0.10	<0.0001	<0.0000675	<0.0246375
Atrazine µg/L	*	*	*	*	*	*	*	*	*	*	*	<0.01	<0.00001	<0.00000675	<0.00246375
Dichloromethane	*	*	*	*	*	*	*	*	*	*	*	<1	<0.001	<0.000675	<0.246375
Simazine µg/L	*	*	*	*	*	*	*	*	*	*	*	<0.01	<0.00001	<0.00000675	<0.00246375
Toluene µg/L	*	*	*	*	*	*	*	*	*	*	*	<1	<0.001	<0.000675	<0.246375
Tributyltin µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Xylenes µg/L	*	*	*	*	*	*	*	*	*	*	*	<1	<0.001	<0.000675	<0.246375
Arsenic µg/L	*	*	*	*	*	*	*	*	*	*	*	<0.96	<0.00096	<0.000648	<0.23652
Chromium mg/L	*	*	<0.02	<0.02	<0.02	<0.02	<0.02	*	*	<0.02	*	<0.02	<0.02	<0.0135	<4.9275
Copper mg/L	*	*	<0.02	0.021	<0.02	0.029	<0.02	*	*	<0.02	*	<0.02	0.0167	0.0112725	4.1144625
Cyanide µg/L	*	*	*	*	*	*	*	*	*	*.	*	<5	<0.005	<0.003375	<1.231875
Fluoride µg/L	*	*	*	*	*	*	*	*	*	*	*	73	0.073	0.049275	17.985375
Lead mg/L	*	*	<0.02	<0.02	<0.02	<0.02	<0.02	*	*	<0.02	*	<0.02	<0.02	<0.0135	<4.9275
Nickel mg/L	*	*	<0.02	<0.02	<0.02	<0.02	<0.02	*	*	<0.02	*	<0.02	<0.02	<0.0135	<4.9275
Zinc mg/L	*	*	0.03	0.025	0.023	0.06	<0.02	*	*	<0.02	*	<0.02	<0.02	<0.0135	<4.9275
Boron mg/L	*	*	*	*	*	<0.02	<0.02	*	*	0.045	*	<0.02	0.0188	0.01269	4.63185
Cadmium mg/L	*	*	<0.02	<0.02	<0.02	<0.02	<0.02	*	*	<0.02	*	<0.02	<0.02	<0.0135	<4.9275
Mercury µg/L	*	*	*	*	*	*	*	*	*	*	*	<0.2	<0.0002	<0.000135	<0.049275
Selenium µg/L	*	*	*	*	*	*	*	*	*	*	*	2.3	0.0023	0.0015525	0.5666625
Barium mg/L	*	*	<0.02	<0.02	<0.02	<0.02	<0.02	*	*	0.022	*	0.022	0.012	0.0081	2.9565

Max.Flow

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Attachment E4 Ladysbridge Upstream Table E4

Sample Date	09/10/2008	27/11/2008				
Sample	River	River	Average			
Sample Code	GS1017	GS1285				
Flow M^3/Day	*	*				
pH	*	7.7	7.7			
Temperature ℃	*	*	*			
Cond 20℃	*	318	318			
SS mg/L	*	<2.5	<2.5			
NH_3 mg/L	*	<0.1	<0.1			
BOD mg/L	*	1.1	1.1			
COD mg/L	*	<21	<21			
TN mg/L	*	9	9			
Nitrite mg/L	*	0.0241	0.0241			
Nitrate mg/L	*	6.77	6.77			
TP mg/L	*	<0.20	<0.20			
O-PO4-P mg/L	<0.05	<0.05	<0.05			
SO4 mg/L	*	<30	<30			
Phenols µg/L	*	<0.10	<0.10			
Atrazine µg/L	*	<0.01	<0.01			
Dichloromethane	*	<1	<1			
Simazine µg/L	*	<0.01	<0.01			
Toluene µg/L	*	<1	<1			
Tributyltin µg/L	*	*	*			
Xylenes µg/L	*	<1	<1			
Arsenic µg/L	*	<0.96	<0.96			
Chromium mg/L	*	<0.02	<0.02			
Copper mg/L	*	<0.02	<0.02			
Cyanide µg/L	*	<5	<5			
Fluoride µg/L	*	41	41			
Lead mg/L	*	0.025	0.025			
Nickel mg/L	*	<0.02	<0.02			
Zinc mg/L	*	<0.02	<0.02			
Boron mg/L	*	<0.02	<0.02			
Cadmium mg/L	*	<0.02	<0.02			
Mercury µg/L	*	<0.2	<0.2			
Selenium µg/L	*	1.6	1.6			
Barium mg/L	*	0.029	0.029			

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Attachment E4 Ladysbridge Downstream Table E4

Sample Date	09/10/2008	27/11/2008				
Sample	River	River	Average			
Sample Code	GS1018	GS1286				
Flow M^3/Day	*	*				
pH	*	7.7	7.7			
Temperature ℃	*	*	*			
Cond 20℃	*	403	403			
SS mg/L	*	<2.5	<2.5			
NH_3 mg/L	*	<0.1	<0.1			
BOD mg/L	*	1.2	1.2			
COD mg/L	*	<21	<21			
TN mg/L	*	15	15			
Nitrite mg/L	*	0.0238	0.0238			
Nitrate mg/L	*	7	7			
TP mg/L	*	<0.20	<0.20			
O-PO4-P mg/L	<0.05	<0.05	<0.05			
SO4 mg/L	*	<30	<30			
Phenols µg/L	*	<0.10	<0.10			
Atrazine µg/L	*	<0.01	<0.01			
Dichloromethane	*	<1	<1			
Simazine µg/L	*	<0.01	<0.01			
Toluene µg/L	*	<1	<1			
Tributyltin µg/L	*	*	*			
Xylenes µg/L	*	<1	<1			
Arsenic µg/L	*	<0.96	<0.96			
Chromium mg/L	*	<0.02	<0.02			
Copper mg/L	*	<0.02	<0.02			
Cyanide µg/L	*	<5	<5			
Fluoride µg/L	*	37	37			
Lead mg/L	*	0.02	0.02			
Nickel mg/L	*	<0.02	<0.02			
Zinc mg/L	*	<0.02	<0.02			
Boron mg/L	*	<0.02	<0.02			
Cadmium mg/L	*	<0.02	<0.02			
Mercury µg/L	*	<0.2	<0.2			
Selenium µg/L	*	1.5	1.5			

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Barium mg/L	*	0.027	0.027			

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Parameter	Temperatu	Dissolved O	Nitrite	Molybdate	Ammonium	Appearanc	Dissolved O
		O2	NO2	P	NH4		
Max.	--	15	0.05	Varies	Varies	--	150
Target	--	--	--	--	--	--	--
Min.	--	5	--	--	--	--	50

Project	Project Refe	Location	Location Referer	Location E	Location N	Sample Template	Sample Refe	Sample Da	Sample Tir	Comments	Degrees C	mg/l	mg/l	mg/l	mg/l	Descriptive	% O2
Womanagh		Br Castlemartyr	19W011000	196422	73207	Phosphate Regs	2008/1125	04-Jun-08	12:00				***0.22***	***0.117***	0.252		
Womanagh		Br Castlemartyr	19W011000	196422	73207	Phosphate Regs	2008/1340	02-Jul-08	12:30		22.3	12.5	***0.086***	***0.088***	0.098	clear	121
Womanagh		Br Castlemartyr	19W011000	196422	73207	Phosphate Regs	2008/2095	03-Sep-08	12:15		12.2	11.8	***0.062***	***0.056***	0.17		111
Womanagh		Br Castlemartyr	19W011000	196422	73207	Phosphate Regs	2008/2501	01-Oct-08	10:55		11.5	10.2	0.035	***0.033***	0.07	clear	95
Womanagh		Br Castlemartyr	19W011000	196422	73207	WFD Operational	2008/2962	05-Nov-08	11:45		94	10.1	0.024	0.026	0.03		95
Womanagh		Br Castlemartyr	19W011000	196422	73207	Phosphate Regs	2008/3368	10-Dec-08	11:50		5.8	12.8	0.043	***0.046***	0.037		100
										Sample Coun	5	5	6	6	6	-	5
										Maximum	94	12.8	0.22	0.117	0.252	-	121
										Minimum	5.8	10.1	0.024	0.026	0.03	-	95
										Mean	29.2	11.5	0.078	0.061	0.11	-	104
										Median	12.2	11.8	0.052	0.051	0.084	-	100
										Std. Deviatior	36.7	1.27	0.073	0.035	0.086	-	11.4
Womanagh		Br. in Ladysbridge				WFD Operational	2008/2961	05-Nov-08	11:25		9.1	10.1	***0.082***	***0.063***	0.248	good	88
Womanagh		Br. in Ladysbridge				Phosphate Regs	2008/3367	10-Dec-08	12:00		5.8	11.4	***0.08***	***0.04***	0.149		90
										Sample Coun	2	2	2	2	2	-	2
										Maximum	9.1	11.4	0.082	0.063	0.248	-	90
										Minimum	5.8	10.1	0.08	0.04	0.149	-	88
										Mean	7.45	10.8	0.081	0.052	0.198	-	89
										Median	7.45	10.8	0.081	0.052	0.198	-	89
										Std. Deviatior	2.33	0.922	0.001	0.016	0.07	-	1.41

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SITE SYNOPSIS

SITE NAME: BALLYMACODA (CLONPRIEST AND PILLMORE)

SITE CODE: 000077

This coastal site stretches north-east from Ballymacoda to within about 6 km of Youghal, Co. Cork. Though moderate in size, it has a good diversity of coastal habitats, including several listed on Annex I of the E.U. Habitats Directive.

The site comprises the estuary of the Womanagh River, a substantial river which drains a large agricultural catchment. Part of the tidal section of the river is included in the site and on the seaward side the boundary extends to the low tide mark. The inner part of the estuary is well sheltered by a stabilised sandy peninsula (Ring peninsula). Sediment types vary from muds to muddy sands in the inner part to fine rippled sands in the outer exposed part. The macro-invertebrate fauna of the intertidal flats is well-developed, with the following species occurring: *Corophium volutator*, *Hediste diversicolor*, *Arenicola marina*, *Macoma balthica*, *Scrobicularia plana*, *Cerastoderma edule* and *Lanice conchilega*. In the more sheltered areas the intertidal flats are colonised by mats of green algae (mostly *Enteromorpha* spp.), with brown seaweeds occurring on the rocky shores of the shingle spits. Common Cord-grass (*Spartina anglica*) has spread within the estuary since the late 1970s.

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The main channel is flanked by salt marshes and wet fields, much of the latter being improved for agriculture. The salt marshes are mainly classified as Atlantic salt meadows, with such species as Sea Purslane (*Halimione portulacoides*), Sea Lavander (*Limonium humile*) and Sea Milkwort (*Glaux maritima*). On the lower levels of the marshes, and extending out onto the open sand and mud flats, occur annual salt marsh species such as Glasswort (*Salicornia* spp.) and Sea Blite (*Suaeda maritima*). The salt marshes at the site are of particular note as they are of the scarce 'lagoon' type. They are also of good quality and parts of them are in active growth.

Part of the site is also a Special Protection Area for birds; the main interest of the area lies in its waterfowl, with flocks of up to 20,000 regularly present during winter (e.g. 1995-96 peak = 19,725). A total of 107 wetland species have been recorded from this site. Maximum figures for the four winters 1994/95-97/98 show that Golden Plover, a species listed under Annex I of the Birds Directive, almost reached internationally important numbers (9,100) and that the Bar-tailed Godwit, another Annex I species, was present in nationally important numbers (494). Eleven other species also occurred in nationally important numbers: Teal (688), Ringed Plover (163), Grey Plover (504), Lapwing (3800), Sanderling (108), Dunlin (3,373), Curlew (1,378), Knot (280), Redshank (300), Black-tailed Godwit (422) and Turnstone (144). Several additional species occur in regionally or locally important numbers.

Much of the land adjacent to the estuary has been reclaimed and is subject to intensive agriculture, with cattle grazing and silage being the most common land uses. However, many of these fields remain marshy and are important feeding and roosting

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areas for wildfowl, Golden Plover and Lapwing. The most serious threat to the site is water pollution, primarily from slurry spreading.

This site's conservation value derives largely from the presence of a number of important coastal habitats listed in Annex I of the E.U. Habitats Directive. But, there is also considerable ornithological interest; Ballymacoda is one of the most important bird sites in the country and supports a higher number of waders than any other Cork estuary of its size. It also contains important numbers of the Golden Plover and Bar-tailed Godwit, two Annex I Bird Directive species, and nationally important numbers of eleven further bird species.

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8.10.2001

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Dixon Brosnan
environmental consultants

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DixonBrosnan Environmental Consultants
Dun Eoin, Ballinrea Road, Carrigaline, Co. Cork, Ireland.
Tel: +353 (0)21 4377947 Fax: +353 (0)21 4377947
Carl Dixon: 086 8511437 carl@dixonbrosnan.com
Damian Brosnan: 086 8131195 damian@dixonbrosnan.com
www.dixonbrosnan.com

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1. INTRODUCTION

1.1 DixonBrosnan Environmental Consultants were commissioned by Cork County Council to carry out an environmental assessment of the River Womanagh catchment in East Cork. Cork County Council proposes to provide appropriate treatment to existing wastewater discharges in the catchment, and to make provision for additional discharges arising at five settlements: Mogeely, Castlemartyr, Ladysbridge, Killeagh and Ballymacoda.

1.2 The tender brief issued by Cork County Council specifies that the assimilative properties of the various receiving waters in the catchment, and their capacity to receive treated effluent from the various settlements, are assessed. The identification of other point discharges and assessment of their impacts is also specified.

1.3 This report does not purport to be an Environmental Impact Statement as described in the European Communities (Environmental Impact Assessment) Regulations, 1989 (SI No. 349 of 1989). However the Environmental Protection Agency documents *Guidelines on the information to be contained in Environmental Impact Statements* (2002) and *Advice notes on current practice in the preparation of Environmental Impact Statements* (2003) were consulted during the preparation of this report.

1.4 The report is presented in three parts as follows:

Part 1: Existing environment
Part 2: Legislation & standards
Part 3: Discharges & recommendations.

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2. CATCHMENT OVERVIEW

2.1 Hydrology

2.1.1 The Womanagh catchment is the largest in East Cork, draining an area of approximately 165 km^2 between Midleton and Youghal. The catchment is bounded to the west by the Dungourney catchment, and to the east by the Tourig catchment. The terrain to the north of the catchment drains northwards to the River Bride, a tributary of the River Blackwater. The southern boundary of the catchment is separated from the coast by a ridgeline which is drained by many small rivers and streams discharging directly to the coast. The Womanagh catchment is indicated in figure 1.

2.1.2 The Womanagh River itself flows in an eastwards direction across the southern end of the catchment. The main channel rises in the southwestern corner of the catchment, in the townland of Innygraga, and flows east through Ladysbridge and onwards to Pillmore strand where it discharges to Youghal Bay. The Womanagh River is joined by several streams and rivers, three of which are significant. All three drain from the north.

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2.1.3 The Kiltha River drains the northwest area of the Womanagh catchment. The river flows through a narrow valley separated from the adjacent Dungourney valley by less than 1 km in parts, and thus the Kiltha is located along the western margin of the catchment. Due to the narrow valley through which the Kiltha flows, the area drained is relatively small at 31 km^2 despite flowing for a distance of 17 km. The river drains the settlements of Mogeely and Castlemartyr before meeting the Womanagh main channel immediately upstream of Ladysbridge.

2.1.4 The largest tributary in the catchment is the Dissour River which drains the eastern parts of the catchment and much of the northern areas. The Dissour also flows through a narrow valley; it differs from the Kiltha however by the increased area drained in its upper reaches and by its confluence with several minor tributaries. Thus the total area drained is a significantly larger 42 km^2 in spite of a relatively short main channel length of 13 km. The only settlement on the Dissour River is Killeagh, 3 km upstream of its confluence with the Womanagh River. Reference is made in this report to the Lagile River, a small tributary of the Dissour.

2.1.5 The Dower River rises to the surface at Dower, 1 km upstream of its confluence with the Womanagh. The substantial flow in the river suggests that it drains a significant subcatchment, most likely located to the north between the Kiltha and Dissour subcatchments. Thus it is likely that the Dower River is continuous with an unnamed river which rises at Bawnadoune and flows southwards to Ballindinis where it disappears beneath the surface. For the purpose of this report it is assumed that the unnamed river becomes the Dower River, and the Dower title is applied to both sections.

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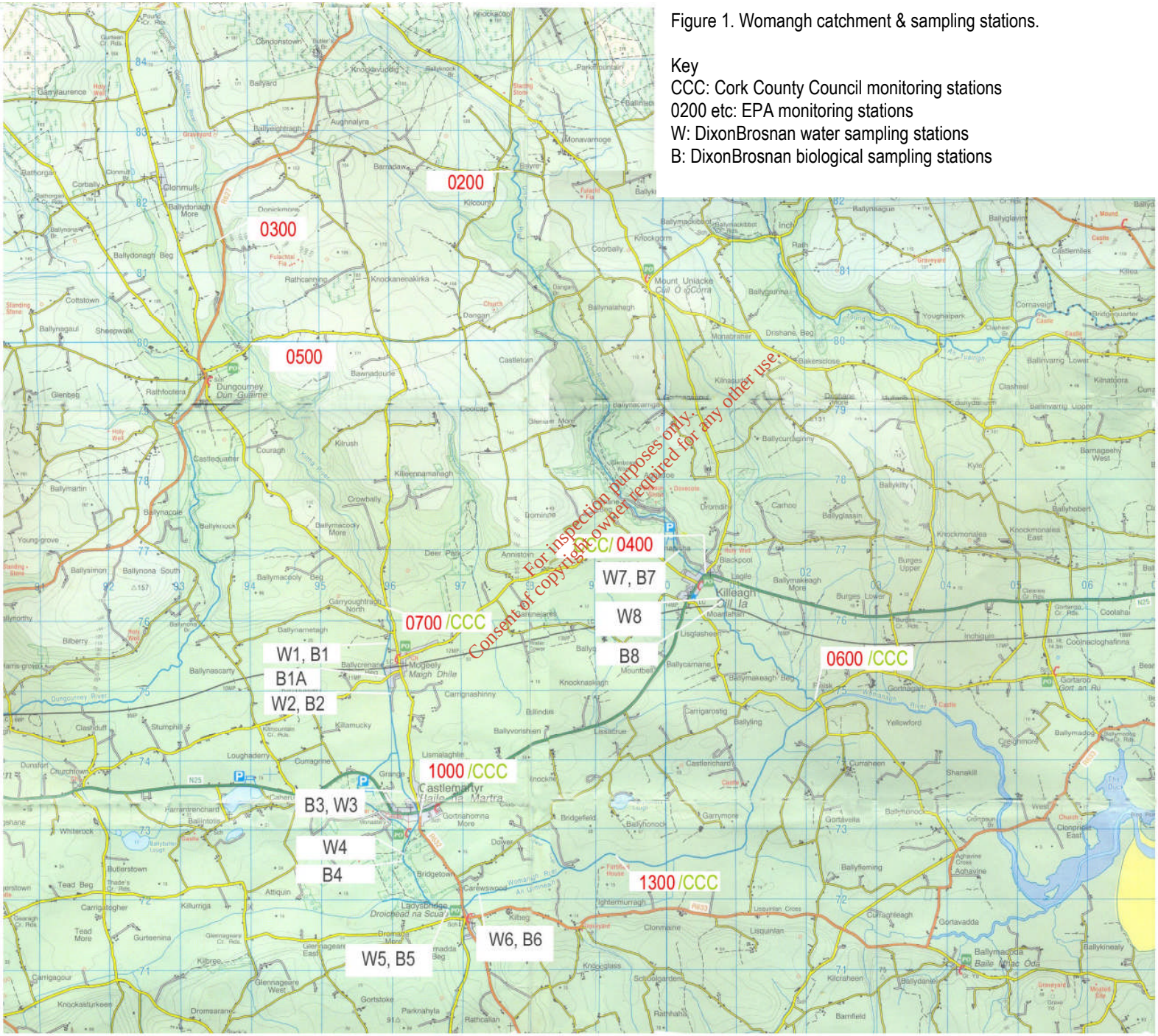

Figure 1. Womangh catchment & sampling stations.

Key
CCC: Cork County Council monitoring stations
0200 etc: EPA monitoring stations
W: DixonBrosnan water sampling stations
B: DixonBrosnan biological sampling stations

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2.1.6 There are no lakes within the Womanagh catchment. The largest standing body of water is Ballyhonock Lough, 3 km east of Castlemartyr and measuring approximately 7 ha in area. Ballyhonock Lough is not directly linked to the 1 km distant Womanagh River by any surface watercourses of significance. The well known Lough Aderra adjacent to the N25 between Midleton and Castlemartyr lies immediately outside of the Womanagh catchment.

