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Administration,
Environmental Licencing programme,
Office of Climate, Licencing and Resource Use,
Environmental Protection Agency,
Headquarters,
PO Box 3000,
Johnstown Castle Estate,
Co Wexford

3rd June 2010

Re : Regulation 18 request for Castlemartyr Agglomeration

Register No D0134-01

Dear Sir or Madam

The request for further information on the above application was received by Cork County Council in August 2009 along with similar requests for two other applications. The date for receipt of the information requested on all three applications was October 5th 2009.

Cork Co Council asked for and were granted a four week extension of time that took the date for receipt of information to 2nd November 2009.

Due to a Dec 23rd deadline for submission of 26 certification applications to the EPA and the loss of staff due to the current economic downturn, we have not been able to meet the deadline set down for the further information requested on this application.

Attached please find the extra information you required under Regulation 18 and all the supporting documentation.

I apologise for the delay in furnishing this to you.

Yours Sincerely

Patricia Power
Director of Services
Area Operations South
Co Hall
Cork

Mr Stuart Huskisson,
Inspector,
Office of Climate, Licencing and Resource use,
EPA

1st June 2010

Re: Regulation 18 Notice for Castlemartyr agglomeration.

Dear Sir

With regard to the queries raised by you on the application for a waste water discharge licence submitted in February 2008 I will try to answer each of your queries in turn

Waste Water Works

Provide a description of the design criteria and construction details of the primary discharge outfall

The primary discharge outfall is a concrete pipe discharging straight into the Kiltha River. There are no construction details available.

In addition provide the following information

(i) ***Update the agglomeration boundary to include the primary discharge (SW01), which forms part of the waste water works. Update drawings where applicable***.

Revised Drawing attached.

(ii) An estimate of the existing and the maximum proposed Population equivalent (p.e.) contribution from (1) domestic, (2) commercial and (3) trade effluent sources.

The existing population being treated at the WWTP is 1685 according to the Geo Directory Data for April 2008. A 15% extra contribution to cover the school and commercial premises in the village and the new Castlemartyr Resort brings the pe being served to 1928. Future expansion based on planning permissions granted would increase the population being served by the WWTP to 2815.
There are no trade effluent sources contributing to the WWTP.

(ii) Clarification whether leachate and/or industrial sludges are treated in the wastewater treatment plant (WWTP). If so provide details of (1) the transfer and storage arrangements, (2) the location in the WWTP where the leachate/industrial sludge residues are introduced and (3) the quantity (volume and p.e.), frequency and rate of the addition to the WWTP.

No leachate or industrial sludges are treated at the WWTP.

(iii) Summary details of all industrial discharges permitted under an IPPC, Waste or single media licence, for treatment in the WWTP and any other wastewaters or wastes accepted at the WWTP for treatment.

No IPPC or waste licences discharging into the WWTP.

(iv) Identify all possible discharge sources to the wastewater works that may contain mercury

No Mercury sources. See section g (i) response.

Existing Environment

(f) Provide a further description of the existing environment in terms of water quality with particular reference to environmental quality standards or other legislative standards. The response should include:

The WWTP discharges into the Kiltha River. This river is classed as having Moderate status. The Kiltha River drains the north-west area of the Womanagh Catchment (approximately 30km ^{2}) including the settlements of Mogeely and Castlemartyr. It flows through a narrow valley for approximately 17km before meeting the Womanagh main channel immediately upstream of Ladysbridge.

There was a consistent trend recorded by the EPA with respect to the four monitoring stations on the Kiltha River (0300, 0500, 0700, 1000). Q-values recorded in station 0700 over 1999 and 2008 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. The results from these stations are shown below.

Station	Location	1989	1994	1997	1999	2002	2005	2008
0700	Second Br N of Mogeely	4	4	4-5	4	4	4	4
1000	Br in Castlemartyr	3-4	4	3-4	3	3-4	3-4	3-4

The Dairygold facility at Mogeely discharges during the period from March to October, 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 in Table 9.4 of the **Womanagh Catchment Assessment** which is attached.

(i)A copy of the most recent water quality management and/or catchment plan in place for the receiving body. Provide an evaluation of the discharge in relation to the objectives of the water quality management plan and catchment plan as applicable.

The SWRBD have assessed the water quality standards for the Kiltha River as Moderate. The River Basin Management System currently being developed will include a programme of measures and a River Basin Management Strategy, designed to achieve at least good status for all waters by 2015, and to maintain high status where it exists.

(i) The number of dilutions available in the receiving water body

The DWF for the Kiltha river upstream of Castlemartyr discharge is 0.00885cu.m/s.
The 95%ile flow is 0.033cu.m/s.
The normal flow from the primary discharge is 417cu.m/day which equates to 0.0048cu.m/sec.
Available dilution in the Kiltha is 1 in 7 for 95%ile flow

Laboratory Monitoring and Analysis

(g) Provide additional information in relation to monitoring, sampling and analysis. The response should include

(i) Clarify the laboratory, method used and limit of detection for analysis of mercury and its compounds.

(i)The laboratory used for the analysis of Mercury was an accredited contract lab which has UKAS accrediation and the scope is attached to this report

After examining the results submitted there are some issues that require clarification in respect of these samples. The analytical method used for hydride metals was ICP-MS with a detection limit of 0.2ug/lfor Hg but from checking the results for this batch of samples the mercury results recorded are not representative of the normal expected results for the river and discharges .There are no known sources of Mercury in the river network and in the treatment plant for the village. The effluent is domestic in nature with a limited number of food service establishments in the locality. The nearest major discharge upstream of the village and treatment plant is a dairy processing facility and given that the product is a food product with milk as its primary source of raw material it would not be expected or normal to have elevated levels of mercury or in fact to have mercury present at all in the discharge or the river network . The river catchment is primarily agricultural in nature and there is no source of mercury emissions from this catchment .

From a scientific perspective when the results are examined as a group it appears that either there was a contamination issue in the laboratory concerned during the ICP-MS run for these samples or that there is an interference for Mercury analysis present in the network . By examining the results as a group the opinion of Cork County Council is that this was an analytical contamination issue in the laboratory concerned as the upstream samples recorded

higher levels of mercury that either the effluent or influent to the works. It also appears that the wastewater network is not the source of mercury emissions to this network and river catchment .

This anomaly was unfortunately not identified at the time of sample collation and submission of results due to the very large number of applications that were submitted at that time. The river network was analysed on two separate occasions since that time and the data recorded in a table below and this supports the view of Cork County Council that the mercury results submitted were not representative of the true levels of mercury in the river at the time of sampling due to the contamination issue that occurred in the contract laboratory at the time of the analysis . From examining the table below there is no mercury in the river network and either on the influent or effluent to the three wastewater treatment plants serving this geographical area all draining to this catchment within a short geographical distance from each other.

Table Details : Mercury results for the Kiltha and Womanagh rivers and municipal wastewater Treatment plants in the general locality around Castlemartyr

Source of sample	Date	Result in ug/l	River name	Details
Influent	17/07/08	0.4	n/a	Castlemartyr WWTP
Effluent	17/07/08	0.5	n/a	Castlemartyr WWTP
Downstream River	17/07/08	0.8	Kiltha	Kiltha River d/s of Castlemartyr WWTP
Upstream River	17/07/08	0.8	Kiltha	Kiltha River u/s of Castlemartyr WWTP
Influent	27/11/08	<0.2	n/a	Ladysbridge WWTP
Effluent	27/11/08	<0.2	n/a	Ladysbridge WWTP
Downstream River	27/11/08	<0.2	Womanagh	Womanagh River d/s of Ladysbridge WWTP
Upstream River	27/11/08	<0.2	Womanagh	Womanagh River u/s of Ladysbridge WWTP
Influent	07/05/09	<0.2	n/a	Mogeely WWTP
Effluent	07/05/09	<0.2	n/a	Mogeely WWTP
Downstream River	07/05/09	<0.2	Kiltha	Kiltha River d/s of MogeelyWWTP
Upstream River	07/05/09	<0.2	Kiltha	Kiltha River u/s of Mogeely WWTP

(ii) In terms of the Urban Wastewater directive ,the directive proscribes a frequency of 4 samples per year for this category of plant i.e. between 2000PE to 10,000 PE provided that the previous results are compliant with the directive in that no absolute failures have occurred and that the number of exceedances which are not absolute exceedances are within the permitted number of failures. Cork County Council intend to comply with this frequency of urban wastewater testing

(iii) The composite sampler is time proportional

(iv) There is a composite sampler in place on the influent to the works and a flow monitor is currently in place on the inlet works

(v) There is a continuous flow monitor in place for the discharge from the wasteworks

(ii) Clarify if primary discharge samples are collected with a composite sampler, and if so if this is carried out on a time or flow proportional basis.

Primary Discharge samples are collected in a time proportional composite sampler

(ii) Clarify the sampling arrangements for the influent waste water to the WWTP and provide details of the proposal and timescale for the provision of composite sampling and continuous flow monitoring, as applicable.

Influent samples are taken weekly from a composite sampler (time proportional). Sample sent to external laboratory to be tested for BOD. COD & SS tests done by operator. Once a month all tests are done externally as part of contractual arrangement.
No Plans in place for continuous flow monitoring. Composite samplers are switched on 24 hours before sample taken.

(iii) Provide details of the proposal and timescale for continuous flow monitoring on the discharges from the waste water works as applicable.

No Plans in place for continuous flow monitoring. Composite samplers are switched on 24 hours before sample taken.

Operational Information

Clarify the details submitted in the application to ensure that it fully describes 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. The response should include:

(i) Clarification as to whether the stormwater/emergency overflow associated with the WWTP joins the primary discharge upstream or downstream of the sampling point. Provide a diagram of the flow and monitoring arrangement. If applicable, provide a proposal and timeframe for the monitoring of the primary discharge prior to mixing with stormwater and/or emergency overflow.

The stormwater overflow joins the final discharge upstream of the sampler location. However at the time the original application was submitted, to ensure that the sample contains treated effluent only, the pipe that feeds the sampler was repositioned upstream of where the two lines meet.

(ii) Clarification in relation to flow monitoring arrangements and include the location at which the flow is measured.

A flow meter is located on the inlet to the WWTP (after the Inlet screening sump and before the influent travels on to the aeration tank). An outlet flow meter is also located on the final discharge line downstream of the composite sampler.
The flow meters are read weekly.

(iii) Information in relation to sections E.1 and E.2 of the Waste Water Discharge Licence Application Form.

Online data has been submitted and is also attached in hard copy. Please note the figures submitted are based on current flow data up to September 2009.

(iv) Information on all of the storm water overflows that may also act as emergency overflow points. Describe events that may lead to an emergency overflow at each location.

Should both pumps fail or no electricity supply then the storm overflow at the PS in Castlemartyr would also act as an emergency overflow. Should both inlet pumps break down at the WWTP or no power supply then the storm overflow at the plant would act as an emergency overflow

Clarification as to whether the emergency overflow from any pumping stations has been known to activate in the last 12 months, if so, identify each pumping station and provide the reason for the activation and details of the frequency, duration and discharge volume (or estimate), where available.

The storm overflow locations in Castlemartyr have not been activated as Emergency overflows in the past year.

(v) Clarification regarding the arrangements for obtaining a standby or mobile generator for use at the WWTP/pumping stations, as applicable.

There is no standby generator at the plant in Castlemartyr**.**

(vi) Clarification as to whether the operator is alerted of a failure of the WWTP inlet pumping station pump and/or other pumping stations. Provide details of the measures taken during a power failure event.

No there is no automatic alert to a failure at the WWTP inlet or elsewhere. There are no proposals in existence for dealing with a power failure.

(vii) Provide a copy of the preliminary assessment report into the options available for upgrading of the current WWTP, where available.

Design Report prepared by outside consultants in 2008 attached.

(viii) Provide details of the proposed sea outfall, approximate timeframe for this proposal and complete all relevant sections of the application in relation to this revised discharge location.

Details available at this time are included in the design report. No timeframe available because as of yet no funding has been approved for either the upgrade of Castlemartyr or the new WWTP at Ballycotton. It is not envisaged that the proposed upgrade and new sea outfall will be a reality during the lifetime of this licence.

(ix) An assessment of the identified stormwater overflows having regard to the requirements of the DoEH&LG guidance.

Please refer to C.1.1 page 29 of original application where this is detailed in full.

Assessment of Imapcts of Waste Water Discharges on Receiving Waters

(k) (i) Submit details of all discharges from the Castlemartyr agglomeration via the following web based link: http//78.137.160.73/epa_wwd_licencing/

Data has been submitted

(ii) Provide a comparison of the predicted receiving water concentrations (based on the waste water treatment plant discharging at maximum average discharge concentration) with the values included in the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 S>I> No 272/2009

The River Kiltha into which the WWTP discharges has a “moderate status”. Therefore the lower “good” standard contained in the surface water regulations was used for comparison purposes.

The upstream and downstream sampling results for 2008 at aSW01CMYRd were compared to the relevant EQR/S from the surface water regulations in the following tables. The sample results and the EQR/S were included only if there were values for both, to allow comparison.

The upstream and downstream sample results incorporated in the following tables are those laid out in the upstream and downstream sheets of the Revised Table E. However many of these results are at the limit of detection, or are results based on averages that include assumed figures. Therefore additional upstream and downstream tables with actual results for metals have been included. These “actual results for metals” are laid out on a separate “metal analysis” sheet in the Revised Table E.

UPSTREAM COMPARISON TABLE

Physico-chemical conditions	***Ecological quality ratio/standard***	***2008 upstream ambient sampling results at aSW01CMYRu***
	Good boundary	
	Rivers (All Types)	
Oxygenation conditions Table 9	***River water body***	***Ambient sampling results***
Biochemical Oxygen Demand (BOD) (mgO_2/l)	Good status≤1.5 (mean) or ≤2.6(95%ile)	1.66mg/L (mean) 3.8mg/L (95%ile)
Acidification Status Table 9	***River Water Body***	***Ambient sampling results***
pH (individual values)	Soft Water 4.5<pH<9.0 Hard Water 6.0<pH<9.0	7.9-8.1
Nutrient conditions Table 9	***River Water body***	***Ambient sampling results***
Total Ammonia (mg N/l)	Good status≤0.065(mean) or ≤0.140(95%ile)	0.1mg/L (mean) 0.265mg/L (95%ile)
Molybdate Reactive Phosphorus (MRP) (mg P/l)	Good status≤0.035(mean) or ≤0.075(95%ile)	0.033mg/L (mean) 0.057mg/L (95%ile)
Specific pollutants Table 10	***Inland surface waters AA-EQS***	***Ambient sampling results***
Phenol	8	<0.1µg/L
Toulene	10	<1.0µg/L
Xylene	10	<1.0µg/L
Arsenic	25	<0.96µg/L
Total Chromium	8.1	<20µg/L
Copper (depending on water hardness)	30	<20µg/L
Cyanide	10	<5µg/L
Flouride	500	<100µg/L
Zinc (depending on water hardness)	100	<20µg/L
Priority Substances Table 11	***Inland surface waters AA-EQS***	***Ambient sampling results***
Atrazine	0.6	<0.01µg/L
Dichloromethane	20	<1.0µg/L
Simazine	1	<0.01µg/L
Lead and its compounds	7.2	16.429µg/L
Nickel and its compounds	20	<20µg/L
Priority Hazardous Substances Table 12	***Inland surface waters AA-EQS***	***Ambient sampling results***
Cadmium and its compounds (depending on water hardness)	0.25	<20µg/L
Mercury and its compounds	0.05	0.8 µg/L

Note the following:

The black results are within the EQR/S.
The red results break the EQR/S.
The blue results may break the EQR/S.
The results highlighted grey are at the limit of detection.
Water hardness in the Kiltha River is 250mg$CaCO_3$/L

UPSTREAM COMPARISON TABLE
(ACTUAL METAL RESULTS)

Physico-chemical conditions	***Ecological quality ratio/standard***	***2008 upstream ambient sampling results at aSW01CMYRu***
	Good boundary	
	Rivers (All Types)	
Specific pollutants Table 10	***Inland surface waters AA-EQS***	***Ambient sampling results***
Total Chromium	8.1	1.64µg/L
Copper (depending on water hardness)	30	0.43µg/L
Zinc (depending on water hardness)	100	1.6µg/L
Priority Substances Table 11	***Inland surface waters AA-EQS***	***Ambient sampling results***
Lead and its compounds	7.2	12.4µg/L
Nickel and its compounds	20	1.93µg/L
Priority Hazardous Substances Table 12	***Inland surface waters AA-EQS***	***Ambient sampling results***
Cadmium and its compounds (depending on water hardness)	0.25	0µg/L

DOWNSTREAM COMPARISON TABLE

Physico-chemical conditions	***Ecological quality ratio/standard***	***2008 Downstream ambient sampling results at aSW01CMYRd***
	Good boundary	
	Rivers (All Types)	
Oxygenation conditions Table 9	***River water body***	***Ambient sampling results***
Biochemical Oxygen Demand (BOD) (mgO_2/l)	Good status≤1.5 (mean) or ≤2.6(95%ile)	1.913mg/L (mean) 2.924mg/L (95%ile)
Acidification Status Table 9	***River Water Body***	***Ambient sampling results***
pH (individual values)	Soft Water 4.5<pH<9.0 Hard Water 6.0<pH<9.0	7.6-7.9 (range)
Nutrient conditions Table 9	***River Water body***	***Ambient sampling results***
Total Ammonia (mg N/l)	Good status≤0.065(mean) or ≤0.140(95%ile)	<0.1mg/L (mean) <0.1mg/L (95%ile)
Molybdate Reactive Phosphorus (MRP) (mg P/l)	Good status≤0.035(mean) or ≤0.075(95%ile)	0.05mg/L (mean) 0.093mg/L (95%ile)
Specific pollutants Table 10	***Inland surface waters AA-EQS***	***Ambient sampling results***
Phenol	8	<0.1µg/L
Toulene	10	<1.0µg/L
Xylene	10	<1.0µg/L
Arsenic	25	<0.96µg/L
Total Chromium	8.1	<20µg/L Chromium
Copper (depending on water hardness)	30	<20µg/L
Cyanide	10	<5µg/L
Flouride	500	<100µg/L
Zinc (depending on water hardness)	100	14.571µg/L
Priority Substances Table 11	***Inland surface waters AA-EQS***	***Ambient sampling results***
Atrazine	0.6	<0.01µg/L
Dichloromethane	20	<1.0µg/L
Simazine	1	<0.01µg/L
Lead and its compounds	7.2	<20µg/L
Nickel and its compounds	20	<20µg/L
Priority Hazardous Substances Table 12	***Inland surface waters AA-EQS***	***Ambient sampling results***
Cadmium and its compounds (depending on water hardness)	0.25	<20µg/L
Mercury and its compounds	0.05	0.8 µg/L

Note the following:

The black results are within the EQR/S.
The red results break the EQR/S.
The blue results may break the EQR/S.
The results highlighted grey are at the limit of detection.
Water hardness in the Kiltha River is 250mg $CaCO_3$/L

DOWNSTREAM COMPARISON TABLE
(ACTUAL METAL RESULTS)

Physico-chemical conditions	***Ecological quality ratio/standard***	***2008 Downstream ambient sampling results at aSW01CMYRd***
	Good boundary	
	Rivers (All Types)	
Specific pollutants Table 10	***Inland surface waters AA-EQS***	***Ambient sampling results***
Total Chromium	8.1	2.78µg/L
Copper (depending on water hardness)	30	0.038µg/L
Zinc (depending on water hardness)	100	2.338µg/L
Priority Substances Table 11	***Inland surface waters AA-EQS***	***Ambient sampling results***
Lead and its compounds	7.2	10.96µg/L
Nickel and its compounds	20	1.925µg/L
Priority Hazardous Substances Table 12	***Inland surface waters AA-EQS***	***Ambient sampling results***
Cadmium and its compounds (depending on water hardness)	0.25	0µg/L

PREDICTED IMPACTS

MASS BALANCE EQUATIONS FOR BOD:

Worst Case Scenario:

Maximum Discharge, Low Flow in the River, Maximum BOD in Discharge.

