

DRAFT FOR CONSULTATION

**NATIONAL SURFACE AND GROUNDWATER
MONITORING PROGRAMMES REPUBLIC OF
IRELAND**

**PREPARED TO MEET THE REQUIREMENTS OF
EU WATER FRAMEWORK DIRECTIVE
(2000/60/EC)**

AND

**NATIONAL REGULATIONS IMPLEMENTING
THE WFD SI NO 722 OF 2003**

AND

**NATIONAL REGULATIONS IMPLEMENTING
THE NITRATES DIRECTIVE SI NO 788 of 2005**

VOLUME 3 – LAKES

Draft Version 12
22 May 2006

Volume 3 – National Lake Monitoring Programme

This is a draft document setting out the proposed National Lakes Monitoring Programme as required by the Water Framework Directive. It documents the principles and approach used in preparing the WFD Lakes Monitoring Programme. It has been developed in consultation with an expert group from the EPA, National Parks and Wildlife and the Central Fisheries Board and has been discussed at the National Monitoring sub group of the WFD Technical Coordination Working Group.

REVISION CONTROL TABLE

For & On Behalf of the National WFD Monitoring Working Group					
Rev.	Description of Changes	Prepared by	Checked by	Issued by	Date
Draft 1	Issued for comment	Ian Codling	P. Kavanagh	P Canney WRBD Project	12 th May 2006
2	Issued for comment	Ian Codling	P. Kavanagh	P Canney WRBD Project	21 th May 2006

The User is Responsible for Checking the Revision Status of this Document

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1. Lakes Monitoring Programme

1.1 Introduction – Lake Monitoring Programme

This chapter describes the WFD Lakes Monitoring programme for Irish lakes. The Surveillance, Operational and Investigative Monitoring programmes are described. A range of subnets targeted at particular requirements of the WFD are outlined with their rationale and indicative size. Locations and details of the actual monitoring points are listed in separate tables in appendices to the lake monitoring programme. Monitoring frequency quality elements are described. The associated precision and confidence for lakes monitoring are described in a separate chapter of the National WFD Monitoring Report

There are 12206 lakes in Ireland ranging in surface area from less than 1 ha to over 50 ha (Table 1.1, Figure 1.1, Map 1.1). The great majority of these are very small (< 1 ha). The criteria developed for the inclusion of lakes under the WFD resulted in the definition of 745 lakes that were included in the river basin characterisation and risk assessment procedures reported in the Article 5 characterisation report.

Lake Size Distribution	Number
Lakes greater than 50 ha	209
Lakes <50 ha and >10 ha	676
Lakes < 10 ha and greater than 5 ha	597
Lakes < 5 ha and > 1 ha	2275
Lakes < 1 ha	8449
Total	12206

Table 1.1 Distribution of Irish lakes by surface area (ha)

The total population of lakes from which the WFD monitoring programme (surveillance and operational) networks are drawn is therefore 745 (Map 1.2).

A major factor affecting the selection of lakes for the surveillance and operational monitoring networks is suitable access to enable the prescribed monitoring techniques to be undertaken. Many lakes are situated some distance from suitable road access and some are located within difficult terrain (i.e. access via steep slopes) or land type (i.e deep peat). For these lakes, monitoring is not possible from a health and safety point of view.

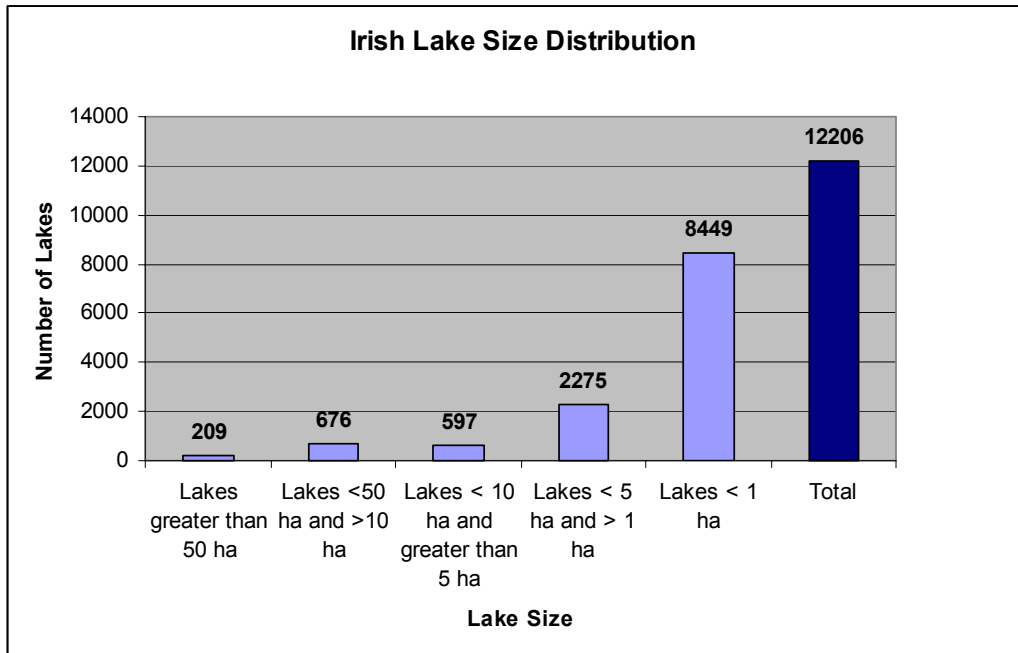


Figure 1.1 Distribution of Irish lakes by surface area (ha)

The selection of lakes for inclusion in the Surveillance Monitoring and Operational Monitoring Programmes was undertaken by an Expert Group from the EPA, National Parks and Wildlife, Central Fisheries Board and the Western RBD Project.