2.1.7 The main channel of the Womanagh meets Youghal Bay at the southeast corner of the catchment. The river becomes tidal at Finisk Bridge, immediately downstream of the Womanagh-Dissour confluence and 8 km upstream of the bay. Like many rivers, the lower stretches of the Womanagh are meandering and characterised by a soft substrate due to silt deposition. The river becomes estuarine near the shoreline; a traditional estuary has not formed however due to the presence of a strand along the final kilometre. The strand, stretching north to Youghal, is an important recreational area. The tidal stretches of the Womanagh are joined by several streams draining a combined area of approximately 32 km^2. One of these flows through Ballymacoda village.

2.1.8 The hydrology of the Womanagh catchment is summarised in table 2.1.

Table 2.1 Womanagh catchment hydrology.

Subcatchment	Main channel length km	Area km^2
Kiltha River	17	31
Dissour River	13	42
Dower River	8	12
Womanagh River	22	80
	Total	165

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2.2 Geology

2.2.1 The majority of the Womanagh Estuary lies within the Little Island formation which extends from Crookstown in the west to Youghal at the east end of the Cork syncline. The limestone of the Cork syncline to the north of Ballymacoda is considered a major aquifer and permeability is generally high. Karst features are typical of such formations and are reflected in large springs such as the Dower water supply near Castlemartyr.

2.2.2 The upper sections of the Dissour and Kiltha catchments are located within the Ballytrasna formation which consists of mudstone with some sandstone. Thus the karst features which are prominent in the lower catchment are absent from the upper sections of both rivers.

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2.3 Landform & use

2.3.1 The upper reaches of the Womanagh tributaries in the northern half of the catchment are characterised by narrow valleys and low hills. The highest elevations in the catchment are seen here with several locations above 200 m OD. These hills generally form the watershed at the northern edges of the catchment. The topography falls gradually southwards and there are no points above 100 m OD south of Killeagh, the most central settlement in the catchment.

2.3.2 The lower half of the catchment consists of the relatively flat Womanagh plain. The topography follows the typical east-west pattern seen across much of County Cork, with the northern and southern boundaries of the plain delineated by low hills. While the northern boundary gradually rises to form the uplands noted in 2.3.1, the southern boundary is more clearly defined by a low ridgeline along the entire southern boundary and rising to 100 m OD. In the southern half of the catchment the eastern and western margins are less apparent. This is particularly the case to the southeast where the lowlands extend eastwards towards marsh areas at Ballyvergan.

2.3.3 Land use within the catchment closely reflects the topography. Upland areas in the north of the catchment are characterised by poorer quality land, and tracts of coniferous forestry have been planted in parts. Such commercial plantations are quite apparent in the northern extremities where the rising terrain is not readily farmed. Difficulties with poor quality soils are compounded by steep hillsides, particularly in the narrow valleys of the Kiltha and Dissour Rivers and their tributary streams. In such areas stands of deciduous tress predominate, and in this regard the upper catchment is similar to the adjacent Dungourney catchment.

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2.3.4 The flat Womanagh plain has been farmed for centuries and historically a number of large estates were developed in the more fertile areas. The plain is now intensively farmed with pasture and tillage predominating. Associated with such practices is the application of artificial fertiliser, the installation of subsurface drainage networks, and the creation of larger fields by the removal of hedgerows. There are few fallow or unworkable zones in the southern half of the catchment, and consequently there is limited planting of coniferous forestry. However, the land assumes marsh characteristics near the southeast corner where the catchment drains to Youghal Bay. In the long term, any increases in sea level attributable to the global warming phenomenon will result in increased risk of flooding here unless suitable prevention measures are taken.

2.4 Settlements

2.4.1 Despite the relatively large surface area of the catchment and its proximity to the two largest towns in East Cork (Midleton and Youghal), there are few settlements located in the Womanagh catchment. This is particularly the case in the northern half of the catchment where the undulating topography and narrow valleys has limited development. The only agglomeration found in these uplands is the small village of Mount Uniacke.

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2.4.2 The lowlands of the lower catchment have permitted greater development of villages, and all five settlements of significance within the catchment are located here. The largest of these are Castlemartyr and Killeagh, both of which are situated on the N25 national route. While neither village is deemed large enough to warrant specific mention in the main body of Cork County Council's Development Plan 2003, both villages are currently undergoing expansion and are likely to see continued development in the future. The populations of Castlemartyr and Killeagh are currently estimated at 1500 and 850 pe respectively.

2.4.3 The village of Ladysbridge lies 1.5 km south of Castlemartyr on regional route R632. This village is also undergoing some expansion due to its proximity to Cork City, and a number of residential developments have been constructed. The population here is estimated at 500 pe The similarly sized village of Ballymacoda is located 8 km east of Ladysbridge. While Ballymacoda is not a commuter village in the conventional sense, the village is seeing some expansion at present due to its attractive coastal location.

2.4.4 Two kilometres north of Castlemartyr is the small village of Mogeely with an estimated population of 100 pe One of the largest industrial discharges in the catchment is located here, and thus the village is of greater significance in the catchment than its size might suggest. The village's proximity to Cork City and Midleton may also encourage local residential development in the future.

2.4.5 Of the five settlements noted, only Ladysbridge is located directly on the main channel of the Womanagh River. Mogeely and Castlemartyr are located on the Kiltha River, while Killeagh straddles the Dissour River. The villages of Mogeely, Castlemartyr and Ladysbridge form an extended development corridor 4 km in length, separated into three agglomerations by agricultural land.

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2.4.6 Ballymacoda village is located on a small unnamed stream which, 400 m downstream of the village, discharges to a tributary of the Womanagh River. The tributary, hereafter referred to as the Ballymacoda River, drains an area of 7.5 km^2 at the southeast corner of the Womanagh catchment. The Ballymacoda River meets the Womanagh in the tidal zone 2 km upstream of Pillmore strand.

3. ABSTRACTIONS & DISCHARGES

3.1 Abstractions

3.1.1 The underlying geology of much of the Womanagh catchment is such that good quality groundwater is readily available. Consequently public water provided by the local authority to Mogeely, Castelmartyr, Killeagh, Ladysbridge and Ballymacoda is supplied from groundwater sources. Excluding the Dower abstraction (see 3.1.4) there are no direct public supply abstractions from surface waters in the catchment. As wastewater discharges

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from the settlements are directed to surface waters, the settlements may be considered net contributors to the surface water catchment.

3.1.2 Water provided at Killeagh and Ballymacoda is abstracted from local borewells. The volume of water taken is estimated at 160 m^3/day and 110 m^3/day respectively. Potable water supplied to Mogeely, Castlemartyr and Ladysbridge is abstracted from an infiltration gallery located adjacent to the Kiltha River at Mogeely. Discussions with Cork County Council technical staff indicate that the gallery is most likely fed by springs rather than river water. This supply, with an estimated demand of 600 m^3/day, is supplemented by several scattered borewells near Castlemartyr and Ladysbridge.

3.1.3 Dairygold operate a milk processing facility at Mogeely. While much of the potable water used onsite is taken from the public supply, supplementary water is also taken from an onsite well.

3.1.4 Potable water supplied to the villages of Whitegate, Aghada, Ballincurrig, Ballycotton and their environs, outside of the Womanagh catchment, is drawn from the Dower River where it rises to the surface at Dower. With a daily demand of 5200 m^3, this supply represents the only significant surface water abstraction in the catchment. It is likely that the abstraction point on the Dower River also draws from springs feeding the river north of its re-emergence at Dower.

3.1.5 During the preparation of this report an inspection of the catchment was undertaken with a view to identifying additional surface water abstractions. Abstractions within the catchment are generally taken from groundwater. A possible surface water abstraction was noted in the Dissour River upstream of the main bridge in Killeagh. The volume of water abstracted at this point is not known but is unlikely to be significant.

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3.2 Discharges

3.2.1 Cork County Council operates a sewage treatment scheme in the village of Mogeely. The scheme directs wastewater to a wastewater treatment plant (WWTP) which provides secondary treatment. The treated effluent is discharged to the Kiltha River on the western side of the village. The estimated load currently treated by the plant is 100 pe although the capacity of the plant is understood to be 200 pe A number of properties in the village discharge to individual septic tanks.

3.2.2 Wastewater arising at Castlemartyr is directed to a modern activated sludge WWTP. The plant also treats effluent arising from a local college and manufacturing facility. The plant provides secondary treatment, without nutrient removal, prior to discharge to the Kiltha River 300 m downstream of the village. While the design capacity of the plant is 2000 pe, the current load discharging to same is 1500 pe The plant is operated by Response Engineering Ltd. on behalf of Cork County Council. A review of monitoring data for the period January-October 2005 (table 3.1) indicates fluctuations in the treatment performance, with a general increase in concentrations of BOD and suspended solids in the treated effluent being apparent during the course of the year. Concentrations

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exceeded recommended levels on more than one occasion. Elevated concentrations of total phosphorus were noted during July, August and September 2005.

Table 3.1 Monitoring data Castlemartyr WWTP 2005.

	January	February	March	April	May	June	July	August	September	October
pH In	7.43	7.61	7.33	7.23	7.23	7.66	7.01	7.16	7.01	6.80
pH Out	7.08	7.15	7.05	7.11	7.08	6.99	6.62	6.89	6.86	6.89
COD In mg/l	592.40	843.00	905.00	718.00	694.00	594.00	651.50	686.00	921.00	916.20
COD Out mg/l	18.20	33.50	44.50	46.75	59.25	56.00	50.00	38.60	50.50	49.00
BOD In mg/l	291.40	402.00	432.75	352.75	330.00	282.20	310.25	325.00	434.50	435.40
BOD Out mg/l	8.40	16.25	19.75	19.50	25.50	20.20	20.00	17.00	21.50	22.40
SS In mg/l	68.80	328.00	422.50	721.50	328.40	137.40	145.00	176.54	1541.00	516.00
SS Out mg/l	6.20	28.50	21.50	20.00	37.20	27.60	14.25	18.12	43.00	28.50
TP In mg/l	11.40						11.70	14.10	11.10	17.00
TP Out mg/l	2.05						4.07	10.30	8.60	2.70

Source: Response Engineering Ltd.

3.2.3 A septic tank currently provides primary treatment of wastewater arising in the village of Ladysbridge. The tank effluent is discharged to the Womanagh River immediately north of the village at the R632 road bridge. The septic tank is currently overloaded with the population load estimated at 500 pe An assessment of this discharge undertaken in 2001 by DixonBrosnan indicated a slight deterioration in river water quality downstream of the discharge.

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3.2.4 Response Engineering Ltd. also operate a WWTP at Killeagh on behalf of Cork County Council. The plant provides secondary treatment, without nutrient removal, for an estimated population load of 850 pe The plant is nearing its design capacity of 1000 pe The treated effluent is discharged to the Dissour River at Moanlahan, several hundred metres downstream of the village. Monitoring data presented in table 3.2 for the period January-October 2005 indicate that this plant is operating satisfactorily, although total phosphorus concentrations in the discharge were elevated in July and August 2005.

3.2.5 At Ballymacoda wastewater arising from an estimated population load of 500 pe is directed to a septic tank located to the north of the village. The tank provides primary settlement prior to discharge to groundwater via a percolation area. A 2002 assessment of this discharge by DixonBrosnan indicated however that the local conditions are not ideally suited to percolation, and some evidence of pollution of an adjacent stream was noted. This stream meets the Ballymacoda River 400 m northeast of the village.

3.2.6 Cork County Council's existing WWTPs are indicated in figure 2. Apart from these, there are no other municipal wastewater discharges in the catchment. The minor agglomeration of Mount Uniacke is served by individual septic tanks.

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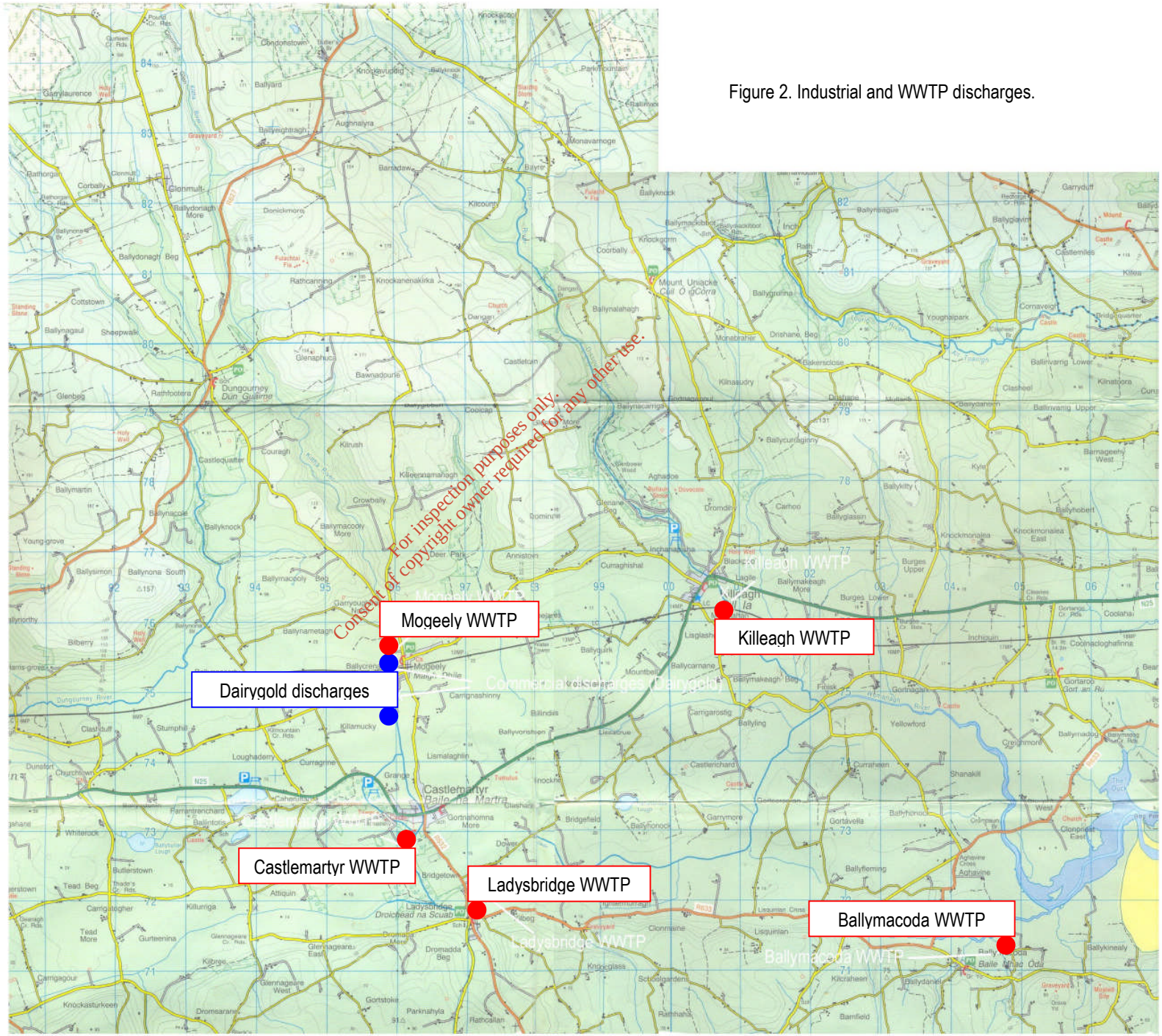

Figure 2. Industrial and WWTP discharges.

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Table 3.2 Monitoring data Killeagh WWTP 2005.

	January	February	March	April	May	June	July	August	September	October
pH In	7.14	7.37	6.97	7.25	7.26	7.30	7.14	7.01	7.28	7.14
pH Out	7.34	7.57	7.30	7.37	7.48	7.15	6.97	7.12	7.31	7.17
COD In mg/l	385.40	405.00	572.50	319.75	291.50	329.80	153.25	375.20	262.25	335.60
COD Out mg/l	11.40	32	32.5	28.25	39.75	49.00	43.25	44.80	32.50	31.40
BOD In mg/l	167.20	193.00	272.75	151.75	138.50	155.52	72.86	178.60	124.25	160.00
BOD Out mg/l	5.60	15	15.75	12	17.75	20.80	20.50	17.40	13.83	14.80
SS In mg/l	67.40	176	268.75	140.5	123.42	39.92	15.80	52.62	20.75	32.33
SS Out mg/l	4.48	19	12.15	14.75	19.55	15.84	11.75	12.88	7.81	2.86
TP In mg/l	2.55						4.8	29.00	3.50	3.40
TP Out mg/l	0.20						3.40	6.20	1.96	1.40

Source: Response Engineering Ltd.

3.2.7 The capacity of a watercourse to assimilate a treated wastewater discharge at a location is a function of dilution which is dependent on the catchment area draining through that particular location. Accordingly the areas of each subcatchment upstream of the WWTP discharges at Mogeely, Castlemartyr, Ladysbridge, Killeagh and Ballymacoda are of some relevance. The area of each subcatchment is presented in table 4.1.

3.2.8 Cork County Council's Environment Department lists three regulated commercial wastewater discharges in the Womanagh catchment. The smallest of these relates to a service station and restaurant at Burges, 3 km east of Killeagh. Wastewater discharge licence WP(W)2/87 permits the discharge of surface waters and kitchen wastewater to a small stream which ultimately meets the main channel of the Womanagh River. This premises is currently closed. An intensive piggery installation at Annistown, 2.5 km west of Killeagh is regulated by the EPA and is currently undergoing changes in its license as a result of the transition from IPC to IPPC licensing.

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3.2.9 The most significant commercial discharge arises from a creamery at Mogeely (discharge licence WP(W) 4/03r). The facility, generally operative between March and September, discharges to the Kiltha River via a modern WWTP which incorporates a sand filtration system and nutrient removal. Licence WP(W) 4/03r specifies the following limits with respect to the discharge: volume 566 m^3/day, COD 30 mg/l, total phosphorus 1.2 mg/l P, detergents 5 mg/l and mineral oils 5 mg/l. Previously this facility operated under licence WP(W) 4/90 with discharge limits of: volume 500 m^3/day, BOD 15 mg/l, suspended solids 15 mg/l, orthophosphate 1 mg/l P and total phosphorus 3 mg/l P. Data provided by Cork County Council suggests that the discharge volume may be 650 m^3/day. For the purposes of this report, it is assumed that the current phosphorus limit of 1.2 mg/l P is being met, despite a measured average total phosphorus concentration of 1.64 mg/l P over two samples taken in 2005 and 2006. It is also conservatively assumed that 50% of the phosphorus discharged to the receiving waters is available as orthophosphate ie. 0.6 mg/l P.

3.2.10 Orthophosphate is generally considered to be the nutrient of greatest concern in freshwater systems. The orthophosphate load discharged to the Kiltha River from the Mogeely creamery facility is calculated at 0.39 kg/day

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P, totalling approximately 83 kg P over the March-September operations period. This loading has been determined on the assumptions outlined in 3.2.9 (650 m^3/day containing 0.6 mg/l P).

3.2.11 During the preparation of this report, the Womanagh catchment was inspected for surface water discharges other than those noted above. Information on discharges observed is presented in appendix 1. Appendix 1 also lists all licensed discharges. A number of housing developments are under construction or are proposed at several villages in the catchment. It is expected that future developments will discharge to their respective local public sewers and will therefore be treated by the local authority WWTPs.

4. FLOW DATA

4.1 The total surface area of the Womanagh catchment is 165 km^2. Surface areas drained by the four chief watercourses in the catchment have been presented in table 2.1. Subcatchment areas upstream of each of the five settlements under consideration in this report are presented in 4.1. The area discharging through Ballymacoda is considered insufficient and a new discharge location is required here.

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Table 4.1 Subcatchment areas upstream of WWTPs.

LOCATION	SUBCATCHMENT AREA km^2
Mogeely WWTP	23
Castlemartyr WWTP	30
Ladysbridge WWTP	45
Killeagh WWTP	31
Ballymacoda WWTP	1.3

4.2 The Environmental Protection Agency document *Hydrological data: A listing of water level recorders and summary statistics at selected gauging stations* (1997) notes the existence of five hydrometric stations on the Womanagh catchment. The flows recorded at these stations are presented in table 4.2. The 95th percentile flow per area recorded at Mogeely is higher than at Castlemartyr, despite the latter's downstream location. The EPA notes that this anomaly is due to the presence of an ornamental pond at Castlemartyr which provides additional storage and impacts slightly on flow readings.

4.3 The EPA Hydrometric Office notes that the correlation between flows and levels are unreliable and that the 95th percentile flows quoted in table 4.2 are based on discrete measured readings rather than continuously logged level data. The only automatic recorder in the catchment, located at Castlemartyr, was removed a decade ago. Consequently the data presented in table 4.2 may not be entirely accurate. Nonetheless, it is necessary to rely on

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these data in the absence of other figures. It is noted that the 95th percentile flow data presented are not dissimilar to those reported for other rivers in County Cork. For the purposes of this report the 95th percentile flow data as determined from flow monitoring stations will be applied. The unit flow data for Mogeely and Castlemartyr are detailed in table 4.3.

Table 4.2 Flow data at Womanagh hydrometric stations.

