Integrated Water Quality Report
Galway, Mayo and Sligo
2011

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EXECUTIVE SUMMARY

Scope

This report summarises water quality in the Counties of Galway, Mayo and Sligo in 2011. These counties lie within two river basin districts: the Western River Basin District (RBD) and a small part of the Shannon RBD. This area is mainly rural with many high quality waters. The principal urban areas include Galway City, Castlebar, Sligo and Ballina.

This report is an evolution of the Annual River Reports that have been produced by the EPA Castlebar since 1979. It is also a step further along the road of transforming these reports into integrated water quality assessments with greater emphasis on the reporting requirements of the Water Framework Directive (WFD).

This integrated water quality assessment places greater emphasis on the reporting requirements of the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009). Data for several key parameters – dissolved oxygen (DO), ammonia, nitrate, Biological Oxygen Demand (BOD) and ortho-phosphate are presented in map format whereby the mean or 95th percentile (as appropriate) are presented as coloured dots on maps, with each dot representing a sampling station on a river. Raw data with appendices are also presented on CD at the back of the report.

This year, as well as a section on river water quality, there are also sections on lakes, groundwaters, transitional and coastal waters. Including these sections is recognition of the importance of these water types in the water cycle and the desire to produce a more integrated report suited to the requirements of the WFD.

The report is based on the biological and physico-chemical sampling and analysis of:

- Over 470 river stations on over 220 rivers
- 56 lakes
- 30 groundwater sites
- 19 transitional and coastal waters
- 36 bathing water sites

Details of the ecological status of Irish waters for the period 2007 – 2009 as required under the Water Framework Directive are available at: Water Quality Status Report 2007 - 2009[1]. The review of ecological quality is an on-going process and preparations are underway for assessment of data for the period up to 2012 covering the first six year cycle of monitoring for the next major report to the EU. This report builds on the information collated to date.

Pressures

The portions of the river basin district covered in this report can be sub-divided into 18 water management units (WMU). These are mapped in Figure 1.1 and the key point pressures are identified in Figure 2.1. Most of the key pressures are common to all WMUs – Waste Water Treatment Plants, Surface Water Abstraction Points for Drinking Water, Landfills and Industrial Effluents. Diffuse pressures such as agricultural discharges, forestry and discharges from septic tanks are also common to all areas. Eutrophication, the over enrichment of surface waters with nutrients, specifically phosphorus and nitrogen, is the most widespread threat to water quality in all three counties.

[1] http://www.epa.ie/downloads/pubs/water/waterqua/Final_Status_Report_20110621.pdf

Rivers

The river monitoring programme covers the following areas:

- Operational Sites
- Surveillance Sites
- Designated Salmonid Sites

They are monitored for a range of parameters and at a suitable frequency, as required by the relevant legislation. Priority substance monitoring on surveillance sites is also carried out and is co-ordinated by the EPA laboratory in Dublin.

Trend graphs, showing annual median for both o-phosphate and nitrate at 60 key river locations are presented in the appendices and show that while nitrate levels have remained relatively stable, o-phosphate levels have increased somewhat in the last ten years. One of the big challenges will be reducing o-phosphate levels to acceptable concentrations in all rivers.

Biological monitoring for rivers generally occurs at least once every three years. The Western RBD continues to be ranked as one of the most unpolluted RBDs in Ireland. When compared to national statistics, there are more unpolluted sites in the West, 71% of river channel nationally is achieving at least good ecological status, compared with over 80% of river channel in the West. However, the number of high quality sites in the country has reduced by almost half in the period 1987-2008. In the West, 117 sites were classified as high status (Q4-5 or better) in the period 2007-2009.

In the West, 109 sites have been identified as priority polluted sites for tackling pollution. The majority of problems at these sites are caused by diffuse agricultural and point source municipal pollution. Tackling pollution at these sites, will not only improve river quality, it may have knock-on beneficial effects on lakes and transitional and coastal waters that are fed by these rivers. Targeted local investigations using a variety of methods such as the Small Stream Risk Score (SSRS) in investigating diffuse pollution will be the most effective way of identifying and eliminating sources of pollution.

Lakes

In total, 56 lakes were monitored in Counties Galway, Mayo and Sligo by the EPA as part of the national lake monitoring programme. Water samples were collected between four and 12 times per year and tested for a wide range of physico-chemical parameters. As the biological communities typically exhibit longer response times to gradual changes in their environment, the biological sampling is completed once every three years. The physico-chemical, hydromorphological and biological results combine to produce overall ecological status and lakes are classified as high, good, moderate, poor or bad status. During the 2007 – 2009 reporting period, over 73% of lakes in the West were either high or good status, with 54% in the latter category. An update of status for the period 2008-2010 showed similar percentage for high (21%) and good status (50%) but more lakes were being classified as poor (11%) and bad (2%) in status compared with 2% for both categories combined for the period 2007-2009. The good/high categories do compare very favourably with the national statistics where 47% of the lakes were either high or good status with 38% in the latter category.

The challenge is to maintain high and good status lakes, prevent the spread of alien species and improve the lakes assigned moderate or less status. The main threats to lake water quality are diffuse pollution from agricultural activities, forestry and septic tanks. But for some lakes, the cause(s) of failing to reach at least good status are unknown and further investigations are required.

Groundwater

Thirty groundwater sites were monitored in Galway, Mayo and Sligo during 2011. Contamination from phosphate and faecal coliforms is the main threat to groundwater quality in the West. There has been a general reduction in nitrate levels in the period 2007-2011 and nitrate levels remain low. However, elevated phosphate levels have been found in a number of groundwater sites in the West of Ireland,

although overall phosphate levels have decreased in the period 2007-2011. While agriculture is a potential source of diffuse pollution, domestic waste water treatment systems, including septic tanks may also be a significant contributor to groundwater pollution.

Transitional and Coastal Waters

Over 4700 km^2 of transitional and coastal waters in 19 water bodies were monitored in the West in 2011. All but two of the 19 estuarine and coastal waters bodies were classified as unpolluted. Thirty six designated bathing water sites were monitored in the West of Ireland in 2011 and all but one (Clifden, Co Galway) were found to be of sufficient or good quality.

Overall Assessment and Conclusions

Overall, water quality in the West of Ireland continues to be very good. Over 70% of rivers, transitional and coastal waters, and lakes and over 65% of groundwaters meet the target of good or better status as required under the WFD.