Flow of River (95%ile) = 0.033m3/sec
Mean BOD in River (upstream) = 1.66mg/L
Max volume of discharge = 0.0081m3/sec
Max value for BOD in discharge = 25mg/L

$$C_{final} = \frac{(0.033 \times 1.66) + (0.0081 \times 25)}{(0.033 + 0.0081)}$$

C_{final} = 6.26mg/l BOD

This is in breach of the 2.6mg/L 95%ile EQS for BOD

Normal Scenario:

Normal Discharge, Median Flow in the River, Mean BOD in Discharge.

Flow of River (Median) = 0.224m3/sec
Mean BOD in River (upstream) = 1.66mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for BOD in discharge = 7.59mg/L

$$C_{final} = \frac{(0.224 \times 1.66) + (0.0049 \times 7.59)}{(0.224 + 0.0049)}$$

C_{final} = 1.79mg/l BOD

This is in breach of the 1.5mg/L mean EQS for BOD

However it is worth noting that the mean upstream BOD value is 1.66mg/L, which is already in breach of the EQS of 1.5mg/L. The 95%ile upstream BOD value is 3.8, which also breaches the EQS of 2.6mg/L.

Theoretical Scenario:

Normal Discharge, Median Flow in the River, Mean BOD in Discharge, Theoretical value for BOD in the River. This “Theoretical value for BOD” in the River is used because the conditions upstream are failing to meet “Good Status”. This scenario assesses the impact of the discharge separately from the impacts upstream. (As suggested in the “Implications of the Surface Water and Groundwater Environmental Objectives Regulations for the EPA” slideshow).

Flow of River (Median) = 0.224m3/sec
Theoretical BOD in River (upstream) = 0.260mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for BOD in discharge = 7.59mg/L

$$C_{final} = \frac{(0.224 \times 0.260) + (0.0049 \times 7.59)}{(0.224 + 0.0049)}$$

C_{final} = 0.42mg/l BOD

This is under the 1.5mg/L mean EQS for BOD

MASS BALANCE EQUATIONS FOR AMMONIA:

Worst Case Scenario:

Maximum Discharge, Low Flow in the River, Maximum Ammonia in Discharge.

Flow of River (95%ile) = 0.033m3/sec
Mean Ammonia in River (upstream) = 0.1mg/L
Max volume of discharge = 0.0081m3/sec
Max value for Ammonia in discharge = 5mg/L

$$C_{final} = \frac{(0.033 \times 0.1) + (0.0081 \times 5)}{(0.033 + 0.0081)}$$

C_{final} = 1.07mg/l Ammonia

This is in breach of the 0.14mg/L 95%ile EQS for Ammonia

Normal Scenario:

Normal Discharge, Median Flow in the River, Mean Ammonia in Discharge.

Flow of River (Median) = 0.224m3/sec
Mean Ammonia in River (upstream) = 0.1mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for Ammonia in discharge = 3.16mg/L

$$C_{final} = \frac{(0.224 \times 0.1) + (0.0049 \times 3.16)}{(0.224 + 0.0049)}$$

C_{final} = 0.17mg/l Ammonia

This is in breach of the 0.065mg/L mean EQS for Ammonia

However it is worth noting that the mean upstream Ammonia value is 0.1mg/L, which is already in breach of the EQS of 0.065mg/L. The 95%ile upstream Ammonia value is 0.265, which also breaches the EQS of 0.14mg/L.

Theoretical Scenario:

Normal Discharge, Median Flow in the River, Mean Ammonia in Discharge, Theoretical value for Ammonia in the River. This "Theoretical value for Ammonia" in the River is used because the conditions upstream are failing to meet "Good Status". This scenario assesses the impact of the discharge separately from the impacts upstream. (As suggested in the "Implications of the Surface Water and Groundwater Environmental Objectives Regulations for the EPA" slideshow).

Flow of River (Median) = 0.224m3/sec
Theoretical Ammonia in River (upstream) = 0.008mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for Ammonia in discharge = 3.16mg/L

$$C_{final} = \frac{(0.224 \times 0.008) + (0.0049 \times 3.16)}{(0.224 + 0.0049)}$$

C_{final} = 0.075mg/l Ammonia

This is in breach of the 0.065mg/L mean EQS for Ammonia

MASS BALANCE EQUATIONS FOR ORTHOPHOSPHATE:

Worst Case Scenario:

Maximum Discharge, Low Flow in the River, Maximum Orthophosphate in Discharge.

Flow of River (95%ile) = 0.033m3/sec
Mean Orthophosphate in River (upstream) = 0.033mg/L
Max volume of discharge = 0.0081m3/sec
Max value for Orthophosphate in discharge = 4mg/L

$$C_{final} = \frac{(0.033 \times 0.033) + (0.0081 \times 4)}{(0.033 + 0.0081)}$$

C_{final} = 0.81mg/l Orthophosphate

This is in breach of the 0.075mg/L 95%ile EQS for Orthophosphate

Normal Scenario:

Normal Discharge, Median Flow in the River, Mean Orthophosphate in Discharge.

Flow of River (Median) = 0.224m3/sec
Mean Orthophosphate in River (upstream) = 0.033mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for Orthophosphate in discharge = 1.48mg/L

$$C_{final} = \frac{(0.224 \times 0.033) + (0.0049 \times 1.48)}{(0.224 + 0.0049)}$$

C_{final} = 0.064mg/l Orthophosphate

This is in breach of the 0.035mg/L mean EQS for Orthophosphate

However it is worth noting that the mean upstream Orthophosphate value is 0.033mg/L, which is very close to the EQS of 0.035mg/L. The 95%ile upstream Orthophosphate value is 0.057, which is close to the EQS of 0.075mg/L. This means that there is very little capacity in the river.

Theoretical Scenario:

Normal Discharge, Median Flow in the River, Mean Orthophosphate in Discharge, Theoretical value for Orthophosphate in the River. This "Theoretical value for Orthophosphate" in the River is used because the conditions upstream are failing to meet "Good Status". This scenario assesses the impact of the discharge separately from the impacts upstream. (As suggested in the "Implications of the Surface Water and Groundwater Environmental Objectives Regulations for the EPA" slideshow).

Flow of River (Median) = 0.224m3/sec
Theoretical Orthophosphate in River (upstream) = 0.005mg/L
Normal volume of discharge = 0.0049m3/sec
Mean value for Orthophosphate in discharge = 1.48mg/L

$$C_{final} = \frac{(0.224 \times 0.005) + (0.0049 \times 1.48)}{(0.224 + 0.0049)}$$

C_{final} = 0.037mg/l Orthophosphate

This is in breach of the 0.035mg/L mean EQS for Orthophosphate

Further Works

(m) Provide further details of any work necessary to meet the relevant effluent discharge standards and a timeframe and schedule for such works. The response should include:

The discharge from the plant at Castlemartyr is in compliance with the Urban Wastewater Regulations.

(i) Clarification of the scope of the proposed works to be carried out in the Castlemartyr agglomeration under the 2007 – 2009 Water Services Investment Programme funding (€1,200,000) and provide an update on these proposed works; including the proposed start date and the completion date of the various works to be carried out, as applicable.

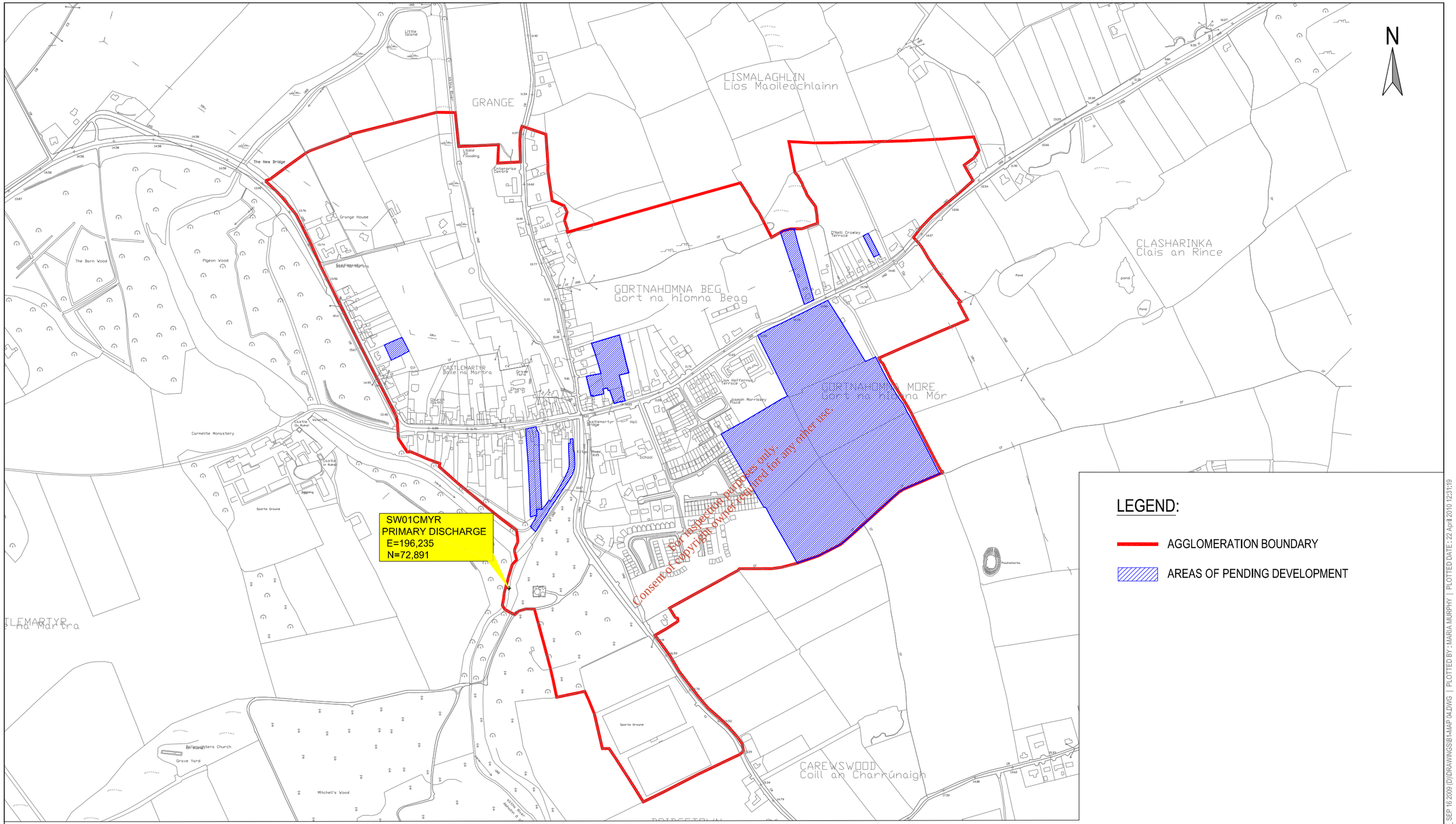
A full review of the Assessment of needs for Cork County Council has been prepared by Cork Co Council for the DoEH&LG and a new document for the period 2010 to 2012 is now with the Dept. awaiting approval. In the 2007 – 2009 programme funding had been set aside for the upgrading of facilities at Castlemartyr under the Serviced land Initiative. However, due to the current economic climate, the Dept have withdrawn all funding for schemes that had been granted funding under the SLI. The upgrading of facilities at Castlemartyr is on the 2010-2012 programme but if funding is made available it will not advance beyond planning stage.

(ii) Provide details of the proposed maximum total phosphorous, ortho-phosphate and total nitrogen discharge concentrations from the upgraded wastewater treatment plant when operational. Identify any proposed measures to be implemented to assist in the achievement of the requirements under the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 S>I> No 272/2009 and to meet the proposed desirable nitrate levels, where applicable.

See design report. See also notes on mass balance calculations above.

(iii) Details of the programme of improvemens to ensure that discharges other than the primary and secondary discharges comply with the DoEHLG guidance on Storm Water Overflows. Include the proposed timeframe for compliance with the DoEHLG guidance.

There are no other discharges other than the primary and secondary discharges on the network in Castlemartyr.



REV	DESCRIPTION	BY	CHK	APP	DATE
A	Primary Discharge Point added & Aglomeration Boundary adjusted.	MM	MS	MM	01.12.09

ENGINEERING
MANAGEMENT
ENVIRONMENTAL
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PROJECT:
CASTLEMARTYR WASTEWATER PLANT: WASTEWATER DISCHARGE LICENCE APPLICATION

CLIENT:
CORK COUNTY COUNCIL

DRAWING TITLE:
APPLICATION FORM ATTACHMENT B1 - MAP 04
CASTLEMARTYR LAYOUT PLAN INDICATING AGGLOMERATION

SCALE @ A3	DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
1:5,000	MK	12/08/08	SL	12/08/08	KT	12/08/08

	OFFICE	TYPE	ATTACHMENT No.	REVISION
C006842	1201	C	B1-MAP 04	A

SHEET SIZE : A3 LANDSCAPE

FILENAME : W:\PROJECTS\EPA LICENCE\EPA CASTLEMARTYR_ SEP 16 2009 (D)\DRAWINGS\B1-MAP 04.DWG | PLOTTED BY : MARIA MURPHY | PLOTTED DATE : 22 April 2010 12:31:19

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

NDP NATIONAL DEVELOPMENT PLAN

CORK COUNTY COUNCIL

UPGRADING OF THE WASTEWATER TREATMENT FACILITIES AT MIDLETON, CASTLEMARTYR, CLOYNE, SALEEN AND BALLYCOTTON

Design Report

Cork County Council
WSIP Office,
Model Business Park,
Model Farm Road,
Cork

November 2008

WYG Engineering (Ireland) Ltd.,
Consulting Engineers,
Unit 2, University Technology Centre,
Curraheen Road,
Cork

C006196

CORK COUNTY COUNCIL

UPGRADING OF THE WASTEWATER TREATMENT FACILITIES AT MIDLETON, CASTLEMARTYR, CLOYNE, SALEEN AND BALLYCOTTON

Design Report

WYG Engineering (Ireland) Ltd.,
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Tel.: 021- 4933200
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Project No.: C006196

Issue No.:	1	2			
Date:	04-04-2008	25-11-2008			
Prepared by:	B Hyde	~~S Little~~ B Hyde			
Approved by:	K Thornton	K Thornton			

1 INTRODUCTION

1.1 Background

In October 2007, WYG Engineering (Ireland) Limited were appointed by Cork County Council as Consulting Engineer / Client's Representative for the preparation of a Design Report and Contract Documents for the upgrading of the Midleton, Castlemartyr, Cloyne and Saleen Waste Water Treatment Plants. The terms of reference for the appointment is the Brief prepared by the Water Services Investment Programme Project Team (South), dated August 2007.

Subsequently, the provision of a treatment plant at Ballycotton was included in the scope of the Project (Letter CCC_WYG 13.02.2008)

This report constitutes the Design Review for the upgrading at each centre as required by the Brief. The Report supersedes and incorporates the Design Report (Issue 1, April 2008), Supplementary Report – Saleen Wastewater Treatment Facilities (April 2008) and Supplementary Report – Longer Term Effluent Disposal: Castlemartyr and Ladysbridge (June 2008).

Refer to Figure 1, Appendix 7 for a location map of the area.

2 DEMOGRAPHICS

2.1 Population Trends

The recent Census figures for the Midleton Rural Area / District and for the three main urban centres (Midleton, Cloyne & Castlemartyr – Saleen is not a statistical entity in the Census) are listed in Table 2.1 below. An analysis of the figures is shown in Table 2.2 below.