1.2 Lakes Surveillance Monitoring Network

The overall objectives of the Surveillance Monitoring (SM) are specified in the text of the WFD (Table 1.2). There are four main objectives for SM and a number of stipulated types of monitoring points that must be included in the SM programme.

The design of the Irish Surveillance Monitoring network is based on key sub-networks (or 'subnets') each designed to fulfil one or more of the main objectives of SM and, in total, comprises 73 lakes (Map 1.3). Maps 1.4 to 1.10 show the SM lake network within each river basin district area. There are no SM lakes in the south eastern RBD area. These are described in greater detail below and lists of monitoring sites are given in Appendix 1.1 to this programme. The distribution of the surveillance monitoring lake network by RBD is presented in Maps 1.4 to 1.10.

1.3.1. Design of surveillance monitoring

Objective

Member States shall establish surveillance monitoring programmes to provide information for:

1. supplementing and validating the impact assessment procedure detailed in Annex II,
-

-
2. the efficient and effective design of future monitoring programmes,
 3. the assessment of long-term changes in natural conditions, and
 4. the assessment of long-term changes resulting from widespread anthropogenic activity.

The results of such monitoring shall be reviewed and used, in combination with the impact assessment procedure described in Annex II, to determine requirements for monitoring programmes in the current and subsequent river basin management plans.

Selection of monitoring points

Surveillance monitoring shall be carried out of sufficient surface water bodies to provide an assessment of the overall surface water status within each catchment or subcatchments within the river basin district. In selecting these bodies Member States shall ensure that, where appropriate, monitoring is carried out at points where:

1. the rate of water flow is significant within the river basin district as a whole; including points on large rivers where the catchment area is greater than 2500 km²,
2. the volume of water present is significant within the river basin district, including large lakes and reservoirs,
3. significant bodies of water cross a Member State boundary,
4. sites are identified under the Information Exchange Decision 77/795/EEC, and
5. at such other sites as are required to estimate the pollutant load which is transferred across Member State boundaries, and which is transferred into the marine environment.

Selection of quality elements

Surveillance monitoring shall be carried out for each monitoring site for a period of one year during the period covered by a river basin management plan for:

1. parameters indicative of all biological quality elements,
2. parameters indicative of all hydromorphological quality elements,
3. parameters indicative of all general physico-chemical quality elements,
4. priority list pollutants which are discharged into the river basin or sub-basin, and
5. other pollutants discharged in significant quantities in the river basin or sub-basin,

Unless the previous surveillance monitoring exercise showed that the body concerned reached good status and there is no evidence from the review of impact of human activity in Annex II that the impacts on the body have changed. In these cases, surveillance monitoring shall be carried out once every three river basin management plans.

Table 1.2 WFD Text concerning design of Surveillance Monitoring Programme for Surface Waters

1.2.1 Lake SM Subnet 1 – ‘Representative’ Subnet for Status

Aim of subnet: This subnet is designed to be representative of the overall surface water status as per the WFD stated requirement: *‘surface water bodies to provide an assessment of the overall surface water status within each catchment or subcatchments within the river basin district’.*

Subnet Size: This subnet comprises all of the 73 lake sites in the surveillance monitoring programme (Map 1.3).

Location of Monitoring Points: Representative sites are not distributed proportionately between RBDs with respect to the number of lakes within their boundary (Table 1.11) but are representative of

status within the RBD and where possible giving a good representation of different river types and pressures within catchments. The overall proportional breakdown for the status of sites within this subnet should match the overall water status within Irish RBDs. (See Appendix 1.1 for details of monitoring points).

	All (of all sizes)	Article 5 Lakes Reported	SM	SM lakes as a % of Total Lakes	SM lakes as a % of Article 5 Lakes Reported
ERBD	552	26	5	0.91	19.23
NBIRBD	364	1	1	0.27	100.00
NWIRBD	1888	181	17	0.90	9.39
SERBD	1027	12	0	0.00	0.00
SHIRBD	1689	113	18	1.07	15.93
SWRBD	1057	90	7	0.66	7.78
WRBD	5629	322	25	0.44	7.76
Total	12206	745	73		

Table 1.3 Distribution of lakes (All), WFD lakes and surveillance monitoring lakes (SM) between RBDs.

Quality Elements: All the biological elements are monitored and supporting elements: physico-chemical, hydromorphological, priority substances and other pollutants appropriate to the individual water bodies are monitored in this Surveillance Network subnet.

1.2.2 Lakes SM Subnet 2 – Long-Term Trend Monitoring

Aim of subnet: Detection of long-term trends as per WFD requirement – *‘the assessment of long-term changes in natural conditions, and the assessment of long-term changes resulting from widespread anthropogenic activity.’*

Subnet Size: This subnet includes a reduced set of 26 lake sites comprising 11 identified as those susceptible to acidification pressure from atmospheric sources as the primary example of widespread anthropogenic activity and 9 reference lake sites representing high status sites. It also includes 12 Eionet_Water Sites for which long-term data is available and which will serve to provide long term trend monitoring. These latter lakes form part of the Nitrates Action Plan Lake Monitoring Programme for sensitive areas.