Pressures on water bodies in the West arise from both point and diffuse source pollution. In particular, waters in the West are affected by high levels of nutrients – especially ortho-phosphate, the levels of which are still high and need to be reduced to achieve WFD targets.

Addressing the sources of pollution – especially diffuse pollution (from agriculture and septic tanks), and understanding the interactions between the various water bodies – rivers, lakes, groundwaters and transitional and coastal waters, is vital in retaining and restoring (where appropriate) good status to all water bodies.

Approximately 20% of river sites in Counties Galway, Mayo and Sligo have been identified as priority polluted sites for tackling pollution (See table 2.1). Addressing pollution at these sites may also result in improved conditions in lakes, groundwaters, and transitional and coastal waters. These sites should be the focus of future local authority investigative work especially with regard to eliminating bad practices.

Development of the agriculture sector, as detailed in *Food Harvest 2020,* will bring large increases in farm outputs over the coming years. The first of these increases will be in milk production expected in 2016 when the milk quota system is abolished. The challenges of meeting the targets set in the strategy in an environmentally sustainable way are significant. It is important that this sector be developed in such a way that Ireland can also meet its targets under the WFD.

INTRODUCTION

This report is a continuation and an evolution of the series of annual reports on river water quality that have been published since 1979 for counties Galway, Mayo and Sligo. This report is different from previous years' format in order to bring it into line with Water Framework Directive (WFD) reporting requirements, with the inclusion of information on lakes, groundwaters and transitional & coastal waters.

This report is also a sequel to those issued previously by the Environmental Protection Agency (EPA) and reviews the water quality monitoring carried out in accordance with the National Water Framework Directive Monitoring Programme for the period 2009 – 2011. This programme, which commenced in 2007, covers the principal water body types of Rivers, Lakes, Groundwaters and Transitional (Estuarine) waters. It was set up to address the requirements of Article 10 (1) of the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). These regulations are the National Regulations implementing the requirements of the Water Framework Directive (WFD) 2000/60/EC which was adopted in 2000.

The following map (Fig. 1.1) shows the boundaries of the relevant River Basin Districts in the West of Ireland along with the Water Management Units. The area covered by the Castlebar Regional Inspectorate includes counties Galway, Sligo and Mayo.

The WFD aims to maintain the high status of surface and groundwaters, to prevent the deterioration of existing status of waters and to achieve high or good status for those waters by 2015. More information on the EU Water Framework Directive can be obtained at www.wfdireland.ie

The WFD specifies three types of monitoring - Operational, Surveillance and Investigative. The EPA carries out surveillance monitoring for rivers and lakes, and also provides analytical services to Galway, Mayo and Sligo Local Authorities in respect of Operational and some Investigative monitoring. Surveillance and Operational groundwater sampling and analyses are undertaken by the EPA. Coastal waters are assessed by the Marine Institute, while the EPA undertakes assessment of Transitional (Estuarine) waters. Investigative Monitoring – aimed at identifying possible causes of pollution and steps required to improve conditions is a responsibility of Local Authorities.

The objectives of Surveillance Monitoring are:

- Supplementing and validating the impact assessment procedure detailed in Annex II of the Directive
- Assisting the efficient and effective design of future monitoring programmes
- Assessment of long term changes in natural conditions
- Assessment of long term changes resulting from widespread anthropogenic activity

Operational Monitoring aims to:

- Establish the status of those bodies identified as being at risk of failing to meet their environmental objectives
- Assess any changes in the status of such bodies resulting from the Programme of Measures

The first full period for the assessment of water quality covers 2009–2015. This report aims to present an assessment of progress towards meeting the objectives of the WFD as set out in the respective River Basin Management Plans[2].

[2] http://www.wfdireland.ie/docs/1_River%20Basin%20Management%20Plans%202009%20-%202015/