Station	River	NGR	Catchment area km^2	DWF* m^3/s	95% flow m^3/s	Unit 95% flow m^3/s/km^2
Mogeely	Kiltha	W960757	21	0.008	0.030	0.00143
Castlemartyr	Kiltha	W962728	27	0.0085	0.033	0.00121
Killeagh	Dissour	X008759	33	0.020	0.040	0.00122
Lagile	Dissour tributary	X013764	8	0.003	0.015	0.00192

Source: EPA Hydrometric Office

*DWF: dry weather flow

Table 4.3 Flows at Mogeely and Castlemartyr.

Location	River	Catchment area upstream of WWTP km^2	Unit 95% flow m^3/s/km^2	95% flow m^3/s
Mogeely	Kiltha	23	0.00143	0.0329
Castlemartyr	Kiltha	30	0.00121	0.0363

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4.4 Two flow monitoring stations are located in proximity to Killeagh: on the Dissour River and on its tributary the Lagile River. Due to variations in the flow data recorded (table 4.4), the mean of their unit 95th percentile flows is considered more representative of the actual flow at Killeagh.

Table 4.4 Flow at Killeagh.

Location	River	Catchment area upstream of WWTP km^2	Unit 95% flow m^3/s/km^2	95% flow m^3/s
Killeagh	Dissour	-	0.00122	-
Killeagh	Lagile	-	0.00192	-
Combined	Dissour	31	0.00157	0.0487

4.5 There is no monitoring station at Ladysbridge and thus flows must be estimated here. During the preparation of this report, an assessment of flows was made by reference to similar catchments and by recording river flows using a flow logger. Following the assessment (summarised in appendix 2) it was decided to apply long term EPA data notwithstanding the possible high error margin contained therein. With respect to Ladysbridge, the unit 95th percentile flow derived from the flow monitoring station at Castlemartyr is applied (table 4.5).

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Table 4.5 Flow at Ladysbridge.

Location	River	Catchment area upstream of WWTP km^2	Unit 95% flow $m^3/s/km^2$	95% flow m^3/s
Ladysbridge	Womanagh	45	0.00121	0.0545

4.6 The source of the Dower River is a natural spring which is one of the largest in Ireland. The spring rises to the surface approximately 2 km southeast of Castlemartyr where it emerges from a limestone cave. Water abstracted is supplied to domestic consumers in Ballinacurra, Ballycotton, Churchtown, Garryvoe, Shanagarry, Gyleen, Trabolgan, Saleen, Upper Aghada, and Whitegate. Whitegate oil refinery is also supplied. Normal abstraction averages 4550 m^3/day. A report entitled *Dower springs: Groundwater source protection zones* by Wright and Gately (2002) estimates the areal extent of the Dower catchment at 19.5 km^2 and notes that its western boundary lies within 200 m of the Kiltha River. The northern boundary of the catchment is defined by the topography of Knockanenakirka hill. Two swallow holes are located at Ballyvorisheen and Carrignashinny. The same report also notes that a weir and automatic recorder located downstream of the spring are affected by weed growth. The report concludes that, while the abstraction exceeds the natural flow in very dry weather, the spring behaves like a large well creating a wide shallow cone of depression. It is thus possible that the presence of the Dower spring causes reduced flows at Castlemartyr and in the main channel of the Womanagh. This effect is difficult to measure.

4.7 All watercourses in the vicinity of Ballymacoda are subject to tidal influence and sluice control. It follows that freshwater flow data are of limited value in calculating assimilative capacity. During a previous assessment at this location (DixonBrosnan report 02001) it was noted that accurate monitoring of the local flow regime was not possible. The 95th percentile flow of the Ballymacoda River was estimated at 650m^3/day. The 95th percentile flow in the Womanagh River, approximately 900 m from the WWTP site, was estimated at 12000 m^3/day.

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5. HABITAT DESIGNATIONS & FISHERIES

5.1 The Ballymacoda coastline at Clonpriest and Pillmore is classified as a Special Area of Conservation (SAC) under Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora (site code 000077). The SAC is flanked on either side by two Natural Heritage Areas (NHAs), namely Ballyvergan Marsh (site code 000078) and a composite coastal site at Ballycotton, Ballymona and Shanagarry (site code 000076). Site synopses for these locations are presented in appendix 3.

5.2 The Ballymacoda SAC stretches northeast from the Ballymacoda River to within 6 km of Youghal. The SAC includes the Womanagh Estuary and foreshore. It also includes a section of the Ballymacoda River which itself is

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not of particular ecological value. Important habitats include salicornia mud, Atlantic salt meadows and large shallow inlets. The Womanagh Estuary has extensive mudflats, marshy fields and salt marsh. The lower estuary is also designated as a Special Protection Area (SPA) under Council Directive 79/409/EEC on the conservation of wild birds (superseded by Directive 92/43/EEC) due to the large number of birds which feed here. Important species include golden plover and bar-tailed godwit, with nationally important numbers of teal, ringed plover, grey plover, lapwing, dunlin, curlew, redshank, black-tailed godwit and turnstone. It follows that the Womanagh Estuary is of considerable ecological value and its protection and conservation is of primary importance. The site synopsis suggests that the main threat to the area is from water pollution arising primarily from the spreading of agricultural slurry.

5.3 The Natural Habitats Regulations 1997 (SI No. 94 of 1997) transposed the Habitats Directive into Irish law. The Regulations specify a number of legal provisions for SACs including a requirement for the assessment of developments which may have a significant impact on a SAC.

5.4 Both the Womanagh and Dissour Rivers are important fisheries for sea trout (*Salmo trutta*) and brown trout (*S. trutta*). Neither river has a large run of salmon (*S. salar*). Sea bass (*Dicentrachus labrax*) have been caught in the Womanagh Estuary. Large shoals of grey mullet (*Chelon labrosus*) move upstream at high tide, while flatfish such as flounder (*Platichthys flesus*) also occur in the estuary. It has been suggested that smelt (*Osmerus eperlanus*) and/or shad (*Alosa* sp.) may be present in the catchment although no data are available. Both species are found in estuaries or shallow coastal waters and spawn in the lower reaches of rivers. The distribution status of both species in Ireland is uncertain, and both are included in the Irish Red Data Book (Whilde, 1993). During the preparation of this report brook lamprey (*Lampetra planeri*) was detected at two biological sampling sites upstream of Mogeely and upstream of Castlemartyr (sites S1 and S3). This non-migratory species is listed under annex II of the Habitats Directive and included in the Irish Red Data Book. The brook lamprey lives in sandy and gravely rivers, particularly in limestone areas. The Irish Red Data Book notes that most records are concentrated in the north and northwest with one positive record in Cork.

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5.5 The Ballymacoda River is unlikely to have serious potential as a fishery due to the physical barrier to upstream movement presented by the sluice. Some species such as flounder and mullet may move through the sluice gates but will generally be small and of no angling value. Spawning gravels are absent from this part of the Womanagh system, and the presence of large numbers of brown trout is considered very unlikely.

6. WATER QUALITY MANAGEMENT PLANS

6.1 The Local Government (Water Pollution) Act, 1977, provides for one or more local authorities to take co-ordinated action on a river catchment basis by the preparation and implementation of river catchment

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management plans. Cork County Council has not previously adopted any plan with respect to the Womanagh catchment.

6.2 The above management function has now been superseded by EU Directive 2000/60/EC establishing a framework for Community action in the field of water policy. Under this Water Framework Directive, local authorities are obliged to prepare river basin management plans. The Womanagh catchment lies within the southwest river basin district. Cork County Council, the designated authority responsible for this district, have adopted an advisory council which will manage the preparation of the river basin management plan. It is likely that the plan will take several years to prepare and implement. In the meantime there are no plans in force with respect to the Womanagh catchment.

6.3 In the absence of any formal management plans, the Phosphorus Regulations and their implementation reports constitute the chief water quality programme in place. The most recent report was prepared in 2004 and the relevant pages of that report are included in appendix 4. The report notes that sites 1000 (Castlemartyr) and 1300 (south of Ballyhonock Lough) have been identified as sites where there may be difficulties in achieving the standards specified by the Phosphorus Regulations by 2007. It also notes that low Q values at these locations are due to agricultural, industrial and urban wastewater discharges and that these sites are subject to limestone spring effects.

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7. WATER QUALITY DATA: CORK COUNTY COUNCIL

7.1 Monitoring data are available for the period 2002-2005 with respect to monitoring locations at Castlemartyr Bridge, south of Ballyhonock Lake, Killeagh Bridge and the Dissour upstream of its confluence with the Womanagh. Results for the period 2004-2005 are also available with respect to Mogeely. Available results are presented for these sites in tables 7.1-7.5. MRP refers to molybdate reactive phosphorus, chiefly orthophosphate. The Freshwater Fish Directive, Salmonid Regulations and Phosphorus Regulations, to which references are made below, are summarised in part 2 of this report.

7.2 Ammonium levels recorded north of Mogeely were satisfactory over the monitoring period, being generally lower than the maximum allowable concentration of 0.82 mg/l N specified in the Freshwater Fish Directive for total ammonium. The recorded levels were also generally lower than the 1 mg/l (for 95% of samples) specified in the Salmonid Regulations. One exception was noted: a concentration of 0.867 mg/l N was recorded in April 2004. Nitrate concentrations were satisfactory. While neither Directive nor Regulations specify mandatory nitrite limits, levels exceeded the 0.009 mg/l N guide value for cyprinid waters on five occasions.

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Table 7.1 Kiltha River water quality at second bridge north of Mogeely 2004-2005.

Date	DO mg/l	DO %	NH_4 mg/l N	NO_3 mg/l N	NO_2 mg/l N	MRP mg/l	Target P P Regs.
25.03.04	-	-	<0.020	6.18	0.006	0.024	Q4-5 to be maintained. 0.2 mg/l MRP to be achieved by 2007.
29.04.04	11.1	100	0.867	6.81	0.007	0.090	
27.05.04	11.2	105	<0.020	6.65	0.008	0.017	
29.06.04	10.1	97	0.021	5.40	0.018	0.046	
26.08.04	10.3	98	0.047	5.85	0.009	0.031	
20.10.04	11.5	100	0.023	5.96	0.005	0.027	
18.11.04	-	-	<0.020	6.38	0.013	0.024	
21.12.04	-	-	0.097	6.13	0.018	0.045	
26.01.05	-	-	0.035	6.72	0.017	0.030	
23.03.05	-	-	0.059	6.04	0.008	0.036	
27.04.05	11.4	102	<0.020	5.98	0.007	0.018	
23.06.05	10.4	103	<0.020	-	0.017	0.050	
21.07.05	9.8	103	0.021	-	0.008	0.052	
24.08.05	10.0	102	<0.020	5.81	<0.004	0.042	
Mean				6.16			
Median						0.034	

Source: Cork County Council Water Laboratory, Inniscarra

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7.3 The median MRP value was calculated at 0.034 mg/l, compared to a target value of 0.02 mg/l to be achieved by 2007. The mean nitrate value is higher than the 5.65 mg/l guideline nitrate value.

7.4 Table 7.2 below indicates that ammonium concentrations were satisfactory and below the Freshwater Fish Directive limit, apart from one sample taken in December 2004. Nitrate values were elevated at 6.20 mg/l N. The target MRP for this site to be achieved by 2007 is 0.03 mg/l; this value was greatly exceeded at this location where a median value of 0.069 mg/l was recorded.

7.5 While the trend with respect to ammonium continued downstream at Ballyhonock (ie. all samples except one were below the 0.82 mg/l N Freshwater Fish Directive limit), a deterioration in nitrate and nitrite levels is apparent, reflecting a gradual increase in eutrophication as the river flows towards the coast. Dissolved oxygen concentrations were also slightly depleted in late summer months. The median MRP value is higher that the 0.03 mg/l targete specified in the Phosphorus Regulations..

7.6 Water quality parameters were more satisfactory in the Dissour River during the monitoring period. Concentrations of ammonium, nitrate, nitrite and orthophosphate were generally less than recorded in the Kiltha and Womanagh Rivers. However, the median MRP value was elevated above the 0.02 mg/l target.

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7.7 Just as water quality in the Kiltha and Womanagh Rivers deteriorated downstream, a general reduction in quality is also apparent in the Dissour tributary between Killeagh and the Womanagh confluence. The median MRP concentration of 0.038 mg/l exceeded the 0.03 mg/l target. Nonetheless, water quality remained superior to that in the Womanagh main channel.

Table 7.2 Kiltha River water quality at Castlemartyr Bridge 2002-2005.

Date	DO mg/l	DO %	NH_4 mg/l N	NO_3 mg/l N	NO_2 mg/l N	MRP mg/l	Target P P Regs.
30.01.02	-	-	0.078	6.37	0.018	0.041	Upgrade to Q4. 0.3 mg/l MRP to be achieved by 2007.
27.03.02	11.6		0.023	6.39	0.014	0.332	
24.04.02	10.8	-	0.023	5.89	0.020	0.051	
26.06.02	11.2	-	0.023	6.39	0.017	0.064	
28.08.02	9.3	-	0.039	6.12	0.029	0.375	
05.09.02	11.1	-	0.023	5.92	0.007	0.052	
24.10.02	8.5	-	0.023	6.25	0.005	0.031	
21.11.02	-	-	0.070	4.06	0.015	0.071	
20.08.03	11.4	118	<0.020	6.03	0.005	0.103	
25.03.04	-	-	<0.020	6.20	0.007	0.027	
29.04.04	11.3	103	<0.020	6.47	0.008	0.110	
27.05.04	10.2	99	<0.020	8.11	0.014	0.144	
29.06.04	9.6	93	0.038	6.42	0.032	0.135	
26.08.04	9.4	99	0.038	5.90	0.009	0.055	
20.10.04	11.6	100	0.026	6.02	0.005	0.036	
18.11.04	-	-	0.023	6.42	0.006	0.023	
21.12.04	-	-	0.093	6.10	0.023	0.048	
26.01.05	-	-	0.040	7.16	0.017	0.044	
23.03.05	-	-	0.062	6.17	0.011	0.117	
27.04.05	11.5	103	0.026	6.42	0.010	0.067	
23.06.05	9.4	96	0.040	-	0.026	0.268	
21.07.05	9.7	104	0.040	-	0.025	0.629	
24.08.05	9.6	99	0.020	6.93	0.009	0.294	
30.09.05	9.6	93	0.039	4.56	0.013	0.122	
Mean				6.20			
Median						0.069	

Source: Cork County Council Water Laboratory, Inniscarra

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Table 7.3 Womanagh River water quality south of Ballyhonock Lake 2002-2005.

Date	DO mg/l	DO %	NH_4 mg/l N	NO_3 mg/l N	NO_2 mg/l N	MRP mg/l	Target P P Regs.
27.02.02	-	-	0.023	6.41	0.014	0.031	Upgrade to Q4. 0.3 mg/l MRP to be achieved by 2007.
27.03.02	11.3	-	0.023	7.27	0.008	0.085	
24.04.02	10.5	-	0.031	6.77	0.016	0.040	
26.06.02	11.2	-	0.023	7.20	0.014	0.037	
28.08.02	8.0	-	0.031	6.64	0.028	0.140	
05.09.02	8.8	-	0.023	6.98	0.007	0.085	
24.10.02	8.5	-	0.023	6.48	0.008	0.038	
21.11.02	-	-	0.117	4.54	0.020	0.085	
20.08.03	-	-	0.031	7.59	0.009	0.029	
23.01.03	-	-	0.016	6.75	0.010	0.027	
27.02.03	-	-	0.016	7.43	0.004	0.017	
27.03.03	-	-	<0.020	6.90	0.007	0.022	
20.08.03	10.9	104	0.040	6.59	0.022	0.042	
25.03.04	-	-	<0.020	7.07	0.006	0.026	
29.04.04	12.3	113	0.026	7.52	0.011	0.054	
27.05.04	11.5	110	<0.020	8.20	0.007	0.036	
29.06.04	9.0	86	0.065	6.84	0.025	0.086	
28.07.04	8.5	83	0.020	7.22	0.037	0.082	
26.08.04	9.8	93	0.040	6.08	0.012	0.047	
20.10.04	10.5	94	0.039	6.76	0.011	0.044	
18.11.04	-	-	0.024	7.60	0.008	0.030	
21.12.04	-	-	0.069	6.93	0.021	0.047	
26.01.05	-	-	0.026	7.63	0.011	0.031	
23.03.05	-	-	0.064	6.71	0.010	0.058	
27.04.05	11.5	102	0.032	7.26	0.014	0.036	
23.06.05	9.8	95	0.040	-	0.039	0.050	
21.07.05	10.3	104	0.033	-	0.024	0.076	
24.08.05	9.2	96	0.044	7.15	0.023	0.172	
30.09.05	8.0	77	0.040	4.92	0.026	0.065	
Mean				6.86			
Median						0.044	

Source: Cork County Council Water Laboratory, Inniscarra

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Table 7.4 Dissour River water quality at Killeagh Bridge 2002-2005.

Date	DO mg/l	DO %	NH_4 mg/l N	NO_3 mg/l N	NO_2 mg/l N	MRP mg/l	Target P P Regs.
30.01.02	-	-	0.054	4.34	0.010	0.025	Q4-5 to be maintained. 0.2 mg/l MRP to be achieved by 2007.
27.02.02	-	-	0.023	4.06	0.011	0.023	
27.03.02	11.6	-	0.023	4.47	0.004	0.019	
24.04.02	10.9	-	0.023	4.09	0.006	0.024	
26.06.02	10.3	-	0.023	4.18	0.007	0.046	
28.08.02	9.9	-	0.023	4.29	0.007	0.074	
05.09.02	10.9	-	0.047	4.00	0.005	0.074	
24.10.02	9.4	-	0.023	4.15	0.005	0.032	
21.11.02	-	-	0.117	3.36	0.014	0.097	
19.12.03	-	-	0.023	4.97	0.004	0.026	
23.01.03	-	-	0.016	5.38	0.006	0.028	
27.02.03	-	-	<0.020	4.38	0.005	< 0.013	
27.03.03	-	-	<0.020	4.28	<0.004	0.019	
20.08.03	11.5	111	<0.020	3.94	<0.004	0.035	
25.03.04	-	-	<0.020	4.87	<0.004	0.019	
29.04.04	11.2	102	<0.020	4.67	0.004	0.018	
27.05.04	11.5	103	<0.020	4.41	0.004	0.016	
29.06.04	10.0	95	0.029	4.10	0.007	0.049	
28.07.04	14.3	135	<0.020	4.14	0.005	0.036	
26.08.04	10.5	101	<0.020	3.95	<0.004	0.027	
22.09.04	-	-	0.020	4.46	<0.004	0.025	
20.10.04	11.5	100	0.020	4.83	<0.004	0.023	
18.11.04	-	-	0.021	5.07	<0.004	0.020	
21.12.04	-	-	0.026	5.06	0.007	0.032	
26.01.05	-	-	<0.020	5.42	0.006	0.023	
23.03.05	-	-	0.035	4.63	0.005	0.027	
27.04.05	11.4	101	<0.020	5.06	0.007	0.020	
23.06.05	10.4	102	<0.020	-	0.009	0.028	
21.07.05	10.3	107	0.023	-	0.004	0.039	
24.08.05	10.3	103	<0.020	4.16	<0.004	0.037	
30.09.05	9.9	94	0.021	3.40	0.004	0.034	
Mean				4.42			
Median						0.027	

Source: Cork County Council Water Laboratory, Inniscarra

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Table 7.5 Dissour River water quality upstream of Womanagh confluence 2002-2005.

Date	DO mg/l	DO %	NH_4 mg/l N	NO_3 mg/l N	NO_2 mg/l N	MRP mg/l	Target P P Regs.
30.01.02	-	-	0.086	4.90	0.022	0.006	Upgrade to Q4. 0.3 mg/l MRP to be achieved by 2007.
27.02.02	-	-	0.023	4.36	0.017	0.036	
27.03.02	11.8	-	0.023	4.90	0.008	0.032	
24.04.02	10.9	-	0.023	4.34	0.011	0.032	
26.06.02	11.7	-	0.023	4.65	0.012	0.053	
28.08.02	8.2	-	0.023	5.76	0.023	0.108	
05.09.02	8.2	-	0.023	6.59	0.004	0.045	
24.10.02	10.0	-	0.023	4.56	0.007	0.033	
21.11.02	-	-	0.140	3.45	0.020	0.100	
23.01.03	-	-	<0.016	4.81	0.003	0.020	
27.02.03	-	-	<0.016	4.67	0.004	0.022	
27.03.03	-	-	<0.020	4.71	0.006	0.029	
20.08.03	11.5	111	<0.020	4.20	0.005	0.048	
25.03.04	-	-	0.035	5.41	0.009	0.036	
29.04.04	11.2	102	<0.020	5.13	0.007	0.042	
27.05.04	12.9	109	<0.020	4.60	0.009	0.035	
29.06.04	10.0	96	0.037	4.33	0.013	0.077	
28.07.04	8.6	87	<0.020	4.25	0.009	0.080	
26.08.04	10.3	98	0.026	4.32	0.006	0.036	
22.09.04	-	-	<0.020	4.81	0.005	0.037	
20.10.04	11.6	101	0.024	5.26	0.006	0.038	
18.11.04	-	-	0.033	5.38	0.012	0.034	
21.12.04	-	-	0.037	5.50	0.013	0.049	
26.01.05	-	-	0.040	5.89	0.013	0.032	
23.03.05	-	-	0.048	5.24	0.009	0.043	
27.04.05	11.1	99	<0.020	1.61	0.011	0.020	
23.06.05	10.4	103	0.023	-	0.019	0.057	
21.07.05	9.8	104	0.029	-	0.012	0.086	
24.08.05	10.2	102	<0.020	4.67	0.005	0.075	
30.09.05	9.9	95	0.026	3.59	0.011	0.055	
Mean				4.71			
Median						0.038	

Source: Cork County Council Water Laboratory, Inniscarra

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8.1 The Environmental Protection Agency carries out a biological assessment of most river channels in the country on a regular basis. The assessments are used to derive Q values, indicators of the biological quality of the water. The biological health of a watercourse provides an indication of long term water quality. The EPA Q value scheme is summarised in table 8.1

Table 8.1 EPA biotic index scheme.