Table 2.1 Populations

Centre	1991	1996	2002	2006
Midleton	5,951	6,209	7,957	10,048
Castlemartyr	587	484	577	978
Cloyne	731	673	785	1,095
Saleen	-	-	-	351[2]
Total [1]	7,269	7,366	9,319	12,121
Midleton Rural Area/District	17,887	18,558	21,133	26,663

Source: Central Statistics Office (not including Saleen)

[1] Excluding Saleen
[2] Figure adopted from RPS Preliminary Report (April, 2006)

Table 2.2 Population Growth Rates

Centre	1991 – 2006	1996 – 2006	2002 -2006
Midleton	3.6%	4.9%	6.0%
Castlemartyr	3.5%	7.3%	14.1%
Cloyne	2.7%	5.0%	8.7%
Saleen	-	-	-
Overall	3.5%	5.1%	6.8%
Rural Area / District	2.7%	3.7%	6.0%

Note - The Population Growth Rates above are the Annual Compound Growth Rates over the specified Period

Reliance on the statistics obtained over a relatively short (4 year) period is considered unsound and it is extremely doubtful if the recent rapid growth in house building in the area, and consequent population growth, is sustainable. The longer term but still recent trends over the past 10-15 years are therefore considered more applicable in any projections of future growth.

2.2 Population Projections

Standardised "high" and "low" population growth projections, based on the recent medium term (10 & 15 years) growth trends as identified in Table 2.2, are made as follows:

- "High": 5% p.a. compound for the period 2008-2018 (10 years from now), which is comparable to the average growth for the three urban areas for the 10 year period 1996-2006, and 3.5% p.a. for 10 years thereafter, comparable to the rate for the 15 year period 1991-2006. This allows for the population at each centre to increase by almost 120% over the next 20 years.
- "Low": 3.5% p.a. compound for the period 2008-2018, comparable to that obtaining for the period 1991-2006, declining to 2.3% ($^2/_3$ of 3.5%) over the following 10 years. This yields a c.80% increase in the current population by 2028.

Population projections for the four centres are shown in Table 2.3 below, and graphically (excluding Saleen) in Figures 2.1 and 2.2. The 2006 Census figures are used as a baseline, except for Saleen where the figure was adapted from the RPS Preliminary Report on the sewerage scheme, dated April 2006. A 5% compound annual growth rate for the period 2006-2008 has been used to estimate the current population.

Table 2.3 Population Projections

	2008	2018		2028	
Centre	-	High	Low	High	Low
Midleton	11,000	18,000	15,600	25,000	19,600
Castlemartyr	1,100	1,750	1,500	2,500	1,900
Cloyne	1,200	2,000	1,700	2,800	2,150
Saleen	390	630	550	890	690

Figure 2.1 Population Trends and Projections for Midleton, Midleton Rural Area, Castlemartyr and Cloyne

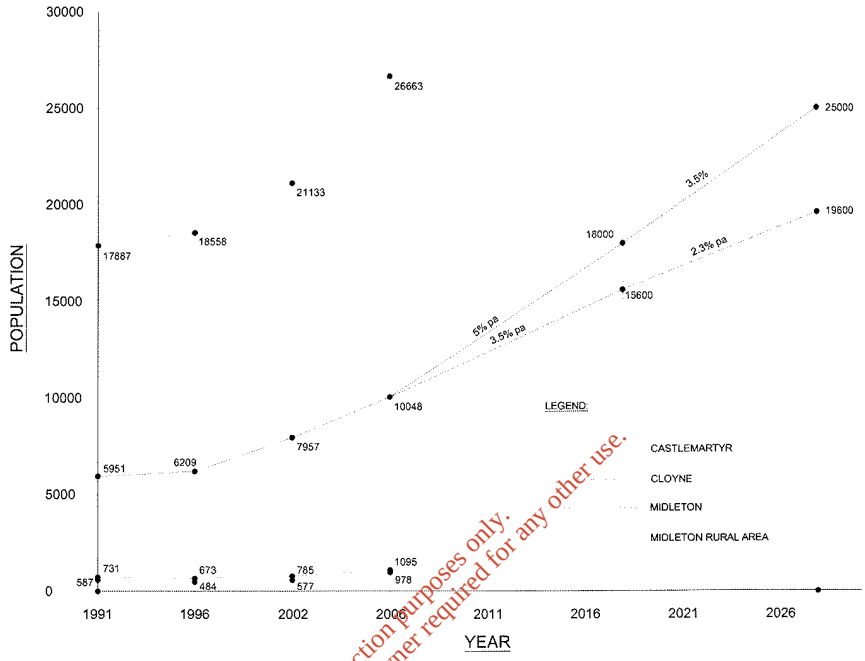
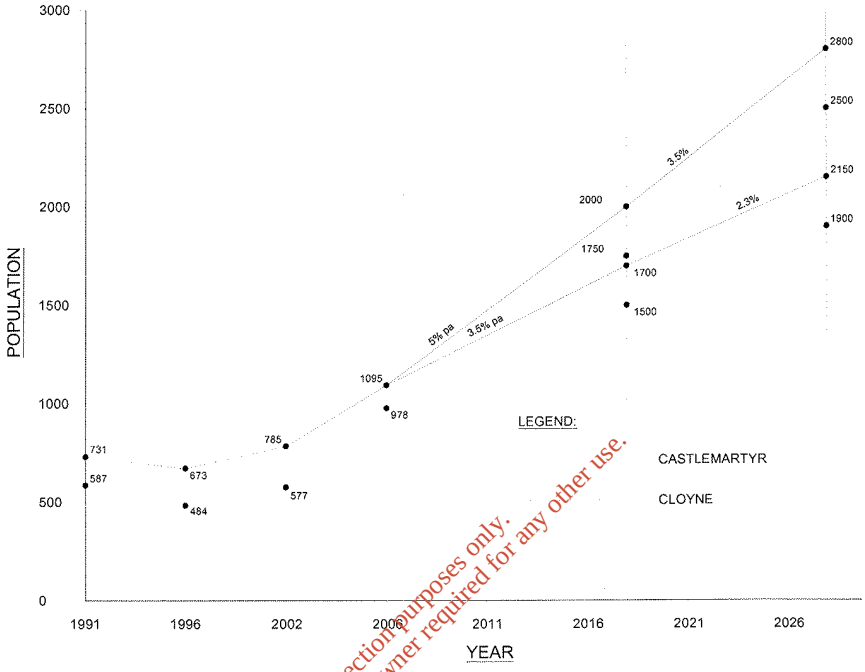


Figure 2.2 Population Trends and Projections for Castlemartyr & Cloyne



The low projection is considered the more appropriate for planning purposes. However, in the light of the recent rapid expansion of the settlements in the area, any proposals developed need to be reviewed for the higher projection, particularly in the short to medium term. The facilities have therefore been designed using an average of the high and low population projections.

The adopted design populations are shown in Table 2.4 below.

Table 2.4 Adopted Design Populations

Centre	2008	2028
Midleton	11,000	22,500
Castlemartyr	1,100	2,200
Cloyne	1,200	2,475
Saleen	390	790

3 DEVELOPMENT PLANS

3.1 Local Area Plan

Development in Castlemartyr, Cloyne and Saleen is covered by the Midleton Electoral Area Local Area Plan (LAP) (Sept 2005), which is to remain in force until late 2011 but is subject to interim variation. The LAP is guided by the County Development Plan 2003. Midleton is covered by a Special Local Area Plan (SLAP).

The LAP maps for Castlemartyr, Cloyne and Saleen are attached in Appendix 1. Estimates of the residential development potential for the Specific Zoning Objectives, in addition to the existing population, for each centre are shown in Tables A1.1 – A1.3 (Appendix 1), and summarised below:

Centre	Population
Castlemartyr	2178
Cloyne	2845
Saleen	1026

The projected population figures for 20 years hence (as per Section 2.2) are also shown in Appendix 1. The comparison would indicate that the lands currently zoned residential at each town/village are adequate to cater for foreseeable development well beyond the LAP objective date of 2011, and that the current zoning will cover normal development over the next 20 years. This is based on the assumption that all the zoned areas become available for development.

3.2 Midleton Special Local Area Plan

The SLAP mapping for Midleton, finalised in 2005, is shown in Appendix 2. An estimate of the existing population plus the population that could be accommodated by the housing potential of the lands zoned for residential development and the "Special Zoning Objectives" Areas X-03 to X-08 is shown in Table A2.1, Appendix 2, and the final figure shown below:

Centre	Population
Midleton	19100

The projected population figures for 2028 are also shown in Appendix 2. A comparison indicates that these areas are adequate to accommodate the "Low" projected population for the year 2028, well beyond the SLAP objective date of 2011.

Two "special zoning" areas in the Plan, X-01 and X-02, are not included in the above assessment. Both are located to the North of the town. X-02, 25.4ha in extent, is designated for mixed use, including an unspecified residential component. X-01 is an extensive area of 133.8ha and is designated as a "Major New Residential Neighbourhood". Any development of these two areas, in particular X-01, would accommodate any longer term population growth above the "Low" projection of 19,000 for the year 2028.

Thus current zoned lands under the Midleton SLAP appear to be more than sufficient to cater for potential development for the next 20-25 years.

A review of planning applications for Midleton for the past 2 years indicates approval for 2,298 dwellings.

4 PROPOSED PLANT DESIGN CAPACITIES

The proposed design capacities for the plants at each centre are shown in Table 4.1 below. This allows for a 20 year design horizon, the mean of the 'High' and 'Low' population projections as detailed in Section 2, and an allowance of 15%-20% of the projected domestic component to cover commercial, institutional and industrial requirements. From experience on other schemes, an allowance of 20% is considered suitable for Midleton, and approximately 15% for the other centres.

The allowance does not cater for the advent of any major water user to the catchments, particularly to a centre other than Midleton.

Figures for Ballycotton have also been included in the Table, taken from the Shanagarry, Garryvoe, Ballycotton Sewerage Scheme Preliminary Report, WYG July 2006.

Table 4.1 Area Population and Plant Capacity Information

	Estimated Current Population (2008)	Design Population – 2028[1]	Proposed Design PE - 2028	Existing Plant Design Capacity (PE)	Current Throughput [2] (PE)
Midleton	11,000	22,500	27,000	10,000	11,500
Castlemartyr	1,100	2,200	3,000 [3]	2,000	2,600 [4]
Cloyne	1,200	2,475	3,000	1,400	1,820 [4]
Saleen	390	790	1,000	-	-
Ballycotton [5]	750	960	1,200	-	-

(1) Refer Table 2.4
(2) Jan – Oct 2007 (BOD) (EPS Operation Reports)
(3) Includes 300 for the Capella Development
(4) These figures are potentially skewed due to spikes in the data
(5) (Design population is the summer projection for the year 2030.

Table 4.1 also shows the design capacities of the existing plants and indicative current throughput. Utilising these, the upgrading requirement for each centre is examined in more detail below.

6 CASTLEMARTYR

6.1 Design Capacity

An analysis of the recent inflow records for the Castlemartyr Plant is shown in Figure 3.7 (Appendix 3). The hydraulic and biological load figures are anomalous in that there was a huge and currently unexplained surge in the biological load in particular, during the summer months (June-August 2007). This leads to an average BOD loading of 156 kg/d (2600 PE). If these three months are excluded however, a PE of c.1800 obtains. This is much more compatible with the estimated current population of c.1100 and the recent connection of the "Capella" complex to the scheme.

The sewer network is a combined system, which terminates at a pump station in the middle of the village, from where the wastewater is pumped to the treatment plant. A storm overflow at the pump station discharges to the adjacent Kiltha River. There is no storm water holding tank at the treatment plant and the pumps thus regulate the inflow. Wastewater from the Capella development is pumped separately to the Plant.

The results of the more recent monitoring of the treated effluent are shown on Figures 3.8 - 3.10 (Appendix 3). They can be summarised as follows:

Table 6.1 Castlemartyr Treated Effluent Monitoring

	Unit	Mean	Max [1]	Required Standard [2]
BOD	mg/l	5.2	7.7	25
SS	mg/l	16.7	38	35
Orthophosphate	mg/l P	4.4	11	-
Total N	mg/l N	-		-

[1] Monthly Average
[2] Urban Waste Water Directive, the Phosphorous Regulations 1998 and Nitrate Directive 1991

This indicates that while BOD and SS concentrations are tolerable, phosphate, and probably nitrate, levels are unacceptably high, particularly when the available dilution is factored in.

6.2 Effluent Disposal and Receiving Waters

Treated effluent from the existing treatment plant is discharged to the Kiltha River, which runs approx 100m to the West of the site. The Kiltha is a tributary of the Womanagh and as such is covered by the "Womanagh Catchment Assessment" carried out by the environmental consultants Dixon Brosnan for Cork County Council, reporting in 2006.

This assessment was of the potential impact of the discharges, current and future, from the WWTPs in the catchment. With regard to Castlemartyr, the findings were as follows:

- The EPA Biological Quality Rating / Q Value at the bridge in Castlemartyr (Stn 1,000-200m upstream of the outfall) has been rated 3-4 (moderately polluted) over the past 10/15 years.
- Following sampling in March 2006, a Q value of 4 (unpolluted) was ascribed to the stretch of river just downstream (45m) of the outfall.
- The available hydrometric data for the catchment (5 no. stations) indicates a relatively low 95% ile flow of only 36 l/s at the outfall (CA = 30km^2).

- This estimated 95% flow (36 l/s) indicates a dilution factor of less than 6:1 for the discharge volume (@ 180 l/h/d) from a putative 3,000 PE treatment plant. For the standard 8:1 minimum dilution to apply, the throughput of plant would be limited to 2,200 PE or only marginally in excess of the current rated capacity (2,000 PE).

- The background nutrient concentrations at the EPA monitoring station at Castlemartyr Bridge, upstream of the outfall, are high. Nitrate levels are in excess of the limit set for Clean Water Quality in the Drinking Water Regulations 2000 (50mg/l $NO_3 \approx 11.3$ mg/l N) and fall into the Doubtful Water Quality Category under the Nitrate Directive 1991.

- Orthophosphate levels are over four times the limit set for Satisfactory Water Quality under the 1998 Phosphorous Regulations.

The relevant water quality data for Stn. 1,000 is shown in Table A4.1 Appendix 4. The high nutrient levels shown, allied to the relatively low flows and consequent low dilution available at the discharge point, indicates that any increase in the current treatment capacity is not practical, if continuing with the existing outfall. Rather, the existing plant needs to be upgraded to produce a higher quality effluent, including denitrification and phosphate removal. If the Phosphorous Regulations are to be complied with and to a lesser degree the Nitrate Directive, a catchment management plan to reduce the background concentrations also needs to be formulated and successfully implemented.

With the recent rapid population growth in the village, throughput at the Treatment Plant has almost reached design capacity. To cater for future development, treatment capacity has to be increased and a new effluent disposal point will be required. Alternative new outfall locations are examined below.

6.3 New Outfall for Castlemartyr

6.3.1 Womanagh at Ladysbridge

The Kiltha flows southwards from Castlemartyr and joins the Womanagh River, just over 1km downstream and 0.5 km to the West of Ladysbridge. At Ladysbridge, a new 1000 PE plant, with the facility for longer term expansion to 1500 PE, has been constructed on the bank of the Womanagh, discharging to the adjacent river. The catchment area at this outfall is 45 km^2, an increase of 50% on that at Castlemartyr. While a commensurate 50% increase in the estimated 95%ile flow, to 54 l/s, would technically increase the dilution available at Ladysbridge, the assimilative capacity, for nutrients in particular, is not boosted. Thus with the current water quality, and continuing if improved, discharge from the Castlemartyr plant, the assimilative capacity for the 1000 PE discharge at Ladysbridge is considered marginal. Expansion of the plant to 1500 PE would certainly create problems, so pumping of some or all of the treated effluent from an expanded plant at Castlemartyr is not feasible. The dilution ratio for the 95%ile flow at Ladysbridge for the combined existing capacity at Ladysbridge and Castlemartyr (3,000 PE) is less than 9:1, which for the projected future combined discharge of 774 m^3/d (4,500 PE) reduces to less than 6:1.

Formulation and implementation of a catchment management plan and upgrading of the plant at Castlemartyr would bring environmental benefits along the watercourse but with such low dilutions occurring, this is unlikely to bring such improvements as to allow any significant increase in any of the discharges to the river. Thus to increase the discharge to the Kiltha, in the short to medium term at least, a high standard "Clean River Water Quality" effluent would have to be produced as follows:

Parameter	Conc. Limit (mg/l)
BOD	3
SS	25
oPO_4 (as P)	0.03 - Median Value
NH_3	0.02
NH_4	0.3
NO_2	0.5
NO_3	25

Research has indicated that even high cost advanced technologies (e.g. MBRs) would not produce an effluent guaranteed to adhere to this standard, particularly with regard to Ammonia, Nitrates and Orthophosphate. Such a plant would also require sophisticated and costly operation and maintenance.

Disposal outside the catchment is therefore seen as the only practical option, to facilitate the construction of new plants or the expansion of the existing plants in the catchment.

6.3.2 Sea Outfall at Ballycotton

There are significant constraints on the expansion of treatment facilities throughout the Womanagh catchment, and to the disposal of the treated effluent within the catchment, even when applying extremely rigorous treatment standards. Formulation and implementation of a catchment management plan will improve current river conditions, which are relatively poor, but will not allow any significant increase in the volume of treated effluent discharged to the river.

There are no significant watercourses in the adjacent catchments to which some or all or the treated effluent could be diverted, except perhaps for the Lower Harbour, some 15 km to the south-east. The obvious solution is therefore to pump the treated effluent, to discharge through the proposed sea outfall at Ballycotton.

A proposal for pumping all effluent from Castlemartyr through Ladysbridge to Ballycotton is shown on Figure 3, Appendix 7. This would permit significant development at the treatment facilities for both centres and a significant improvement in water quality in the Kiltha. Mogeely and Killeagh, the other two major urban centres in the Womanagh catchment, could also potentially be connected to the system at some stage in the future if warranted.

The discharge from the Ladysbridge Treatment Plant could also be effectively routed to the Ballycotton Outfall, further improving water quality in the Kiltha.