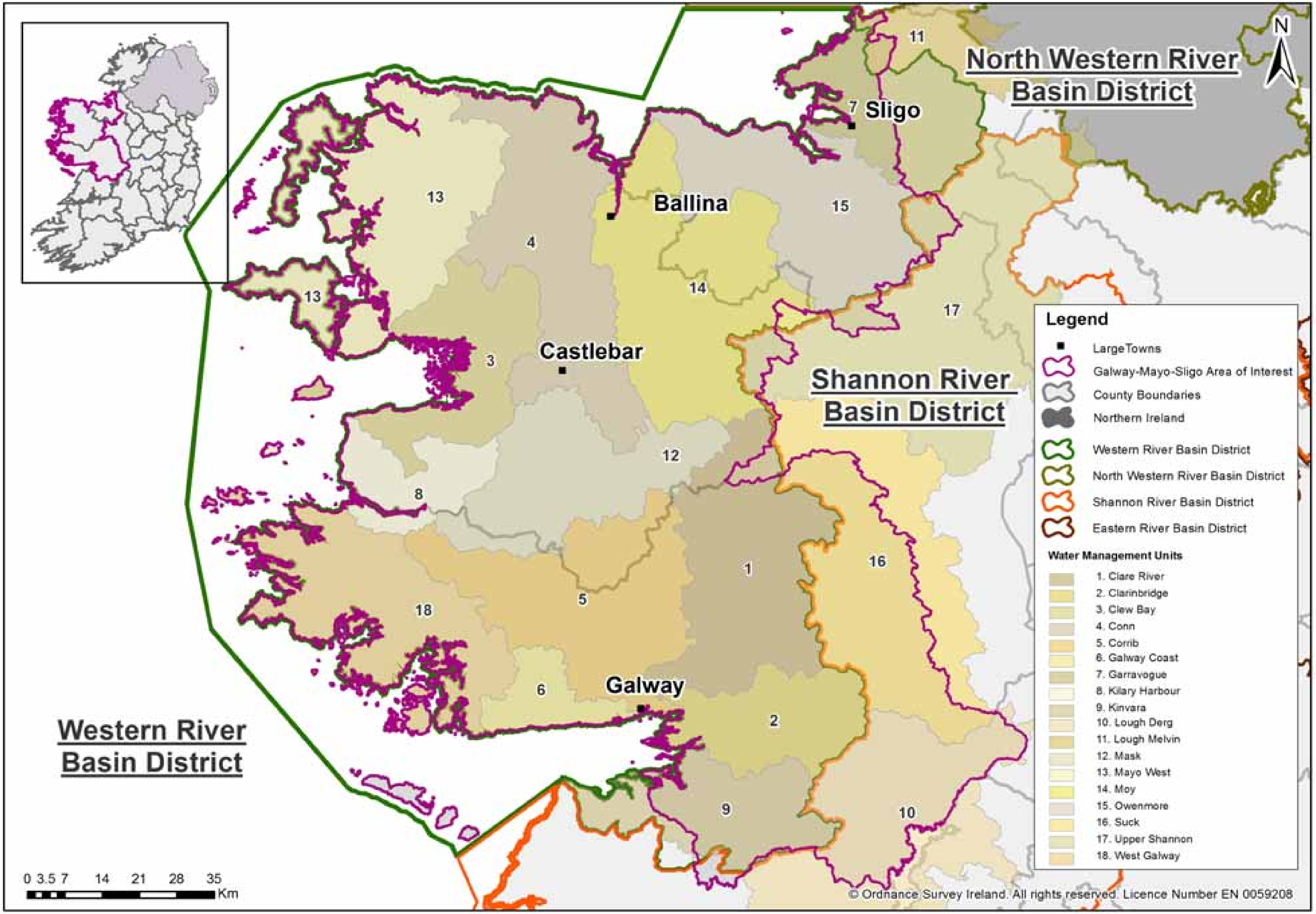

Figure 1.1 River Basin Districts in the West of Ireland with 18 Water Management Units

Change in Report Format

The format of this report differs from previous years in that it is more focussed towards the objectives of the WFD. Changes from previous formats include:

- A greater emphasis on assessing compliance with the Water Framework Directive and in particular the reporting requirements of the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (SI 272 of 2009) and other relevant legislation.

- One overall report for the West of Ireland covering counties Galway, Mayo and Sligo with a table included in the Appendices with more detailed information on rivers in each county.

- Focus on pressures at Water Management Unit (WMU) level as defined in the WFD River Basin District Management Plans.

- Data for several key parameters are presented in map format whereby the annual mean values are presented as coloured dots on maps, with each dot representing a sampling station on a river or lake.

- Graphical presentation of water quality parameter trends for nitrate and ortho-phosphate.

- Analytical data and supporting text are now provided on an accompanying disc at the back of this report.

SUMMARY OF PRESSURES

The area covered in this report relates to the Western River Basin District (RBD) and some of the Shannon RBD. Each RBD is subdivided into Hydrometric areas and divided again into Water Management Units (WMUs).

Figure 2.1 summarises the key point pressures in each RBD. More detailed information may be found on www.wfdirelend.ie. Table 2.1 identifies the key priority polluted river sites in each county.

Many of the point pressures are common to all WMUs – for example there are waste water treatment plants in almost all WMUs, and abstraction points for drinking water in the majority of WMUs. Industrial effluents, landfills and Section 4 licences are all point source pressures as well.

In Mayo, some of the sites in which the chemical monitoring has highlighted issues include the Ballindine, the Dalgan at station 0200, Loughnaminoo Stream, the Trimoge and the Yellow (Knock).

In Galway, the Clarinbridge, the Kilcolgan and the Terryland all have water quality issues at some locations. In Sligo, the Charlestown Stream, Gurteen Stream, Owenmore, Tubbercurry, and Tubbercurry Stream are also subject to intermittent pollution. These are mainly caused by diffuse agricultural or municipal pollution or point source pollution from waste water treatment plants.

It is hoped that targeting pollution at these sites will lead to continued improvement in river water quality in the West of Ireland. Refer to table 2.1 for further details of all the priority polluted river sites in each of the three counties. These are the sites which should be the focus of future investigative monitoring.

The West of Ireland is predominantly rural, and diffuse pollution from agriculture and septic tanks are also significant contributory pressures which are expected to grow in the coming years. *Food Harvest 2020*, which was developed as a cohesive road map for the agriculture, fisheries and forestry sectors to build capacity, predicts the value of primary output in this sector will increase by 33% from the 2007-2009 average.

Table 2.1. Key Priority Polluted River Sites in each County.

Sligo

River	Station	Key Pressure Diffuse V`s Point	Comments
CHARLESTOWN STREAM	34C280100	Point: Municipal D0214-01	
TUBBERCURRY	34T020050/0200	Point: Municipal D0092-01	Poorly treated sewage
TUBBERCURRY STREAM	34T030400	Point: Municipal D0092-01	Poorly treated sewage
BUNCROWEY	35B090100 35B090500	Forestry Diffuse: Agricultural	
DOONBEAKIN	35D090400	Diffuse: Agricultural	Agricultural catchment
OWENMORE (SLIGO)	35O060250/400/0500	Diffuse: Agricultural	Agricultural catchment
LUGDOON STREAM	35L010400	Diffuse: Agricultural	
GURTEEN STREAM	35G050200	Point: Municipal D0382-01	Gurteen WWTP
MULLAGHANOE	34M030200/0220	Point: Municipal D0214-01	Charlestown WWTP
DOUGLAS (SLIGO)	35D021400	Point: Municipal D0383-01	Riverstown WWTP
DRUMCLIFF	35D040250	Forestry	
UNSHIN	35U010100	Lake Effects	Site is immediately d/s of Lough Arrow Agricultural catchment
MAD	34M040100	Diffuse: Agriculture	Overgrazing effects
BUNNANADDAN STREAM	35B080200	Hydromorphological Groundwater	Low DO levels due to groundwater input
MOY	34M020010	Forestry	

