Interim Lake Status

Introduction

The 2010 reporting sheets and the latest River Basin Management Plan (RBMP) guidance from the Department outline requirements in the area of surface water status. A list of background documents needs to be prepared to go accompany the RBMP and one will be in relation to surface water status determination and results. The status of all surface water bodies, and the causes of any failures need to be outlined.

The River Basin District Projects (RBDs), need to have this information in order to complete their draft RBMPs.Status is needed to produce objectives, develop measures, produce the plan, consult and finalise the draft plan for December 2008. The final visitation on status will be in March 2010 (according to DEHLG guidance).

Materials and Methods

Ecological status was based on the biological quality elements and the supporting elements of the general physico-chemical components and in the case of high status – hydromorphology. Final status was based on the outcome of chemical status and ecological status amended for alien/invasive species, artificial fisheries, and unfavourable conservation status (UCS) in Special Areas of Conservation (SPAC).

The WFD has a one out all out (OOAO) strategy for assigning status but in light of the limited data, this was not deemed to be appropriate. For the purposes of advising status for the 1st RBD plan, the approach taken was weight of evidence. For most lakes, this was OOAO. Intercalibated biological quality elements - chlorophyll and macrophytes - and parameters with ecological quality standards - ammonium and dissolved oxygen - had the greatest weight.

Interim status was primarily carried out for the pressure enrichment. Hydromorphological pressure was accounted by the fish experts as well as alien/introduced a species pressure.

The following data and methods were utilised to assign lake interim status:

- BQE – macrophyte, phytoplankton – chlorophyll - , fish communities (including expert opinion),
- general physical chemical components 2004-2006, 2007,
- Priority substances and Priority Action Substances
- Lake MIMAS for hydromorphology; high status lakes only
- Whether the lake contains alien/invasive/introduced species e.g. zebra mussel
- Expert opinion
- NPW, expert opinion regarding unfavourable conservation satus (UCS)

Biological Elements

Phytoplankton - Chlorophyll

Chlorophyll is the surrogate for phytoplankton biomass as detailed in Annex V of the WFD. It was used to quantify the response of phytoplankton biomass to enrichment. It was measured using the methanol extraction method or a variation thereof.

The H/G and G/M EQR boundaries applied were determined by intercalibration as outlined in the decision document. The original values used were the growing season mean values expressed as ug/l but annual means may also be used by applying a conversion factor. The intercalibrated boundaries are applied to national lake types comparable to the intercalibration lake types identified as being present in Ireland as outlined in the decision document.

Provisional boundaries for national lake types with no comparable intercalibration type or, for which no comparable intercalibration type has been intercalibrated were adopted for the purposes of assigning interim status. The details are provided in Table 1. All boundaries not intercalibrated are subject to change.

Chlorophyll data was available for the period 2004-2006 and 2007 but the sampling occasions were not necessarily sufficiently frequent to adequately assign status. It was assumed based on the relationship between average chlorophyll and maximum chlorophyll that a lake with a trophic status of strongly eutrophic or worse was at least moderate or worse in WFD status.

There is currently no confidence associated with the chlorophyll metric.

Table 1. The Irish (IE) lake types, typology and overlap with AGIG and NGIG lake types. The IE lake types which have a corresponding **GIG** type are highlighted and the relevant GIG EQRs were applied for interim status.

*Rare in * GIG type - due to small overlap in depth category between shallow (very shallow) Irish lakes and GIG lake types