Alternative 1

- 3,200 PE plant in Ballycotton
- Pumpstation and 2 x 150mm diameter rising mains from Shanagarry to Ballycotton (raw sewerage) (Shanagarry & Garryvoe)

Cost Estimate (Incl. VAT)

		€	€
(i)	Treatment Plant	2,500,000	
	Land acquisition and Site Investigation	250,000	2,750,000
(ii)	Pumpstation and Rising Mains (raw)		1,575,000
			4,325,000

[1] Base Cost - PR + 5% p.a. for inflation

Alternative 2

- 1,200 PE plant in Ballycotton
- 2,000 PE Plant in Shanagarry
- Pumpstation - Shanagarry

Cost Estimate (including VAT)

		€	€
(i)	Ballycotton - 1200 PE plant	1,460,000	
	Land acquisition and Site Investigation	200,000	1,660,000
(ii)	Shanagarry - 2000 PE plant	1,720,000	
	Land acquisition and Site Investigation	200,000	1,920,000
(iii)	Pumpstation		110,000
			3,690,000

Indicative Saving = €635,000

This indicates significant savings for the evolved layout. The scheme also offers more flexibility for phased implementation and is therefore recommended for adoption.

6.5 Upgrading of the Wastewater Treatment Plant at Castlemartyr

Assuming that the above proposal for the provision of a regional pumped network to convey treated effluent for disposal at Ballycotton is adopted, this will permit further development in Castlemartyr and the resultant requirement to increase in WWTP capacity. In Table 4.1, the current population of c.1,100 was projected to double over the next 20 years, indicating a requirement to increase treatment capacity to 2,800PE. However, it is recommended that the plant be upgraded to a nominal capacity of 3,000 PE. An indicative layout of this expansion, incorporating the treated effluent pumping station is shown on Figure 5, Appendix 7. The required effluent standard could be relaxed from that which would be required for continued disposal to the Kilna, and high nutrient reduction is no longer necessary.

The estimated cost of the proposed upgrading, amounting to €977,000 (including VAT) is shown in Appendix 9. This does not include the costs associated with the treated effluent pump station or the rising main to Ballycotton, as costed above.

6.6 Outfall

The outfall at Ballycotton was designed for a nominal maximum discharge of 20 l/s (3200 PE @ 180 l/h/d: 3 DWF), and a foreshore licence application has been made for the 350mm diameter line extending c. 330m into the bay on this basis. The outfall is adequate hydraulically to take the additional flow from Castlemartyr and Ladysbridge. An assessment of the previous modelling work (Shanagarry Garryvoe Ballycotton Preliminary Report, WYG, 2006) has also indicated that the required water quality standards would not be breached due to the additional discharge volume. It is recommended however that the discharge of treated effluent be remodelled to confirm that there is no unacceptable impact on the receiving waters. The viability of extending the line as against providing disinfection, should the current discharge location prove inadequate, would also be examined.

6.7 Proposal

Expansion of the treatment plant at Castlemartyr above the current 2000 PE is constrained by the limited assimilative capacity at the existing plant outfall on the Kiltha River. Expansion of the plant therefore requires a new disposal point but assimilative capacity throughout the Womanagh catchment and neighbouring catchments is fully utilised. Pumping treated effluent from Castlemartyr to the proposed sea outfall at Ballycotton is therefore seen as the only practical solution in catering for future development in the village and the requisite commensurate increase in treatment capacity. Effluent from Ladysbridge, where the receiving waters are also under stress, could also be conveyed to Ballycotton under the scheme.

The estimated cost of providing pump stations at Castlemartyr and Ladysbridge, and the 10.15 km 150/200mm diameter rising main to Ballycotton is €2.34 million (including VAT) but this is offset by an estimated €300,000 capital cost to be spent in the upgrading of the existing treatment plant in Castlemartyr. However, a review of the proposal to pump to Ballycotton in conjunction with current proposals for the upgrading of the sewerage schemes at Cloyne and Shanagarry, Garryvoe & Ballycotton has led to the development of a regional network, and a reappraisal and revision of the proposed scheme for Shanagarry, Garryvoe and Ballycotton, resulting in an indicative capital saving of €635,000 on the individual schemes. Up to half of this saving would be absorbed by the probable need to provide disinfection or extend the outfall at Ballycotton to cater for the significantly increased discharge, and the capitalisation of the pumping costs associated with the proposal. The regional network does however appear to offer the only practical solution to facilitating any further significant development in the Womanagh catchment, in Castlemartyr in particular, and for improving water quality in the Womanagh and the Lower Harbour (Saleen and Cloyne).

The works proposed would include:

- Upgrading the plant at Castlemartyr to cater for a capacity of 3,000 PE (commensurate with the projected 2028 requirement of 2,800 PE) involving:
  - Upgrading / duplicating the inlet works (screens and pumps)
  - Addition of a 9m diameter Aeration tank
  - An additional 7m diameter Clarifier
  - A second 60m^3 (6m diameter) Sludge Thickening/Holding Tank
  - A storm water holding/balancing tank (80m^3)
  - Odour Control
- Construction of treated effluent pumping stations at Castlemartyr and Ladysbridge;
- Construction of an 10.15km 150/200mm diameter rising main from Castlemartyr, via Ladysbridge to Ballycotton.

The cost estimate for the Proposal is included in Appendix 9.

6.8 Statutory Processes

The following outlines the current status for the site regarding statutory requirements / legislation:

- Land acquisition and wayleaves - currently underway.
- Part 8 Planning is being processed.
- A Waste Discharge Licence Application for the existing plant has been lodged with the EPA.

11 CONTRACT STRATEGY

The treatment plants at Midleton, Castlemartyr and Cloyne are currently being operated and maintained by EPS under a 10 year contract, of which there is approximately 8 ½ years to run. There are therefore a number of options for the procurement, as a bundle, of the upgrades of these plants and the construction, maintenance and operation of the new plants at Saleen and Ballycotton. The procurement of the necessary associated upgrading of the collection systems in Saleen and Ballycotton are also a consideration. The various options have been reviewed in the Public Private Partnership Assessment Report and procurement through two contracts using DB/DBO for Contract 1 and Public Works Designed by the Employer for Contract 2 has been recommended.

12 SUMMARY

The original project covered four urban centres – Midleton, Castlemartyr, Cloyne and Saleen. Subsequently Ballycotton was included. All have experienced significant growth since the census year 1996 (average 5.1% p.a.) and particularly so in the latest census period 2002 – 2006 (average 6.8% p.a.). To cater for this recent rapid development and projected future requirements, the following upgrades of the wastewater treatment facilities are proposed:

12.1 Midleton

For the 2006 Census the population of Midleton is shown as 10,048. This is projected to rise to between 19,600 (low/medium growth) and 25,000 (high growth) by the year 2028. This order of development can be catered for within the zoning of the current Midleton Special Local Area Plan.

The existing treatment plant at Midleton has an indicated design capacity of 10,000 PE and is currently operating at an average daily throughput of c.11,500 PE (BOD). To cater for a design PE of 27,000 (including commercial, industrial and community contributions) for the year 2028, the following phased upgrading of the existing plant is proposed:

Phase 1
Provision of:
- A third 5,000 PE EAS tank similar to the existing (40m x 12m)
- A clarifier (19m diameter)
- A picket fence thickener (120m^3)
- A second centrifuge (10m^3/hr)

Phase 2
Development of an EIS and planning documents for the continued expansion of the works up to a long term design capacity of 30,000 PE.

12.2 Castlemartyr

The population of Castlemartyr for the 2006 Census is shown as 978. This is projected to rise to between 1,900 and 2,500 by the year 2028. This order of development can be catered for within the zoning of the current Local Area Plan for the village.

The existing treatment plant at Castlemartyr has an indicated design capacity of 2,000PE but last year had an anomalous average throughput of 2,600 PE (BOD). The projected long term (year 2028) requirement at Castlemartyr is for 3,000 PE. The Kiltha River, to which the plant effluent is discharged, is deemed to provide inadequate dilution and to have inadequate assimilative capacity to accommodate this discharge, even if high treatment standards are applied. It is therefore proposed to increase the existing plant capacity to 3,000 PE, and pump the treated effluent to the proposed sea outfall at Ballycotton for discharge.

The upgrade works proposed would include:

- Upgrading the plant at Castlemartyr to 3,000 PE capacity;
- Construction of a pump station and associated 8.6km rising main from Castlemartyr, via Ladysbridge to Monagurra; where it would join with the proposed Cloyne to Ballycotton treated effluent rising main.

12.3 Cloyne

The 2006 Census population for Cloyne was 1,095. This is projected to rise to between 2,150 and 2,700 by the year 2028, producing a design PE of 3,000, including commercial, industrial and community contributions. This projected level of development could be accommodated within the zoning contained in the current Cloyne Local Area Plan.

The existing treatment plant has an indicated capacity of 1,400 PE but the units are considered to equate more to a 2,000 PE plant. To cater for the projected longer term development and the additional raw effluent to be pumped from Saleen for treatment at Cloyne, it is proposed that the existing plant is duplicated by the provision of:

- Upgrading / duplicating the inlet works (screens and pumps)
- A second 11m diameter aeration tank
- A second 9m diameter clarifier
- A second 60m^3 Sludge Thickening/Holding Tank

Disposal of the effluent from the plant is problematic with no significant watercourse in the area. It is therefore proposed to provide a pumpstation and a 9.6km long, 200mm diameter rising main to pump the effluent to the proposed sea outfall at Ballycotton.

12.4 Saleen

Existing treatment at Saleen is a totally inadequate septic tank which discharges to the adjacent "Saleen Stream". It is proposed that the untreated wastewater from Saleen be pumped to Cloyne for treatment.

Proposed works include construction of:

- A sewage pumping station (6KW) with duty/standby non-clogging submersible pumps;
- A Control House to house pump controls and an emergency generator (10kW);
- A 4.05 km100mm diameter rising main to Cloyne;
- A header chamber with odour control at Cloyne WWTP.

It is also proposed to lay a new trunk sewer (0.5 km x 225mm diameter) connecting the existing collection network in the village to the pump station and to carry out minor modification of the existing collection system to facilitate this.

Appendix 1

Development Plans

Table A1.1 LAP Development Potential – Castlemartyr

Residential	Ha.	No. of Units		PE [1]
Medium Density [2]	11.9	240		700
Low Density [3]	17.2	170		500
				1,200
Current (2006 Census)				978
Total				2,178
Projected (2028)			High	2,500
			Low	1,900

Table A1.2 LAP Development Potential – Cloyne

Residential	Ha.	No. of Units		PE[1]
Medium Density[2]	23.1	460		1,350
Low Density[3]	14.1	140		400
				1,750
Current (2006 Census)				1,095
Total				2,845
Projected (2028)			High	2,780
			Low	2,150

Table A1.3 LAP Development Potential – Saleen

Residential	Ha.	No. of Units		PE[1]
Medium Density[2]	10.4	210		600
Low Density[3]	2.6	25		75
				675
Current (PR)				351
Total				1,026
Projected (2028)			High	890
			Low	690

[1] CSO: c. 3 persons / dwelling
[2] Midleton Electoral LAP: MD = 12-25/ha – Allow 20
[3] Midleton Electoral LAP: LD = 5-12/ha – Allow 10

Appendix 3

Existing WWTPs: Current Performance

Castlemartyr

Figure 3.7 Castlemartyr Waste Water Treatment Plant Hydraulic and Biological Loads (2007)

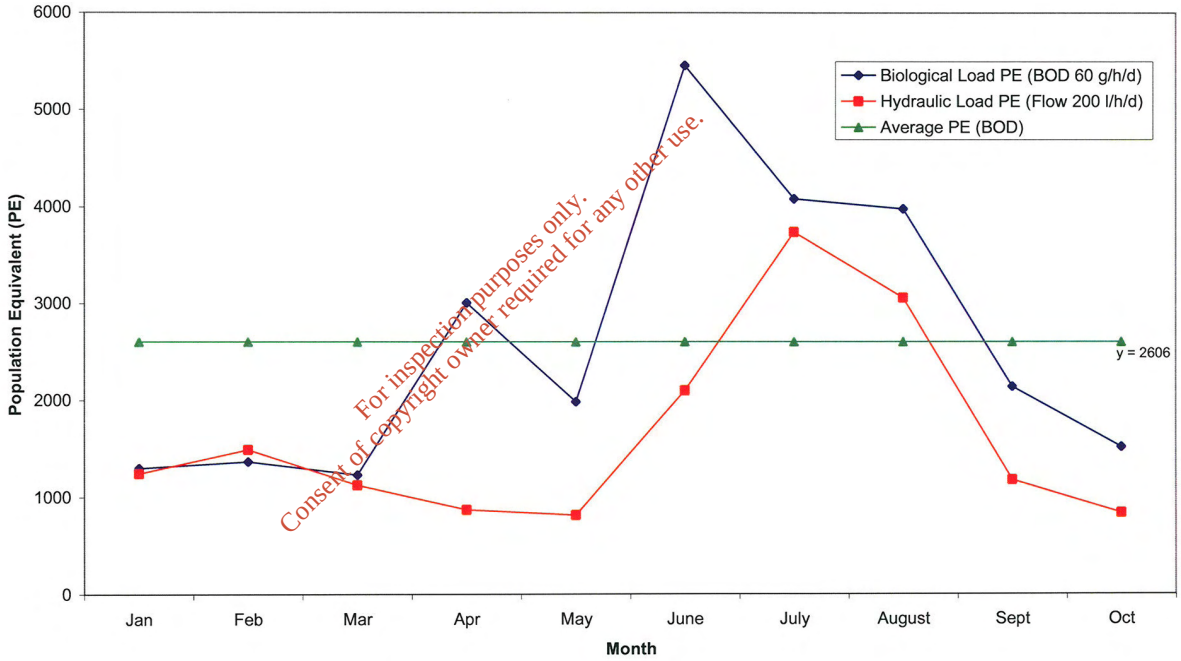


Figure 3.8 Castlemartyr Effluent BOD Concentration (2007)

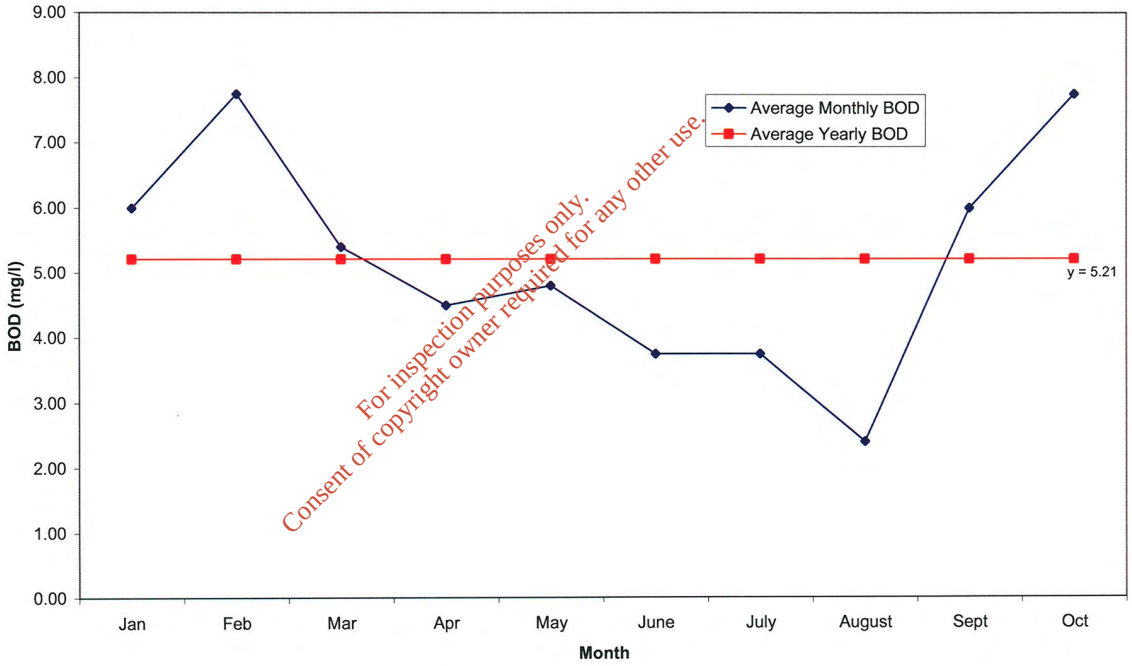


Figure 3.9 Castlematyr Effluent Suspended Solids Concentration (2007)