Mayo

River	Station	Key pressures: Point v`s Diffuse	Comments
AILLE (MAYO)	30A020010	Forestry	
CLAUREEN (MAYO)	30C120400	Diffuse: Agriculture	Agriculture slurry discharge, most likely pig slurry
BUNOWEN (LOUISBURGH)	32B030150	Diffuse: Agricultural	
CARROWNISKY	32C010020/0250	Diffuse: Agricultural	
CARROWBEG (WESTPORT)	32C050300	Diffuse: Urban D0055-01	
CLOONEEN (MAYO)	33C030050	Peat Harvesting	Extensive turf cutting
GWEEDANEY	33G060100	Diffuse: Agriculture	Overgrazing effects
CASTLEBAR	34C010180/0200/0300/0400	Point: Municipal D0047-01	
OWENBRIN	30O010050	Diffuse: Agriculture	Overgrazing effects
GLORE (MAYO)	34G020010	Diffuse: Agricultural	
OWENGARVE (MAYO)	32O020100/0200	Diffuse: Agricultural	Overgrazing effects
LOUGH MUCK STREAM	34L050600	Diffuse: Agricultural	
POLLAGH	34P010260	Point: Municipal D0217-01	Kiltimagh WWTP
SONNAGH (MOY)	34S020060/0100	Industrial/Engineering works	Quarrying/Road works
SLIEVECLAUR	34S060400	Diffuse: Agricultural	
DALGAN	30D010200/0300/0500	Industrial IPPC	Meat processing and rendering
MANULLA	34M010500 34M010300	Diffuse: Agricultural Point: Municipal D0366-01	 Bellcarra WWTP
DOOEGA	33D010200	Diffuse: Agricultural	Overgrazing effects
TRIMOGE	34T010200	Point: Municipal D0357-01	Kilkelly WWTP
BALLINDINE	30B030200 30B030100	Point: Municipal D0355-01 Diffuse: Agricultural	Poor quality WWTP
ROBE	30R010030 30R010310/0400	Diffuse: Agricultural Point: Municipal D0071-01	 Claremorris WWTP
OWENNADORNAUN	32O070100	Forestry	Extensive forestry u/s
LOUGHNAMINOO STREAM	34L040200	Point: Municipal D0216-01	Balla WWTP
CLOONDAVER STREAM (NORTH)	30C090100	Diffuse: Agricultural	
YELLOW (KNOCK)	34Y020250	Point: Municipal D0065-01	Knock WWTP
DOOLOUGH STREAM	33D020100	Forestry	
MUING	33M010100	Peat Harvesting	
MOY	34M021100	Point: Municipal D0016-01	

Galway

River	Station	Key Pressure Diffuse V`s Point	Comments
WOODFORD (GALWAY)	25W010040	Forestry	Heavily silted from suspected forestry impacts
AHASCRAGH	26A010400	Point: Municipal	Ahascragh sewage
LAURENCETOWN STREAM	26L070300/0500	Industrial Section 4	Fellmongering discharge
SHIVEN (SOUTH)	26S030040/0200	Diffuse: Agricultural	
CLARINBRIDGE	29C020300/0400/0500	Point: Municipal D0193-01	Athenry WWTP
CARRA STREAM	29C030900/1000	Diffuse: Agricultural	
KILCOLGAN	29K010200 29K010600	Landfill Diffuse: Agricultural	
EYRECOURT STREAM	25E010100/0200	Diffuse: Agricultural	Agricultural catchment
ABBERT	30A010300/0500	Diffuse: Agricultural	
BALLYCUIRKE	30B140100	Point: Municipal D0191-01	
CLARE (GALWAY)	30C010650/0700 30C010100 30C010800	Urban D0031-01 Industrial IPPC Diffuse: Agricultural	Tuam WWTP Ballyhaunis meat factory Maybe be a karst-groundwater link
GRANGE (GALWAY)	30G020200/0400/0700	Diffuse: Agricultural	
GLENNAMUCKA STREAM	30G040015	Diffuse: Agricultural	
CAPPAGH (GALWAY)	25C030400	Diffuse: Agricultural	Agricultural catchment
KILCROW	25K010500	Diffuse: Agricultural	Agricultural catchment
GORTGARROW STREAM	30G050025	Diffuse: Agricultural	
NANNY (TUAM)	30N010300	Diffuse: Urban D0031-01	
TERRYLAND	30T010500	Diffuse Urban	
SCREEB	31S010570	Aquaculture	Fish Farming river
BALLINABOY	32B070100/0300	Aquaculture	
LISDUFF (KILCROW)	25L060100/0400	Diffuse: Agricultural	Agricultural catchment
CASTLEGAR	26C030100 26C030200	Diffuse: Agricultural Point: Municipal D0219-01	Intensive agriculture upstream of Mountbellew. Mountbellow WWTP
SINKING	30S010300/0400	Point: Municipal D0370-01	
OWENTOOEY	31O030100	Forestry	Extensive forest in upper catchment
SUCK	26S071400/1500	Industrial IPPC	rendering plant
DAWROS	32D010020	Diffuse: Agricultural	Overgrazing effects
LISDUFF STREAM (SHANNON)	25L070200	Diffuse: Agricultural	Agricultural catchment
TOBERDONEY	29T010300	Diffuse: Agricultural	
LAGHTYSHAUGHNESSY LOUGH STREAM	27L030300	Diffuse: Agricultural	
BARNACULLIA STREAM	25B140100	Industrial-mining	Old Tynagh mines
SHANNON (Lower)	25S012060	Point: Municipal D0375-01	

Source: (EPA)