Lake type	Altitude (m)	alkalinity (meq/l)	depth (m)	size (km2)	MS- GIG type (NGIG & AGIG) overlap**	Comments	Proposed GIG Boundary		values	EQRs
Lake type 1	<200	<0.4	<4	<0.5	NONE	small lakes Very shallow No corresponding GIG type	N/A (IE ref lakes LN1 boundaries)	Ref HG GM	3.5 7 10.5	 0.5 0.33
Lake type 2*	<200	<0.4	<4	>0.5	LN2a*, LN3*a+b+c*, (LN1*), LN8*	Very shallow Overlap in depth only 1m therefore few (RARE) IE lake type 2 in corresponding N GIG types	N/A (IE ref lakes LN1 boundaries)	Ref HG GM	3.5 7 10.5	 0.5 0.33
Lake type 3	<200	<0.4	>4	<0.5	NONE	small lakes No corresponding N GIG type	N/A (IE ref lakes LN1 boundaries)	Ref HG GM	3 6 9	 0.5 0.33
Lake type 4	<200	<0.4	>4	>0.5	LN2a, LN3a+b, LN1, LN8	The listed GIG types occur in corresponding MS type.	LN1 mean	Ref HG GM	3 6 9	 0.5 0.33
Lake type 5*	<200	0.4-2	<4	<0.5	LA1/2*	small lakes. No corresponding NGIG type.	N/A (IE ref lakes LA1/2 boundaries)	Ref HG GM	3.5 6.4 10.9	 0.55 0.32
Lake type 6*	<200	0.4 - 2	<4	>0.5	LN1*, LN8* (LA1/2)	Very shallow Overlap in depth only 1m therefore few (RARE) IE lake type 6 in corresponding N GIG types and LA1/2	N/A (IE ref lakes LA1/2 boundaries)	Ref HG GM	3.5 6.4 10.9	 0.55 0.32
Lake type 7	<200	0.4 - 2	>4	<0.5	LA1/2	small lakes. No corresponding NGIG type. The listed GIG types occur in corresponding MS type.	LA1/2	Ref HG GM	3.2 5.8 10	 0.55 0.32
Lake type 8	<200	0.4 -2	>4	>0.5	LA1/2, LN1, LN8		LA1/2	Ref HG GM	3.2 5.8 10	 0.55 Hundu

Macrophytes

The Free Lake Macropyhte Index – Free Index –was used to assess lake macrophyte responses to the pressure enrichment. The Free Index is a multimetric index specifically developed to assess lake macrophyte response to enrcihment. The metrics comprising the index cover the parameters; taxonomic composition and abundance as outlined for macrophytes in the WFD. It is expressed as an index score which has a corresponding EQR. The index score ranges from 0 to 1 representing bad to high status..

The H/G and G/M EQR boundaries -described in the intercalibration decision document and an associated technical report- are provided in Table 2. These are applicable to all Irish lake types.

Table 2. The boundaries applicable to the Free Index and their corresponding EQR values.

Classes	High	Good	Moderate	Poor	Bad
Free Index values	>=0.72	0.72>=0.54	0.54>=0.34	0.34>=0.26	<0.26
EQRs at boundaries		>=0.90	>=0.68	>=0.42	>=0.33

Data was available for 82 lakes e surveyed in 2007. A further 66 lakes were sampled in 2008. A number of lakes were also sampled between 2001 and 2006 some on multiple occasions under an ERTDI funded project and for intercalibration. These data were also used. The most recent survey was used for setting interim status based on macorophytes.

Confidence was determined using expert judgement and non-statistical confidence. Non-statistical confidence for lakes with multiple year data was based on the trend in Index values – status -, the most recent status class, age of data - current or old ie. >/<3 years- and where in the status band the Index value fell. All status bands were divided into 4 sub-bands termed quartiles.

Table 3. Confidence in status based on position within the status band i.e. quartiles=Q1 to Q4.

Data <=3 years	Q1	Q2	Q3	Q4
Confident not worse than good				
High Status	High	High	High	High
Good Status	High	High	Medium	Low
Confidence not better than moderate				
Moderate Status	low	medium	High	High
Poor Status	High	High	High	High
Bad Status	High	High	High	High

Data >=3 years				
Confident not worse than good				
High Status	High	High	High	High
Good Status	Good	Good	Good	Good
Confidence not better than moderate				
Moderate Status	Low - old	Medium - old	High - old	High - old
Bad Status	High - old	High - old	High - old	High - old

Fish

Fish status was based on the fish tool; Fish in Lakes – not currently WFD compliant - ; which responds to enrichment, in combination with expert opinion, knowledge of perceived hydromorphology impacts, post 1950s introductions of fish species to a fish community and alien species pressure.

The presence of roach automatically downgraded a high status lake to good but where an impact on native and naturalised fish populations was noted, a lake was placed in moderate status.

Post 1950 fish species introductions also warrant a downgrade but the extent of the downgrade depends on the resilience of the existing fish community to the potential impacts as a result of the introduction i.e. % community change.

Lakes with an artificial fishery could not be high status.