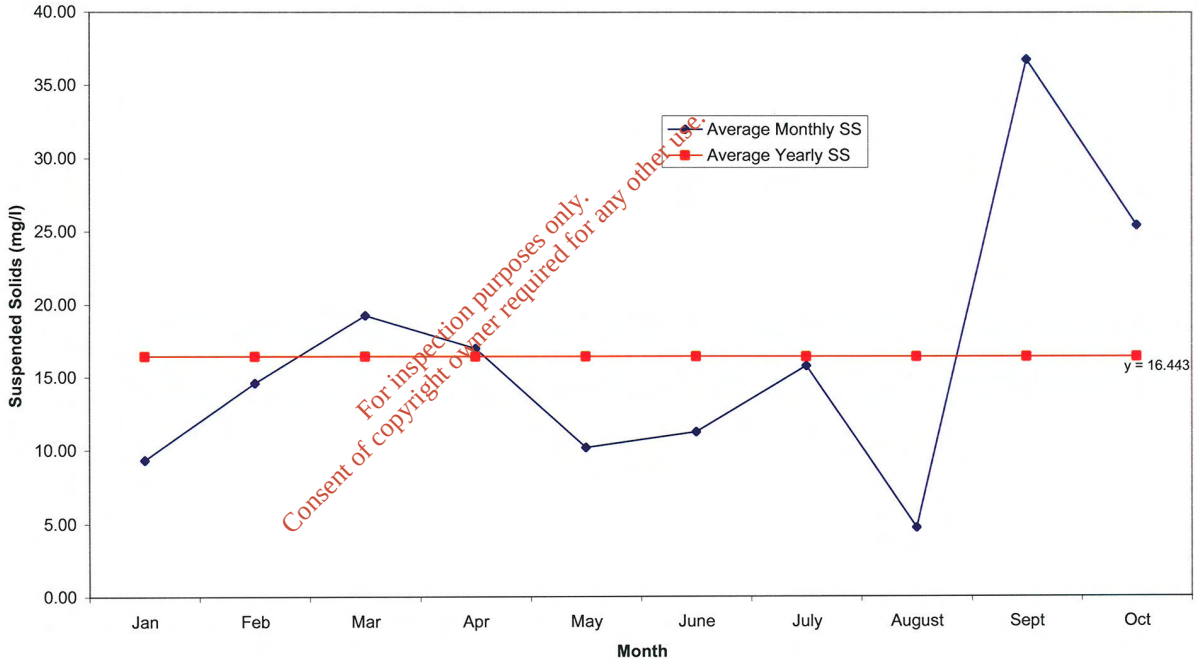
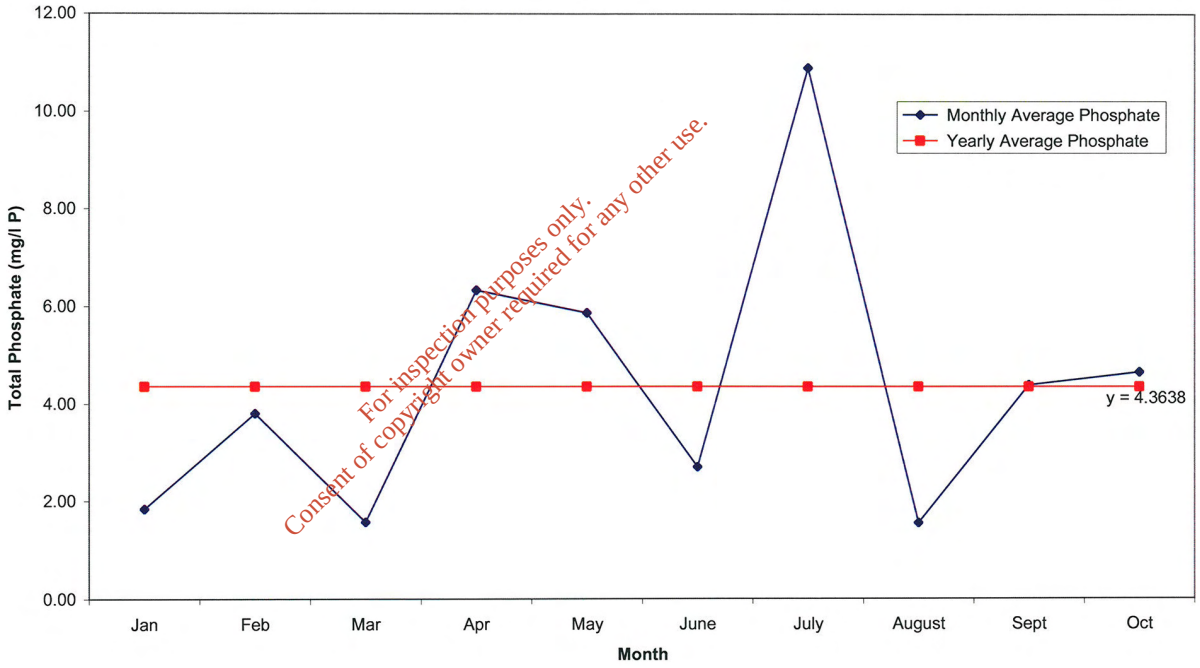


Figure 3.10 Castlemartyr Effluent Total Phosphate Concentration Detected (2007)



Appendix 4

Water Quality: Kiltha River

Table A4.1 Water Quality - Castlemartyr Bridge (Stn. 1000)

Parameter	Unit	1998 – 2000	2002 – 2005	Limit (1)
pH	-	8.0	-	-
BOD	mg/l	1.3	-	3.0
COD	mg/l	-	-	-
SS	mg/l	-	-	25
Nitrate	mg/l N		6.2	5.6
Nitrite	mg/l N	6.5	0.014	0.5
Orthophosphate	mg/l P	0.2	0.135	0.03
Ammonia	mg/l NH_3	0.001	-	0.02
Ammonium	Mg/l NH_4	0.076	0.046	0.3

(1) Source: Cork County Council Guideline Water Quality Limit Values.

Table A4.2 Potential Treated Effluent Standard (for upgraded existing plant)

PE	2,000
Av. Flow	360m^3/d
BODs	10mg/l
SS	10mg/l
Ammonium	4mg/l NH_4
Orthophosphate	0.5mg/l P
Total Nitrogen	15mg/l N(1)

(1) Predominately Nitrate

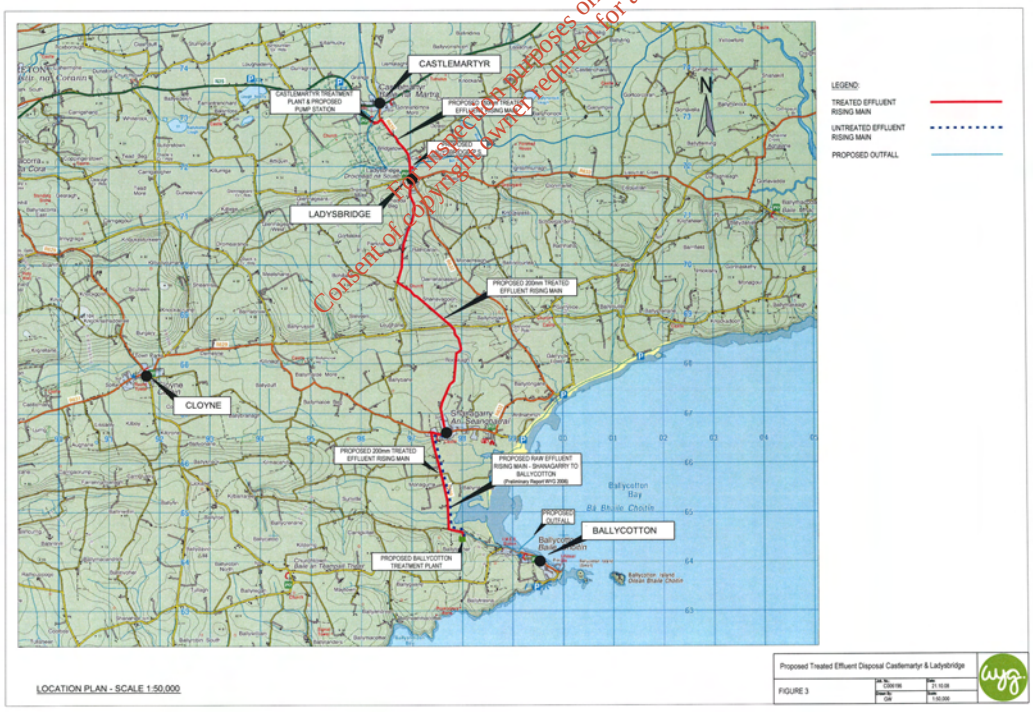
Table A4.3 Projected Water Quality – Upgraded 2000 PE Plant

	Unit	Current	Post Discharge.	Limit
Flow	l/s	36	40	-
pH		8.0	8.0	-
BOD_5	mg/l	1.3	2.2	3
SS	mg/l	-	-	25
Ammonium	mg/l NH_4	0.06	0.45	0.3
Orthophosphate	mg/l P	0.16	0.29	0.03
Nitrate	mg/l N	6.2	6.8	5.6

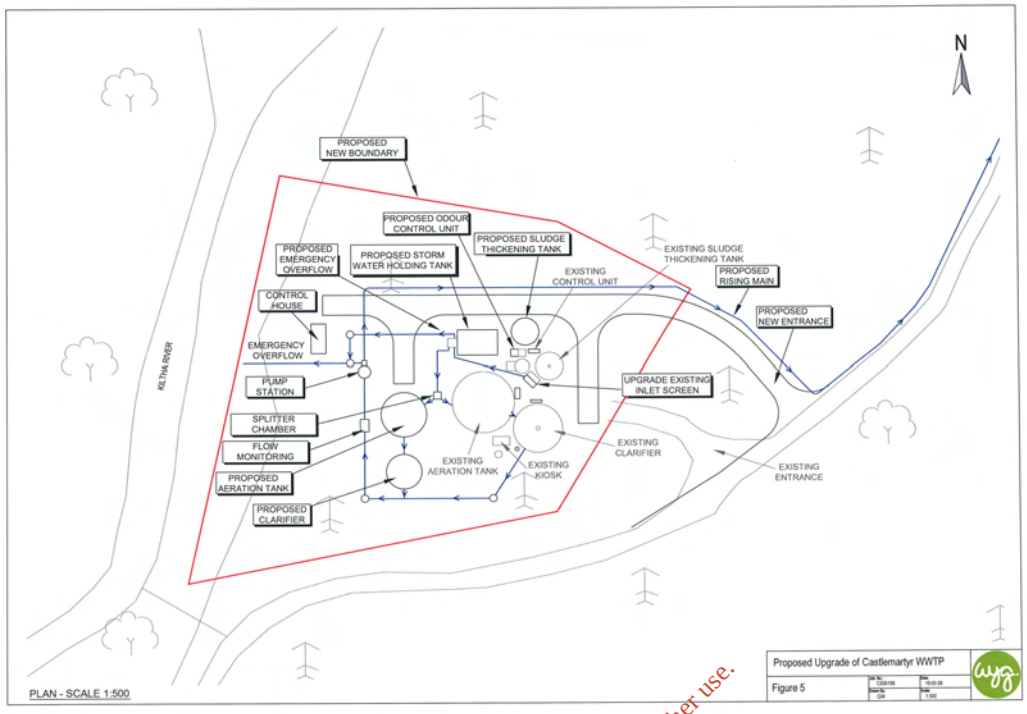
Appendix 7

Figures

LOCATION PLAN - SCALE 1:50,000



LOCATION PLAN - SCALE 1:50,000



Appendix 8

Outline Designs

Castlemartyr

Existing

1) Inlet Works
Design PE = 2,000
DWF = 360 m^3/d = 15m^3/hr

2) Aeration Tank
Tank dimensions: Diameter = 12m; Area = 113 m^2; h_w = 2.5m
Tank Volume ≈ 280 m^3
Detention time = 18.6 hours

BOD loading = 2000 x 60mg
= 120 kg/d

Organic loading = 120/280
= 0.43 kg BOD/m^3.d (recommended organic loading range is 0.3 – 0.6).

Allow MLVSS = 2,000 mg/l
FM Ratio (F) = 120 x 10^3 / 280 x 10^3 x 2
= 0.21 /d (recommended F range is 0.2 – 0.5)

3) Clarifier
Clarifier dimensions: Diameter = 9m; Area = 64 m^2; h_w = 1.8m.
Clarifier Volume = 115 m^3
Detention time = 7.6 hours

Surface loading = 5.6 m/d @ 1 DWF
= 16.8 m/d @ 3 DWF (recommended maximum 30-40 m/d)

4) Sludge Holding Tank
Sludge holding tank dimensions: Diameter = 5.5m; Area = 23.7m^2; h_s = 3m
Sludge holding tank Volume = 71 m^3

Excess Sludge Production	= 0.85 kg DS /kg BOD removed
BOD in	= 120 kg/d
BOD out (360 m^3/d @ 5ppm)	= 1.8 kg/d
BOD removed	≈ 118 kg/d
Excess Sludge	= 118 x 0.85
	= 100 kg/d DS
Sludge Volume	= 10 m^3/d pre-thickening @ 1% DS
	= 4.0 m^3/d post-thickening @ 2.5% DS

Currently c. 10 days storage for 2000 PE / 360 m^3/d throughput

Proposed Upgrade

Design PE = 3000

- Upgrading / duplicating the inlet works (screens and pumps)
- Additional 9m diameter Aeration tank
- Additional 7m diameter Clarifier
- A second 60m^3 (6m diameter) Sludge Thickening/Holding Tank
- Storm Water Holding/Balancing Tank (80m^3)
- Treated effluent pumping stations
- Odour Control Unit

Dixon Brosnan
environmental consultants

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CONTENTS

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.

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.

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.

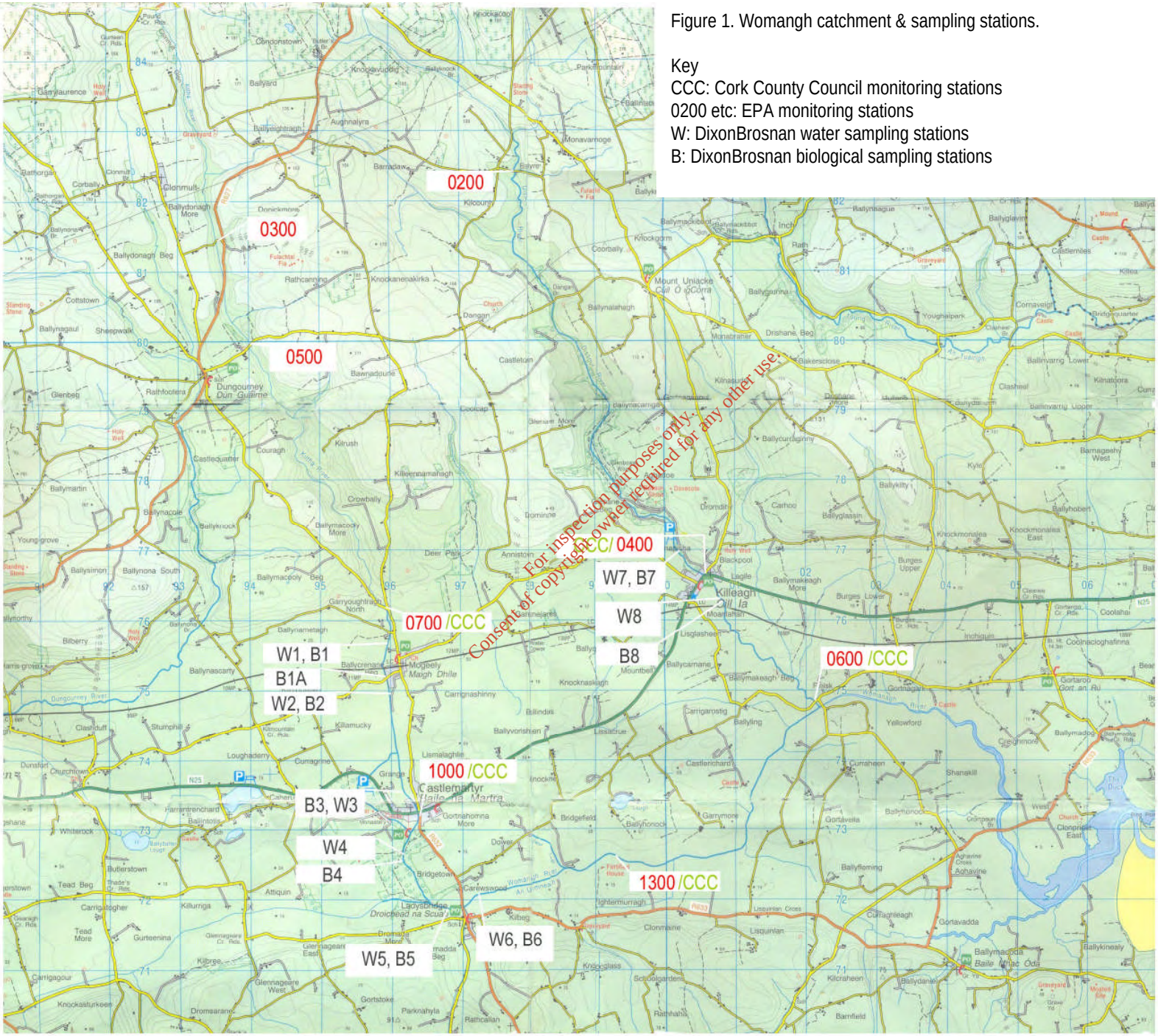

Figure 1. Womangh catchment & sampling stations.

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

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

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.

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.

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.

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.

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

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.

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

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.

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.

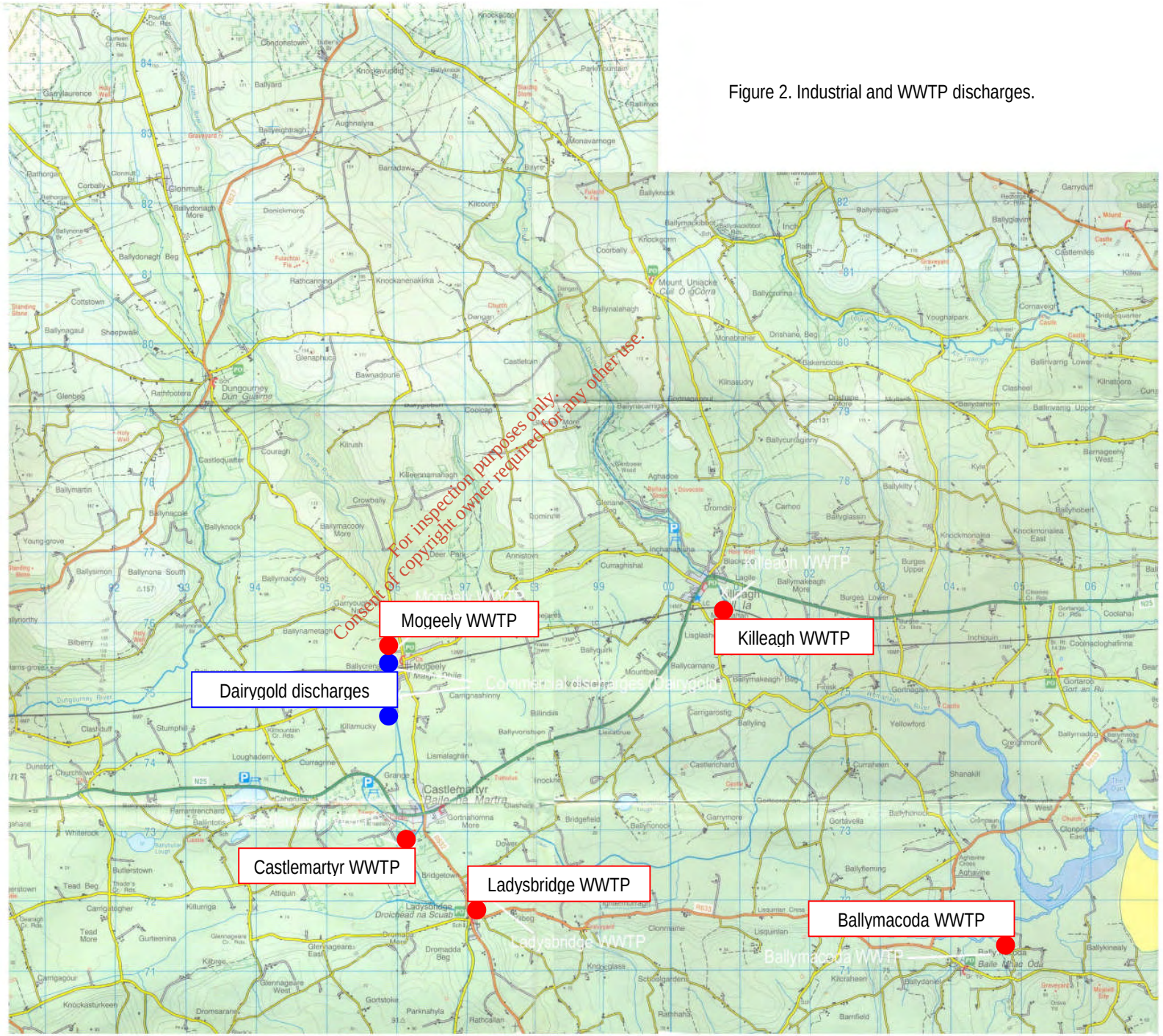

Figure 2. Industrial and WWTP discharges.