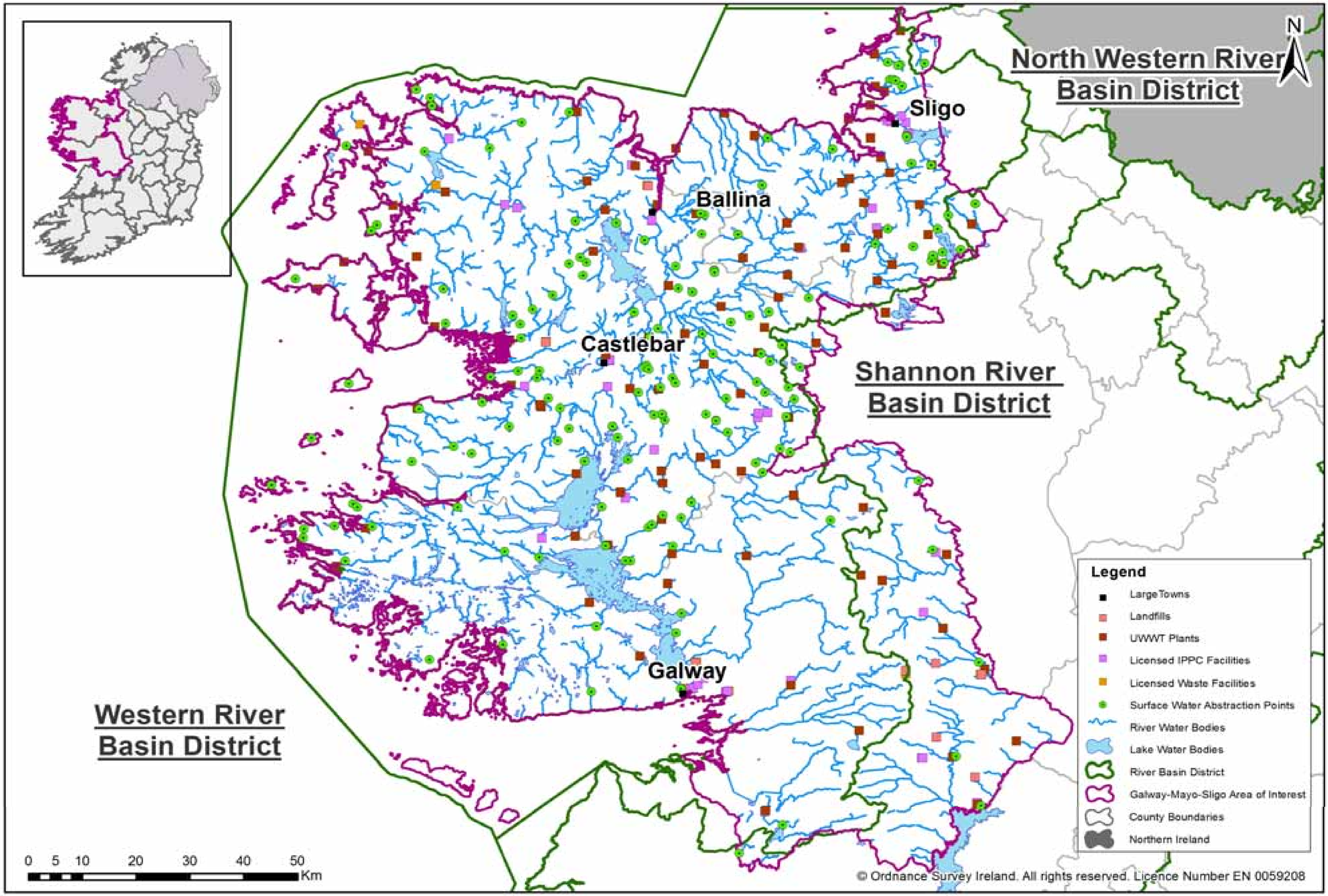

Figure 2.1 Environmental pressures in the West of Ireland (Source: www.wfdireland.ie)

RIVER WATER QUALITY

Sampling locations

Physico-chemical monitoring under the Water Framework Directive is being undertaken at 260 stations in 122 rivers in the West of Ireland. These sites were selected as representative of clean waters near the source of the river, or spring and also at regular locations along the river, where sampling is convenient, safe and representative of the river in general. Sites were also selected downstream of discharges that might impact on the general quality of the river. A full list of these stations is available in Appendix 1.

Physico-chemical monitoring is carried out on each river site between four and 12 times per year, depending on the legislative requirements. This can take the form of surveillance monitoring which is undertaken by the EPA to determine long term variations in water quality; or operational or investigative monitoring which is undertaken by (or on behalf of) Local Authorities for the purposes of assessing the impacts of localised pollution sources.

Biological monitoring is generally carried out once every three years at each site. The map in Fig. 3.1 indicates the locations of the river monitoring sites in the West of Ireland.

Further information on the design and operation of National Monitoring programmes is available from the EPA website at: National Monitoring Programmes[3]

Physico-Chemical Monitoring of Rivers

The rivers monitored by the EPA Castlebar laboratory are monitored for one or more of the following reasons:

- Operational Sites
- Surveillance Sites
- Designated Salmonid Sites
- Others

Operational sites require the following monitoring: temperature, dissolved oxygen (DO), pH, conductivity, hardness, colour, alkalinity, ortho-phosphate, Total Oxidised Nitrogen (TON), nitrite, ammonium, chloride and Biological Oxygen Demand (BOD).
Surveillance sites require these parameters as well as priority substances (including certain metals and organic compounds). Designated Salmonid sites require the operational suite, as well as suspended solids, free ammonia, copper and zinc. Other sites are dealt with as problems arise.

In previous reports water quality has generally been characterised on a broadly defined scale of "Satisfactory Water Quality", "Slightly Polluted" "Moderately Polluted" and "Seriously Polluted" depending on the concentrations of nutrients such as ortho-phosphate, ammonium, TON, and reference to the biological Q-value and BOD. This approach will be continued for now and the summary of water quality using this approach can be found for each county in Appendix 2.

The Water Framework Directive does not accommodate such an approach and physico-chemical data is now assessed against its compliance with the criteria set out in the "European Communities Environmental Objectives (Surface Water) Regulations 2009" (S.I 272 of 2009)[4]. The Water Framework Directive has introduced a new system of ecological status which incorporates supporting general physico-chemical data and hydromorphological criteria. A separate system for assessing "chemical status" for a short list of priority substances and priority hazardous substances as per Annex X of the WFD is also now in place.

[3] http://www.epa.ie/downloads/pubs/water/other/wfd/
[4] http://www.environ.ie/en/Legislation/Environment/Water/FileDownLoad,20824,en.pdf