Supporting Elements

Physical-chemical components

The parameters relevant to enrichment i.e. nutrients and dissolved oxygen were selected for setting interim status. Ecological quality standards have been set for Ammonium in the draft regulations. But only the mean value was used to set status for interim status. However, few if any lakes failed on this parameter alone. Provisional EQS' of 10 and 25 ug/L for the high\good and good\moderate boundaries were applied to total phosphorus. However, the widespread application and appropriateness of these values has not been proven and therefore were used with caution

Data was available from 2007 and 2004-2006. The 2007 data comprised data from many sources. Every dataset submitted was checked for unusual values as far as was possible with the exception of the EPA MN data for SM lakes, the CLS data and chlorophyll for CLS samples analysed by the regional laboratories and EPA Cork data for SM lakes. Mean values generated from less 8 sampling occasions were used with caution. In some instances expert opinion was used to over - ride data indications.

2004-2006 lake data was initially collected for the purposes of assigning trophic status based on maximum chlorophyll for the period 2004-2006. The data underwent a separate collation exercise for status determination. Therefore the following assumptions and criteria apply:

Ammonium expressed as mg/L N was assumed, it may not have been,

Data validation was assumed before submission to the EPA,

Some data expressed as less than was not halved and therefore the maximum effect was expressed.

Only the EPA and Kerry Data was used to determine status, data from other sources was used to confirm status.

Few changes were made to status upon inclusion of the 2004-2006 data

Priority Substances

Priority substances were available for 25 lakes and all passed.

Hydromorphology

The EPA have carried out LHS (Lake Habitat Survey) on some lakes. These were used to generate Lake MIMAS scores. Hydromorphology is only applied lakes where the biology was found to be at high status. Only 2 lakes were subsequently downgraded from high to good as a result of hydromorphology.

Alien Species

The presence of the alien species, Zebra Mussel downgraded a lake from high status to good status. See fish section for additional actions.

Protected Areas

Special Areas of Conservation

National Parks and Wildlife commissioned a collation of all SACs and made a determination based on expert opinion whether or not a SAC met the ecological quality necessary to support its protected/conservation status. If they did not meet the perceived quality, they were deemed to be in unfavourable conservation status – UCS –and thus moderate status All lakes that were designated habitats and those with *Najas flexilis* were considered.

Bathing Directive

There 9 inland freshwater bathing areas: Lough Derg on the Shannon– 3 sites - , Loughs Lene, Owel, Ennell in Westmeath, Ballyallia Co. Clare and Keeldra, Co Leitrim. All comply with EU mandatory standards.

Assigning status to unmonitored lakes

Of the 12,000 odd lakes in Ireland; over 800 were identified as WFD lakes i.e. >50ha, SAC, abstractions >100m^3, protected areas, bathing waters, fish directive etc. 225 of these lakes are on the WFD lakes monitoring programme and are representative of the unmonitored lakes.

It was intended to statistically cluster monitored lakes to unmonitored lakes and thus extrapolate status to the latter. This was not possible due to a lack of suitable data. Ideally not only would biologically typing be considered in linking unmonitored to monitored lakes, but also all factors that would determine their sensitivity to pressures and quantification of those pressures. Thus monitored lakes would be linked to unmonitored lakes exposed to the same pressures with the same sensitivity to those pressures. Although not the ideal method to assign status, desktop status using expert judgment was undertaken as outlined below, in order to facilitate the setting of objectives and programme of measures for approximately 600 lakes.

The interim status of unmonitored WFD lakes was determined from expert opinion using a combination of risk assessment from the Article 5 Characterisation Report, CORINE Data in particular forestry, pasture – improved/unimproved – (Table 1), natural vegetation type, bare rock and moor/heath/peat; topography, river network, monitored lakes within the catchment and

upstream and downstream river Qs, using GIS. In some instances housing was also considered. Each lake was individually assessed with associated brief notes. No quantified data was used i.e. it was carried out largely by eyeballing the GIS. This could be termed desktop status. Furthermore the status categories applied were high, good and moderate for enrichment and potential effects of forestry and high and good for morphology i.e. presence of abstractions

Table 4 CORINE 'pressure' land use data.

Code	URBAN	Arable	211	
111	Continuous Urban Fabric	211		Non-irrigated arable land
112	Discontinuous Urban Fabric			
121	Industrial or commercial units	Pasture		
		2.3.1.1		Improved grassland
122	Road and Rail Networks			
123	Sea ports	Forestry	311 , 312, 313	
124	Airports		311	Broad leaved forests
131	Mineral Extraction Sites		312	Coniferous forests
132	Dump		313	Mixed forest
133	Construction Sites			

Under the risk assessment, if L _Assess transferred to the L_OVERALL , then a query was returned to the experts concerned.