Q value	Water quality	Pollution	Condition
5	Good	Unpolluted	Satisfactory
4	Fair	Unpolluted	Satisfactory
3	Doubtful	Moderately polluted	Unsatisfactory
2	Poor	Seriously polluted	Unsatisfactory
1	Bad	Seriously polluted	Unsatisfactory

Source: EPA

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8.2 The intermediate ratings Q1-2, Q2-3, Q3-4 and Q4-5 are used to denote transitional conditions, while ratings within parenthesis indicate borderline values. Great importance is attached to the EPA biotic indices, and consequently it is these data that are generally used to form the basis of water quality management plans for river catchments.

8.3 Hydrometric area no. 19, which includes the Womanagh system, was most recently surveyed in 2005. Survey results for the years 1989 to 2005 are listed in tables 8.2 and 8.3.

Table 8.2 EPA Q values for Dissour River 19/D/03.

Station	Location	1989	1994	1997	1999	2002	2005	Target P Regs.
0200	Br WSW of Ballyre	4-5	3	4	4	4	4	4
0400	Killeagh Br	4-5	4	4-5	3-4	3-4	4	4-5
0600	Br u/s Womanagh confl	4-5	4	3-4	4	4	4	4
2002 assessment: No change. Satisfactory apart from middle reach where treated sewage enters river from right hand side immediately downstream of Killeagh Bridge (0400). 2005 unpublished data: Site 0400 is currently noncompliant in respect of the target value under the Phosphorus Regulations.								

Source: EPA

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Table 8.3 EPA Q values for Womanagh River 19/W/01.

Station	Location	1989	1994	1997	1999	2002	2005	Target P Regs.
0300	Br WNW of Donickmore Ho	-	-	4	4	4	4	4
0500	Br NE of Dungourney	3	3	3-4	4	4	4	4
0700	Second Br N of Mogeely	4	4	4-5	4	4	4	4-5
1000	Br in Castlemartyr	3-4	4	3-4	3	3-4	3-4	4
1300	S of Ballyhonock Lake	4	4-5	3-4	3-4	3	3	4
2002 assessment: Known as the Kiltha River in upper reaches, it was satisfactory except in lower reaches (1000, 1300) where again suspected discharges from Mogeely (industrial) and Castlemartyr (sewage) were responsible respectively for the slight and moderate pollution recorded. The lower reaches had large colonies of two American alien plants, the water fern (*Azolla filiculoides*) and least duckweed (*Lemna minuta*); these floating species reflect highly eutrophic conditions. 2005 unpublished data: Sites 0700, 1000 and 1300 are currently noncompliant in respect of the target value under the Phosphorus Regulations							

Source: EPA

8.4 Q values recorded on the Dissour show an overall reduction in water quality between 1989 and 2005. However the reduction has stabilised and 2005 values recorded were similar to those of 1999 and 2002, with a slight improvement at Killeagh Bridge. The EPA notes that the water quality in 2002 was satisfactory apart from Killeagh Bridge where sewage pollution was observed. Overall, Q values recorded in the Dissour were indicative of satisfactory water quality; however results need to be considered with respect to the target values under the Phosphorus Regulations.

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8.5 A more consistent trend has been recorded by the EPA with respect to the four monitoring stations on the Kiltha tributary (0300, 0500, 0700 and 1000). Q values recorded over 1999 and 2005 did not change. The three upstream stations on the Kiltha River were satisfactory in 2005, and only Castlemartyr exhibited reduced water quality. The EPA noted in 2002 that deleterious discharges at two locations influenced water quality.

8.6 Water quality in 2005 at station 1300, the only station on the main channel of the Womanagh, was unsatisfactory with a Q3 recorded. While a specific source or reason for the reduced water quality was not noted by the EPA in their 2002 assessment, it was suggested that the river was experiencing eutrophic conditions.

8.7 Overall, the Womanagh system would appear to be suffering from some degree of eutrophication, and Q values recorded are not entirely compliant with the requirements of the 1998 Phosphorus Regulations. The EPA have noted three specific point sources of potentially polluting material (industrial at Mogeely, and municipal at Castlemartyr and Killeagh), and have linked reduced quality data to these discharges. It is apparent from the data however that falling Q values recorded since 1989 appear to have stabilised somewhat, particularly since 1999, and this may be related to implementation of the Phosphorus Regulations by Cork County Council. Site 1300 represents an exception to this pattern. Continued enforcement of the Regulations, including remedial works and

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improved management of WWTPs and better agricultural management, coupled with the imminent preparation of the southwest river basin district management plan, is likely to encourage further recovery of the Womanagh and its tributaries.

8.8 In association with several authorities, the EPA carry out annual monitoring at 25 of the largest estuaries around the country. Monitoring is carried out in order to identify sensitive areas in the context of the Nitrates and Urban Waste Water Treatment Directives discussed below. While the monitoring programme does not include the Womanagh estuary, Youghal Bay into which the Womanagh discharges is included. Available information indicates that water quality in Youghal Bay is generally satisfactory, despite some evidence of eutrophication in the lower estuary of the River Blackwater. No data are available specifically for the Womanagh estuary.

9. SITE SURVEYS

9.1 A number of surveys were undertaken along the Womanagh catchment: catchment assessment, physicochemical survey and biological survey. The results of the catchment assessment have been described in section 2. The remaining surveys are discussed below. The Ballymacoda environment was assessed in 2002. Investigations carried out during the preparation of this report suggest that little or no changes have occurred here, and thus results obtained previously are applied below.

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9.2 Physicochemical survey

9.2.1 In order to determine the current water quality in the Womanagh catchment, water samples were taken during February and March 2006 at eight locations as indicated in table 9.1 and figure 1, and forwarded to Consultus Laboratories for analysis. Results of analysis are presented in table 9.2. Due to complex flow dynamics at Ballymacoda attributable to tidal operation of a sluice, no samples were taken here and results recorded during 2002 are used.

9.2.2 The sample taken upstream of Mogeely village indicated that water quality was generally satisfactory at the time of sampling with the exception of nitrate which was slightly elevated. Results of analysis on sample W2, taken downstream of all possible discharges from the village and Dairygold plant, were broadly similar. The orthophosphate level recorded downstream was markedly lower however.

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Table 9.1 Sampling locations.

Station	Location	Comments
W1	150 m upstream of Mogeely village	Chemical and biological surveys were carried out at the same locations. Biological monitoring is most accurate when water flow is fast and there is a hard, mixed substratum. Where possible deep flows and muddy sites are avoided. Due to the necessity of avoiding unsuitable sites monitoring was carried out at varying distances upstream and downstream of discharges and settlements.
W2	50 m downstream of Mogeely village and all discharges including Dairygold	
W3	20 m upstream of Castlemartyr village	
W4	45 m downstream of discharge from Castlemartyr WWTP	
W5	10 m upstream of all discharges from Ladysbridge village	
W6	15 m downstream of discharge from Ladysbridge WWTP	
W7	50 m upstream of all discharges from Killeagh village	
W8	35 m downstream of all discharges from Killeagh village	

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Table 9.2 Water quality in Womanagh catchment February and March 2006.

Parameter	Mogeely		Castlemartyr		Ladysbridge		Killeagh		Limits
	W1	W2	W3	W4	W5	W6	W7	W8	
pH	7.8	7.9	7.9	7.9	7.8	7.7	7.8	7.7	6.0-9.0[1]
BOD (mg/l)	<2	3	<2	<2	<2	<2	<2	<2	5[2] 7[3]
SS (mg/l)	<5	7	<5	13	22	12	<5	<5	50[2]
Cond. (µs/cm)	244	254	352	378	463	244	216	217	1000[4]
NO_3 (mg/l N)	6.2	6.7	6.9	6.8	7.5	7.3	4.9	4.9	-
NO_2 (mg/l N)	0.01	<0.01	<0.02	0.02	0.03	0.02	0.01	0.01	-
oPO_4 (mg/l P)	0.02	<0.01	0.50	0.49	0.36	0.40	0.02	0.03	0.03 (Q4)[5] 0.02 (Q4-5)[5]

[1]Freshwater Fish Directive – salmonid waters

[2]Surface Water Directive – A1 waters

[3]Surface Water Directive – A3 waters

[4]Surface Water Directive – A1-A3 waters

[5]Phosphorous Regulations

9.2.3 The concentrations of nitrate and orthophosphate measured upstream of Castlemartyr were elevated. Levels recorded downstream of the village and WWTP discharge were similar. Orthophosphate concentrations at both sites were almost identical.

9.2.4 At Ladysbridge, orthophosphate levels were elevated upstream and downstream of the village. Suspended solid concentrations were also raised, and some cloudiness was noted at the upstream site, most likely due to

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local impacts further upstream. No significant differences were noted between the upstream and downstream results.

9.2.5 Results obtained from Killeagh indicated satisfactory water quality at both upstream and downstream sites. Nitrate levels were particularly satisfactory and lower than measured elsewhere in the catchment.

9.3 Biological survey

9.3.1 Biological monitoring was carried out at a number of locations on the rivers and Q values were assigned on the basis of macroinvertebrate density and diversity found. The objectives of the biological survey were:

A. To determine the background water quality upstream of the specific discharges at each location.
B. To determine the effects of the existing discharges.
C. To assess biological quality at locations not included in the EPA monitoring programme.

9.3.2 Samples were taken during March 2006 at nine locations as indicated in table 9.3 and figure 1. Table 9.3 also includes the biological indices recorded. The species list recorded is presented in appendix 5. Saline and tidal conditions at Ballymacoda preclude the use of biological indices here.

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Table 9.3 Q values recorded March 2006.

Station	Location	Q value
B1	150 m upstream of Mogeely village	4-5
B1A	50 m downstream of Mogeely WWTP discharge	4-5
B2	50 m downstream of Mogeely village and all discharges including Dairygold	4-5
B3	20 m upstream of Castlemartyr village	4
B4	45 m downstream of discharge from Castlemartyr WWTP	4
B5	10 m upstream of all discharges from Ladysbridge village	4-5
B6	15 m downstream of discharge from Ladysbridge WWTP	3-4
B7	50 m upstream of all discharges from Killeagh village	4-5
B8	35 m downstream of all discharges from Killeagh village	4

9.3.3 At Mogeely Q values of 4-5 were assigned to all threes sites. Pollution sensitive genera found included the stoneflies *Isoperla*, *Chloroperla* and *Protonemura*, and the mayflies *Rhrithrogena* and *Ecdynorus*. Trout were noted within the watercourse at sites B1 and B2, stoneloach at B1A, and the rare brook lamprey (listed in annex 2 of the Habitats Directive) at B1 and B3.

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9.3.4 Brook lamprey was also recorded at station B3 upstream of Castlemartyr. Due to the silted nature of the river bed downstream of the village it was necessary to move 45 m downstream of the WWTP outfall to obtain an area of gravels with relatively turbulent water. A Q value of 4 was assigned here although diversity was relatively low.

9.3.5 A Q value of 4-5 was assigned upstream of Ladysbridge reflecting the relatively high number of sensitive species recorded. Pollution sensitive genera included the stoneflies *Isoperla*, *Chloroperla* and *Protonemura*, and the mayflies *Rhrithrogena*. Trout were noted within the watercourse immediately downstream of B5. It was noted that the discharge from the WWTP at Ladysbridge is clearly impacting on water quality, and sewage fungus was noted along the river bed downstream of the discharge point. This has reduced macroinvertebrate density and diversity, resulting in a lower Q value of 3 at B6.

9.3.6 Sensitive macroinvertebrate species were noted at both Killeagh stations and a Q value of Q4-5 was assigned upstream of the town. The discharge from the existing WWTP would appear to impacting on local water quality and a build up of silt was evident at the discharge point. However water quality was found to be satisfactory 35 m downstream of the discharge point where a Q4 was assigned.

9.3.7 The Dairygold facility at Mogeely discharges during the period from March to September, and thus there may be seasonal impacts on water quality. To determine if there is a greater impact on the watercourse when the plant is discharging and water levels are low, additional biological monitoring was carried out at three locations in September 2006. Results are detailed below in table 9.4.

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Table 9.4 Q values recorded September 2006.

Station	Location	Q value September 2006	Q value March 2006
B1	150 m upstream of Mogeely village	4	4-5
B2	50 m downstream of Mogeely village and all discharges including Dairygold	3	4-5
B3	20 m upstream of Castlemartyr village	3-4*	4

*Borderline Q3 and Q3-4. Assigned Q3-4 on basis of small numbers of *Ephemera* sp.

9.3.8 Table 9.4 indicates that there was a significant change in Q values obtained at these locations. The Q value upstream of Mogeely decreased from 4-5 to 4. This may be due to seasonal factors. It is noted that the summer of 2006 was characterised by low rainfall and low flows in watercourses. The fall in Q values at both downstream sites was more extreme. No stonefly or heptageniid mayflies were detected at either location, and the dominant groups/species were *Gammerus* sp. and *Hydropsyche* sp., with smaller number of *Lymnea* sp. *Asecellus* sp. and tubificid worms were also detected. A Q value of 3 was assigned to the site closest to Mogeely, and Q3-4 was assigned to the site 20 m upstream of Castlemartyr. The results suggest that the seasonal discharge from Dairygold at Mogeely is impacting on water quality.

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9.4 Ballymacoda

9.4.1 Results of investigations on the Ballymacoda River and Womanagh River (Crompaun Bridge) in 2002 revealed the following water quality parameters:

Table 9.5 Ballymacoda water quality 2002.

Location	Ballymacoda River upstream of WWTP stream	Ballymacoda River downstream of WWTP stream	Womanagh
pH	7.5	7.5	7.3
BOD mg/l	<1	<1	<1
SS mg/l	5	5	20
NH_4 mg/l N	0.08	0.09	0.15
NO_3 mg/l N	2.3	2.3	4.3
MRP mg/l P	0.06	0.05	0.3
Total P mg/l P	0.09	0.12	0.5

9.4.2 Results indicated that water quality in the Ballymacoda River was satisfactory, despite receiving a discharge of dubious quality from the local WWTP via a short stream. Results obtained from the Womanagh sample were generally unsatisfactory and indicative of eutrophication. It was not possible to undertake biological assessments of these sites.

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10. NOISE & ODOUR

10.1 All five WWTP sites under consideration are located near public roads in the environs of their respective villages. The noise environment at each location is therefore influenced to some degree by traffic. Occasional noise emissions arise from other sources such as playing children, agricultural machinery, birds and rustling vegetation. Building work may also elevate noise levels on occasions and there will be some small scale industrial activity at Castlemartyr.

10.2 There are no significant point sources of air emissions in the vicinity of the WWTP sites, and site observations made during the preparation of this report indicate that air quality in the environs of Mogeely, Castlemartyr, Ladysbridge, Killeagh and Ballymacoda is satisfactory. There are no significant industrial or commercial zones of significance within the catchment.

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11.1 This section provides a summary and analysis of information documented in part 1 (sections 2 to 10) regarding the existing environment.

11.2 The discharge from the WWTP in Mogeely was relatively small when observed during the preparation of this report. Visually there was no evidence of a significant impact on water quality. A high volume discharge to the river of heated water, with concomitant surface foam, was observed downstream of the bridge in Mogeely. There may also be additional discharge(s) from the Dairygold plant. While it is possible that discharges from the Dairygold plant may be having an impact on water quality, a biological sample downstream of the plant in March 2006 did not indicate negative impacts, and a satisfactory Q value of 4-5 was awarded. A Q4-5 value was also assigned upstream of the village, suggesting that discharges from the village and Dairygold treatment plants were not significantly affecting water quality during March.

11.3 The Dairygold facility discharges during the period from March to September. A second biological assessment undertaken in September detected reduced Q values upstream and downstream of Mogeely. The most significant reductions were measured downstream, where both sites were assigned Q3 values. It is concluded that the seasonal discharge is most likely impacting on water quality in the river.

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11.4 The Q4-5 values recorded in the vicinity of Mogeely during the preparation of this report contrast with those recorded by the EPA during their 2005 monitoring programme. The closest EPA monitoring station upstream of Mogeely (station 19W01 0700) was assigned a Q4 in 2005, while a Q3-4 was assigned downstream at Castlemartyr Bridge. The lower Q values recorded by the EPA, who undertake their monitoring during summer months, may reflect more significant impacts on water quality during the height of the summer. The Q values are similar to those recorded by DixonBrosnan in September 2006.

11.5 In the interests of maintaining a conservative approach, the Q4 value recorded upstream by the EPA will be applied in this report in the assessment of assimilative capacity at Mogeely. This approach is supported by the median MRP concentration calculated from Cork County Council monitoring data presented in table 7.1; the median concentration of 0.0335 mg/l P approximates to a Q4 value, indicating fair water quality. It should be noted that the nitrate concentrations recorded by Cork County Council (median 6.09 mg/l N and mean 6.16 mg/l N) are also indicative of fair water quality. A Q4 was assigned to this location by DixonBrosnan in 2006.

11.6 Cork County Council and the EPA include Castlemartyr Bridge in their routine monitoring programmes. A number of discharge pipes are evident upstream of the bridge, possibly associated with surface water runoff from several dwellings and a small industrial estate located upstream of the village. It is probable that discharges arise via these outfalls periodically. The impact on the watercourse from these discharges is not known; they may

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possibly be the cause of dense stands of water crowfoot here. It is possible that dissolved oxygen levels in this stretch of the Kiltha River fall significantly during low summer flows.

11.7 The EPA assigned a Q value of 3-4 to Castlemartyr Bridge in 2005. This figure contrasts with the Q value of Q4-5 assigned by DixonBrosnan at a site 20 m upstream of the village The protected species brook lamprey was observed at this site, and it was noted that growth of water crowfoot is considerably less dense here than at the bridge. However, repeat sampling by DixonBrosnan in September 2006 found that water quality had deteriorated and a Q value of 3-4 was assigned. Given that levels of MRP are high (a median of 0.069 mg/l from Cork County Council data) a Q value of 3-4 is considered a reasonable estimate of water quality upstream of Castlemartyr.

11.8 The nearest monitoring station used by the EPA and Cork County Council upstream of Ladysbridge is Castlemartyr Bridge where a Q3-4 value was awarded in 2005. A closer station used by DixonBrosnan during the preparation of this report, located 10 m upstream of all village discharges, was assigned a Q value of 4-5 indicating fair-good quality. Due to possible seasonal fluctuations in water quality, a conservative Q4 value is applied in the assimilative capacity assessment below. It should be noted that the Q3-4 value recorded immediately downstream of the Ladysbridge WWTP discharge, and the poor aesthetic quality of the watercourse, suggests that the existing WWTP discharge is impacting on water quality.

11.9 As before, the Q4 value assigned in 2005 by the EPA to their monitoring station at Killeagh Bridge is lower than the Q4-5 value awarded by DixonBrosnan to a station upstream of the village. Again, the more conservative Q4 value is applied below. Cork County Council monitoring data recorded between 2002 and 2005 are indicative of good water quality at Killeagh Bridge, with a median MRP concentration of 0.027 mg/l P, and nitrate levels of 4.42 mg/l N (mean) and 4.34 mg/l N (median).

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11.10 DixonBrosnan report 02001 which described an assessment undertaken at Ballymacoda in 2002 concluded that there were no ready discharge options available to surface watercourses in this area. Given the severely restricted dilution capacities available locally, it was concluded that a discharge to the tidal section of the Womanagh River represented the only option consistent with all water quality criteria. A practical alternative, discharging to the Ballymacoda River, would not specifically meet the dilution criterion. Q values and short term physicochemical assessments are of reduced relevance here due to tidal influence, and thus this area was not resampled during the preparation of this report. The conclusions of the original report are still considered relevant, and it is likely that specific engineering solutions will be necessary here to allow further development at Ballymacoda.

11.11 Background levels of the most relevant parameters at Mogeely, Castlemartyr, Ladysbridge and Killeagh are presented in table 11.1. BOD concentrations are taken from water samples collected during the preparation of this report. Laboratory reporting obligations resulted in BOD analysis data presented as <2 mg/l; a level of 2 mg/l is applied below to maintain a conservative approach. As a short term event most likely affected water quality upstream of Ladysbridge, the suspended solids level applied here is taken from the next upstream sampling station at Castlemartyr. Nitrate and ammonium levels at Castlemartyr are also applied to Ladysbridge as Cork

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County Council do not maintain a sampling station at the latter. All nitrate and ammonium concentrations presented are median values of Cork County Council data recorded between 2002 and 2005. MRP concentrations are derived from the conservative Q values applied at each site as discussed above.