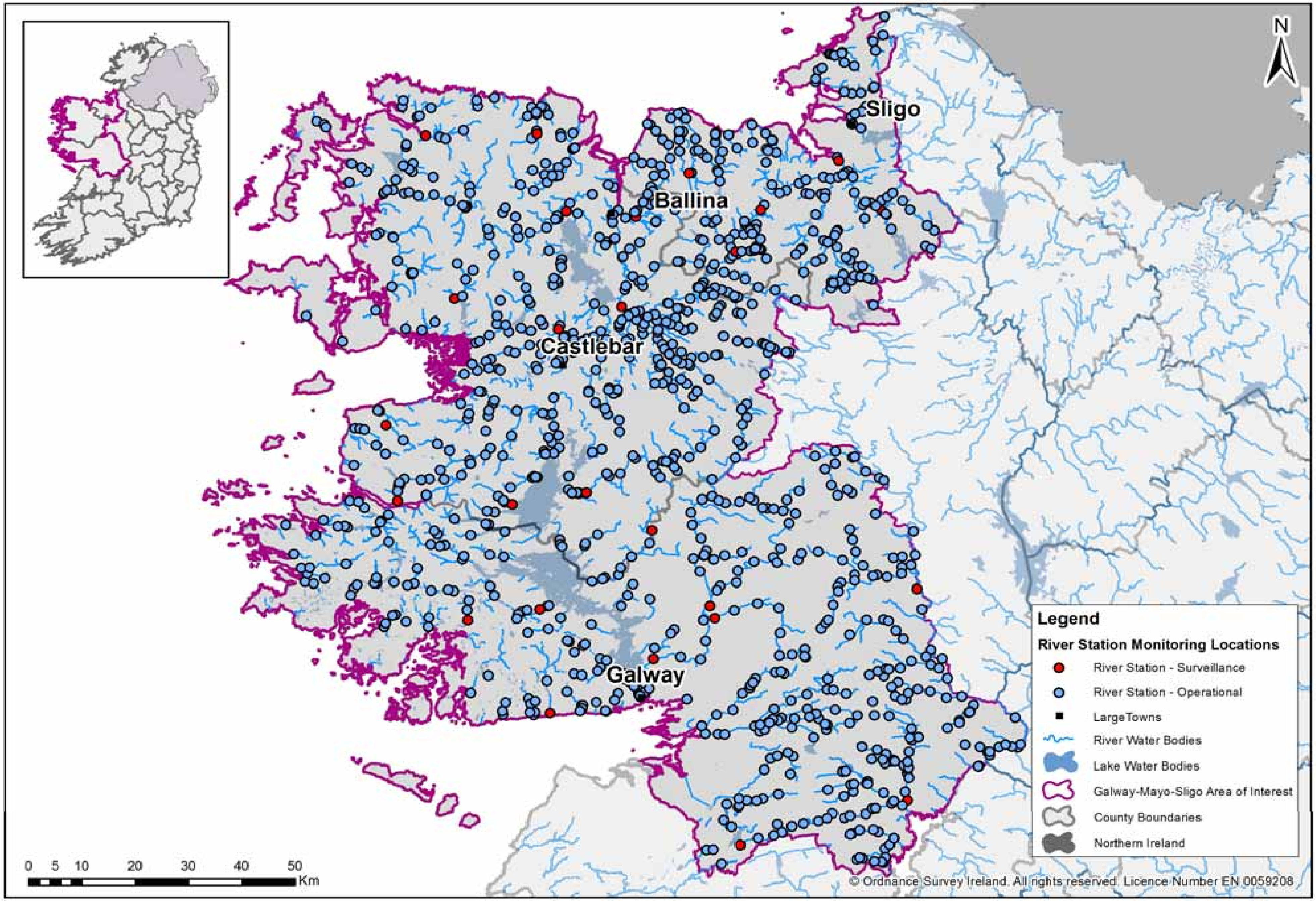

Figure 3.1 River Monitoring Points in counties Galway, Mayo and Sligo in 2011

In determining the ecological status of a river water body, a number of general physico-chemical parameters are assessed against annual mean and 95%ile standards which have been set for each. The assessment is based on a statistical approach whereby the pass/fail criterion requires 50% of these parameters, namely, ortho-phosphate, ammonia, BOD and nitrate to exceed the mean and 95%ile standards at a 99% confidence level.

The key parameters are discussed in greater detail in the following sub-sections. It should be noted however that in these sections the maps present the data as face value comparisons against the relevant EQS rather than using the aforementioned statistical approach. This is largely due to the small amount of data available for each site in one year. For future reports, it is anticipated that the assessment period will be extended to three years which will allow for a more appropriate assessment of the data. Information on the main physico-chemical parameters can be found in Appendix 3.

Phosphate in River Waters in the West of Ireland

River water quality monitoring has shown increased eutrophication in most Irish rivers since the 1970s and this is caused fundamentally by increased phosphorus run-off from agricultural land and farmyards, from municipal and industrial effluent discharges (McGarrigle et al., 2010), from septic tanks discharges and/or from forestry operations.

Eutrophication in surface waters arises from the marked increase in nutrient supply leading to excessive growth of algae or other plants. Phosphorus (P) is usually the limiting nutrient for plant growth in freshwaters. Phosphorus is an essential element for life and is non-toxic. Plants require phosphorus (along with other nutrients) for growth and a small amount of phosphorus in surface waters is natural.

However, if natural levels of phosphorus are exceeded, there can be excessive plant growth leading to high levels of photosynthesis (and oxygen production) during the day, followed by excessive respiration (and oxygen consumption) during darkness. This diurnal variation can lead to a significant drop in oxygen levels at night, which can have detrimental effects on water quality of the river. This in turn can disturb the ecological balance of the river, leading to shifts in species composition, food-chain effects, increases in toxic algal blooms and collapse of populations of sensitive fish and other species.

Much of the phosphorus added to soil in the form of agricultural fertiliser or animal slurry tends to accumulate in the top inch of soil and the surface soil layer can easily become saturated with P. Water can leach significant amounts of phosphorus from surface soil, especially during the early stages of heavy rainfall events. The higher the soil phosphorus content, the higher the potential for loss of phosphorus to waters (Tunney *et al.,* 2000). Rivers also receive direct discharges of wastes that contain various forms of P - for example sewage, animal slurry, industrial effluents, landfill leachate, etc. Figure 3.2 shows the annual average ortho-phosphate concentration in rivers in Galway, Mayo and Sligo in 2011. The map is based on a face value comparison of the annual mean against the EQS for High and Good status. In general, ortho-phosphate levels are fairly stable, but they are high - 25% of river sites in the West had an average concentration >0.035mg/l P. A summary of the relevant ortho-phosphate standards (as mg/l P) for rivers is given below. These replace the older Phosphorus Regulations.

Water Framework Directive Inland Surface Waters SI 272 of 2009		Surface Water Abstraction – A1 SI 294 of 1989
Annual Mean	95%ile	
0.035 good 0.025 high	0.075 good 0.045 high	0.22

Ortho-phosphate is a very dynamic biologically active substance and is freely removed from water by aquatic plants and algae, especially during the spring/summer/autumn period. Consequently increases in eutrophication are not always evident from the analyses of ortho-phosphate in river water samples. In many instances, increased eutrophication is more evident from the biomass of plant and algae and from the effects of plant respiration and photosynthesis on dissolved oxygen and pH.