All lakes that returned 2b – not at risk – for all tests including the overall test and where CORINE data supported this i.e. indicated a natural catchment landuse, were designated high status. Hydromorphology was not considered for these lakes and therefore would need to be checked.

All lakes designated as abstractions in the absence of other noted pressures – checked using the CORINE Data - were designated Good status on the assumption that the abstraction had a hydromorphological impact and therefore could not be high status. The risk score i.e. 1a, 1b, was not taken into account, possibly the extent of risk should be taken into account. Therefore, some lakes may be actually high status and others may be worse than good. But in the absence of quantifiable data, this is the best that can be achieved.

All lakes over 300m - Type 13 - were selected out and those with no risk i.e. 2b were assigned High Status. Lakes at > 300m returning an overall risk of 2a – probably not at risk – were

assigned good status. The status assigned for at risk and probably at risk high altitude lakes depended on the cause. The LM4 test - intensive landuse test - was not considered for these lakes because they were upland lakes and would normally be surrounded by natural landcover.

All lowland lakes <200m - types 1-12 – with forestry or pasture covering >50% of the shoreline or catchment were assigned moderate status. All lowland lakes <200m - types 1-12 – with forestry or pasture covering <50% of the shoreline or catchment were assigned good status.Lakes at risk or probably at risk from channelisation – LM_1 – were assigned good status. River Qs were used to confirm not override lake status. Monitored lakes upstream and downstream of unmonitored lakes if present were considered when assigning status including their land cover types.

Therefore the primary pressure screened for was nutrient enrichment/eutrophication but hydromorphological pressure linked to abstractions and forestry effects were also taken into account. ***Note that the status of these lakes will not change until they have been linked to monitored lakes.***

Confidence in Final Status

Confidence in Final Status for monitored lakes was dependent on the driving element and its confidence e.g. macrophytes, the age of the data, if there were supporting elements, frequency of the data i.e. low frequency therefore low confidence, and so was largely done by expert opinion. Low medium and high confidence were also assigned to confidence not worse than good and confidence not better than moderate. No confidence was assigned to the status of unmonitored lakes.

Results

Data was collated for 303 lakes with status assigned to 301 lakes. Of these 303 lakes, 208 are on the WFD monitoring programme and identified as WFD lakes; 11 are on the WFD monitoring programme but are not identified as WFD lakes. The remaining 85 lakes are not on the WFD monitoring programme - 34 non WFD lakes and 51 WFD lakes - . Tables 5 summarise lake status nationally and for each of the RBDs by number of lakes.

The excel file output contains summaries of all the data collated to inform status. Also included is the outcome of an expert meeting on status and subsequent changes made to status are highlighted and noted.

Table 5 The number of lakes in each status category is presented by RBD according to WFD monitoring programme membership and nationally with summary percentages for each status category.

RBD	H	G	M	P	B	N\A	Grand Total
Lakes on WFD monitoring programme							
EA	2	7	4	2	1		16
NB			2	1	1		4
NW	4	22	29	4	3		62
SE			4	1			5
SH	4	12	33	1	2		52
SW	4	7	12				23
WE	11	25	21	3	1	1	62
TOTAL	**25**	**73**	**105**	**12**	**8**	**1**	**224**
%	**11.16**	**32.59**	**46.88**	**5.36**	**3.57**	**0.45**	
Remaining WFD lakes							
EA	2	6	3				11
NB		2	10				12
NW	55	38	76	2	1		172
SE		7					7
SH	15	25	21	1		1	63
SW	48	14	5				67
WE	178	52	30				260
TOTAL	**298**	**144**	**145**	**3**	**1**	**1**	**592**
%	**50.34**	**24.32**	**24.49**	**0.51**	**0.17**	**0.17**	
All WFD Lakes							
EA	4	13	7	2	1	0	27
NB	0	2	12	1	1	0	16
NW	59	60	105	6	4	0	234
SE	0	7	4	1	0	0	12
SH	19	37	54	2	2	1	115
SW	52	21	17	0	0	0	90
WE	189	77	51	3	1	1	322
National Total	**323**	**217**	**250**	**15**	**9**	**2**	**816**
%	**39.58**	**26.59**	**30.64**	**1.84**	**1.10**	**0.25**	