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.1 (Map 1.12).

Quality Elements: All the biological elements are monitored and supporting elements: physico-chemical, hydromorphological, priority substances and other pollutants appropriate to the individual water bodies are monitored in this Surveillance Network subnet.

1.2.3 Lake SM Subnet 3 – Supplementing and Validating the Risk Assessments

Aim of Subnet: Supplementing and validating risk assessments particularly at those sites where the degree of uncertainty is greatest as per the WFD requirement – “*supplementing and validating the impact assessment procedure detailed in Annex II*”.

Size of Subnet: This subnet comprises the 73 in the surveillance monitoring programme drawn from the four risk classes (Table 1.4).

Risk class	All	SM	%
1a	133	25	19
1b	147	16	11
2a	99	9	9
2b	366	23	6
Total	745	73	10

Table.4 Distribution of all lake sites and surveillance monitoring (SM) lake sites among risk classes

The selection of lake sites for this subnet was heavily influenced by the accessibility of sites for monitoring.

The greater proportion of lake sites in the 1a (at risk) category reflects an attempt to include the larger lakes. These lakes generally have a good long term record of monitoring which has contributed more reliable information to the risk assessments and resulted in many cases in the at risk designation.

The lesser proportion of lakes sites in the 2b (not at risk) category was due in part to the inaccessibility of many of these lakes and their exclusion from the monitoring networks on that basis.

The selection of 11% of 1b and 9% of 2a lakes adequately covers the supplementing and validating of the risk assessment as they were selected to represent as many pressures as possible.

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.1 (Map 1.13).

Quality Elements: All the biological elements are monitored and supporting elements: physico-chemical, hydromorphological, priority substances and other pollutants appropriate to the individual water bodies are monitored in this Surveillance Network subnet.

1.2.4 Lake SM Subnet 4 – Stipulated lakes

Aim of Subnet: To explicitly include those categories of LWB that are specifically stipulated in the text of the WFD. This includes lakes mentioned in the main text of the WFD as follows for surface waters generally:

-
1. the rate of water flow is significant within the river basin district as a whole; including points on large rivers where the catchment area is greater than 2500 km²,
 2. the volume of water present is significant within the river basin district, including large lakes and reservoirs,
 3. significant bodies of water cross a Member State boundary,
 4. sites are identified under the Information Exchange Decision 77/795/EEC, and
 5. at such other sites as are required to estimate the pollutant load which is transferred across Member State boundaries, and which is transferred into the marine environment.
-

Size of Subnet: The Lake SM programme includes 53 lakes under the following headings:

- 53 sites (>50 ha) representing the large lakes within each RBD
- 2 sites representing the significant cross border lakes - (Lough Melvin (35_160) and Macnean Upper (36_673))

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.1 (Map 1.14).

Quality Elements: All the biological elements are monitored and supporting elements: physico-chemical, hydromorphological, priority substances and other pollutants appropriate to the individual water bodies are monitored in this Surveillance Network subnet.

1.2.5 Lake SM Subnet 5 – Protected Areas

Aim of Subnet: To explicitly include those categories of lake that are contained within the two types of Protected Areas listed in Annex IV of the Directive that have associated monitoring requirements: '*Areas designated for the abstraction of water intended for human consumption*' and '*Areas designated for the protection of habitats and*

species where maintenance of the status of water is an important factor in the their protection, including relevant Natura 2000 sites designated under [the Birds and Habitats Directives].

Size of Subnet: The Lake SM programme includes lakes under the following headings:

1. 'Areas designated for the abstraction of water intended for human consumption' - 23 lakes for water abstraction (6 abstraction only)
2. 'Areas designated for the protection of habitats and species where maintenance of the status of water is an important factor in the their protection, including relevant Natura 2000 sites designated under [the Birds and Habitats Directives]' - 57 lakes in designated SACs. (18 SAC only and less than 50 ha, 22 both SAC and over 50 ha in size and 17 which are both SAC and water abstraction.

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.1 (Map 1.15).

Quality Elements: All the biological elements are monitored and supporting elements: physico-chemical, hydromorphological, priority substances and other pollutants appropriate to the individual water bodies are monitored in this Surveillance Network subnet.

1.2.6 Other Overlapping Subnets

Within the structure of the above subnets the SM programme will also include the following overlapping subnets – overlapping in the sense that they will also be contained in one or more of the five principal subnets above.

- Acidification Monitoring Programme
- Eionet_Water (Eurowaternet) sites,
- High Status Waterbodies
- River Lake interaction sites - Lake flux sites to measure nutrient loading to some major lakes five to 10 sites on eg Conn, Derg, Ree, Sheelin, Leane
- Selected reference condition sites to ensure that sufficient of the highest status LWBs are included
- WFD Intercalibration register sites

Individual monitoring points may be included in one or more of the main subnets.

1.2.7 Design of Future Lake Monitoring Networks

This is an important objective of the SM programme. It does not require a specific set of sites or subnet, as in the case of other objectives of SM, but is

taken here to refer to the network as a whole. As the SM programme proceeds and status is assigned to lakes those that are shown to be of less than good status at any point in the programme may be added to the operational monitoring programme if they are not already included there. This does not mean, however, that they necessarily have to be dropped from the SM programme, as it is essential to maintain continuity in, for example, the long-term trend monitoring subnet. It is obvious too that it is necessary to maintain a representative selection of sites, which mirror the overall surface water status in each RBD.