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.

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

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.

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

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

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).

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.

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

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.

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

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.

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.

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

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.

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

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

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

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

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

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

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.

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

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.

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.

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	

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

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.

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.

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.

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.

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.

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.

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.

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

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).

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

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

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.

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.

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.

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.

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'.

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

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.*

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.

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.

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.

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.

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

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.

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.

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

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.

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.

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.*

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

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.

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).

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

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.

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.

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.

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

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.

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

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.

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

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.

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.

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.

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.

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.

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.

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.

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

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.

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

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.

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.

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.

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.

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

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.

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

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.

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

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.

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.

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.

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.

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.

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.

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.

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

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.

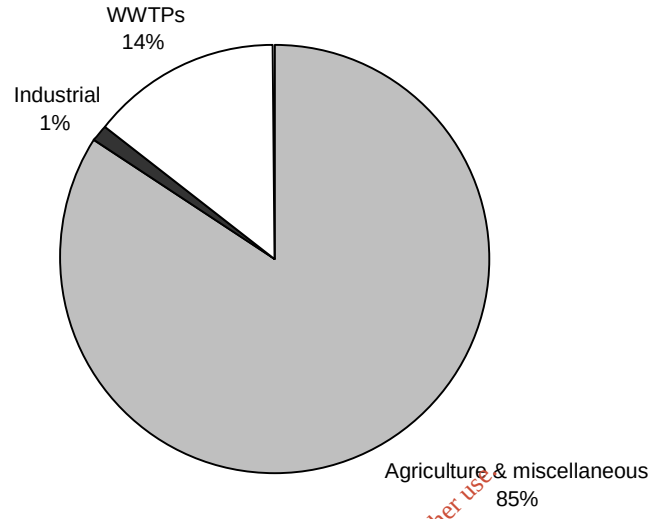

Figure 3. Current loading sources in Womanagh catchment.

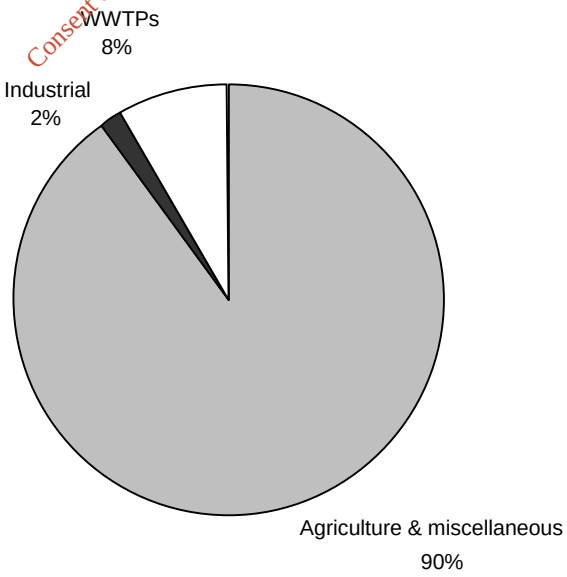

Figure 4. Loadings in Womanagh catchment following proposed upgrade programme.

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

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.

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.

Appendix 1 –Discharges within the Womanagh Catchment
The following discharges were noted during surveys of the catchment.

Location	GPS	Comments	Impact
Killeagh u/s of bridge	X006 766	Large pipe. No discharge noted	No impact noted.
Killeagh d/s of bridge (RHS)	X006 765	Stone channel	No impact noted.
Killeagh d/s of bridge (LHS)	X006 765	Large pipe. No discharge noted.	Possible impact. May be some sewage contamination
Killeagh approximately 50m d/s of bridge on LHS	X006 764	Pipe from dwelling. Minimal discharge noted.	Sink and/or sewage discharge. Impacting on water quality.
Killeagh 65m d/s of bridge approximately on LHS	X006 764	Pipe from dwelling.	Sink and/or sewage discharge. Impacting on water quality with strong odour and sewage fungus noted
Killeagh d/s of bridge approximately 70m on LHS	X006 764	2 pipe.	Slight impact on river. Probably grey water.
Killeagh WWTP RHS	X007 764	1st pipe strong flow of relatively clear water 2nd pipe discharge of cloudy liquid.	2nd pipe having an obvious impact on water quality with high silt levels and strong odour immediately downstream of the discharge.
Bridge Castlemartyr LHS	W964 733	Concrete chute. No discharge	No impact noted.
80m upstream of Castlemartyr Bridge	W963 733	Plastic pipe. No discharge	No impact noted.
100 m upstream of Castlemartyr Bridge	W963 734	Plastic pipe. No discharge	No impact noted.
140 m upstream of Castlemartyr Bridge RHS	W963 734	Plastic pipe. No discharge	May be a limited impact.
145 upstream of Castlemartyr Bridge	W963 734	Plastic pipe. No discharge	Probably having a limited impact.
200m upstream of Castlemartyr Bridge RHS	W963 735	2 pipes	May be a limited impact from one of these pipes
Castlemartyr WWTP RHS	W962 729	Discharge	Impact moderate
50 u/s of bridge in Ladysbridge to main channel RHS	W968 719	Small discharge, relatively clear	No obvious impact.
Ladysbridge WWTP discharge LHS to Main channel	W972 720	Cloudy discharge	Obvious impact for approximately 50m downstream of discharge.
Bridge in Ladysbridge	W972 718	Concrete pipe no discharge	No impact noted. Probably surface water
20m upstream of bridge on a tributary of the main channel	W972 718	New concrete pipe	No impact noted. Probably surface water
40 m upstream of bridge . on a tributary of the main channel	W972 718	Pipe	No impact noted. Probably surface water
60m upstream of bridge on a tributary of the main channel	W972 718	Pipe	No impact noted. Probably surface water
100 upstream of bridge on a tributary of the main channel	973 717	Concrete pipe. Slight discharge	May be slight impact. Probably surface water

Appendix 1 –Discharges within the Womanagh Catchment (continued)

Location	GPS	Comments	Impact
Womanagh 1st bridge west of Ladysbridge	939 719	Pipe	May be slight impact.
Mogeely WWTP discharge		Small volume of cloudy water. Moderate odour	Some impact noted.
50m upstream of Mogeely Bridge on LHS		Concrete pipe. Cloudy discharge with moderate odour.	Possibly a sewage discharge. Slight impact.
60m upstream of Mogeely Bridge		Plastic pipe. No discharge	No impact noted
80 m upstream of Mogeely		Plastic pipe. No discharge	No impact noted

Quarries and Pits

Based on the list of registered quarries under Section 261 of the Panning and Development At 2000 and an examination of aerial photographs it was determined that there were a number of quarries within the catchment. These include sites at Killeagh, Kilcraheen, Gortnagark, Gortavella, Ballyeightra and Ightermurragh. No significant impacts on the Womanagh, Dissour or Kiltha were noted. The ste closest to the main channel namely Cronins at Ightermurragh has a recirculating system and does not discharge to the Womanagh. Several of the pits are small. Generally it does not appear that these sites are significantly impacting on water quality.

Abstraction

An apparent abstractions point was noted upstream of the bidge in Killeagh. The purpose of this abstraction is not known.

Appendix 2 –Direct flow measurements

To ascertain the proportionality between the flows at Castlemartyr and Ladysbridge direct flow measurements were taken by Dixon.Brosnan. Although values for flow at each location were determined they do not represent low flows and the objective was to determine the relative flows at each location. The flows at the sites are detailed in table 4.6

Table 4.6 Direct flow measurements

Station		Catchment area Km2	Total flow m3/s	Unit flow M3/s/km2
Castlemartyr WWTP	Kiltha	30	0.197	0.00657
Ladysbridge WWTP	Womanagh	45	0.415	0.00922
Killeagh WWTP	Dissour	31	0.323	0.01042
Finisk	Womanagh	88	1.329	0.0151

As detailed above direct flow measurements suggest that flows are proportionally higher at Ladysbridge compared to Castlemartyr. Results also suggest that flows are proportionally higher at Killeagh than at Castlemartyr. However in the absence of more flow measurements the use of long term data from flow monitoring stations is considered a safer option notwithstanding that there may be a relatively high margin of error on the recorded values.

Appendix 3–Site Synopses

SITE NAME: BALLYCOTTON, BALLYNAMONA AND SHANAGARRY (NHA)
SITE CODE: 000076

This is a composite coastal site stretching northwards from Ballycotton towards Garryvoe. Much of the area was a tidal inlet until 1930 when it was cut off from the sea by the development of a shingle storm beach. This created a series of three wetlands, only the middle of which remained tidal. Recently, however, the shingle bar at the southern end of the site was breached destroying Ballycotton Lake and rendering this inlet tidal also.

The site is important for its wetlands, which have, however, been damaged by drainage, land reclamation and a breach in the shingle bar in recent years. Wetlands on the site include reedswamp with Common Reed (Phragmites australis) and marshes near Garryvoe with Greater Pond-sedge (Carex riparia), Water Dock (Rumex hydrolapathum) and Pink Water-speedwell (Veronica catenata), amongst others.

The shingle beach on the site is mobile and is influenced by storms, which create open conditions that favour a particular suite of species. Species found here include Grass-leaved Orache (Atriplex littoralis), Black Mustard (Brassica nigra), Sea Radish (Raphanus raphanistrum subsp. maritimum), Sand Couch (Elymus farctus) and Lyme-grass (Leymus arenarius). Also growing on the shingle beach is Sea-kale (Crambe maritima), a rare species listed in the Red Data Book.

The site is also of ornithological importance. It contains nationally important numbers of eight species of waterfowl, i.e. Bewick's Swan (100), Gadwall (70), Shoveler (93), Coot (311), Ringed Plover (122), Grey Plover (60), Sanderling (93) and Turnstone (112) - all counts are the average of 19 counts over three seasons between 1984/85 and 1986/87. A further thirteen species occur in regionally or locally important numbers. The site is also notable for its use by rare migrant species. Reed Warblers, rare in Ireland, breed in the Common Reed beds.

Land use within the site is varied, but grazing is dominant. The site has been much damaged by land reclamation, drainage and breaching of the shingle bar, the latter leading to the loss of a brackish lake (Ballycotton Lake) and the almost total disappearance of the many wildfowl, including the Swan species that used it. The site is a Wildfowl Sanctuary, and part of it a Special Protection Area.

The site has some geological interest, with the eroding cliffy shoreline at Garryvoe revealing two glacial tills, one being produced by the local mountain glacier and the other by the Irish Sea ice sheet. Several habitats that are listed on Annex I of the EU Habitats Directive occur on the site and it is of considerable ornithological importance, particularly for the waterfowl that use it. The presence of breeding Reed Warblers is also of interest. The occurrence of the rare, Sea-kale adds to the interest of the site. Despite the damage to some of the habitats on the site, it remains a very diverse site of considerable ecological and conservation importance.

SITE NAME: BALLYMACODA (CLONPRIEST AND PILLMORE) (SAC)
SITE CODE: 000077

This coastal site stretches north-east from Ballymacoda to within 6 km of Youghal, Co. Cork and is situated between two other NHAs (Ballycotton, Ballynamore and Shanagarry and Ballyvergan Marsh). The site contains several habitats listed in Annex I of the EU Habitats Directive, namely: Salicornia Mud, Atlantic Salt Meadows, Large Shallow Inlets and Bays, Estuaries.

The Womanagh River forms an estuary comprised of sand and mud flats, flanked by reclaimed marshy fields and saltmarsh. The area is sheltered by a stabilised shingle bar and extensive sandy beach. In places, the inter-tidal flats are colonised by algal mats (Enteromorpha sp.) with brown seaweeds (Fucus sp.) occurring on the rocky shores of the shingle spits. Common Cord-grass (Spartina anglica) has spread within the estuary since the late 1970's and may pose a threat to mudflat feeders.

This 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 (1995-96 peak = 19,725). A total of 107 wetland species have been recorded from this site. Maximum figures for 1996-1997 show that the Golden Plover, a species listed under Annex I of the Birds Directive, reached internationally important numbers (10,250) and that the Bar-tailed Godwit, another Annex I species, was present in nationally important numbers (611). Ten other species also occurred in nationally important numbers: Teal (911), Ringed Plover (246), Grey Plover (427), Lapwing (4260), Sanderling (113), Dunlin (3,650), Curlew (1,246), Redshank (366), Black-tailed Godwit (489) and Turnstone (127). 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 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 EU 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 ten further bird species.

SITE NAME: BALLYVERGAN MARSH (NHA)

SITE CODE: 000078

This site is located about 3km south-west of Youghal adjacent to the Cork Road. The area includes an extensive reed bed with some marshy land around the edges. The marsh is separated from the area by a shingle bank and sand hills.

The following habitat description for the site is derived largely from the 1986 An Foras Forbartha County Report: Common Reed (Phragmites australis) covers the largest area, but a great variety of the larger Sedges also occur (Carex riparia, C. acuta, C. pseudo-cyperus and C. acutiformis). Water Dock (Rumex hydrolapathum), Purple-loosestrife (Lythurim salicaria) and Branched Bur-reed (Spargamium erectum) grow interspersed among the sedges, while on muddier ground, which is flooded only in winter, Celery-leaved Buttercup (Raminculus sceleratus) and nodding Bur-Marigold (Bidens cernua) occur.

A secondary habitat, described in the Rare Plant Survey of Co. Cork (1992-93), is a clay/sand cliff occurring on the coast adjacent to the marsh. This adds to the interest of the site since it supports a rare species (see below), along with abundant Kidney Vetch (Anthylliz vulneraria) and Red Fescue (Festuca rubra).

Growing abundantly on the cliff is Wild Clary (Salvia verbenaca), a species described as rare in the Irish Red Data Book.

The main interest of the marsh is ornithological, with the reed bed supporting a sizeable proportion of the Irish breeding population of Reed Warblers. This species has only recently become an established breeding bird in Ireland. Other breeding birds using the site include Reed Buntings, Moorhen, Coot, Water Rail and Mallard.

The recent NHA survey reports that grazing is the dominant land use, but that the greatest threats come from land reclamation (for agriculture and tourism developments) along with large-scale reed burning.

This site is of interest because it contains the largest freshwater coastal marsh in Co. Cork, exhibiting well developed plant communities and holding a sizeable breeding population of Reed Warblers. Adding to the importance of the site is Wild Clary (Salvia verbenaca), a Rare Red Data Book species.

APPENDIX 4: MACROINVERTEBRATE SPECIES LIST

Leutra sp.	Limniphilidae
Amphinemura sp.	Polycentropus sp.
Protonemura sp	Rhyacophila sp.
Chloroperla sp.	Hydropsyche sp.
Perla sp.	Philopotomous sp.
Isoperla grammatica	Gammerus sp.
Baetis rhodani	Asellus sp.
Ecdynorus sp.	Ancylidae
Rhrithrogena sp.	Tipulidae
Caenis sp.	Tabanidae
Gammarus sp.	Simulidae
Seristocomatidae	Chironomidae
Goeridae	Chironomous sp.
Hminthidae	Oligochaeta
Dytnidae	Tubificidae

Fish species noted include grey mullet, stickleback, stone loach, flounder, brook lamprey and brown trout.