Table 11.1 Background concentrations of key parameters at four inland settlements.

Location	95% flow m^3/s	BOD mg/l	SS mg/l	NH_4 mg/l N	NO_3 mg/l N	MRP mg/l P	Q value
Mogeely	0.0329	2	5	0.021	6.09	0.03	4
Castlemartyr	0.0363	2	5	0.026	6.23	0.05	3-4
Ladysbridge	0.0545	2	13	0.026	6.23	0.03	4
Killeagh	0.0487	2	5	0.021	4.34	0.03	4

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12. SURFACE WATER DIRECTIVE

12.1 Council Directive 75/440/EEC concerning the quality of surface water intended for the abstraction of drinking water in the member states was incorporated into Irish law by the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989 (SI No. 294 of 1989). The Regulations set out quality standards for a total of 39 parameters for waters which are to be treated for distribution, with the standards varying with the degree of treatment provided. The Regulations divide surface waters from which water for public supply will be taken into three categories; these categories are based on the degree of treatment which will be applied. The degree of treatment for the three categories A1, A2 and A3 are as follows:

A. Simple physical treatment and disinfection eg. rapid filtration and disinfection.
B. Normal physical treatment, chemical treatment and disinfection eg. prechlorination, coagulation, flocculation, decantation, filtration, chlorination.
C. Intensive physical and chemical treatment, extended treatment and disinfection eg. chlorination to break point, coagulation, flocculation, decantation, filtration, adsorption, ozone/UV disinfection, chlorination.

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12.2 As the degree of treatment is based on the quality of water to be abstracted there are obvious financial implications should the water quality deteriorate to such a degree that it moves into an A2 or A3 classification.

12.3 The only surface water abstraction within the Womanagh catchment is on the Dower River at Dower. There are no discharges to this river, either upstream or downstream of its 2 km subterranean stretch. Consequently the provisions of the Surface Water Directive do not directly apply.

13. BATHING WATER DIRECTIVE

13.1 Council Directive 76/160/EEC concerning the quality of bathing water, and the follow up Quality of Bathing Waters Regulations 1992 (SI No. 155 of 1992) and amendments, lay down quality requirements for inland and coastal waters as designated bathing areas. The quality standards refer chiefly to microbiological parameters, with provision for monitoring of other parameters where it is suspected that conditions have deteriorated. Microbiological limit values specified in the Directive and Regulations are listed in table 13.1.

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Table 13.1 Bathing waters limits (per 100ml).

Legislation	Total cliforms	Faecal coliforms	Faecal streptococci
Directive 76/160/EEC	500[1] 10,000[2]	100[1] 2,000[2]	100[3]
SI No. 155 of 1992	5,000[1] 10,000[2]	1,000[1] 2,000[2]	300[2,4]

[1]Compliance by 80% of samples

[2]Compliance by 95% of samples

[3]To be measured where present or where deterioration suspected

[4]Compliance by 90% of samples

13.2 There are no designated inland bathing areas in the Womanagh catchment nor any designated beaches on the Womanagh estuary. Consequently Directive 76/160/EEC and SI No. 155 of 1992 do not directly apply.

13.3 The final kilometre of the Womanagh River flows through a strand which extends 5 km northeast to Youghal along the Yougal Bay coastline. A number of bathing areas are located along this strand, the nearest being at Pillmore. While Pillmore strand is not designated under the Regulations, the strand is of some recreational value and therefore deserves some degree of protection. To the north of Pillmore lie three designated beaches: Redbarn, Claycastle and Youghal main beach. A review of monitoring data indicates that satisfactory conditions have bee recorded by Cork County Council at Claycastle and Youghal for several years. Slightly poorer quality has been noted at Redbarn however, and in 2004 (year for which most recent data are available) the water quality here did not meet EU guide values, although mandatory values were met.

13.4 It is likely that the Bathing Waters Directive will be replaced shortly. The new Directive will contain only two microbiological parameters, limits for which will be stricter than those currently in force. It is therefore possible that many beaches around Ireland, including those along Youghal Bay, will be less likely to be awarded satisfactory status in the future. It is expected that fewer Blue Flags will be awarded during subsequent years. In order to guarantee the retention of satisfactory status at Claycastle and Youghal, and the necessary improvement at Redbarn, it is essential that existing and proposed wastewater discharges to Youghal Bay feed rivers meet relevant microbiological criteria. With respect to the Womanagh River and the settlements under consideration, these microbiological criteria apply chiefly to the discharge at Ballymacoda.

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14. FRESHWATER FISH DIRECTIVE & SALMONID REGULATIONS

14.1 Council Directive 78/659/EEC on the quality of fresh waters needing protection in order to support fish life was given Irish effect by the European Communities (Quality of Salmonid Waters) Regulations 1988 (SI No. 293 of 1988). The Regulations specify a separate range of standards for salmonid and cyprinid fish in waters designated as needing protection or improvement for their support.

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14.2 Neither the Womanagh River nor its tributaries have been designated under the Regulations and it is not expected that they will be designated in the immediate future. The fisheries significance of the catchment has been discussed in section 5.

14.3 Notwithstanding the absence of any fisheries designation, the Freshwater Fish Directive carries some weight due to its strict limits and the consequent suitability of a watercourse for other uses should it meet these limits. The most significant wastewater parameters are examined in table 14.1 with respect to the Directive.

Table 14.1 Freshwater Fish Directive limits.

Parameter	Limit mg/l	
	Salmonid	Cyprinid
BOD	3	6
Suspended solids	25	25
Ammonia	0.02 N[1] 0.82 N[2]	0.02 N[1] 0.82 N[2]
Nitrite	0.003[3]	0.009[3]
Nitrate	-[4]	-[4]
Orthophosphate	-[4]	-[4]
Total phosphorus	0.062[5]	0.124[5]

[1]Un-ionised ammonia

[2]Total ammonium

[3]Guide value, no mandatory limit specified

[4]No limit given

[5]Not specified as limit but rather 'may be regarded as indicative in order to reduce eutrophication'.

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14.4 It is recommended where practical that the cyprinid criteria listed in table 14.1 are applied in assessing impacts of the existing and proposed discharges at the settlements under consideration.

15. SHELLFISH DIRECTIVE

15.1 Council Directive 79/923/EEC on the quality required by shellfish waters, and the associated Quality of Shellfish Waters Regulations 1994 (SI No. 200 of 1994) specify designated coastal and brackish waters needing protection or improvement in order to support shellfish. Specified limit values apply to these areas. There are no designated shellfish areas on this stretch of the Irish coastline and thus the Directive and Regulations do not apply.

15.2 Pursuant to Council Directive 91/492/EEC laying down the health conditions for the production and the placing on the market of live bivalve molluscs, the Minister for the Marine and Natural Resources issued a list of

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production areas from which molluscs may be taken. Included in the list is Youghal Bay from which mussels are harvested. Under this designation shellfish tissue is required to contain limited numbers of faecal coliforms. It is noted that live bivalve molluscs must not exceed, in 90% of samples, the limits of a five tube three dilution MPN test of 6000 faecal coliforms per 100 g of flesh, or 4600 E. coli per 100 g of flesh.

15.3 While the Live Bivalve Molluscs (Production Areas) Designation of 2004 does not include Youghal Bay, it is advisable that the proposed wastewater treatment projects at the settlements under consideration in this report result in an improvement in microbiological quality of the discharged effluent. No deterioration should be allowed to occur. This recommendation particularly applies with respect to Ballymacoda, the closest discharge point to Youghal Bay.

16. URBAN WASTE WATER TREATMENT DIRECTIVE

16.1 The Environmental Protection Agency Act 1992 (Urban Waste Water Treatment) Regulations 1994 (SI No. 419 of 1994) were issued to give effect to EU Council Directive 91/271/EEC concerning urban wastewater treatment. The Regulations specify that wastewater arising from populations of less than 2000 shall, by the end of 2005, be subject to appropriate treatment prior to discharge. Appropriate treatment is defined as:

> *…any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of the Directive and of other Community Directives.*

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16.2 Relevant Community Directives are Directives 75/440/EEC, 76/160/EEC, 78/659/EEC and 79/923/EEC, all of which have been discussed above.

16.3 This requirement applies to freshwater and estuarine discharges. It also applies to coastal discharges from agglomerations of less than 10000. Where the agglomeration served is over 2000 pe (10000 pe if coastal) the second schedule of the Regulations notes that final concentrations of BOD and suspended solids in the treated discharge shall not exceed 25 mg/l and 35 mg/l respectively.

16.4 The wastewater loads arising at Mogeely, Castlemartyr, Ladysbridge, Killeagh and Ballymacoda are in all cases less than 2000 pe at present. It is proposed to upgrade the plants to cater for increased loads; only at Castlemartyr will the proposed capacity exceed 2000 pe Regardless of the size of the load proposed, the limits specified in the Urban Waste Water Treatment Directive are not considered onerous, and compliance with stricter articles of legislation such as the Fisheries Directive will ensure compliance with the Urban Waste Water Treatment Directive.

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16.5 The Directive notes in annex IIA that a water body (freshwater, estuarine or coastal) must be identified as a sensitive area if certain criteria are met and to where treated waste from agglomerations of greater than 10000 pe will discharge. Neither the Womanagh River nor Youghal Bay has been designated as a sensitive area, although the Blackwater Estuary to Youghal Harbour area has been designated under the Environmental Protection Agency Act 1992 (Urban Waste Water Treatment) Regulations 2001 (SI No. 254 of 1994). The designation process is directed at agglomerations significantly larger than that under consideration with respect to the Womanagh catchment.

16.6 The Directive specifies a number of obligations regarding the design of wastewater treatment plants as follows:

A. Such plants shall be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.
B. When designing the plants, seasonal variations of the load shall be taken into account.
C. Waste water treatment plants shall be designed or modified so that representative samples of the incoming wastewater and of treated effluent can be obtained before discharge to receiving waters.
D. The points of discharge of urban wastewater shall be chosen, as far as possible, so as to minimize the effects on receiving waters.

16.7 It is recommended that items A-C are taken into account at the design and installation stage of the proposed wastewater treatment projects under consideration. Item D is addressed in this report.

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17. PHOSPHORUS REGULATIONS

17.1 The Local Government (Water Pollution) Act 1977 (Water Quality Standards for Phosphorus) Regulations 1998 (SI No. 258 of 1998) were introduced to counter eutrophication observed throughout Irish watercourses and also to comply with Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment.

17.2 The Regulations oblige local authorities to maintain or improve the water quality at any part of a river by 2007 with reference to the biotic index (Q value) or to the concentration of molybdate reactive phosphate (MRP, largely orthophosphate). The target values specified are set out in the third schedule of the Regulations and are reproduced in table 17.1.

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Table 17.1 Phosphorus Regulations target values.

Q values at 1997	Either to be applied	
	Target Q value	Target MRP level µg/l
5	5	15
4-5	4-5	20
4	4	30
3-4	4	30
3	3-4	50
2-3	3-4	50
≤2	3	70

17.3 In practical terms indices of Q4 or higher are taken to represent satisfactory water quality and where eutrophication is unlikely to be a problem. Because annual median phosphate values in such waters rarely exceed 30 µg/l P, this concentration has been adopted as the general target value to be achieved by 2007. The empirical relationship between phosphate and eutrophication suggests that, once annual MRP levels exceed 30 µg/l P, there is a strong statistical likelihood that the stretch of river in question will have a significant eutrophication problem.

17.4 On the basis of Q value information available for the Womanagh catchment (presented in tables 8.2 and 8.3), target values to be met by 2007 are indicated below.

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Table 17.2 2007 target Q values in Womanagh catchment.

River	Station	Location	1997 Q value	2007 Target	2005 Q value	P Regs.
Dissour	0200	Br WSW of Ballyre	4	4	4	Compliant
	0400	Killeagh Br	4-5	4-5	4	Non-compliant
	0600	Br u/s Womanagh confl	3-4	4	4	Compliant
Kiltha	0300	Br WNW of Donickmore Ho	4	4	4	Compliant
	0500	Br NE of Dungourney	3-4	4	4	Compliant
	0700	Second Br N of Mogeely	4-5	4-5	4	Non- compliant
	1000	Br in Castlemartyr	3-4	4	3-4	Non-compliant
Womanagh	1300	S of Ballyhonock Lake	3-4	4	3	Non-compliant

17.5 Four sampling stations were not on course to meet the target at 2005. It was noted in 8.7 that three of these were affected to some degree by wastewater discharges. In this context, any proposals to upgrade or improve the respective WWTPs may be seen as a positive step.

17.6 The target values specified in the Regulations were adopted on the basis of the empirical relationship between the biotic indices and orthophosphate concentrations in Irish waters as monitored extensively by the

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EPA. Some concern has been expressed that this simplistic approach does not apply equally throughout Irish watercourses, with consequent complications in the assessment of existing and proposed discharges. It is noted that the empirical correlation between Q4 status and an orthophosphate level of 0.03 mg/l P does not hold true for all situations. Elevated orthophosphate levels affect watercourses by causing eutrophication which in turn causes depletion of oxygen levels. Rivers are dynamic and variable systems however, and high phosphate levels are not always correlated with low oxygen concentrations. For example the presence of turbulent water, waterfalls or weirs may prevent significant deoxygenation of water, while shaded conditions will affect plant and algal growth. Moreover, orthophosphate concentrations may fluctuate considerably over time and the use of a limited number of samples/results may provide a misleading picture of water quality at a given location.

17.7 It follows that Q values, rather than orthophosphate concentrations, are often better indicators of long term water quality in a watercourse. Q values also provide a better indication of the real impact of water quality on the ecology of the watercourse. Invertebrates are valuable as indicator species, and information on the diversity and density of invertebrates can provide an accurate assessment of the suitability of the monitoring location for species such as fish.

17.8 While the Phosphorus Regulations are directly applicable to the current study, limited orthophosphate data are available with respect to the Womanagh catchment and these results may not provide accurate information on long term trends within the catchment. Given the reliability of Q values over longer periods, these values are considered more relevant as a basis for determining background orthophosphate levels.

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18. NITRATES DIRECTIVE

18.1 Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources obliges member states to identify Nitrate Vulnerable Zones within which restricted agricultural practices will apply. Zone designation is undertaken by reference to a number of criteria listed in annex I of the Directive including excessive nitrate concentrations in surface or ground waters and high trophic status. With respect to surface waters, the Directive notes that sensitive waters shall be identified where nitrate levels exceed the maximum concentration specified in the Surface Water Directive ie. 11.3 mg/l N.

18.2 A limit of 11.3 mg/l N may be considered high, and allowing nitrate concentrations to rise towards this limit is not desirable. In this context a guideline value equal to 50% of the mandatory value is considered an appropriate target value. This equates to 5.65 mg/l N, or 25 mg/l NO_3.

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18.3 Under Ireland's implementation of the Nitrates Directive, the whole country has been designated as a Nitrate Vulnerable Zone and limited to a 170 kg/ha/year application limit of animal manure or fertiliser. However a derogation is being sought for a 250 kg/ha/year limit.

19. ROYAL COMMISSION STANDARDS

19.1 The standards noted in the *Eight Report of the Royal Commission on Sewage Disposal* (1912) have played an important part in water quality management since their publication. The standards are summarised in table 19.1.

Table 19.1 Royal Commission standards, 1912.

Dilution	Standard mg/l		Treatment required
	BOD	Suspended solids	
8-150	20	30	Primary & secondary
150-300	-	60	Chemical precipitation
300-500	-	150	Plain sedimentation
>500	-		No treatment

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19.2 The normal standard fixed was 20 mg/l BOD and 30 mg/l suspended solids. The Commission did not include a quality standard for receiving waters in their recommendations, but noted that river waters with a BOD of 4 mg/l will be ordinarily free from signs of pollution. In accordance with the Commission's report, most river authorities have traditionally sought a minimum dilution of 1:8 in the discharge of treated wastewater to a watercourse, regardless of treatment efficiency. It is noted however that the Royal Commission Report dates to 1912 when a treatment standard of less than 20/30 was difficult to obtain.

19.3 The Commission standards formed the basis for *Memorandum no. 1: Water quality guidelines* (1978) issued by the Irish Department of the Environment Technical Committee on Effluent and Water Quality Standards. The majority of quality standards specified in the memorandum have since been superseded by more recent legislation and standards such as those described on previous pages.

19.4 *Memorandum no. 1: Water quality guidelines* also makes reference to dilution capacities within estuaries. The report notes that, due to complex dynamics with estuaries, dilution capacities therein are more safely determined using freshwater flow data. The report also states that a limit of 200 mg/l BOD may be discharged to a closed estuary such as the Womanagh where the daily discharge does not exceed 45 kg BOD.

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20. WATER FRAMEWORK DIRECTIVE

20.1 EU Directive 2000/60/EC establishing a framework for Community action in the field of water policy requires member states to restore the quality of their watercourses by 2015. In order to achieve this objective, Irish local authorities are obliged to prepare river basin management plans. Cork County Council have assembled an advisory council which will manage the southwest river basin district within which the Womanagh catchment is located. In the meantime there are no specific quality objectives in force with respect to the catchment.

20.2 The Water Framework Directive includes a substantial set of provisions which member states are obliged to apply. The provisions chiefly relate to the categorising of water bodies within each river basin district. While no specific standards are specified with respect to water quality criteria and discharges to waters, the Directive states that due regard is to be given to relevant Community Directives. In particular, the Water Framework Directive notes that the most stringent limits should be applied where more than one set of criteria are relevant. This approach is adopted within the current assessment.

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21. NOISE & ODOUR

21.1 There are no national noise limits in place in Ireland. Most developments are usually restricted by way of noise conditions in relevant planning permissions or Environmental Protection Agency licences. In the granting of permission to developments, authorities will often refer to the EPA document *Integrated Pollution Control Licensing: Guidance note for noise in relation to scheduled activities* (1995) which notes that the noise level at a sensitive location should be kept below an L_{Ar} value of 55 dB during the hours 0800-2200, and below 45 dB outside of these hours, the L_{Ar} being equal to the L_{Aeq} (the average noise level) plus a penalty applied where the noise is tonal or impulsive. The guidance note states in particular that audible tones and impulsive noise at sensitive locations should be avoided at night, irrespective of the noise level.

21.2 The EPA guidance note defines a noise sensitive location as:

> *Any dwelling house, hotel or hostel, health building, educational establishment, places of worship or entertainment, or any other facility or area of high amenity, which for its proper enjoyment requires the absence of noise at nuisance levels.*

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21.3 It follows that any local residence or establishment, internally and externally, in the vicinity of any of the WWTP sites under consideration is a noise sensitive location within the terms of the guidance note.

21.4 While the EPA document was prepared as a guidance note for activities specified only in the first schedule to the EPA Act (1992) and subsequently in follow up orders, the absence of other Irish guides or standards lends the document some significance and consequently the document now carries some weight outside of the industrial sectors regulated by the EPA.

21.5 There are no odour limits specified in Irish legislation, and only the Air Pollution Act 1987 makes any reference to odour nuisance. In the absence of any limits, the EPA in their document *Wastewater treatment manuals: Treatment systems for small communities, business, leisure centres and hotels* (1999) has recommended minimum buffer zones to be applied around WWTPs over certain threshold pe values. The zones have been selected to reduce both odour and noise impacts. The document notes that for systems designed to treat greater than 161 pe a buffer zone of 50 m should allowed ie. the WWTP should not be located nearer than 50 m to existing development. It is further noted that at least 30 m of this distance should be in the possession of the WWTP operator.

22. INTERPRETATION: LEGISLATION & STANDARDS

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22.1 This section provides a summary and analysis of information documented in part 2 (sections 12 to 21) regarding legislation and standards pertinent to the proposed developments and the aquatic environment.

22.2 The Urban Waste Water Treatment Directive specifies that due regard should be given to other European Directives in the assessment of impacts associated with wastewater discharges. The Water Framework Directive further states that where a number of limits are relevant through various Directives, the most stringent should be applied. The only Community Directive directly applicable to the Womanagh catchment is the Nitrates Directive which has been applied across the country.

22.3 Two Directives are not directly relevant to the catchment, yet are relevant to Youghal Bay into which the Womanagh discharges. These are the Bathing Waters Directive and the Bivalve Molluscs Directive. Both Directives, with their follow up national Regulations, specify microbiological criteria applicable respectively to beaches and shellfish. These criteria are of relevance to the assessment of Ballymacoda WWTP. The distance inland to the remaining WWTPs is such that the microbiological criteria will not apply to Mogeely, Castlemartyr, Ladysbridge or Killeagh.

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22.4 The Fisheries Directive and associated Salmonid Regulations apply only to designated watercourses and consequently do not apply to the Womanagh system. However, the strict limits specified in these instruments means that compliance with same will guarantee compliance with other limits and therefore suitability for other uses. This approach is also in keeping with the thrust of the Water Framework Directive. It is thus recommended that the cyprinid Freshwater Fish Directive limits are applied from the outset.