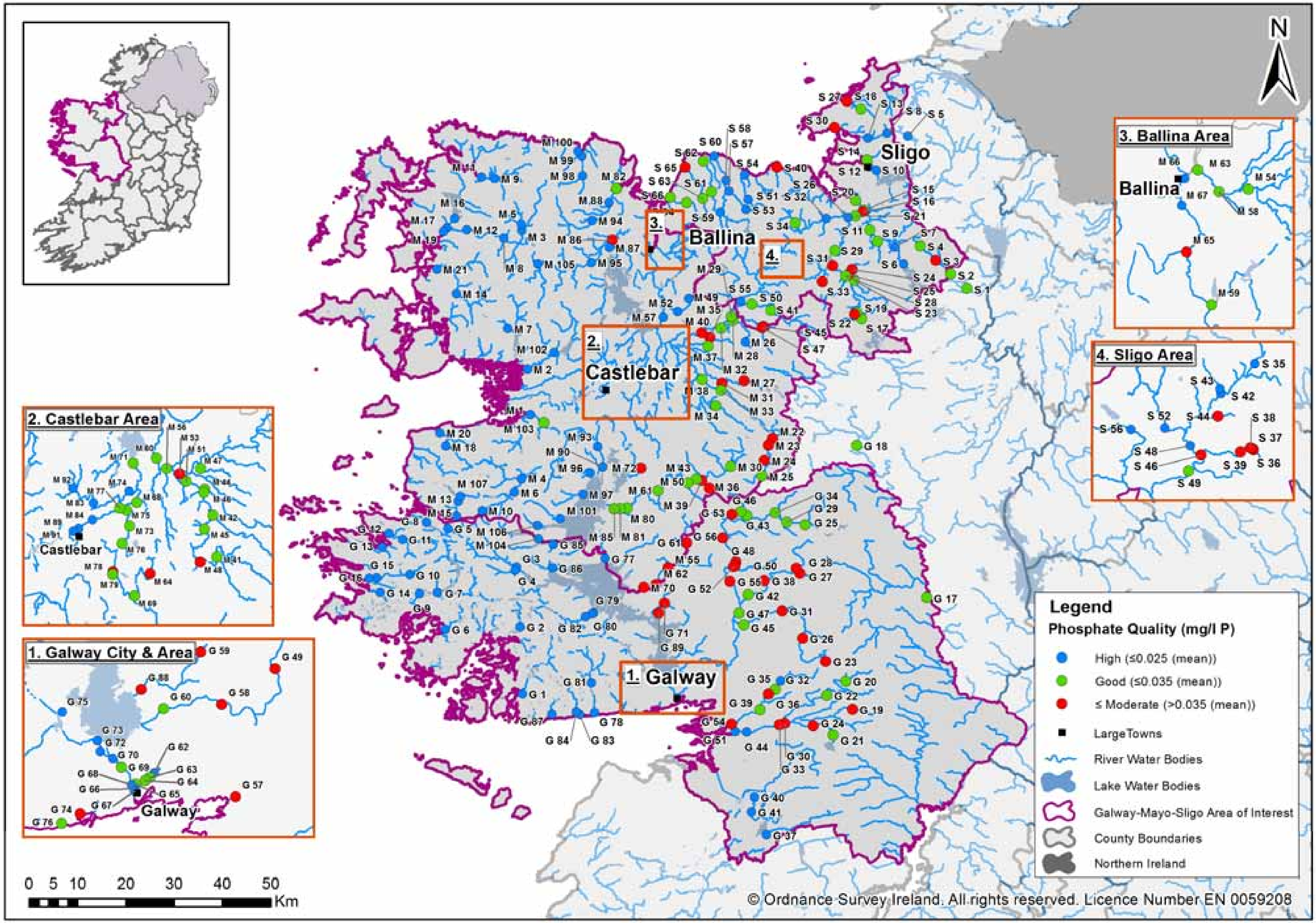

Figure 3.2 Annual average ortho-phosphate in rivers in Galway, Mayo & Sligo in 2011. See Appendix 1 for details of station codes.

Annual median ortho-phosphate concentrations at 60 river stations in the West of Ireland are presented in graphical form in Appendix 4. Ortho-phosphate trends from eight of these rivers are presented in Figure 3.3. The data covers the period 1980-2011 (except in some cases where the data was unavailable). In order to facilitate easier comparison of median levels between different river stations, the scales on each graph are the same. These graphs indicate that the overall levels of ortho-phosphate recorded in river water samples have remained fairly constant over the 30 year period. The majority of rivers in the West show an increase in ortho-phosphate levels particularly in the last ten years e.g. the Corroy, Cregg, Black (Shrule). Median ortho-phosphate levels in the Corroy have increased from 0.025mg/l P in the late 1990`s to 0.040mg/l P in 2011. Where ortho-phosphate levels have reduced due to improvements in municipal wastewater treatment (e.g. the Nanny, Castlebar, Owenmore, Swinford and Gurteen), this reduction has been quite significant.

Over the period 1980 to the present, the laboratory reporting limit for ortho-phosphate has changed for a number of reasons. The current reporting limit is <0.012 mg/l P (i.e. values less than 0.012 mg/l P are reported as <0.012 mg/l P). For the purpose of this report, all values <0.012 mg/l P appear on the graphs as 0.012 mg/l P.

In relation to these graphs it is important to point out the following:

- The median values displayed on the graphs are simply the median ortho-phosphate values for each year in question and can only be taken at face value.

- The number of samples taken from each station from year to year varied and some stations (e.g. salmonid stations) were sampled at a much higher frequency than other river stations due to legislative requirements.

- Samples were obviously taken at different times of the year but no account is taken of seasonal factors (e.g. rainfall) in preparing these graphs.