The results from the SM network will be used at the end of each RBMP cycle to revise the overall network. The document entitled "Reporting Sheets for Reporting Monitoring Requirements" (DGENV and Littlejohn, 2005) states "The Directive allows for monitoring programmes to be amended during the period of the river basin management plan, and between RBMP cycles." Thus, it is not essential to wait until the end of a River Basin Management Plan (RBMP) cycle to change the location of sites or to increase or decrease the number of monitoring points. It is envisaged that, for example, the subnet for supplementing and validating the risk assessment will be reduced as time goes by as the risk factors affecting the status of lakes becomes clearer on foot of the monitoring results. If a site is found to be unsuitable for the purpose intended following initial monitoring, it is proposed to replace such a site with a new one, ideally within the same lake. Similarly, alterations in the range of quality elements or changes to the frequency of monitoring are possible where such a course is dictated by emerging data from the core monitoring programme and in response to other related sources of information such as ongoing risk assessments. All such changes to the Surveillance Monitoring network should, however, be referred to the EPA in order that the central database of WFD monitoring sites can be updated.

The long-term trend subnet is likely to point up potential new threats to water status – e.g. climate change or other as yet unforeseen pressures or impacts and this may suggest revision of the overall network for future RBMP cycles. Similarly, the WFD allows revision of the SM where the monitoring shows that a water body has reached good status.

1.2.8 Quality Elements for the Lakes SM Programme

The quality elements for SM are clearly designated in Annex V of the WFD – see Table 1.5 below.

The monitoring frequencies indicated in Table 1.5 are to be interpreted as minimum requirements with actual frequencies determined by the required precision of the selected parameters (see below). These can only be confirmed when the classification schemes have been fully developed.

“Selection of quality elements

Surveillance monitoring shall be carried out for each monitoring site for a period of one year during the period covered by a River Basin Management Plan for:

- parameters indicative of all biological quality elements*
- parameters indicative of all hydromorphological quality elements*
- parameters indicative of all general physico-chemical quality elements*
priority list pollutants which are discharged into the river basin or sub-basin and
- other pollutants discharged in significant quantities in the river basin or sub-basin*

unless the previous surveillance monitoring exercise showed that the body concerned reached good status and there is no evidence from the review of impact of human activity under Annex II that the impacts on the body have changed. In these cases, surveillance monitoring shall be carried out once every three River Basin Management Plans.”

Quality Element	Rivers	Lakes	Transitional	Coastal
Biological				
Phyto-Plankton	6 months	6 months	6 months	6 months
Other aquatic flora	3 years	3 years	3 year	3 year
Macro invertebrates	3 years	3 years	3 years	3 years
Fish	3 years	3 years	3 years	
Hydromorphological				
Continuity	6 years			
Hydrology	continuous	1 month		
Morphology	6 years	6 years	6 years	6 years
Physico-Chemical				
Thermal Conditions	3 months	3 months	3 months	3 months
Oxygenation	3 months	3 months	3 months	3 months
Salinity	3 months	3 months	3 months	

Nutrient Status	3 months	3 months	3 months	3 months
Acidification Status	3 months	3 months		
Other Pollutants	3 months	3 months	3 months	3 months
Priority Substances	1 month	1 month	1 month	1 month

Table 1.5 Quality elements and minimum required frequency of monitoring for individual quality elements in surface waters monitoring.

1.2.9 Biological elements for lake monitoring

Macroinvertebrates

The monitoring technique and associated classification scheme is under development. It is proposed that the 73 SM sites are sampled on a 3-year cycle at a frequency of once per year.

Phytoplankton

The monitoring technique and associated classification scheme is under development. It is proposed that the 73 SM sites are sampled on a 3-year cycle at a frequency of 12 times per year. Phytoplankton populations in rivers downstream of lakes will be inferred from the lake monitoring programme results.

Macrophytes

The monitoring technique and associated classification scheme is under development. It is proposed that the 73 SM sites are sampled on a 3-year cycle at a frequency of once per year.

Benthic algae

The monitoring technique and associated classification scheme is under development. It is proposed that the 73 SM sites are sampled on a 3-year cycle at a frequency of once per year.

Fish

The monitoring technique and associated classification scheme is under development. It is proposed that the 73 SM sites are sampled on a 3-year cycle at a frequency of once per year.

1.2.10 Hydromorphological elements for lake monitoring

Hydrology

The requirements for hydrological monitoring of lakes has yet to be confirmed in terms of the requirements for water levels, residence times and estimates of hydrological inputs and outputs. With regards to this latter requirement, there is a link to the river hydrometric network monitoring that should allow lakes inputs from rivers to be estimated and outputs from lakes to rivers to be measured. It has been proposed that appropriate hydrological monitoring is undertaken on an annual basis (73 sites per year) at a frequency of 12 times per year.

Morphology

The technique for assessing lake morphology has yet to be developed. It has been proposed that the appropriate morphological monitoring will be undertaken on a 6-year cycle at a frequency of once per year.

1.2.11 Physico-chemical elements for lake monitoring

Standard limnological techniques will be employed to measure the required physico-chemical parameters. The sampling strategy has yet to be decided but it is likely that it will be associated with sampling for other quality elements as far as is practicable. It has been proposed that monitoring of the physico-chemical parameters will be undertaken on a 3 year cycle at a frequency of 12 times per year. The results will be judged against EQSs set for the individual determinands.