22.5 In the absence of any adopted catchment management plan or river basin management plan, the Phosphorus Regulations assume an important role in overall water quality across the catchment. The Regulations specify target Q values to be met by 2007 at selected sites on the Womanagh system. Any works undertaken with respect to the five WWTPs under consideration should aid compliance with these targets.

22.6 Guidance on noise and odour control is provided by two EPA documents; the maintenance of buffer zones of at least 50 m around each WWTP under consideration should guarantee compliance with these. Remaining legislative or guidance documents discussed in part 2 do not apply, due to their being irrelevant (Surface Water Directive and Shellfish Directive) or superseded (Royal Commission standards).

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23. IMPACT ASSESSMENT

23.1 The impacts of the proposed discharges to the Womanagh system are assessed below under a number of headings: waste assimilative capacity and BOD, suspended solids, nitrogen, phosphorus and pathogens.

23.2 Mass balance equations may be used to determine the concentration of a parameter in a watercourse downstream of its discharge. A typical equation is as follows:

$$T = (FC + fc) / (F + f)$$

where:

T = downstream pollutant concentration

F = upstream river flow

C = background pollutant concentration

f = effluent flow

c = effluent pollutant concentration

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23.3 It is noted that the relationship between water quality and the ecological health of a watercourse is complex and that the impact of a specific discharge cannot be predicted with a high degree of certainty. It is also noted that the use of formulae does not provide conclusive answers, particularly as such calculations are often based on limited data. It is necessary therefore to continually review water quality data to ascertain what changes are occurring within a watercourse.

24. PROPOSED DEVELOPMENTS

24.1 Cork County Council operates a sewage scheme in the villages of Mogeely, Castlemartyr, Ladysbridge, Killeagh and Ballymacoda. The Council proposes to upgrade the level of treatment provided by the WWTPs at these villages as required, and to install additional treatment capacity to facilitate future development. The proposed works are summarised in table 24.1.

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Table 24.1 Summary of proposed WWTP works.

Location	Description	Existing load pe	Proposed capacity pe	Proposed volume m^3/day
Mogeely	WWTP with secondary treatment, 200 pe capacity	100	500	90
Castlemartyr	WWTP with secondary treatment, 2000 pe capacity	1500	3000	540
Ladysbridge	Septic tank, overloaded	500	1000	180
Killeagh	WWTP with secondary treatment, 1000 pe capacity	850	2000	360
Ballymacoda	Septic tank, unsatisfactory percolation	500	1000	180

24.2 With respect to Ladysbridge and Ballymacoda it is proposed to divert the existing discharges from the septic tanks to new WWTPs, most likely proprietary units. The provision of extra capacity at Castlemartyr and Killeagh will most likely require the installation of additional components at the existing WWTP sites. It is unclear at this point if new WWTPs will be required, or if the existing plants may simply be upgraded.

24.3 The EPA document *Wastewater Treatment Manuals: Treatment systems for small communities, business, leisure centres and hotels* (1999) notes that research suggests that per capita wastewater flows average 180 l/day, and the document recommends this figure be used. Accordingly this per capita wastewater flow is now accepted as the standard flow to be used in the design of wastewater treatment systems. The volume of wastewater proposed for treatment at each site is presented in table 24.1 above.

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24.4 At all five settlements there is minimal industrial input to the wastewater stream. The most significant industrial source of wastewater, a milk processing facility at Mogeely, discharges to an onsite WWTP. Therefore the wastewater stream arising at each village is assumed to be domestic in nature. The characteristics of such wastewater streams have been documented by the EPA (1999) and are summarised in table 24.2. No unusual variations in the wastewater streams have been noted.

24.5 In addition to the new wastewater treatment systems, new or upgraded collection systems may be required so that all discharges are effectively managed. It is recommended that surface water at each settlement is discharged directly to the nearest watercourses. It is advisable that an assessment be carried out of all dwellings and pubs/restaurants etc. to ensure that grey water entry to the surface water systems is limited. If surface water is prevented from entering each WWTP facility, it is recommended that each plant does not allow storm water overflow and that the plant tender specifications include provision for a flow balancing system to cater for flows up to 6 DWF.

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Table 24.2 Domestic inflow wastewater characteristics.

Parameter	Mean concentration
SS	163 mg/l
BOD	168 mg/l
COD	389 mg/l
oPO_4	7.1 mg/l P
Total N	40.6 mg/l N
NH_3	31.5 mg/l N
NO_3	0.25 mg/l N
NO_2	0.04 mg/l N
pH	7.5
Total coliforms	$1x10^8$ CFU/100ml
Faecal coliforms	$4x10^7$ CFU/100ml

Source: EPA

25. DISCHARGE OPTIONS

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25.1 The septic tank located at Ladysbridge, and the WWTPs at Mogeely, Castlemartyr and Killeagh are located at sites adjacent to the main tributaries of the Womanagh River. The most practical option at these sites is the continued discharge of the treated effluent to the adjacent watercourses, subject to compliance with relevant quality criteria noted in part 2 of this report and the availability of sufficient assimilative capacity. In any case, no suitable alternatives exist at these sites.

25.2 At Ballymacoda the existing septic tank discharges ostensibly to groundwater via a percolation area. An assessment of this site undertaken by DixonBrosnan in 2002 noted that this disposal method was not working satisfactorily, and it was concluded that local conditions do not favour disposal by percolation. While a stream flows in proximity to the septic tank, its low flow and poor quality precludes it from receiving a wastewater stream, regardless of treatment quality. Marine disposal was ruled out on economic grounds. Two feasible disposal options were presented in the report: discharge to the Ballymacoda River, and discharge to the Womanagh River. While disposal to the latter would immediately meet all water quality criteria, installation of an outfall main over 1000 m of difficult terrain would be required. It was concluded that disposal to the Ballymacoda River presented a more practical alternative. Both options are included in the assessment below.

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26. DILUTION CAPACITIES

26.1 Cork County Council proposes to increase the treatment capacities of WWTPs at the five settlements under consideration. Table 26.1 presents the dilution factors available at these settlements calculated on the basis of 95th percentile flow data and a per capita wastewater volume of 180 l/day. Both disposal options are shown with respect to Ballymacoda.

Table 26.1 Proposed discharges and dilution factors.

Location	River	Capacity proposed	Commercial discharge pe	95% flow m^3/s	Dilution factor
Mogeely	Kiltha	500	3610	0.0329	3.8
Castlemartyr	Kiltha	3000	-	0.0363	5.8
Ladysbridge	Womanagh	1000	-	0.0545	26.2
Killeagh	Dissour	2000	-	0.0487	11.7
Ballymacoda	Womanagh	1000	-	0.1389	66.7
Ballymacoda	Ballymacoda	1000	-	0.0069	3.3

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26.2 The table indicates that sufficient flows will be available at Ladysbridge and Killeagh to provide greater than a 1:8 dilution of the discharge volumes proposed. The 95th percentile flow of the Kiltha River will not be sufficient to provide a 1:8 dilution of the 3000 pe proposed at Castlemartyr. Calculations indicate that compliance with the 1:8 criterion here will limit the maximum discharge load to 2180 pe At Mogeely, the discharge from the Dairygold facility significantly reduces the available dilution capacity here.

26.3 At Ballymacoda, only a discharge to the Womanagh will automatically meet the 1:8 criterion. However, as noted in 26.2, a discharge to the Ballymacoda River presents a less impractical option. At its nearest point the Ballymacoda River approaches to within approximately 500 m of the WWTP site. The intervening terrain consists of flat agricultural grassland. The river is slow flowing and exhibits some development of marsh like conditions in parts. The 95th percentile flow of the river was estimated to be 650 m^3/day (600 m^3/day at the likely location of an outfall from the WWTP), although it was noted that the flow rate follows tidal movements via a sluice gate. The river showed negligible salinity during onsite inspections, and it can be assumed that there is little or no inward flow due to tidal movements. Water quality in the river was observed to be reasonably satisfactory, and it was concluded in DixonBrosnan report 02001 that the river's natural wetland characteristics might favourably be employed in the disposal of treated wastewater arising from a then proposed population load of 600 pe Cork County Council now proposes to increase the treatment capacity at Ballymacoda to 1000 p.e, resulting in a reduced dilution of 3.3. Unless an innovative engineering solution can be employed, the reduced dilution available will most likely necessitate a direct discharge to the Womanagh River via a 1000 m mains.

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26.4 It is noted that the Royal Commission Report dates to 1912 when a treatment standard of less than 20/30 was difficult to obtain. In recent times it has become feasible to reduce treatment standards below this level. In the modern context, a 1:8 dilution factor may not be the limiting design criterion. At locations where the 1:8 factor will not be met (Mogeely, Castlemartyr and Ballymacoda River), these discharges may be permitted where stricter treatment standards are applied.

27. WASTE ASSIMILATIVE CAPACITY & BOD

27.1 The waste assimilative capacity (WAC) of a watercourse is the mass of BOD which the watercourse can healthily absorb in one day. The WAC is a function of the existing BOD in the watercourse, the maximum permissible BOD and the minimum flow rate. The WAC may be determined as follows:

$$WAC = (Cmax – Cback) \times 95\% \text{ flow}$$

where:

Cmax = maximum permissible BOD

Cback = background upstream BOD

95% flow = 95th percentile flow rate at discharge location

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27.2 A number of different quality criteria may be applied in the assessment of impacts on waste assimilative capacity. The strictest criterion is presented in Department of the Environment *Memorandum No. 1: Water Quality Guidelines* (1978) which specifies that the maximum BOD concentration in salmonid freshwaters and estuarine waters should not exceed 4 mg/l. While the Womanagh catchment has not been designated as salmonid, this stricter limit is applied below. The 4 mg/l criterion is also supported by the Royal Commission report of 1912 which noted that river waters with a BOD of 4 mg/l will be ordinarily free from signs of pollution.

27.3 Table 27.1 presents the proposed discharges in the context of waste assimilative capacities available at the four inland settlements. Background BOD concentrations are taken from table 11.1.

27.4 Memorandum No. 1 notes that a discharge to a watercourse should not increase the BOD within the watercourse by more than 1 mg/l, regardless of the background BOD concentration within the river. The maximum BOD loads which may be discharged without breaching this criterion are presented in table 27.2.

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Table 27.1 Waste assimilative capacities at four inland WWTPs.

Location	WAC available kg/day
Mogeely	5.7
Castlemartyr	6.3
Ladysbridge	9.4
Killeagh	8.4

Table 27.2 Maximum BOD loads without increasing by more than 1 mg/l downstream.

Location	Capacity proposed	Maximum BOD in discharge mg/l	BOD load kg/day	WAC available kg/day
Mogeely	500	34.6	3.1	5.7
Castlemartyr	3000	8.8	4.8	6.3
Ladysbridge	1000	29.2	5.3	9.4
Killeagh	2000	14.7	5.3	8.4

27.5 The BOD treatment standards required at the four inland WWTPs are indicated in the shaded column in table 27.2. From the table it is apparent that the proposed discharges at Mogeely and Ladysbridge will not result in downstream increases of more than 1 mg/l, even where treated to relatively lenient standards of 34 and 29 mg/l respectively. Conversely, treatment to a typical 20 mg/l standard will readily comply with this criterion. The table indicates that stricter treatment standards will be necessary at Castlemartyr and Killeagh in order to meet the criterion. The standard required at the former will be particularly onerous if a downstream increase of greater than 1 mg/l is to be avoided.

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27.6 Where the BOD concentrations in the treated wastewater streams will comply with the maximum limits presented in table 27.2, the daily BOD loads discharged will in all cases be less than the WAC available, ranging from 54% to 76% of the available capacities. It should be noted that these calculations are based on background BOD concentrations of 2 mg/l; concentrations are likely to be generally lower, thus providing greater assimilative capacities than indicated above. It should also be noted that the WAC specified for any watercourse is only indicative of the greatest extent to which the oxygen level in that watercourse may be theoretically depleted by the decomposition of organic matter present. In reality, factors such as low temperatures, aeration at turbulent riffles and other variables may prevent significant deoxygenating from occurring.

27.7 With respect to Ballymacoda, it was determined in 2002 that the WAC available in the local stretch of the Womanagh River was a significantly large 38 kg/day. It was noted that the concentration of BOD in a treated wastewater stream discharged to the Womanagh will not be a limiting factor, and a typical limit of 20 mg/l was recommended. This conclusion still applies.

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27.8 With a background BOD concentration of 1 mg/l in the Ballymacoda River as determined in 2002, the maximum BOD concentration in the proposed discharge from 1000 pe is required to be 5.3 mg/l in order to meet the 1 mg/l increase specified in Memorandum No. 1. Such a treatment standard is onerous. However, this level of treatment would result in a daily BOD discharge of 0.95 kg, well within the 1.8 kg/day WAC capacity estimated previously.

28. SUSPENDED SOLIDS

28.1 Of the various standards and articles of legislation discussed in part 2, the strictest suspended solids limits are specified in the Freshwater Fish Directive which notes that a guide limit of 25 mg/l of suspended solids is desirable in fresh waters. The same maximum concentration is specified by the Salmonid Waters Regulations. The application of this limit will ensure compliance with those specified in the Urban Waste Water Directive and in Memorandum No. 1.

28.2 The maximum concentration of suspended solids generally permitted in a treated wastewater discharge is 30 mg/l. Table 28.1 presents the resulting levels of suspended solids which will arise downstream of the five discharges proposed where a 30 mg/l is applied. Background suspended solids levels at the four inland sites are taken from table 11.1. Background concentrations at Ballymacoda are drawn from DixonBrosnan report 02001.

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Table 28.1 Suspended solids concentrations downstream of 30 mg/l discharges.

Location	River	Capacity proposed	Background SS mg/l	Downstream SS mg/l
Mogeely	Kiltha	500	5	5.8
Castlemartyr	Kiltha	3000	5	8.7
Ladysbridge	Womanagh	1000	13	13.6
Killeagh	Dissour	2000	5	7.0
Ballymacoda	Womanagh	1000	20	20.1
Ballymacoda	Ballymacoda	1000	5	10.8

28.3 The calculations presented in table 28.1 indicate that downstream suspended solids concentrations will not be significantly increased at most locations where a treatment standard of 30 mg/l is applied. The greatest increase will arise at Ballymacoda River where a limited dilution capacity prevails. Regardless of this increase, downstream levels at all sites will remain below the 25 mg/l limit specified in the Freshwater Fish Directive and Salmonid Waters Regulations. It follows that suspended solids discharge will not be a limiting factor at any of the study sites.

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29. NITROGEN

29.1 Elemental nitrogen may be present in a number of forms in a wastewater discharge. Ammonia and nitrates are of most significance, with the relative proportions of their take up by plants and algae varying with their ratio, the local conditions and the species involved. The nitrite form is an intermediate stage in the conversion of these two parameters.

29.2 Of greatest importance is that any proposed discharge does not elevate nitrate levels in the receiving watercourse significantly and does not affect the status of the aquatic environment with respect to the 11.3 mg/l N limit specified in the Nitrates Directive and the Surface Water Directive. It is noted that a figure of 11.3 mg/l N is a maximum value, and allowing levels of nitrate to rise close to this level is not recommended. A guide value equal to 50% of the mandatory value is considered an appropriate target, equivalent to 5.65 mg/l N.

29.3 Nitrogen present as nitrate will rarely impact directly on fish life and thus there are no limits specified in the Freshwater Fish Directive or Salmonid Regulations. Nitrite limits are specified under Quality of Salmonid Waters Regulations. Of more significance are levels of ammonia, particularly the un-ionised form. The European Inland Fisheries Advisory Commission (1970) have reported that an un-ionised concentration of 0.02 mg/l NH_3 will present a long term sublethal dose for salmonid and cyprinid fish. This level of 0.02 mg/l is specified under the Salmonid Regulations. The same regulations have specified a maximum total ammonium concentration of 1 mg/l N.

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29.4 Most modern packaged treatment units produce a nitrified effluent, with the major portion of nitrogen converted from ammonia to nitrates as a result of nitrification processes incorporated in the design. Due to the conversion dynamics within secondary stage treatment units, it is difficult to specify separate concentrations of ammonia and nitrates to be met in the treated effluent. The application of a total nitrogen limit, consisting of ammonia, nitrates and intermediate stages, provides a more common sense approach and limits below are specified accordingly.

29.5 Without the installation of specific nitrogen removal processes, secondary stage treatment units will not significantly reduce nitrogen levels but merely convert the various forms present to oxidised nitrate with consequent reductions in ammonia concentrations. The total nitrogen concentration in the treated wastewater stream is likely to be similar to the influent concentration of approximately 40 mg/l (taken from table 24.2). The modular design of packaged systems allows further nitrification to be introduced following commissioning. It is unlikely that a modern WWTP providing secondary stage treatment will result in problematic levels of ammonia. Nonetheless, it is recommended that the 1 mg/l N limit noted above is applied as a guide quality standard downstream of the mixing zone.

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29.6 With a total nitrogen concentration of 40 mg/l in the treated wastewater stream, the resulting downstream nitrate concentrations in the various watercourses may be determined. These concentrations are presented in table 29.1. For the purposes of the calculations, it is assumed that almost all of the nitrogen present in the discharges will be present as nitrate. The calculated concentrations do not change significantly where other assumptions are applied eg. that 80 or 90% of the nitrogen is present as nitrate. Background concentrations are taken from tables 9.4 and 11.1

Table 29.1 Total nitrogen concentrations downstream of 40 mg/l discharges.

Location	River	Capacity proposed	Background NO_3 mg/l N	Background NO_3 D/S of commercial discharge mg/l N	Downstream NO_3 mg/l N
Mogeely	Kiltha	500	6.09	7.25*	8.27
Castlemartyr	Kiltha	3000	6.23	-	11.19
Ladysbridge	Womanagh	1000	6.23	-	7.47
Killeagh	Dissour	2000	4.34	-	7.15
Ballymacoda	Womanagh	1000	4.30	-	4.83
Ballymacoda	Ballymacoda	1000	2.30	-	11.04

*See 29.8

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29.7 At all discharges, excluding that to the Womanagh River from Ballymacoda, the nitrate concentration downstream of the mixing zone will exceed the 5.65 mg/l guide value noted in 29.2. The concentration at Castlemartyr will be particularly unsatisfactory. The concentration in the Ballymacoda River will also be unsatisfactory if this option is applied at Ballymacoda. It is likely that removal of nitrogen will be required at all sites, except where the Ballymacoda discharge is piped to the Womanagh River.

29.8 It is noted that there is a significant discharge of 650 m^3/day from Dairygold with a licensed total nitrogen limit of 12 mg/l N. If it is assumed that this nitrogen exists as nitrate, calculations indicate that the discharge increases downstream nitrate levels from 6.09 mg/l N to 7.25 mg/l N during the March-September discharge period. The discharge of nitrogen from 500 pe will further increase downstream levels to 8.27 mg/l N.

29.9 As noted in 29.5, the majority of nitrogen in the treated wastewater stream will be present as oxidised nitrate. Calculations presented in table 29.2 indicate that, where 90% of the nitrogen is oxidised, the residual 4 mg/l of ammonia in the treated discharge will result in downstream concentrations generally below the 1 mg/l limit noted in 29.3. Concentrations will be significantly increased over background levels, however, providing further incentive to install nitrogen removal processes at the study sites.

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Table 29.2 Ammonia concentrations downstream of 4 mg/l discharges.

Location	River	Capacity proposed	Background NH_4 mg/l N	Background NH_4 D/S of commercial discharge mg/l N	Downstream NH_4 mg/l N
Mogeely	Kiltha	500	0.021	0.110	0.229
Castlemartyr	Kiltha	3000	0.026	-	0.610
Ladysbridge	Womanagh	1000	0.026	-	0.172
Killeagh	Dissour	2000	0.021	-	0.335
Ballymacoda	Womanagh	1000	0.15	-	0.210
Ballymacoda	Ballymacoda	1000	0.08	-	0.990

30. PHOSPHORUS

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30.1 Within the aquatic environment phosphorus will be present in a number of forms, both organic and inorganic, and within solution or bound in solids. The combination of all forms present is referred to as total phosphorus. A significant fraction of total phosphorus is available for biological metabolism and is termed orthophosphate. The analytical procedure used in the determination of orthophosphate is the molybdate reactive method which is used to derive the concentration of molybdate reactive phosphate (MRP) in a sample. Although the MRP may slightly overestimate the level of orthophosphate present the two expressions have become synonymous.

30.2 Despite the important role of phosphorus and orthophosphate in eutrophication, few water quality standards specify guideline or maximum allowable concentration values. The introduction of the Phosphorus Regulations in 1998 changed this situation, and the Regulations have now become the most significant quality criteria in assessing discharges to waters. Target values specified in the Regulations are indicated in table 17.1.

30.3 On the basis of site surveys undertaken during the preparation of this report, and following a review of EPA monitoring data, existing Q values at the four inland sites were ascertained. From these values, the equivalent background MRP concentrations were determined. These figures are summarised in table 11.1. At three of the four sites Q4 values were awarded, corresponding to an orthophosphate level of 0.03 mg/l P. The situation at Castlemartyr is more complex, and a Q3-4 value and background orthophosphate level of 0.05 mg/l P was measured.