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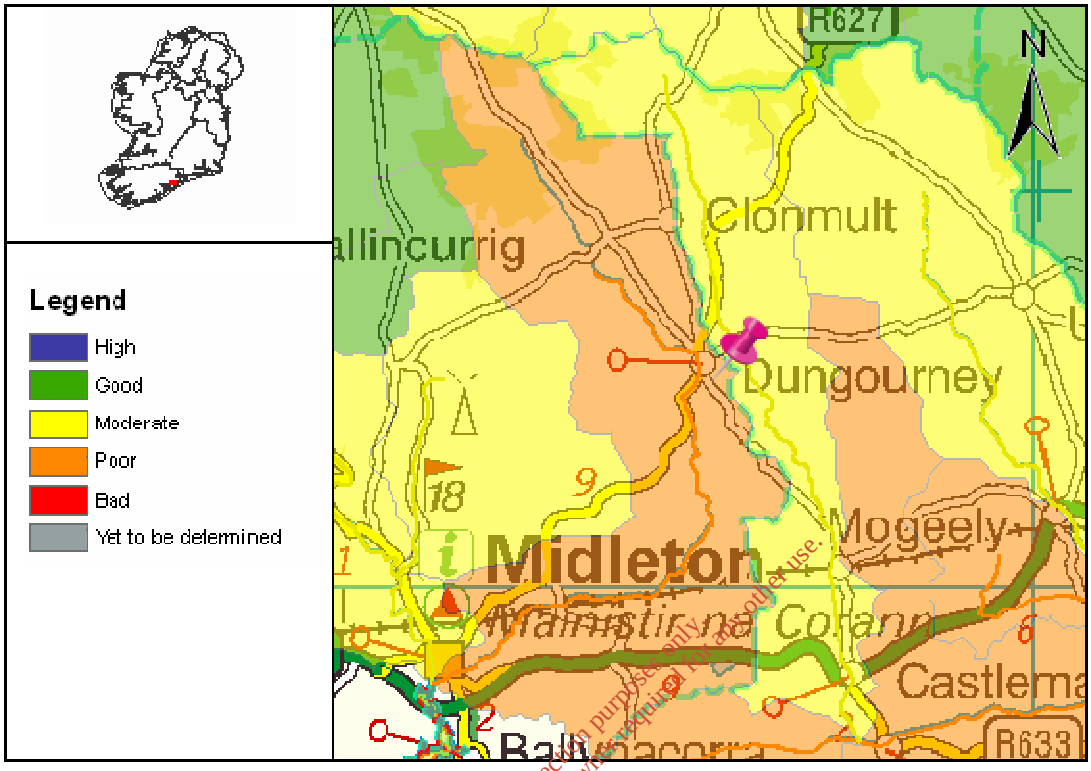
Full Report for Waterbody Kiltha, Trib of Womanagh



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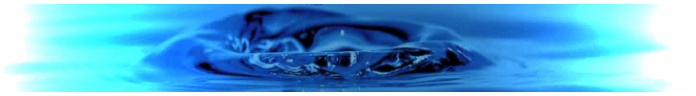

Summary Information:

WaterBody Category:	Subbasin Waterbody
WaterBody	Kiltha, Trib
WaterBody	IE_SW_19_1909
Overall	Moderate
Overall	Restore
Overall Risk:	1a At Risk
Applicable Supplementary	Unsewered; Report data

south western river basin district

Date Reported to Europe: 22/12/2008

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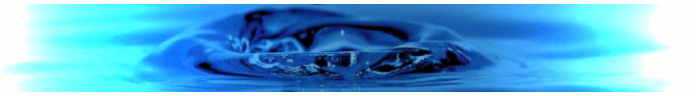

Status Report

WaterBody Category: Subbasin

WaterBody Name: Kiltha, Trib

WaterBody Code: IE_SW_19_1909

Overall Status Result: Moderate

south western river basin district

	Status Element Description	Result
EX	Status from Monitored or Extrapolated Waterbody	
	Biological Elements	
Q	Macroinvertebrates (Q-Value)	Moderate
F	Fish	Good
DI	Phytobenthos (Diatoms)	n/a
FPM	Status value as determined by Margartifera	n/a
	Supporting Elements	
MOR	Hydromorphology	n/a
SP	Specific Pollutants	n/a
PC	General Physico-Chemical	n/a
	Chemical Status	
PAS	Chemical Status	n/a
	Overall Ecological Status	
O	Overall Ecological Status	Moderate

Date Reported to Europe: 22/12/2008

Date Report Created 02/06/2010

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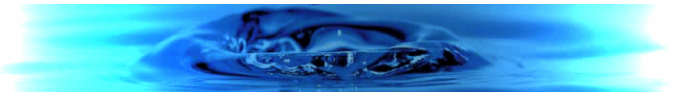

Risk Report

WaterBody Category: Subbasin

WaterBody Name: Kiltha, Trib

WaterBody Code: IE_SW_19_1909

Overall Risk Result: 1a At Risk

south western river basin district

	Risk Test Description	Risk
	Point Risk Sources	
RP1	WWTPs (2008)	1a At Risk
RP2	CSOs	1b Probably At Risk
RP3	IPPCs (2008)	2b Not At Risk
RP4	Section 4s (2008)	2b Not At Risk
RPO	Overall Risk from Point Sources - Worst Case (2008)	1a At Risk
	Diffuse Risk Sources	
RD1	EPA diffuse model (2008)	1b Probably At Risk
RD2a	Road Wash - Soluble Copper	2b Not At Risk
RD2b	Road Wash - Total Zinc	2b Not At Risk
RD2c	Road Wash - Total Hydrocarbons	2b Not At Risk
RD3	Railways	2b Not At Risk
RD4a	Forestry - Acidification (2008)	2b Not At Risk
RD4b	Forestry - Suspended Solids (2008)	2b Not At Risk
RD4c	Forestry - Eutrophication (2008)	2a Probably Not At Risk
RD5a	Unsewered Areas - Pathogens (2008)	2a Probably Not At Risk
RD5b	Unsewered Phosphorus (2008)	2b Not At Risk
RD5	Overall Unsewered (2008)	2b Not At Risk
RD6a	Arable	2a Probably Not At Risk
RD6b	Sheep Dip	2b Not At Risk
RD6c	Forestry - Dangerous Substances	2b Not At Risk
RDO	Diffuse Overall -Worst Case (2008)	1b Probably At Risk
	Morphological Risk Sources	
RM1	Channelisation (2008)	2b Not At Risk
RM2	Embankments (2008)	2b Not At Risk
RM3	Impoundments	2b Not At Risk
RM4	Water Regulation	2b Not At Risk
RMO	Morphology Overall - Worst Case (2008)	2b Not At Risk

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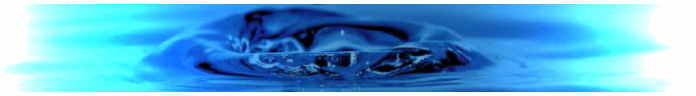

	Q/RDI or Point/Diffuse	
QPD	Q class/EPA Diffuse Model or worst case of Point and Diffuse (2008)	1a At Risk
	Hydrology	
RHY1	Water balance - Abstraction	2b Not At Risk
	Overall Risk	
RA	Rivers Overall - Worst Case (2008)	1a At Risk

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Objectives Report

WaterBody Category: Subbasin Waterbody

WaterBody Name: Kiltha, Trib

WaterBody Code: IE_SW_19_1909

Overall Objective: Restore

south western river basin district

	Objectives Description	Result
	Objectives	
OB1	Objective 1 - Protected Areas	Not Applicable
OB2	Objective 2 - Protect High and Good Status	Not Applicable
OB3	Objective 3 - Restore Less Than Good Status	Restore
OB4	Objective 4 - Reduce Chemical Pollution	Not Applicable
OBO	Overall Objective	Restore
	Deadline	
YR	Default Year by which the objective must be met	2015
EX	Revised Objective Deadline	2015
OBO	Overall Objective and Deadline	Restore - 2015

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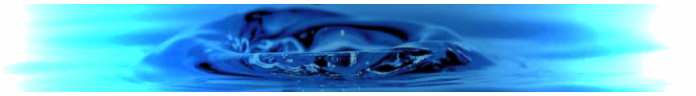

Basic Measures Report

WaterBody Category: Subbasin Waterbody

WaterBody Name: Kiltha, Trib of Womanagh

WaterBody Code: IE_SW_19_1909

south western river basin district

	Basic Measures Description	Applicable
	Key Directives	
BA	Bathing Waters Directive	No
BI	Birds Directive	No
HA	Habitats Directive	No
DW	Drinking Waters Directive	Yes
SEV	Major Accidents and Emergencies (Seveso) Directive	Yes
EIA	Environmental Impact Assessment Directive	Yes
SE	Sewage Sludge Directive	Yes
UW	Urban Waste Water Treatment Directive	Yes
PL	Plant Protection Products Directive	Yes
NI	Nitrates Directive	Yes
IP	Integrated Pollution Prevention Control Directive	Yes
	Other Stipulated Measures	
CR	Cost recovery for water use	Yes
SU	Promotion of efficient and sustainable water use	Yes
DWS	Protection of drinking water sources	Yes
AB	Control of abstraction and impoundments	Yes
PT	Control of point source discharges	Yes
DI	Control of diffuse source discharges	Yes
GWD	Authorisation of discharges to groundwater	No
PS	Control of priority substances	Yes
MOR	Control of physical modifications to surface waters	Yes
OA	Controls on other activities impacting on water status	Yes
AP	Prevention or reduction of the impact of accidental pollution incidents	Yes

Date Reported to Europe: 22/12/2008

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Urban and Industrial Discharges Supplementary Measures Report

WaterBody Category: Subbasin Waterbody

WaterBody Name: Kiltha, Trib of Womanagh

WaterBody Code: IE_SW_19_1909

south western river basin district

	Point discharges to waters from municipal and industrial sources	Result
PINDDIS	Is there one or more industrial discharge (Section 4 licence issued by the local authority or IPPC licence issued by the EPA) contained within the water body?	No
PINDDISR	Are there industrial discharges (Section 4 licence issued by the local authority or IPPC licence issued by the EPA) that cause the receiving water to be 'At Risk' within the water body?	No
PB1	Basic Measure 1 - Measures for improved management.	Yes
PB2	Basic Measure 2 - Optimise the performance of the waste water treatment plant by the implementation of a performance management system.	No
PB3	Basic Measure 3 - Revise existing Section 4 license conditions and reduce allowable pollution load.	Yes
PB4	Basic Measure 4 - Review existing IPPC license conditions and reduce allowable pollution load.	Yes
PB5	Basic Measure 5 - Investigate contributions to the collection system from unlicensed discharges.	Yes
PB6	Basic Measure 6 - Investigate contributions to the collection system of specific substances known to impact ecological status.	Yes
PB7	Basic Measure 7 - Upgrade WWTP to increase capacity.	Yes
PB8	Basic Measure 8 - Upgrade WWTP to provide nutrient removal treatment.	Yes
PS1	Supplementary Measure 1 - Measures intended to reduce loading to the treatment plant.	Yes
PS2	Supplementary Measure 2 - Impose development controls where there is, or is likely to be in the future, insufficient capacity at treatment plants.	Yes
PS3	Supplementary Measure 3 - Initiate investigations into characteristics of treated wastewater for parameters not presently required to be monitored under the urban wastewater treatment directive.	No
PS4	Supplementary Measure 4 - Initiate research to verify risk assessment results and determine the impact of the discharge.	Yes
PS5	Supplementary Measure 5 - Use decision making tools in point source discharge management.	Yes
PS6	Supplementary Measure 6 - Install secondary treatment at plants where this level of treatment is not required under the urban wastewater treatment directive.	No
PS7	Supplementary Measure 7 - Apply a higher standard of treatment (stricter emission controls) where necessary.	Yes
PS8	Supplementary Measure 8 - Upgrade the plant to remove specific substances known to impact on water quality status.	No

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PS9	Supplementary Measure 9 - Install ultra-violet or similar type treatment.	No
PS10	Supplementary Measure 10 - Relocate the point of discharge.	Yes

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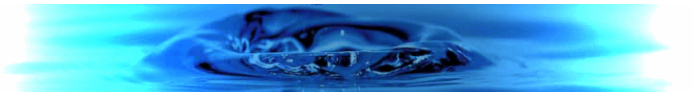

Physical Modifications Supplementary Measures Report

WaterBody Category: Subbasin

WaterBody Name: Kiltha, Trib

WaterBody Code: IE_SW_19_1909

south western river basin district

	Physical Modifications Supplementary Measures	Applicable
	Reduce	
SM1	Codes of Practice	Yes
SM2	Support for voluntary initiatives	Yes
	Remediate	
SM3	Channelisation impact remediation schemes	No
SM4	Channelisation investigation	No
SM5	Overgrazing remediation	No
SM6	Impassable barriers, impact confirmed, investigation into feasibility of remediation required	No
SM7	Impassable barriers investigation	Yes

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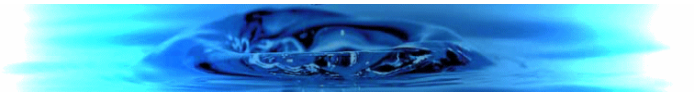

Unsewered Properties Supplementary Measures Report

WaterBody Subbasin Waterbody

WaterBody Name: Kiltha, Trib of Womanagh

WaterBody IE_SW_19_1909

south western river basin district

	Supplementary Measures for Unsewered Properties	Applicable
SP1	Amend building regulations	Yes
SP2	Establish certified expert panels for site investigation and certification of installed systems	Yes
SP3	Assess applications for new unsewered systems by applying risk mapping/decision support systems and codes of practice	Yes
SP4	Carry out an inspection programme in prioritised locations for existing systems and record results in an action tracking system	No
SP5	Enforce requirements for percolation	No
SP6	Enforce requirements for de-sludging	Yes
SP7	Consider connection to municipal systems	No

Date Reported to Europe: 22/12/2008

Date Report Created 02/06/2010

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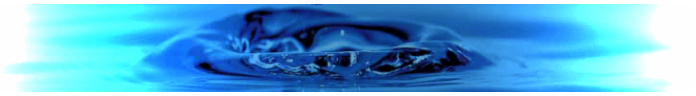

Forestry Measures Report

WaterBody Category: Subbasin Waterbody

WaterBody Name: Kiltha, Trib of Womanagh

WaterBody Code: IE_SW_19_1909

south western river basin district

	Forestry Measures for Forestry	Applicable
SF1	Management Instruments - Ensure regulations and guidance are cross referenced and revised to incorporate proposed measures	No
SF2	Acidification - Avoid or limit afforestation on 1st and 2nd order stream catchments in acid sensitive areas	No
SF3	Acidification - Revise the Acidification Protocol to ensure actual minimum alkalinities are detected and revise boundary conditions for afforestation in acid sensitive areas	No
SF10	Pesticide Use - Pre-dip trees in nurseries prior to planting out	No
SF11	Pesticide Use - Maintain registers of pesticide use	No
SF12	Acidification - Restructure existing forests to include open space and structural diversity through age classes and species mix, including broadleaves	No
SF13	Acidification - Mitigate acid impacts symptomatically using basic material	No
SF14	Acidification - Manage catchment drainage to increase residence times and soil wetting	No
SF15	Acidification - Implement measures to increase stream production.	No
SF16	Eutrophication - Establish riparian zone management prior to clearfelling	No
SF17	Eutrophication and Sedimentation - Enhance sediment control	No
SF18	Eutrophication - Manage catchment drainage to increase residence times and soil wetting, including no drainage in some locations	No
SF19	Sedimentation - Establish riparian zone management prior to clearfelling	No
SF20	Sedimentation - Enhance sediment control	No
SF21	Sedimentation - Manage catchment drainage to increase residence times and soil wetting, including no drainage in some locations	No
SF22	Hydromorphology - Enhance drainage network management, minimise drainage in peat soils	No
SF23	Pesticide Use - Develop biological control methods	No

Date Reported to Europe: 22/12/2008

Date Report Created 02/06/2010

SF4	Eutrophication and Sedimentation - Avoid or limit forest cover on peat sites	No
SF5	Eutrophication and Sedimentation - Change the tree species mix on replanting	No
SF6	Eutrophication and Sedimentation - Limiting felling coup size	No
SF7	Eutrophication and Sedimentation - Establish new forest structures on older plantation sites	No
SF8	Hydromorphology - Audit existing drainage networks in forest catchments	No
SF9	Pesticide Use - Reduce pesticide usage	No

Date Reported to Europe: 22/12/2008

Date Report Created 02/06/2010

Attatchment E4-Castlemartyr Inlet Revised D0134-01

Sample Date	05/09/2007	08/08/2007	17/10/2007	22/11/2007	28/02/2007	07/02/2008	03/04/2008	22/05/2008	17/07/2008	Average
Sample	influent	influent	influent	influent	Influent	Influent	Influent	Influent	Influent	
Flow M^3/Day	*	*	*	*	*	*	*	*	*	
pH	*	*	7.6	*	*	*	*	*	7.3	7.45
Temperature ℃	*	*	*	*	*	*	*	*	*	
Cond 20℃	*	*	*	*	*	*	797	*	889	843
SS mg/L	*	*	*	*	88	*	*	*	418	253
NH_3 mg/L	11.4	*	21.4	*	*	27.7	*	*	53.1	28.4
BOD mg/L	*	*	*	*	*	*	*	*	356	356
COD mg/L	1476	*	507	571	340	294	1177	*	1083	778.285714
TN mg/L	*	*	37	*	*	43	*	*	91	57
Nitrite mg/L	*	*	*	*	*	*	*	*	0.0069	0.0069
Nitrate mg/L	*	*	*	*	*	*	*	*	0.678	0.678
TP mg/L	33	*	*	*	*	5.23	*	*	13.8	17.3433333
O-PO4-P mg/L	12.44	*	*	*	4.9	3.23	4.52	*	9.63	6.944
SO4 mg/L	43.7	*	49.1	*	*	41.7		*	62.4	49.225
Phenols µg/L	*	*	*	*	*	*	*	*	<0.1	<0.1
Atrazine µg/L	*	*	*	*	*	*	*	*	<0.01	<0.01
Dichloromethane µg/L	*	*	*	*	*	*	*	*	<1.0	<1.0
Simazine µg/L	*	*	*	*	*	*	*	*	<0.01	<0.01
Toluene µg/L	*	*	*	*	*	*	*	*	<1.0	<1.0
Tributyltin µg/L	*	*	*	*	*	*	*	*	not required	*
Xylenes µg/L	*	*	*	*	*	*	*	*	<1.0	<1.0
Arsenic µg/L	*	*	*	*	*	*	*	*	1	1
Chromium ug/L	10	56	10	10	*	10	*	10	*	17.6666667
Copper ug/L	1153	1950	10	165	*	135	*	187	*	600
Cyanide µg/L	*	*	*	*	*	*	*	*	5	5
Fluoride ug/l	*	*	*	*	*	*	*	*	<100	<100
Lead ug/L	51	152	10	96	*	10	*	37	*	59.3333333
Nickel ug/L	32	45	10	10	*	10	*	10	*	19.5
Zinc ug/L	727	1568	10	74	*	61	*	91	*	421.833333
Boron ug/L	*	*	*	*	*	24	*	68	*	46
Cadmium ug/L	20	20	20	20	*	20	*	20	*	
Mercury µg/L	*	*	*	*	*	*	*	*	0.4	0.4
Selenium µg/L	*	*	*	*	*	*	*	*	2	2
Barium ug/L	165	304	10	10		21	*	23	*	88.8333333