1.2.12 Other Pollutants and Priority Substances for lake monitoring

Other pollutants

The list of other pollutants will be determined partly from the National Pilot Screening Survey and partly from knowledge of possible sources of the categories of other pollutants listed in Annex VIII of the Directive in the lakes or their catchments. The properties of the substance will determine whether it is measured in the water column, sediment or biota. It has been proposed that monitoring for these substances will take place on a 3-year cycle at a frequency of 12 times per year.

Priority substances

Priority substances listed in Annex X of the Directive will be monitored in the surveillance programme. The properties of the substance will determine whether it is measured in the water column, sediment or biota. It has been proposed that monitoring for these substances will take place on a 3-year cycle at a frequency of 12 times per year.

1.3 Lakes Operational Monitoring Network

1.3.1 Introduction to the Lakes OM Programme

The WFD requires Operational Monitoring (OM) primarily in support of measures aimed at achieving the main objectives of the WFD – attainment of at least good status in water bodies that are less than good at present and also to retain high and good status where it exists at present. The success of the WFD depends crucially on the Programmes of Measures (POM) implemented in the RBDs. The Operational Monitoring (OM) Programme outlined here is focussed on support of POM – it is designed to provide highly targeted information on the success or otherwise of particular measures within catchments.

OM is obviously required where pollution or other impacts on ecological status are apparent. Crucially, however, because the protection of high and good status are such high level objectives of the WFD, OM must also provide information on whether the POMs aimed at maintaining high and good status are effective. Thus, even waterbodies which may not be deemed to be at risk in the Characterisation Report prepared under Article 5 of the WFD may be included in the OM programme because measures are required to maintain them at their current high or good status regardless of existing risk status.

The OM programme for lakes comprises 214 lakes (Appendix 1.2, Map 1.16). The distribution of these lakes by RBD is presented in Maps 1.17 to 1.23. This programme is designed to be flexible in order to respond to changes within catchments that impact on water status.

The Irish Lakes OM has five separate subnets aimed at monitoring particular aspects of POMs and providing feedback for the national Environmental Management System within RBMPs. There is considerable overlap of lakes between the subnets because very few lakes are influenced by single types of pressure (i.e. point sources, diffuse sources or hydromorphological pressure). The majority of lakes are influenced by a combination of the main pressure types and in many cases these pressures are exerted in the lake catchment rather than on the lake itself.

1.3.2 OM Subnet 1: Monitoring of the Effectiveness of Point Source Measures

Aim of Subnet: Monitoring to assess whether the measures aimed at improving the impact of individual and combined point sources are successful. This includes assessment of ambient levels of organic pollution, eutrophication impacts and priority substances.

Subnet Size: 42 lakes were determined to be at risk (1a and 1b) (Ireland Summary Article 5 report) due to point source pressures and all of these LWBs are included in the OM programme.

Location of Monitoring Points: The aim of the POMs for point sources is to achieve good status in lakes. The location of monitoring points in relation to the discharge is still to be determined on a site-specific basis but there may be a need for more than one monitoring site. The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.24).

1.3.3 OM Subnet 2: Monitoring of Effectiveness of Diffuse Pollution Measures –

Aim of Subnet: To assess effectiveness of diffuse pollution control measures

Subnet Size: Diffuse pollution risk was the predominant risk to water status identified in the Article 5 Characterisation Report published in December 2004. 142 Lakes were determined to be at risk (1a and 1b) from diffuse pollution pressures (LD1 Risk Assessment) in that report and 61 of these lakes are included in this subnet. Additionally 8 lakes identified as being at risk from monitoring data, based on total phosphorous or chlorophyll a, or expert judgement and for which no other pressure indicated a risk category have been included in the diffuse pollution network.

Location of Monitoring Points:

The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.25).

1.3.4 OM Subnet 3: Monitoring of Effectiveness of Measures to reduce Hydromorphological pressures–

Aim of Subnet: To assess effectiveness of measures to reduce hydromorphological pressures and impacts

Subnet Size: Hydromorphological risk was an important source of risk to water status identified in the Article 5 Characterisation Report published in December 2004. Some 90 LWBs were determined to be at risk (1a and 1b) from hydrological pressure (abstraction) and 135 at risk from morphological pressure. This subnet of the OM programme contains 9 lakes at risk due to hydromorphological pressure to assess the effectiveness of hydromorphological measures.

Location of Monitoring Points:

The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.26).

1.3.5 OM Subnet 4: Monitoring of the Effectiveness of Measures aimed at retaining High and Good status RWBs

Aim of Subnet: To monitor high and good status sites currently not deemed to be at risk in order to assess the effectiveness of POMs aimed at maintaining high and good status sites.

Subnet Size: 465 lakes were determined to be not at risk (2a and 2b) and these lakes are therefore likely to be either of good or high status. 33 of these lakes are included in the OM programme to assess the effectiveness of measures aimed at retaining high and good status.

The selection of these sites was driven primarily by accessibility to the lakes.

A further four lakes have been identified by the Central Fisheries Board, which were not included in the National Risk Assessment of Irish Lakes, but which are included on the basis of fish populations and which have been assessed as part of the development of classification tools. These are Vearty (Donegal 36_711), FAD (Donegal 40_2), Naglack (Monaghan 06_55) and Monalty (Monaghan (06_234).

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.27).

1.3.6 OM Subnet 5: Species and Habitat Protected Areas

Aim of Subnet: To monitor Species and Habitat Protected Areas that are at risk.