30.4 Modern treatment plants can lower the discharge concentration of total phosphorus to 2 mg/l P. 1 mg/l is technically difficult to achieve. The concentration of orthophosphate present will usually be approximately 80% of the total phosphorus, equivalent to 1.6 mg/l and 0.8 mg/l P respectively.

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30.5 Table 30.1 presents the likely downstream concentrations of MRP arising from the discharges proposed at the four inland WWTPs. The table indicates that the discharges will result in significant increases in the receiving waters. In this context, treatment to a 1 mg/l total phosphorus standard will be required as a minimum at the four inland plants.

Table 30.1 MRP concentrations downstream of four inland WWTPs.

Location	Capacity proposed	Background MRP mg/l P	Downstream MRP where effluent MRP = 1.6 mg/l P	Downstream MRP where effluent MRP = 0.8 mg/l P
Mogeely	500	0.03	0.078	0.054
Castlemartyr	3000	0.05	0.261	0.143
Ladysbridge	1000	0.03	0.088	0.058
Killeagh	2000	0.03	0.154	0.091

30.6 The proximity of Mogeely and Castlemartyr requires that cumulative impacts are considered. The most significant discharge at Mogeely arises from the Dairygold facility, equivalent to 3610 pe at an estimated discharge concentration of 0.6 mg/l P orthophosphate. Applied to an estimated upstream orthophosphate concentration of 0.03 mg/l, the Dairygold discharge increases the concentration to 0.136 mg/l P. The proposed discharge of 500 pe from Mogeely, at a treatment standard of 0.8 mg/l P orthophosphate, will further increase the downstream level to 0.156 mg/l P.

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30.7 Based on these calculations, the background orthophosphate concentration upstream of Castlemartyr will be 0.156 mg/l P. However, the Dairygold discharge arises only during the period March-September. It is not clear what proportion of the discharged phosphate becomes bound up in sediments and aquatic plants in the stretch of river between Mogeely and Castlemartyr resulting in year-round release of orthophosphate. A reasonable approach is to assume that the higher value of 0.05 mg/l orthophosphate, presented in table 11.1 as the background orthophosphate concentration at Castlemartyr, already factors in the discharges from Mogeely.

30.8 At Ballymacoda, it was concluded in 2002 that the discharge of a treated wastewater stream containing 2 mg/l of total phosphorus directly to the Womanagh River will not result in a significant increase in the downstream concentration. With a significantly large dilution available, calculations indicate that downstream concentrations of MRP are likely to rise by less than 0.02 mg/l as a result of the proposed discharge, a relatively low increase in an estuarine environment. It follows that a 2 mg/l treatment standard may be applied in this case.

30.9 Due to the limited dilution available in the Ballymacoda River, the discharge of 2 mg/l total phosphorus from 1000 pe will increase the background MRP concentration by 0.36 mg/l to 0.42 mg/l. Treatment to a 1 mg/l standard will result in an increase of 0.17 mg/l. These increases are significantly high. Following the assessment of this discharge possibility in 2002, it was concluded that such a discharge should be allowed only where a constructed wetland system is installed and an intensive monitoring routine put in place.

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31. PATHOGENS

31.1 Table 24.2 indicates that domestic wastewater will contain on average 100 million and 40 million colony forming units of total and faecal coliforms respectively per 100 ml. These organisms, while not overtly pathogenic in themselves, are used as indicators of pathogenic activity. Due to growth and decay dynamics within bacterial populations, normal mass balance calculations cannot be applied in the assessment of bacteriological impacts. Significant variations in local environmental conditions and wastewater microbiological characteristics do not facilitate the generation of discharge-specific models.

31.2 All treatment processes applied to wastewater will provide some degree of coliform reduction, usually via the filtration of suspended solids in the wastewater stream. Gray (1999) reports that conventional treatment will remove up to 90% of bacterial pathogens, with tertiary treatment increasing this to 98%. Further reduction to 99.99% may be achieved using disinfection. He also notes that dilution and the effects of natural biotic and abiotic factors in surface waters will reduce the density of pathogens further.

31.3 In 13.4 and 15.3 it is noted that the microbiological quality of the waters around Youghal Bay are of importance and that the proposed discharges should not interfere with same. However, given the difficulties associated with the modelling of microbiological impacts of a discharge, the varying treatment abilities of treatment plants, and the absence of coliform quality objectives applicable to treated discharges, no specific coliforms standards are recommended. It is instead recommended that a monitoring programme is undertaken following the commissioning of each WWTP. An ongoing examination of key microbiological parameters, including total and faecal coliforms, faecal streptococci and sulphite reducing clostridia, may be used to determine the overall treatment efficiency of each plant.

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31.4 It is also recommended that the design of each WWTP be such that the post installation of disinfection equipment is facilitated. This recommendation applies particularly to the proposed discharge at Ballymacoda.

32. WWTP SUMMARIES

32.1 Mogeely

32.1.1 Two discharges to the Kiltha River currently arise at Mogeely: a municipal discharge from 100 pe and a licensed discharge from Dairygold. Both are treated in WWTPs. The outfalls are located in close proximity to each other, and their impacts on the watercourse are therefore cumulative. Cork County Council proposes to increase

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the capacity of the municipal WWTP to 500 pe Site investigations indicate that there is little or no visual evidence of significant impacts on the Kiltha River specifically arising from the current discharge of 100 pe

32.1.2 The discharge from Dairygold's facility at Mogeely is significantly greater than from the municipal WWTP. The discharge of approximately 650 m^3/day, equating to over 3600 pe, contains a treated MRP concentration of approximately 0.6 mg/l P. This discharge, coupled with the proposed increase in the municipal plant capacity to 500 p.e., will result in a combined downstream increase in MRP levels to approximately 0.156 mg/l P. This significantly high concentration will result even where the total phosphorus concentration in the municipal discharge is treated to 1 mg/l P.

32.1.3 The utilisation of most of the WAC available at this location leaves little spare capacity for significant increases in the municipal plant. Treatment of BOD to a 10 mg/l standard will result in a daily BOD load of 0.9 kg, bringing the total BOD load at this location to almost 5 kg/day, 88% of the total available. It is generally advisable to maintain a reserve assimilative capacity of at least 30% to allow effective management of natural fluctuations in organic load. In this context, treatment towards a 5 mg/l target is advisable. No restrictions apply to the suspended solids concentration in the treated municipal discharge, and conventional treatment standards of 30 mg/l will suffice here. Nitrogen removal will be required in the plant.

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32.2 Castlemartyr

32.2.1 The EPA monitoring station at Castlemartyr Bridge has consistently exhibited unsatisfactory water quality since 1997. The EPA notes that the Dairygold discharge at Mogeely is the likely cause. The EPA also notes that the existing discharge from the WWTP at Castlemartyr is negatively affecting water quality downstream at Ballyhonock.

32.2.2 Cork County Council proposes to increase the capacity of the WWTP, the largest in the catchment, from 1500 to 3000 pe Flow data indicate that this increase will result in a dilution factor of less than 1:6. Compliance with the traditional 1:8 standard would limit the WWTP capacity to approximately 2200 pe The limited dilution available also has implications for BOD: a treatment standard of 10 mg/l will result in a downstream increase of greater than 1 mg/l (1.2 mg/l), and will utilise 85% of the available WAC. It is advisable that a stricter BOD limit is applied to the treated discharge, and BOD performance should be made an important criterion when comparing WWTP tenders.

32.2.3 Due to the elevated nitrate concentrations detected in this stretch of the Kiltha River, and the limited dilution available, nitrogen removal will be required. The total phosphorus concentration will need to be reduced to 1 mg/l as a minimum in the treated discharge.

32.2.4 Monitoring data supplied by Response Engineering Ltd. who operate the existing WWTP at Castlemartyr indicate that total phosphorus concentrations in the discharge averaged 5.54 mg/l P in 2005, with a median of 4.07

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mg/l P. The average daily discharge of phosphorus is estimated at 1.5 kg/day P. Despite this load, a Q value of Q4 was assigned 50 m downstream of the WWTP outfall during the preparation of this report, suggesting that the current discharge may be having a limited and/or local impact only. With treatment to a standard of 1 mg/l of total phosphorus, the proposed discharge from 3000 pe will result in a significantly smaller load of 0.54 kg/day P. This estimate is of course based entirely on satisfactory compliance with the 1 mg/l P standard.

32.2.5 It is noted that the proposed increase to a population equivalent of 3000 has the potential to negatively impact on the watercourse. It is recommended therefore that the impact be reassessed on an ongoing basis through EPA Q values and Cork County Council water quality data where relevant. It is also recommended that site specific biological and physicochemical surveys are undertaken downstream of the discharge. It is recommended that this assessment be carried out prior to the population equivalent reaching 2200 pe

32.3 Ladysbridge

32.3.1 While EPA monitoring data suggest eutrophication in the middle stretch of the Womanagh River, which includes Ladysbridge, investigations undertaken by DixonBrosnan indicate fair-good water quality immediately upstream of Ladysbridge. These investigations also suggest that the existing WWTP discharge is impacting significantly on water quality.

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32.3.2 It is proposed to install a new WWTP to cater for up to 1000 pe The existing poor quality discharge will be eliminated. Ample dilution is available to accept the increased wastewater volume, and the available waste assimilative capacity is entirely sufficient. Treatment to a conventional BOD/suspended solids standard of 20/30 mg/l will be adequate. In the interest of improving water quality in the middle and lower reaches of the Womanagh catchment, treatment to a 10/15 mg/l standard is preferable, particularly in light of elevated suspended solids concentrations seen during site surveys.

32.3.3 As before, the installation of a nitrogen removal process will be required to maintain the downstream nitrate level below the 5.65 mg/l N limit noted in 30.2. Phosphorus treatment to a 1 mg/l P standard is also advisable.

32.3.4 It is noted that the current wastewater discharge at Ladysbridge approaches 500 pe which is directed to the Womanagh River via an overloaded septic tank. The main function of a septic tank is to act as a primary settlement tank, removing some of the BOD and the majority of the suspended solids. The EPA document *Wastewater treatment manuals: Primary, secondary and tertiary treatment* (1997) estimates that typically 50-70% of suspended solids are removed in primary settlement tanks; BOD is reduced by 20-50% and the bacterial count by 25-75%. In this instance, due to overloading of the septic tank, the level of treatment provided is likely to be very low.

32.3.5 Table 24.2 indicates that the mean orthophosphate concentration in a typical influent stream is 7.1 mg/l, equating to approximately 8.9 mg/l of total phosphorus. If it is conservatively assumed that the septic tank at

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Ladysbridge reduces the total phosphorus concentration to 5 mg/l, the daily load discharged to the river from the 500 pe served may be estimated at 0.45 kg P. Following the proposed upgrade, the discharge of treated wastewater from 1000 pe containing 1 mg/l of total phosphorus, as recommended in 32.3.3, will result in a discharge load of 0.18 kg/day P. It follows that, with a 1 mg/l P treatment standard, the proposed WWTP upgrade will significantly reduce the daily total phosphorus load discharged to the Womanagh River at this location.

32.4 Killeagh

32.4.1 Monitoring data recorded by the EPA, Cork County Council and DixonBrosnan during the preparation of this report indicate satisfactory water quality at Killeagh. Nitrate and median MRP concentrations have generally been lower here than at the other sites, due most likely to limited development and discharges in the upstream Dissour River and at Killeagh village.

32.4.2 Cork County Council proposes to increase the capacity of the WWTP at Killeagh from 850 to 2000 pe The available dilution will exceed the traditional 1:8 standard. At 1:11.7, however, the dilution will not be great enough to preclude the need for nitrogen removal.

32.4.3 The available WAC to accept the proposed increase is adequate. No BOD or suspended solids restrictions will apply, and thus a 20/30 mg/l standard will suffice. As before, a treated phosphorus concentration of 1 mg/l will be necessary to minimise downstream increases in the Dissour River.

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32.4.4 2005 monitoring data provided by Response Engineering Ltd. indicate a mean total phosphorus concentration of 2.63 mg/l P in the treated effluent. The daily phosphorus load discharged to the Dissour River at this location is estimated at 0.40 kg P. If a final treatment standard of 1 mg/l total phosphorus is successfully applied at the upgraded plant, the total load discharged from 2000 pe will be 0.36 kg/day P, representing a reduction of 10% in the current load discharged. It is also noted that, although the existing discharge at Killeagh may be having a localised impact, it appears that the ecology of the river recovers relatively quickly. There may be limited impacts further downstream.

32.5 Ballymacoda

32.5.1 Following an assessment of local conditions at Ballymacoda in 2002, two discharge options were presented. Both options were reassessed in light of the increased treatment capacity to 1000 pe now proposed. The less practical of these, disposal to the Womanagh River via a direct main of approximately 1000 m in length, will allow ready compliance with all relevant water quality criteria due to the considerable dilution available. A BOD/suspended solids standard of 20/30 mg/l and a total phosphorus concentration of 2 mg/l in the treated effluent will suffice. Nitrogen removal will not be required, although its inclusion is preferable in a discharge to an estuarine environment, particularly as nitrate levels remain elevated in the Womanagh system.

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32.5.2 While water quality criteria favour direct disposal to the Womanagh, engineering constraints favour the alternative: disposal to the Ballymacoda River. With a severely restricted dilution of less than 1:4, it is unlikely than most water quality criteria will be met in the river. The BOD concentration will need to be reduced towards 5 mg/l to allow direct compliance with Memorandum No. 1. Nitrogen and phosphorus removal will also be required. It was concluded in the DixonBrosnan report 02001 that, despite these limitations, disposal to the Ballymacoda River represents a practical alternative. The reasons put forward in 2002 still apply with the increased load currently proposed, and they are reproduced below:

A. The river lies relatively close to the WWTP site, with no difficult features to be crossed in the intervening terrain such as roads or rivers.
B. The management of river flow by a sluice limits tidal input, thereby reducing the possibility of backwashing up the river. The sluice control also provides an effective flushing system.
C. A survey of the river indicates that it has suffered limited damage from the imperfect discharge which it has been receiving for some years. The river would appear to have a significant capacity to accept and assimilate wastewater.
D. The ecology of the river, particularly in sluggish areas with extensive macrophyte development, is quite similar to that seen in constructed wetlands. The river may provide an ideal natural environment to assimilate a polished wastewater.
E. While the ecology of the river may be ideal, it is not of biological significance. No rare or unusual species were noted during site surveys, and the river is not of fisheries importance.
F. The available dilution was determined using the estimated 95th percentile flow. The normal flow is likely to significantly exceed this level; the EPA notes that the average flows in Irish rivers correspond to the 30th percentile flow.
G. Approximately 900 m downstream of the likely outfall location, the available dilution increases 20-fold where the Ballymacoda River meets the Womanagh. Accordingly the river stretch subject to any immediate impacts will be limited.

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32.5.3 It is considered that disposal to the Ballymacoda River remains a practical option if water quality criteria can be relaxed over its short stretch to the Womanagh. Innovative engineering solutions may be required to incorporate the river into a satisfactory wastewater treatment proposal. It is recommended that any solutions proposed include the installation of a constructed wetland to provide flow balancing and additional reduction in BOD, nitrogen, phosphorus and pathogen concentrations.

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33.1 The calculations detailed in this report have generally focused on the individual settlements rather than the catchment as a whole. Of the various discharge parameters, phosphorus is the most limiting factor and is also the most difficult to remove using modern wastewater treatment plants. This sections therefore focuses on this parameter although it may be relevant for other parameters.

33.2 The impacts of phosphorus will vary and how it effects a given watercourse will be affected by elements such as shade levels, plant growth, current and disturbance of the channel. There may also be impacts considerable distances away from the discharge point and cumulative impacts from different discharge points. Thus there is merit in considering impacts on an overall catchment basis.

33.3 Although exact measurements are outside the scope of this report, investigations across the study site suggest that the main sources of phosphorus are as follows:

A. Agricultural sources.
B. One off dwellings and septic tanks.
C. Commercial discharges.
D. Discharges from wastewater treatment plants.

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33.4 It would appear that there are no significant commercial or residential discharges upstream of Mogeely, and therefore phosphorus loadings upstream of the village are generally derived from agricultural sources and/or from one off dwellings. These loadings may be extrapolated to determine agricultural and residential derived inputs from the overall catchment.

33.5 The median MRP concentration determined for the only monitoring site upstream of Mogeely (station 0700) was 0.034 mg/l (from table 7.1). Data provided by Met Eireann indicate that the long term (1961-1990) average rainfall is 1000-12000mm per annum. The average applied across the country by the EPA hydrometric office is 1150mm. The average runoff within a catchment is the total rainfall less evapotranspiration losses and, where the groundwater resource is small, can be defined as the average river flow. The average evapotranspiration loss in Ireland is estimated at 450 mm, and thus the average total runoff is estimated at some 700 mm per year. Based on these figures the EPA hydrometric office calculates the average run off in the southern region at 27 l/s/km^2.

33.6 The catchment area contributing to flows at monitoring station 0700 is estimated at 20.4 km^2. The average flow is calculated at 551 l/s. With a median MRP concentration 0.034 mg/l, the daily orthophosphate loading at this point is estimated at 1.6 kg/day orthophosphate, equivalent to 580 kg/year. The unit orthophosphate load is calculated at 0.08 kg/km^2/day, or 29 kg/km^2/year.

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33.7 Although the intensity of agricultural management and number of one off dwellings will vary, it is assumed for the purposes of this report that the subcatchment upstream of Mogeely is similar to the remainder of the catchment. With a total surface area of 165 km^2, the total orthophosphate loading within the entire Womanagh catchment attributable to agriculture and one off dwellings is calculated at 13.2 kg/day or 4820 kg/year.

33.8 The only large scale discharge noted in the catchment arises from Dairygold at Mogeely. The orthophosphate loading from this site was estimated in 3.2.10 at 0.39 kg/day, totalling 83 kg over the operations period.

33.9 Estimated orthophosphate loadings from the existing WWTP sites are detailed in table 33.1. Table 33.2 indicates the proposed upgrade loadings. A comparison between the tables indicates that incorporation of the recommended treatment standards into the proposed upgrades will result reduce current orthophosphate loadings from the WWTPs by almost half.

Table 33.1 Estimated orthophosphate loadings from existing WWTPs.

WWTP	Current pe	Orthophosphate discharged mg/l	Orthophosphate discharged kg/day	Orthophosphate discharged kg/year
Mogeely	100	2.0[1]	0.04	15
Castlemartyr	1500	4.4[2]	1.19	434
Ladysbridge	500	4.0[3]	0.36	131
Killeagh	850	2.1[4]	0.32	117
Ballymacoda	500	4.0[3]	0.36	131
Total			2.27	828

[1]Assumed conservative treatment standard of 2 mg/l.

[2]From mean total phosphorus value of 5.54 mg/l derived from sample results. Assumed 80% orthophosphate ie. 4.4 mg/l.

[3]Mean orthophosphate concentration in typical influent stream is 7.1 mg/l (table 24.2). Assumed this is reduced to 4 mg/l orthophosphate by septic tank.

[4]Phosphorus concentration in discharge is calculated at 2.63 mg/l. Assumed 80% orthophosphate ie. 2.1 mg/l.

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Table 33.2 Estimated orthophosphate loadings from upgraded WWTPs.

WWTP	Proposed pe	Proposed orthophosphate treatment mg/l	Orthophosphate discharged kg/day	Orthophosphate discharged kg/year
Mogeely	500	0.8 (1 total P)	0.07	26
Castlemartyr	3000	0.8 (1 total P)	0.43	157
Ladysbridge	1000	0.8 (1 total P)	0.14	51
Killeagh	2000	0.8 (1 total P)	0.29	106
Ballymacoda	1000	1.6 (2 total P)	0.29	106
Total			1.22	446

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33.10 Figures 3 and 4 present a comparison between all loadings arising from within the Womanagh catchment. Figure 3 shows the current situation, while figure 4 represents loadings following the proposed upgrade programme.

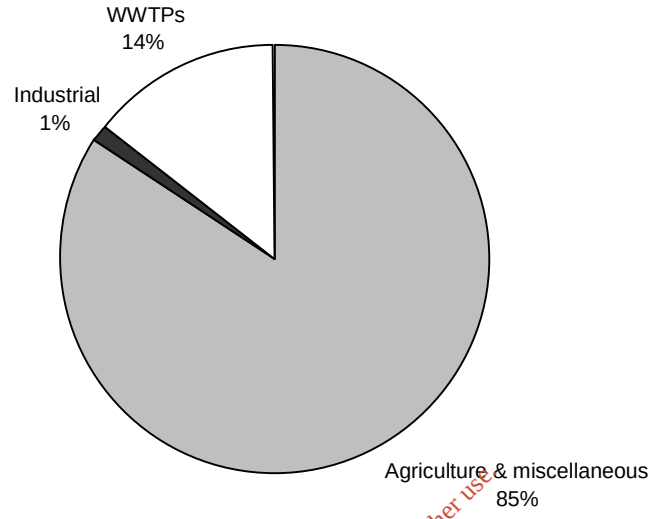

Figure 3. Current loading sources in Womanagh catchment.