half of LOD for statistical purposes

Attatchment E4-Castlemartyr Outlet Revised D0134-01

Sample Date	07/02/2008	28/02/2008	13/03/2008	03/04/2008	22/05/2008	10/07/2008	17/07/2008	21/08/2008	03/09/2008	09/10/2008	02/12/2008	10/12/2008	Average	Kg/Day	Kg/year	17/01/2007	########	04/04/2007	30/05/2007	06/06/2007	########	#######	05/09/2007	17/10/2007	22/11/2007	12/12/2007	13/12/2007	Average
Sample	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	2008	2008	2008	effluent	effluent	effluent	effluent	effluent	effluent	effluent	effluent	effluent	effluent	effluent	effluent	2007
Flow M^3/Day	266.6	219.5	405.5	260.6	126.7	253.2	244.4	*	*	*	*	*	253.79	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
pH	7.2	7.3	*	*	7.6	*	7.3	7.4	7.7	*	7.2	*	7.35	*	*	7.1	7.1	7.1	7.2	8	7.3	7.4	7.4	7.2	7.1	7.7	7	7.3
Temperature ℃	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cond 20℃	*	*	*	715	644	1208	683	*	594	*		*	812.5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
SS mg/L	6	10	19	14	15	16	14	19	16	9	7	10	12.9	3.278	1196.4939	61	15	11	300	3	11	5	3	16	34	102	29	49.1666667
NH_3 mg/L	1.2	0.3	3.7	12.3	1.5	2.6	0.5	*	0.2	*	*	*	3.157	0.801	292.4518	*	*	*	*	*	0.05	0.05	0.1	0.2	0.5	1.1	*	0.33333333
BOD mg/L	5.23	8	8.11	10.72	7.47	12	3.28	10.6	7.8	6.5	3.4	8.0	7.5925	1.927	703.3068	11	5.7	4.1	90	1.2	2.6	2.7	1.7	5.04	*	29.9	5.41	14.4863636
COD mg/L	10.5	50	34	70	32	61	29	47	27	21	25	30	36.4	9.231	3369.4812	62	32	36	441	10.5	26	25	10.5	37	51	131	44	75.5
TN mg/L	2.4	2.37	*	15.6	3.7	11.3	5.3	*	11	*	*	*	6.78	1.720	627.8891	13	11.7	24.2	18.5	7.55	*	11.2	4.9	7.6	26	17.1	18.9	14.6045455
Nitrite mg/L	*	*	*	*	*	*	1.07	*	*	*	*	*	1.07	0.272	99.1160	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nitrate mg/L	*	*	*	*	*	*	3.96	*	*	*	*	*	3.96	1.005	366.8219	*	*	*	*	*	*	*	*	*	*	*	*	*	*
TP mg/L	2.1	1.99	1.3	4.75	1.32	0.68	1.19	1.05	2.05	*	*	*	1.83	0.463	169.1045	1.71	0.97	10.53	15.6	<0.2	3.3	1.29	1.41	*	3.83	2.47	2.49	4.36
O-PO4-P mg/L	*	1.9	0.82	4.02	1.16	0.27	0.72		1.57	*	*	*	1.482	0.376	137.2494	*	*	*	*	*	*	0.4	1.28	1.86	*	*	*	1.18
SO4 mg/L	48.4	55.9	*	*	*	*	49.5	*	*	*	*	*	51.3	13.011	4748.9229	*	*	*	*	*	*	58.8	65.8	59.1	42	50	48.7	54.0666667
Phenols µg/L	*	*	*	*	*	*	<0.1	*	*	*	*	*	<0.1	<0.025379	<9.263335	*	*	*	*	*	*	*	*	*	*	*	*	*
Atrazine µg/L	*	*	*	*	*	*	<0.01	*	*	*	*	*	<0.01	<0.0025379	<0.9263335	*	*	*	*	*	*	*	*	*	*	*	*	*
Dichloromethane µg/L	*	*	*	*	*	*	<1.0	*	*	*	*	*	<1.0	<0.25379	<92.63335	*	*	*	*	*	*	*	*	*	*	*	*	*
Simazine µg/L	*	*	*	*	*	*	<0.01	*	*	*	*	*	<0.01	<0.0025379	<0.9263335	*	*	*	*	*	*	*	*	*	*	*	*	*
Toluene µg/L	*	*	*	*	*	*	<1.0	*	*	*	*	*	<1.0	<0.25379	<92.63335	*	*	*	*	*	*	*	*	*	*	*	*	*
Tributyltin µg/L	*	*	*	*	*	*	not required	*	*	*	*	*	not required	not required	not required	*	*	*	*	*	*	*	*	*	*	*	*	*
Xylenes µg/L	*	*	*	*	*	*	<1.0	*	*	*	*	*	<1.0	<0.25379	<92.63335	*	*	*	*	*	*	*	*	*	*	*	*	*
Arsenic µg/L	*	*	*	*	*	*	1	*	*	*	*	*	1	0.000254	0.0926	*	*	*	*	*	*	*	*	*	*	*	*	*
Chromium ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	*	*	<20	<0.005076	<1.8526	*	*	*	*	*	<20	<20	<20	<20	<20	*	*	<20
Copper ug/L	10	10	135	10	10	10	10	10	*	*	*	*	27.8571	7.069745	2580.4569	*	*	*	*	*	<20	<20	<20	<20	43	*	*	43
Cyanide µg/L	*	*	*	*	*	*	6	*	*	*	*	*	6	0.001523	0.5558	*	*	*	*	*	*	*	*	*	*	*	*	*
Fluoride ug/l	*	*	*	*	*	*	190	*	*	*	*	*	190	0.048219	17.6000	*	*	*	*	*	*	*	*	*	*	*	*	*
Lead ug/L	10	10	34	10	10	25	48	35	30	*	*	*	23.5556	5.978063	2181.9932	*	*	*	*	*	<20	<20	<20	<20	48	*	*	48
Nickel ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	*	*	<20	<0.005076	<1.8526	*	*	*	*	*	<20	<20	<20	<20	<20	*	*	<20
Zinc ug/L	25	25	10	25	10	10	10	10	*	*	*	*	15.6250	3.965402	1447.3717	*	*	*	*	*	27	<20	<20	<20	51	*	*	39
Boron ug/L	53	53	48	53	111	127	95	27	91.3	*	*	*	73.1444	18.563	6775.5005	*	*	*	*	*	*	*	*	*	*	*	*	*
Cadmium ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	*	*	<20	<0.005076	<1.8526	*	*	*	*	*	<20	<20	<20	<20	<20	*	*	<20
Mercury µg/L	*	*	*	*	*	*	0.5	*	*	*	*	*	0.5	0.000127	0.0463	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Selenium µg/L	*	*	*	*	*	*	3	*	*	*	*	*	3	0.000761	0.2779	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Barium ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	*	*	<20	<0.005076	<1.8526	*	*	*	*	*	<20	<20	<20	<20	<20	*	*	<20

half of LOD for statistical purposes

Attatchment E4-Castlemartyr Upstream Revised D0134-01

Sample Date	17/01/2007	07/03/2007	04/04/2007	30/05/2007	06/06/2007	04/07/2007	08/08/2007	05/09/2007	17/10/2007	22/11/2007	Average	07/02/2008	28/02/2008	13/03/2008	03/04/2008	22/05/2008	10/07/2008	17/07/2008	03/09/2008	Average
Sample	river	river	river	river	river	river	river	river	river	river	2007	River	River	River	River	River	River	River	River	2008
Flow M^3/Day	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
pH	7.9	7.6	*	7.8	7.2	*	*	8	7.8	7.9	7.74285714	7.9	8.1	*	*	7.9	*	8.0	7.9	7.975
Temperature ℃	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cond 20℃	*	*	*	*	*	*	*	*	*	*	*	*	*	*	332	262	234	318	247	278.6
SS mg/L	6	11	13	5	10	3	8	6	1.25	1.25	6.45	7	5	5	4	11	13	3	7	6.8750
NH_3 mg/L	0.05	0.05	0.05	0.4	0.05	0.05	0.05	0.4	0.05	0.05	0.12	0.3	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.1000
BOD mg/L	0.5	0.5	0.5	3.2	4.1	0.5	0.5	1.1	1.44	1.03	1.337	0.5	0.5	1.61	0.5	2.61	1.39	1.73	4.44	1.6600
COD mg/L	*	*	*	<21	*	*	*	*	<21	*	<21	<21	*	*	*	*	*	<21	<21	<21
TN mg/L	5.9	6.4	6.6	7.06	5.66	<1	13.3	12	5.2	9.5	7.958	7	6.64	*	*	3.9	6.5	6.1	6.0	6.02333333
Nitrite mg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0.0219	*	0.0219
Nitrate mg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	5.44	*	5.44
TP mg/L	.	.	.	.	.	.	.	.	.	0.1	0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
O-PO4-P mg/L	*	*	*	*	*	*	0.025	*	0.07	0.025	0.04	0.025	0.025	0.025	0.025	0.05	0.025	0.025	0.06	0.03250
SO4 mg/L	*	*	*	*	*	<30	<30	<30	<30	<30	<30	<30	<30	*	*	*	*	<30	*	<30
Phenols µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<0.1	*	<0.1
Atrazine µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<0.01	*	<0.01
Dichloromethane µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<1.0	*	<1.0
Simazine µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<0.01	*	<0.01
Toluene µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<1.0	*	<1.0
Tributyltin µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	not required	*	*
Xylenes µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<1.0	*	<1.0
Arsenic µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<0.96	*	<0.96
Chromium ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	<20	<20	<20
Copper ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	<20	<20	<20
Cyanide µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<5	*	<5
Fluoride ug/l	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	<100	*	<100
Lead ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	10	10	26	10	39	*	10	10	16.4285714
Nickel ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	<20	<20	<20
Zinc ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	<20	<20	<20
Boron ug/L	*	*	*	*	*	*	*	*	*	*	*	10	10	10	10	10	*	62	10	17.4286
Cadmium ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	*	<20	<20	<20
Mercury µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0.8	*	0.8
Selenium µg/L	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1	*	1
Barium ug/L	*	*	*	*	*	<20	<20	<20	<20	<20	<20	10	10	10	10	35	*	28	10	16.1428571

Attatchment E4-Castlemartyr 2009 Urban Wastewater Monitoring Data

Sample Date	19/02/2009	26/03/2009	03/04/2009	02/07/2009	30/07/009	20/08/2009	13/10/2009	22/10/2009	26/11/2009	01/12/2009	18/12/2009	30/12/2009	**Mean**	**Median**
Sample Type	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	**n/a**	**n/a**
Lab Code	GT219	GT367	GT454	GT845	GT919	GT1023	GT1246	GT1293	GT1445	GT1465	GT1506	GT1515	**n/a**	**n/a**
pH	7.4	*	*	7.1	*	*	*	*	*	*	*	7.3	**7.267**	**7.3**
SS mg/L	7	11	6	16	1.25	1.25	41	23	14	61	16	11	**17.375**	**12.5**
BOD mg/L	5.0	5.0	4.0	8.0	3.0	2.0	70.0	7.0	6.0	27.0	4.0	8.0	**12.4**	**5.5**
COD mg/L	40	31	10.5	25.0	10.5	25	120	49	27	73	16	40	**38.917**	**29**

half of LOD for statistical purposes

Attatchment E4-Castlemartyr Upstream Revised D0134-01--actual results for metals 2008

Sample Date	07/02/2008	28/02/2008	13/03/2008	03/04/2008	22/05/2008	10/07/2008	17/07/2008	03/09/2008	Average
Sample	River	River	River	River	River	River	River	River	2008
Chromium ug/L	2	2	2	2.5	0		2	1	1.642857143
Lead ug/L	13.5	8.5	14	12.5	21.5		9	7.8	12.4
Copper ug/L	0	0	0	0	0		2	1	0.428571429
Nickel ug/L	1.7	3.3	3.3	0.7	1		1.7	1.83	1.932857143
Zinc ug/L	0	0	0	0	9.7		0	1.5	1.6
Boron ug/L	1	0	10	0	0		62	0	12.1667
Cadmium ug/L	0	0	0	0	0		0	0	0
Barium ug/L	9.5	9	10.5	8.5	35		28	17.3	16.75

Attatchment E4-Castlemartyr Downstream Revised D0134-01-actual results for metals 2008

Sample Date	07/02/2008	28/02/2008	13/03/2008	03/04/2008	22/05/2008	10/07/2008	17/07/2008	03/09/2008	Average
Sample	river	river	river	river	river	river	river	river	2008
Chromium ug/L	2.5	4.0	3.0	3.5	2.5	2.5	2.5	1.75	2.78125
Copper ug/L	0	0	0	0	0	0	0	0.3	0.0375
Lead ug/L	12.5	16.5	14.0	9.0	12.0	7.5	9.0	7.2	10.9625
Nickel ug/L	1.3	3.0	3	1.7	1.3	1.7	2	2.4	1.925
Zinc ug/L	0.7	0	0	0	0	10	3.3	4.7	2.338
Boron ug/L	3	0	0	0	19.3	11.3	22	0	7.9428571
Cadmium ug/L	0	0	0	0	0	0	0	0	0
Barium ug/L	10	14.5	10	10	27	29	24	21.8	18.2875

NOTE ALL UNITS ARE ug/l

10/07/08-no metal results available for upstream

Attatchment E4-Castlemartyr Downstream Revised D0134-01

Sample Date	07/02/2008	28/02/2008	13/03/2008	03/04/2008	22/05/2008	10/07/2008	17/07/2008	03/09/2008	Average	Median	95%ile	Range	17/01/2007	07/03/2007	04/04/2007	30/05/2007	04/07/2007	08/08/2007
Sample	river	river	river	river	river	river	river	river	2008	2008	2008	2008	river	river	river	river	river	river
Flow M^3/Day	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*
pH	7.8	7.9	*	*	7.9	*	7.8	7.6	7.8			7.6-7.9	7.7	7.6	*	7.8	*	*
Temperature ℃	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*
Cond 20℃	*	*	*	349	303	286	289	244	294.2				*	*	*	*	*	*
SS mg/L	6	9	15	3	7	5	6	15	8.250				*	*	*	*	*	*
NH_3 mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				0.05	0.05	0.05	0.4	0.1	0.05
BOD mg/L	1.6	0.5	1.97	1.31	2.41	1.97	2.34	3.2	1.9125		2.9235		0.5	0.5	2.1	3.8	1.7	0.5
COD mg/L	<21	<21	*	*	*	*	<21	<21	<21				*		*	<21	*	*
TN mg/L	4.8	6.19	*	*	3.4	4.5	4.5	14	6.2317				5.6	6.1	9.7	7.14	0.5	12.6
Nitrite mg/L	*	*	*	*	*	*	0.053	*	0.053				*	*	*	*	*	*
Nitrate mg/L	*	*	*	*	*	*	5.43	*	5.43				*	*	*	*	*	*
TP mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			0.1	0.1	0.1	0.21	0.2	0.1
O-PO4-P mg/L	0.025	0.1	0.025	0.025	0.06	0.025	0.06	0.08	0.0500	0.0250	0.0930		*	*	*	*	*	0.025
SO4 mg/L	<30	<30	*	*	*	*	<30	*	<30				*	*	*	*	<30	<30
Phenols µg/L	*	*	*	*	*	*	<0.1	*	<0.1				*	*	*	*	*	*
Atrazine µg/L	*	*	*	*	*	*	<0.01	*	<0.01				*	*	*	*	*	*
Dichloromethane µg/L	*	*	*	*	*	*	<1.0	*	<1.0				*	*	*	*	*	*
Simazine µg/L	*	*	*	*	*	*	<0.01	*	<0.01				*	*	*	*	*	*
Toluene µg/L	*	*	*	*	*	*	<1.0	*	<1.0				*	*	*	*	*	*
Tributyltin µg/L	*	*	*	*	*	*	not required	*	*				*	*	*	*	*	*
Xylenes µg/L	*	*	*	*	*	*	<1.0	*	<1.0				*	*	*	*	*	*
Arsenic µg/L	*	*	*	*	*	*	<0.96	*	<0.96				*	*	*	*	*	*
Chromium ug/L	<20	*	<20	<20	<20	<20	<20	<20	<20				*	*	<20	*	<20	<20
Copper ug/L	<20	*	<20	<20	<20	<20	<20	<20	<20				*	*	<20	*	<20	<20
Cyanide µg/L	*	*	*	*			<5	*	<5				*	*	*	*	*	*
Fluoride ug/l	*	*	*	*			<100		<100				*	*	*	*	*	*
Lead ug/L	<20	*	<20	<20	<20	<20	<20	<20	<20				*	*	<20	*	<20	<20
Nickel ug/L	<20	*	<20	<20	<20	<20	<20	<20	<20				*	*	<20	*	<20	<20
Zinc ug/L	23	*	29	10	10	10	10	10	14.571				*	*	<20	*	<20	<20
Boron ug/L	10	*	10	10	10	10	22	*	12				*	*	*	*	*	*
Cadmium ug/L	<20	*	<20	<20	<20	<20	<20	<20	<20				*	*	<20	*	<20	<20
Mercury µg/L	*	*	*	*	*	*	0.8	*	0.8				*	*	*	*	*	*
Selenium µg/L	*	*	*	*	*	*	1	*	1				*	*	*	*	*	*
Barium ug/L	10	*	10	10	27	29	24	21.5	18.7857143				*	*	<20	*	<20	<20

half of LOD for statistical purposes

05/09/2007	17/10/2007	22/11/2007	**Average**	**Median**
river	river	river	**2007**	**2007**
*	*	*	*	
7.8	7.7	7.8	7.733333333	
*	*	*	*	
*	*	*	*	
*	*	*	*	
0.05	0.1	0.05	0.1	
2.7	2.07	1.84	1.74556	
*	<21	*	<21	
5.9	3.6	*	6.3925	
*	*	*	*	
*	*	*	*	
0.24	*	0.1	0.14375	0.1
*	0.21	0.15	0.128333333	0.15
<30	<30	<30	<30	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
*	*	*	*	
<20	<20	<20	<20	
<20	<20	<20	<20	
*	*	*	*	
*	*	*	*	
<20	<20	<20	<20	
<20	<20	<20	<20	
<20	<20	<20	<20	
*	*	*	*	
<20	<20	<20	<20	
*	*	*	*	
*	*	*	*	
<20	<20	<20	<20	