Text from Article 1.3.5 of Annex V

"Habitat and species protection areas

Bodies of water forming these areas shall be included within the operational monitoring programme referred to above where, on the basis of the impact assessment and the surveillance monitoring, they are identified as being at risk of failing to meet their environmental objectives under Article 4. Monitoring shall be carried out to assess the magnitude and impact of all relevant significant pressures on these bodies and, where necessary, to assess changes in the status of such bodies resulting from the programmes of measures. Monitoring shall continue until the areas satisfy the water-related requirements of the legislation under which they are designated and meet their objectives under Article 4."

Size of Subnet: 106 LWBs designated as being at least part of a SAC are included in the OM programme and 79 of these have been designated as being at risk (1a and 1b) and are therefore included in this subnet.

Location of monitoring points: The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.28).

1.4 Quality Elements for OM Programme

1.4.1 Biological elements

Macroinvertebrates

The monitoring technique and associated classification scheme is under development. It is proposed that the 214 OM sites are sampled on a 3-year cycle at a frequency of once per year.

Phytoplankton

The monitoring technique and associated classification scheme is under development. It is proposed that the 214 OM sites are sampled on a 3-year cycle at a frequency of 4 times per year.

Macrophytes

The monitoring technique and associated classification scheme is under development. It is proposed that the 214 OM sites are sampled on a 3-year cycle at a frequency of once per year.

Benthic algae

The monitoring technique and associated classification scheme is under development. It is proposed that the 214 OM sites are sampled but the phasing and frequency of the sampling has yet to be decided.

Fish

The monitoring technique and associated classification scheme is under development. It is proposed that the 215 OM sites are sampled on a 3-year cycle (72 sites per year) at a frequency of once per year.

1.4.2 Hydromorphology

Hydrology

The requirements for hydrological monitoring of lakes has yet to be confirmed in terms of the requirements for water levels, residence times and estimates of hydrological inputs and outputs. With regards to this latter requirement, there is a link to the river hydrometric network monitoring that should allow lakes inputs from rivers to be estimated and outputs from lakes to rivers to be measured. It has been proposed that appropriate hydrological monitoring is undertaken on an annual basis (214 sites per year) at a frequency of 12 times per year.

Morphology

The technique for assessing lake morphology has yet to be developed. It has been proposed that the appropriate morphological monitoring will be undertaken on a 6-year cycle at a frequency of once per year.

1.4.3 Physico-chemical elements

Standard limnological techniques will be employed to measure the required physico-chemical parameters. The sampling strategy has yet to be decided but it is likely that it will be associated with sampling for other quality elements as far as is practicable. It has been proposed that monitoring of the physico-chemical parameters will be undertaken on an annual cycle (214 sites

per year) at a frequency of 12 times per year. The results will be judged against EQSs set for the individual determinands,

1.4.4 Other Pollutants and Priority Substances

Other pollutants

The list of other pollutants will be determined partly from the Pilot Survey and partly from knowledge of significant sources of the categories of other pollutants listed in Annex VIII of the Directive in the lakes or their catchments. The properties of the substance will determine whether it is measured in the water column, sediment or biota. The phasing and sampling frequency of sampling has yet to be decided.

Priority substances

Priority substances listed in Annex X of the Directive will be monitored in lakes where significant sources exist within the lake or its catchment. The properties of the substance will determine whether it is measured in the water column, sediment or biota. The phasing and sampling frequency of sampling has yet to be decided.

1.4.5 Monitoring of Drinking Water Abstraction Points

Additional monitoring is required for drinking water sources as per the text of article 1.3.5 of Annex V of the WFD independently of the SM or OM programmes outlined above:

Bodies of surface water designated under Article 7 which provide more than 100 m³ a day as an average shall be designated as monitoring sites and shall be subject to such additional monitoring as may be necessary to meet the requirements of that Article. Such bodies shall be monitored for all priority substances discharged and all other substances discharged in significant quantities which could affect the status of the body of water and which are controlled under the provisions of the Drinking Water Directive. Monitoring shall be carried out in accordance with the frequencies set out below:

Community served	Frequency
< 10 000	4 per year
10 000 to 30 000	8 per year
> 30 000	12 per year.

Size of Programme: 90 lakes have been identified that fulfil these criteria and are included for the purposes of this monitoring programme (included in Sub net 3).

Location of Monitoring Points: The locations of the sites in this subnet are detailed in Appendix 1.2 (Map 1.29).

1.5 Investigative Monitoring of Lakes

Design of Investigative Monitoring – WFD Quotation

*“1.3.3 Design of investigative monitoring
Objective*

Investigative monitoring shall be carried out:

- where the reason for any exceedances is unknown;*
 - where surveillance monitoring indicates that the objectives set under Article 4 for a body of water are not likely to be achieved and operational monitoring has not already been established, in order to ascertain the causes of a water body or water bodies failing to achieve the environmental objectives; or*
 - to ascertain the magnitude and impacts of accidental pollution;*
- and shall inform the establishment of a programme of measures for the achievement of the environmental objectives and specific measures necessary to remedy the effects of accidental pollution.”*
-

The details of the design and extent of the investigative monitoring programme cannot be fully developed until the results of the surveillance and/or operational monitoring are known and any exceedance for which the cause is unknown can be identified. Similarly, the details of the response to accidental pollution cannot be fully developed. However, the procedures for monitoring the cause and the impact of accidental pollution should be developed for inclusion in the 2007 report on monitoring to the Commission.