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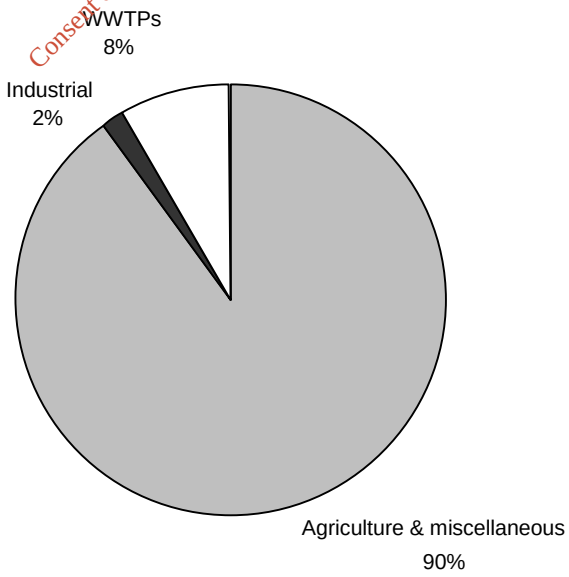

Figure 4. Loadings in Womanagh catchment following proposed upgrade programme.

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33.11 The figures above indicate the predominance of agricultural and miscellaneous sources such as one of houses. Most orthophosphate discharging to the Womanagh is derived from these sources. The proportion of orthophosphate reaching the river from the wastewater treatment plants is relatively low. This proportion will decrease by approximately 50% following their upgrade. d will decrease further following upgrades of the treatment plants. In this context, changes in agricultural management, and correct management of septic tanks associated with houses, has the potential to significantly reduce inputs of orthophosphate reaching the aquatic environment. Given the difficulties associated with orthophosphate reduction at WWTPs, where high costs are required to obtain marginal improvements in treatment efficiencies, the practical advantages of focussing on extensive sources across the catchment cannot be ignored.

33.12 It should be noted that, although calculations indicate that orthophosphate loadings from the WWTPs will be reduced, there is significant pressure on the available assimilative capacity within the catchment.

34. OTHER CONSIDERATIONS

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34.1 As nitrification processes may interfere with the wastewater pH, it is recommended that the effluent discharges from all WWTPs are monitored to ensure the pH does not fall outside the range 6-9 where such processes are employed.

34.2 It is recommended that any existing discharges be removed following commissioning of upgraded plants. It is also advisable that an assessment be carried out of all premises to ensure that grey water entry to the surface water system is limited.

34.3 It is recommended that grit traps, grease traps and interceptors as appropriate are stipulated in planning permissions granted to any commercial developments intending to discharge to the Womanagh.

34.4 In the final selection of WWTP units it is recommended that the following criteria be applied by each supplier at the design stage:

A. WWTPs should be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.
B. Seasonal variations of the load should be taken into account, particularly at Ballymacoda.
C. Provision should be made for possible future retrofitting of additional nitrogen removal and disinfection processes.
D. Sampling points should be provided on the influent and effluent lines to each WWTP unit.

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34.5 The EPA's noise guidance note states that the noise level at a sensitive location should not exceed 55 dB during daytime hours and 45 dB at night-time. As the proposed WWTPs will be operative during both periods, it is recommended that the 45 dB limit is applied. In order to meet this limit, and also to prevent odour nuisance, it is recommended that a buffer zone of at least 50 m is allowed between the site of the each WWTP and the nearest existing development, of which 30 m or more should lie within the WWTP site boundary.

34.6 Modern treatment plants if correctly maintained should not cause excessive odours and similarly noise pollution is unlikely to be a significant issue. However it is important that both noise and odour are assessed on an ongoing basis. The treatment plants to be used should allow retrospective fitting of control systems should odour become a problem in the future.

34.7 It is advisable that a maintenance contract is agreed with each WWTP supplier.

34.8 It is recommended that any proposed upgrades to new or existing WWTPs or any increases in loadings to the plants are accompanied by a reassessment of waste assimilative capacities in the local catchment.

34.9 The construction phases of each WWTP upgrade should be carried out in a manner which does not interfere with adjacent watercourses in any way. Untreated discharges during the construction phase and during commissioning should not be permitted.

34.10 At all plants, and particularly at Ballymacoda, it is recommended that a pathogen monitoring programme is undertaken following the commissioning of the WWTP selected. The design and layout of each WWTP should provide for retrofitting of disinfection equipment if deemed necessary.

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Appendix 1: Surface water discharges in Womanagh catchment.

Appendix 2: Desktop flow assessment.

Appendix 3: Site synopses.

Appendix 4: Extract from Cork County Council Phosphorus Regulations Implementation Report 2004.

Appendix 5: Biological survey species list.

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Agglomeration details

Leading Local Authority	Cork County Council
Co-Applicants	
Agglomeration	Ladysbridge
Population Equivalent	950
Level of Treatment	Secondary
Treatment plant address	Ladysbridge WWTP
Grid Ref (12 digits, 6E, 6N)	197033 / 071948
EPA Reference No:	

Contact details

Contact Name:	Patricia Power
Contact Address:	Water Services South, Cork County Council, County Hall, Carrigrohane Road, Co. Cork
Contact Number:	021 4285285
Contact Fax:	021 4276321
Contact Email:	patricia.power@corkcoco.ie

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Table D.1(i)(a): EMISSIONS TO SURFACE/GROUND WATERS (Primary Discharge Point)

Discharge Point Code: SW-1

Local Authority Ref No:	SW01LADY	
Source of Emission:	Primary Discharge	
Location:	Carewswood	
Grid Ref (12 digits, 6E, 6N)	197057 / 071972	
Name of Receiving waters:	Womanagh River	
Water Body:	River Water Body	
River Basin District	South Western RBD	
Designation of Receiving Waters:	SPA, SAC	
Flow Rate in Receiving Waters:	0	$m^3.sec^{-1}$ Dry Weather Flow
	0.301	$m^3.sec^{-1}$ 95% Weather Flow
Additional Comments (e.g. commentary on zero flow or other information deemed of value)	recent shellfish designation of Ballymacoda /Youghal Bay - estuarine waters of river SPA, SAC - estuarine waters of river Information on DWF of receiving water unavailable at time of submission	

Emission Details:

(i) Volume emitted			
Normal/day	212 m^3	Maximum/day	675 m^3
Maximum rate/hour	57.6 m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	0.003 m^3/sec		

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Table D.1(i)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of The Emission (Primary Discharge Point)

Discharge Point Code: SW-1

Substance	As discharged			
	Unit of Measurement	Sampling Method	Max Daily Avg.	kg/day
pH	pH	24 hr composite	= 9	
Temperature	°C	24 hr composite	= 25	
Electrical Conductivity (@ 25°C)	µS/cm	24 hr composite	= 1000	
Suspended Solids	mg/l	24 hr composite	= 35	23.63
Ammonia (as N)	mg/l	24 hr composite	= 0	0
Biochemical Oxygen Demand	mg/l	24 hr composite	= 15	10.13
Chemical Oxygen Demand	mg/l	24 hr flow proportional	= 125	84.38
Total Nitrogen (as N)	mg/l	24 hr composite	= 35	23.63
Nitrite (as N)	mg/l	24 hr composite	= 0	0
Nitrate (as N)	mg/l	24 hr composite	= 0	0
Total Phosphorous (as P)	mg/l	24 hr composite	= 8	5.4
OrthoPhosphate (as P)	mg/l	24 hr composite	< 2	1.33
Sulphate (SO_4)	mg/l	24 hr composite	= 0	0
Phenols (Sum)	µg/l	24 hr composite	= 0	0

For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

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Table D.1(i)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of The Emission (Primary Discharge Point)

Discharge Point Code: SW-1

Substance	As discharged			
	Unit of Measurement	Sampling Method	Max Daily Avg.	kg/day
Atrazine	µg/l	24 hr composite	= 0	0
Dichloromethane	µg/l	24 hr composite	= 0	0
Simazine	µg/l	24 hr composite	= 0	0
Toluene	µg/l	24 hr composite	= 0	0
Tributyltin	µg/l	24 hr composite	= 0	0
Xylenes	µg/l	24 hr composite	= 0	0
Arsenic	µg/l	24 hr composite	= 0	0
Chromium	µg/l	24 hr composite	= 0	0
Copper	µg/l	24 hr composite	= 0	0
Cyanide	µg/l	24 hr composite	= 0	0
Flouride	µg/l	24 hr composite	= 0	0
Lead	µg/l	24 hr composite	= 0	0
Nickel	µg/l	24 hr composite	= 0	0
Zinc	µg/l	24 hr composite	= 0	0
Boron	µg/l	24 hr composite	= 0	0
Cadmium	µg/l	24 hr composite	= 0	0
Mercury	µg/l	24 hr composite	= 0	0
Selenium	µg/l	24 hr composite	= 0	0
Barium	µg/l	24 hr composite	= 0	0

For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

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Table D.1(iii)(a): EMISSIONS TO SURFACE/GROUND WATERS (Storm Overflow)

Discharge Point Code: SW-2

Local Authority Ref No:	SW02LADY	
Source of Emission:	Strom Water Overflow	
Location:	River	
Grid Ref (12 digits, 6E, 6N)	197057 / 071972	
Name of Receiving waters:	Womanagh River	
Water Body:	River Water Body	
River Basin District	South Western RBD	
Designation of Receiving Waters:	SPA, SAC	
Flow Rate in Receiving Waters:		$m^3.sec^{-1}$ Dry Weather Flow
	0.301	$m^3.sec^{-1}$ 95% Weather Flow
Additional Comments (e.g. commentary on zero flow or other information deemed of value)	The volume of discharge is not available.	

Emission Details:

(i) Volume emitted			
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	min/hr hr/day day/yr
Dry Weather Flow	m^3/sec		

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TABLE E.1(i): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Primary and Secondary Discharge Points

Identification Code for Discharge point	Frequency of discharge (days/annum)	Quantity of Waste Water Discharged (m^3/annum)
SW-1	365	77380

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TABLE E.1(ii): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Storm Water Overflows

Identification Code for Discharge point	Frequency of discharge (days/annum)	Quantity of Waste Water Discharged (m^3/annum)	Complies with Definition of Storm Water Overflow
SW-2			No

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TABLE F.1(i)(a): SURFACE/GROUND WATER MONITORING

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1d
Grid Ref (12 digits, 6E, 6N)	198612 / 072455

Parameter	Results (mg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	09/10/08	27/11/08	01/01/09				
pH		= 7.7			Grab	2	Electrochemical
Temperature			= 0		Grab	0	Electrochemical
Electrical Conductivity (@ 25°C)		= 403			Grab	0.5	Electrochemical
Suspended Solids		< 2.5			Grab	0.5	Gravimetric
Ammonia (as N)		< 0.1			Grab	0.02	Colorimetric
Biochemical Oxygen Demand		< 1.2			Grab	0.06	Electrochemical
Chemical Oxygen Demand		< 21			Grab	8	Digestion & Colorimetric
Dissolved Oxygen			= 0		Grab	0	ISE
Hardness (as $CaCO_3$)			= 0		Grab	0	Titrimetric
Total Nitrogen (as N)		= 15			Grab	0.5	Digestion & Colorimetric
Nitrite (as N)		= 0.0238			Grab	0	Colorimetric
Nitrate (as N)		= 7			Grab	0.5	Colorimetric
Total Phosphorous (as P)		< 0.2			Grab	0.2	Digestion & Colorimetric
OrthoPhosphate (as P)	< 0.05	< 0.05			Grab	0.02	Colorimetric
Sulphate (SO_4)		< 30			Grab	30	Turbidimetric
Phenols (Sum)		< 0.1			Grab	0.1	GC-MS2

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For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

Additional Comments:	

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TABLE F.1(i)(b): SURFACE/GROUND WATER MONITORING (Dangerous Substances)

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1d
Grid Ref (12 digits, 6E, 6N)	198612 / 072455

Parameter	Results (µg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	27/11/08	01/01/09					
Atrazine	< 0.01				Grab	0.96	HPLC
Dichloromethane	< 1				Grab	1	GC-MS1
Simazine	< 0.01				Grab	0.01	HPLC
Toluene	< 1				Grab	0.02	GC-MS1
Tributyltin		= 0			Grab	0.02	GC-MS1
Xylenes	< 1				Grab	1	GC-MS1
Arsenic	< 0.96				Grab	0.96	ICP-MS
Chromium	< 20				Grab	20	ICP-OES
Copper	< 20				Grab	20	ICP-OES
Cyanide	< 5				Grab	5	Colorimetric
Flouride	= 37				Grab	100	ISE
Lead	= 20				Grab	20	ICP-OES
Nickel	< 20				Grab	20	ICP-OES
Zinc	< 20				Grab	20	ICP-OES
Boron	< 20				Grab	20	ICP-OES
Cadmium	< 20				Grab	20	ICP-OES
Mercury	< 0.2				Grab	0.2	ICP-MS
Selenium	= 1.5				Grab	0.74	ICP-MS
Barium	= 27				Grab	20	ICP-OES

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Additional Comments:	TBT value is 0.02ug/l as Sn no requirement for TBT testing in freshwater samples

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TABLE F.1(i)(a): SURFACE/GROUND WATER MONITORING

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1u
Grid Ref (12 digits, 6E, 6N)	196980 / 071900

Parameter	Results (mg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	09/10/08	27/11/08	01/01/09				
pH		= 7.7			Grab	2	Electrochemical
Temperature			= 0		Grab	0	Electrochemical
Electrical Conductivity (@ 25°C)		= 318			Grab	0.5	Electrochemical
Suspended Solids		< 2.5			Grab	0.5	Gravimetric
Ammonia (as N)		< 0.1			Grab	0.02	Colorimetric
Biochemical Oxygen Demand		= 1.1			Grab	0.06	Electrochemical
Chemical Oxygen Demand		< 21			Grab	8	Digestion & Colorimetric
Dissolved Oxygen			= 0		Grab	0	ISE
Hardness (as $CaCO_3$)			= 0		Grab	0	Titrimetric
Total Nitrogen (as N)		= 9			Grab	0.5	Digestion & Colorimetric
Nitrite (as N)		= 0.0241			Grab	0	Colorimetric
Nitrate (as N)		= 6.77			Grab	0.5	Colorimetric
Total Phosphorous (as P)		< 0.2			Grab	0.2	Digestion & Colorimetric
OrthoPhosphate (as P)	< 0.05	< 0.05			Grab	0.02	Colorimetric
Sulphate (SO_4)		< 30			Grab	30	Turbidimetric
Phenols (Sum)		< 0.1			Grab	0.1	GC-MS 2

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For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

Additional Comments:	

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TABLE F.1(i)(b): SURFACE/GROUND WATER MONITORING (Dangerous Substances)

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1u
Grid Ref (12 digits, 6E, 6N)	196980 / 071900

Parameter	Results (µg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	27/11/08	01/01/09					
Atrazine	< 0.01				Grab	0.96	HPLC
Dichloromethane	< 1				Grab	1	GC-MS1
Simazine	< 0.01				Grab	0.01	HPLC
Toluene	< 1				Grab	0.02	GC-MS1
Tributyltin		= 0			Grab	0.02	GC-MS1
Xylenes	< 1				Grab	1	GC-MS1
Arsenic	< 0.96				Grab	0.96	ICP-MS
Chromium	< 20				Grab	20	ICP-OES
Copper	< 20				Grab	20	ICP-OES
Cyanide	< 5				Grab	5	Colorimetric
Flouride	= 41				Grab	100	ISE
Lead	= 25				Grab	20	ICP-OES
Nickel	< 20				Grab	20	ICP-OES
Zinc	< 20				Grab	20	ICP-OES
Boron	< 20				Grab	20	ICP-OES
Cadmium	< 20				Grab	20	ICP-OES
Mercury	< 0.2				Grab	0.2	ICP-MS
Selenium	= 1.6				Grab	0.74	ICP-MS
Barium	= 29				Grab	20	ICP-OES

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Additional Comments:	TBT value is 0.02ug/l as Sn no requirement for TBT testing

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Annex 2: Check List For Regulation 16 Compliance

Regulation 16 of the waste water discharge (Authorisation) Regulations 2007 (S.I. No. 684 of 2007) sets out the information which must, in all cases, accompany a discharge licence application. In order to ensure that the application fully complies with the legal requirements of regulation 16 of the 2007 Regulations, all applicants should complete the following.

In each case, refer to the attachment number(s), of your application which contains(s) the information requested in the appropiate sub-article.

Regulation 16(1) **In the case of an application for a waste water discharge licence, the application shall -**		**Attachment Number**	**Checked by Applicant**
(a)	give the name, address, telefax number (if any) and telephone number of the applicant (and, if different, of the operator of any treatment plant concerned) and the address to which correspondence relating to the application should be sent and, if the operator is a body corporate, the address of its registered office or principal office,	B1	Yes
(b)	give the name of the water services authority in whose functional area the relevant waste water discharge takes place or is to take place, if different from that of the applicant,	Not Applicable	Yes
(c)	give the location or postal address (including where appropriate, the name of the townland or townlands) and the National Grid reference of the location of the waste water treatment plant and/or the waste water discharge point or points to which the application relates,	B2	Yes
(d)	state the population equivalent of the agglomeration to which the application relates,	B9	Yes
(e)	specify the content and extent of the waste water discharge, the level of treatment provided, if any, and the flow and type of discharge,	C,D	Yes
(f)	give details of the receiving water body, including its protected area status, if any, and details of any sensitive areas or protected areas or both in the vicinity of the discharge point or points likely to be affected by the discharge concerned, and for discharges to ground provide details of groundwater protection schemes in place for the receiving water body and all associated hydrogeological and geological assessments related to the receiving water environment in the vicinity of the discharge.	D2, F	Yes
(g)	identify monitoring and sampling points and indicate proposed arrangements for the monitoring of discharges and, if Regulation 17 does not apply, provide details of the likely environmental consequences of any such discharges,	E3	Yes
(h)	in the case of an existing waste water treatment plant, specify the sampling data pertaining to the discharge based on the samples taken in the 12 months preceding the making of the application,	E4	Yes
(i)	describe the existing or proposed measures, including emergency procedures, to prevent unintended waste water discharges and to minimise the impact on the environment of any such discharges,	G3	Yes
(j)	give particulars of the nearest downstream drinking water abstraction point or points to the discharge point or points,	Not Applicable	Yes
(k)	give details, and an assessment of the effects, of any existing or proposed emissions on the environment, including any environmental medium other than those into which the emissions are, or are to be made, and of proposed measures to prevent or eliminate or, where that is not practicable, to limit any pollution caused in such discharges,	F1	Yes
(l)	give detail of compliance with relevant monitoring requirements and treatment standards contained in any applicable Council Directives of Regulations,	G	Yes
(m)	give details of any work necessary to meet relevant effluent discharge standards and a timeframe and schedule for such work.	G3	Yes
(n)	Any other information as may be stipulated by the Agency.	Not Applicable	Yes
Regulation 16(3) **Without prejudice to Regulation 16 (1) and (2), an application for a licence shall be accompanied by -**		**Attachment Number**	**Checked by Applicant**
(a)	a copy of the notice of intention to make an application given pursuant to Regulation 9,	B8	Yes
(b)	where appropriate, a copy of the notice given to a relevant water services authority under Regulation 13,	Not Applicable	Yes
(c)	Such other particulars, drawings, maps, reports and supporting documentation as are necessary to identify and describe, as appropriate -	B, C, E	Yes
(c) (i)	the point or points, including storm water overflows, from which a discharge or discharges take place or are to take place, and	B3, B5	Yes
(c) (ii)	the point or points at which monitoring and sampling are undertaken or are to be undertaken,	E3	Yes
(d)	such fee as is appropriate having regard to the provisions of Regulations 38 and 39.	B9(ii)	Yes

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Regulation 16(4) An original application shall be accompanied by 2 copies of it and of all accompanying documents and particulars as required under Regulation 16(3) in hardcopy or in an electronic or other format as specified by the Agency.		Attachment Number	Checked by Applicant
1	An Original Application shall be accompanied by 2 copies of it and of all accompanying documents and particulars as required under regulation 16(3) in hardcopy or in electronic or other format as specified by the agancy.		Yes
Regulation 16(5) **For the purpose of paragraph (4), all or part of the 2 copies of the said application and associated documents and particulars may, with the agreement of the Agency, be submitted in an electronic or other format specified by the Agency.**		**Attachment Number**	**Checked by Applicant**
1	Signed original.		
2	2 hardcopies of application provided or 2 CD versions of application (PDF files) provided.		
3	1 CD of geo-referenced digital files provided.		
Regulation 17 **Where a treatment plant associated with the relevant waste water works is or has been subject to the European Communities (Environmental Impact Assessment) Regulations 1989 to 2001, in addition to compliance with the requirements of Regulation 16, an application in respect of the relevant discharge shall be accompanied by a copy of an environmental impact statement and approval in accordance with the Act of 2000 in respect of the said development and may be submitted in an electronic or other format specified by the Agency**		**Attachment Number**	**Checked by Applicant**
1	EIA provided if applicable		
2	2 hardcopies of EIS provided if applicable.		
3	2 CD versions of EIS, as PDF files, provided.		

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