Where an incidence of accidental pollution occurs a system will be in place to allow notification through established hotlines to the Local authorities, Regional Fisheries Boards and the EPA. Where such pollution incidence occurs it will be investigated by the appropriate relevant authority to establish cause and instigate remedial measures.

1.6 Frequency of Monitoring

1.6.1 Introduction

Sample frequency will vary depending on the monitoring programme and the individual subnets and the quality element. Basic requirements for quality elements are specified in the WFD (Table 1.6). Long-term trend monitoring sites will require higher frequency sampling than for example, than those

required for supplementing and validating the risk assessment or for general representative monitoring.

The text of the WFD outlines the requirements under frequency of monitoring (Table 1.6) below.

Table 1.6. WFD text concerning monitoring frequency

1.3.4 Frequency of monitoring

"For the surveillance monitoring period, the frequencies for monitoring parameters indicative of physico-chemical quality elements given below should be applied unless greater intervals would be justified on the basis of technical knowledge and expert judgement. For biological or hydromorphological quality elements, monitoring shall be carried out at least once during the surveillance monitoring period."

"For operational monitoring, the frequency of monitoring required for any parameter shall be determined by Member States so as to provide sufficient data for a reliable assessment of the status of the relevant quality element. As a guideline, monitoring should take place at intervals not exceeding those shown in the table below unless greater intervals would be justified on the basis of technical knowledge and expert judgment."

"Frequencies shall be chosen so as to achieve an acceptable level of confidence and precision. Estimates of the confidence and precision attained by the monitoring system used shall be stated in the River Basin Management Plan."

"Monitoring frequencies shall be selected which take account of the variability in parameters resulting from both natural and anthropogenic conditions. The times at which monitoring is undertaken shall be selected so as to minimise the impact of seasonal variation on the results, and thus ensure that the results reflect changes in the water body as a result of changes due to anthropogenic pressure. Additional monitoring during different seasons of the same year shall be carried out, where necessary, to achieve this objective."

Frequency of monitoring will determine the confidence and precision of the results obtained particularly in the physico-chemical monitoring programmes as outlined in [Chapter 8](#). Target sample frequencies for the individual sub-networks of the main monitoring programme are outlined in [Appendix 5](#).

1.6.2 Monitoring Reporting Sheet Table C2 Surveillance and Operational Monitoring Programmes for Irish lake water Bodies

(Table C2 from: EC-DG Environment D.2 and Carla Littlejohn, (2005))

Monitoring Reporting Sheet Table C2 Surveillance and Operational Monitoring Programmes for Irish Lakes

(Table C2 from: EC-DG Environment D.2 and Carla Littlejohn, (2005))

Surveillance Monitoring Programme Lake water bodies		
Category:	Lake	
	No. sites	Freq
Parameters indicative of all biological quality elements		
QE: Benthic invertebrate fauna	73	Once per three years
QE: Macrophytes and Phytobenthos	73	Once per three years
QE: Fish	73	Once per three years
QE: Phytoplankton Chlorophyll	73	Once per three years

Surveillance Monitoring Programme Lake water bodies		
Category:	Lake	
	No. sites	Freq
QE: Parameters indicative of all general physico-chemical quality elements Thermal Conditions Temperature Stratification Oxygenation Dissolved Oxygen Diurnal Oxygen range BOD Salinity Conductivity Hardness Chloride Nutrients Phosphorus Nitrogen Silicon Acidification Status pH Alkalinity ANC	(Not all parameters will be measured in all subnets of the Lakes SM Programme)	12 times per year

Surveillance Monitoring Programme Lake water bodies		
Category:	Lake	
	No. sites	Freq
QE: Hydromorphological quality elements	73	
Hydrology		12 times per year for one year in 3-year cycle
Morphology		Once per year for one year in 6-year cycle
QE: Priority Substances (Annex X)	73	
1. Alachlor	(Note that the precise list of compounds will vary from site to site depending on whether the Annex X substance in question is discharged in the river basin or sub-basin in which the SM monitoring point is located. The initial approach will be conservative in that it will be assumed that all Annex X compounds are likely to be discharged until evidence to the contrary becomes available. The initial list of compounds will be based on the results from an intensive screening programme.)	12 times per year for one year in 3-year cycle
2. Anthracene		
3. Atrazine		
4. Benzene		
5. Brominated diphenylethers		
6. Cadmium and its compounds		
7. C ₁₀₋₁₃ -chloroalkanes		
8. Chlorfenvinphos		
9. Chlorpyrifos		
10. 1,2-Dichloroethane		
11. Dichloromethane		
12. Di(2-ethylhexyl)phthalate		
13. Diuron		
14. Endosulfan, (alpha-endosulfan)		
15. Fluoranthene		

Surveillance Monitoring Programme Lake water bodies		
Category:	Lake	
	No. sites	Freq
16. Hexachlorobenzene		
17. Hexachlorobutadiene		
18. Hexachlorocyclohexane, (gamma-isomer, Lindane)		
19. Isoproturon		
20. Lead and its compounds		
21. Mercury and its compounds		
22. Naphthalene		
23. Nickel and its compounds		
24. Nonylphenols, (4-(para)-nonylphenol)		
25. Octylphenols, (para-tert-octylphenol)		
26. Pentachlorobenzene		
27. Pentachlorophenol		
28. Polyaromatic hydrocarbons, (Benzo(a)pyrene), (Benzo(b)fluoranthene), (Benzo(g,h,i)perylene), Benzo(k)fluoranthene, (Indeno(1,2,3-cd)pyrene)		
29. Simazine		
30. Tributyltin compounds, (Tributyltin-cation)		
31. Trichlorobenzenes, (1,2,4-Trichlorobenzene)		

Surveillance Monitoring Programme Lake water bodies		
Category:	Lake	
	No. sites	Freq
32. Trichloromethane (Chloroform)		
33. Trifluralin		

Surveillance Monitoring Programme Lake water bodies

Category:	Lake	
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	No. sites	Freq
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<p>QE: Other pollutants discharged in significant quantities in the river basin or sub-basin (Annex VIII pollutants)</p> <ol style="list-style-type: none"> 1. Organohalogen compounds and substances which may form such compounds in the aquatic environment. 2. Organophosphorus compounds. 3. Organotin compounds. 4. Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment. 5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances. 6. Cyanides. 7. Metals and their compounds. 8. Arsenic and its compounds. 9. Biocides and plant protection products. 10. Materials in suspension. <p>Volume 3 – Lakes</p> <ol style="list-style-type: none"> 11. Substances which 	<p>(Note that the precise list of substances analysed for at any individual site will vary from site to site depending on whether the pollutant in question is discharged in significant quantities in the river basin or sub-basin in which the SM monitoring point is located.)</p>	<p>12 times per year for one year on a 3-year cycle</p>
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Operational Monitoring Programme Lake water bodies		
Category:	Lake water bodies	
	No. sites	Freq
Parameters indicative of all biological quality elements		
QE: Benthic invertebrate fauna	214	Once per year on a 3-year cycle
QE: Macrophytes and Phytobenthos	214	Once per year on a 3-year cycle
QE: Fish <ul style="list-style-type: none"> • Composition and abundance and age structure of population 	214	Once per year on a 3-year cycle
QE: Phytoplankton Chlorophyll Cell Counts/Biomass Metrics Taxonomic Metrics	214	4 times per year on a 3-year cycle
QE: Parameters indicative of all general physico-chemical quality elements Thermal Conditions Temperature Stratification Oxygenation Dissolved Oxygen Diurnal Oxygen range BOD Salinity Conductivity Hardness Chloride Nutrients Phosphorus Nitrogen Silicon Acidification Status PH Alkalinity ANC	214	4 times per year

Operational Monitoring Programme Lake water bodies		
Category:	Lake water bodies	
	No. sites	Freq
QE: Hydromorphological quality elements		
Hydrology	215	12 times per year
Morphology		Once per year on an annual cycle

Operational Monitoring Programme Lake water bodies		
Category:	Lake water bodies	
	No. sites	Freq
<p>QE: Priority Substances</p> <p>Annex X Substances</p> <ol style="list-style-type: none"> 1. Alachlor 2. Anthracene 3. Atrazine 4. Benzene 5. Brominated diphenylethers 6. Cadmium and its compounds 7. C₁₀₋₁₃-chloroalkanes 8. Chlorfenvinphos 9. Chlorpyrifos 10. 1,2-Dichloroethane 11. Dichloromethane 12. Di(2-ethylhexyl)phthalate 13. Diuron 14. Endosulfan, (alpha-endosulfan) 15. Fluoranthene 16. Hexachlorobenzene 17. Hexachlorobutadiene 18. Hexachlorocyclohexane, (gamma-isomer,Lindane) 19. Isoproturon 20. Lead and its compounds 21. Mercury and its compounds 22. Naphthalene 23. Nickel and its compounds 24. Nonylphenols, (4-(para)-nonylphenol) 25. Octylphenols, (para-tert-octylphenol) 26. Pentachlorobenzene 27. Pentachlorophenol 28. Polyaromatic hydrocarbons, (Benzo(a)pyrene), (Benzo(b)fluoranthene), (Benzo(g,h,i)perylene), Benzo(k)fluoranthene), (Indeno(1,2,3-cd)pyrene) 29. Simazine 30. Tributyltin compounds, (Tributyltin-cation) 31. Trichlorobenzenes, (1,2,4-Trichlorobenzene) 32. Trichloromethane (Chloroform) 33. Trifluralin 	<p>(Note that the precise list of compounds will vary from site to site depending on whether the Annex X substance in question is discharged in the river basin or sub-basin in which the SM monitoring point is located. The initial approach will be conservative in that it will be assumed that all Annex X compounds are likely to be discharged until evidence to the contrary becomes available. The initial list of compounds will be based on the results from an intensive screening programme.)</p>	<p>12 times per year</p>
<p>QE: Other pollutants discharged in significant quantities in the river basin or sub-basin (Annex VIII pollutants)</p>		

Operational Monitoring Programme Lake water bodies		
Category:	Lake water bodies	
	No. sites	Freq
1. Organohalogen compounds and substances which may form such compounds in the aquatic environment.		12 times per year
2. Organophosphorus compounds.		
3. Organotin compounds.		
4. Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment.		
5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances.		
6. Cyanides.		
7. Metals and their compounds.		
8. Arsenic and its compounds.		
9. Biocides and plant protection products.		
10. Materials in suspension.		
11. Substances which contribute to eutrophication (in particular, nitrates and phosphates).		
12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.).		

1.7 Appendix 1.1. Lake Water Body Surveillance Monitoring Programme

See attached tables for SM lakes (Table is A3 landscape)

1.8 Appendix 1.2. Operational Monitoring Programme for Lake Water Bodies

See attached tables for OM lakes (Table is A3 landscape)