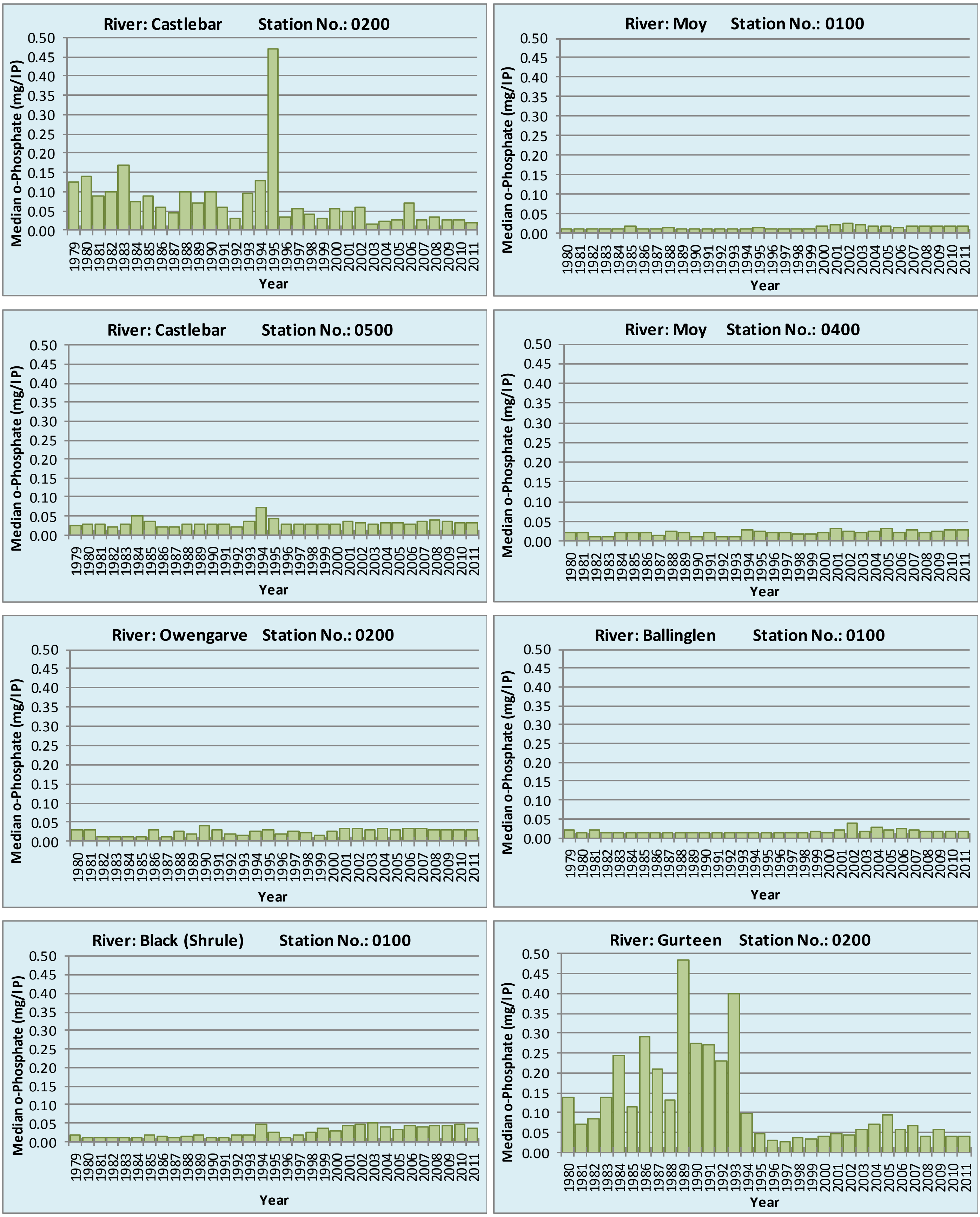

Figure 3.3. Long Term Trends for ortho-phosphate in a selection of River Waters in the West of Ireland

Nitrate in River Waters in the West of Ireland

EU Directives and Nitrate Standards for Water: The EU Directive on the quality of water for human consumption (Council Directive 98/83/EC) specifies a maximum admissible concentration of 11.3 mg/l N for nitrate (= 50 mg/l as NO_3) and also sets out a guide level of 5.65 mg/l N (= 25 mg/l as NO_3) – the lower guide level is not mandatory but should nonetheless be aimed for as a quality objective.

Normal treatment processes for drinking water do not reduce the nitrate content and consequently, the limits above are also specified in the EU Directive on the quality of surface water intended for the abstraction of drinking water (Council Directive 75/440/EEC). It is considered that all river waters in the West of Ireland should meet these standards therefore these are the criteria that are used here to assess river nitrate levels.

The EC Directive regarding the protection of waters from pollution caused by nitrate from agricultural sources was introduced in 1991 because of concern for nitrate concentrations in surface and ground waters (Council Directive 91/375/EC). Further regulations introduced in 2006 allow for the control of animal stocking rates, farmyard management, and fertilisers and slurry application rates for various crops (S.I. No. 378 of 2006).

Long Term Trends for Nitrates in River Waters in the West of Ireland: The graphs in Appendix 5 show the annual median nitrate concentrations at 60 river stations in the West of Ireland. Nitrate trends from eight of these rivers are presented in Figure 3.4. The data covers the period 1980-2011 (except in some cases where the data was unavailable). In order to facilitate easier comparison of median levels between different river stations, the scales on each graph are the same. The graphs show the long-term trends and indicate that the nitrate concentrations in some rivers have slightly increased since 1980 e.g. the Dalgan, Swinford both of which previously suffered from intense organic pollution with a resultant high degree of denitrification. These graphs also indicate that while there have been fluctuations in the levels in some rivers, in the majority of the rivers with low nitrate levels i.e. <0.5mg/l N, the levels of nitrate have remained constant (e.g. Cannahowna, Corrib, Owenriff, Ballinglen, Clydagh, Owenmore, Drumcliff, Garavogue).

Factors Affecting River Nitrate Concentrations: The ploughing of agricultural land is by far the principal factor affecting the concentrations of nitrate in rivers. Research by several groups (Neill 1989, HMSO, 1986 & Ryan *et al.,* 1995) compared the nitrogen loss from ploughed and unploughed land and found losses from the former significantly higher than from the latter.

In its 2004 *Signals* Report, the European Environment Agency states that "*Nitrate concentrations in rivers are linked to the proportion of arable land in the upstream catchment: ….. In 2001, nitrate levels in rivers where arable land covers more than 50 % of the upstream catchment area were three times higher than in catchments with arable land cover of less than 10 %".* The highest annual river nitrate concentrations normally occur in the months of January/February with the lowest concentrations in July/August.

Figure 3.5 shows the annual average nitrate concentration in the rivers in Galway, Mayo & Sligo in 2011 (based on the nitrates directive classification of water quality). Nitrate concentrations in rivers in the West of Ireland are all well below the 11.3 mg/l N drinking water standard, but also the majority are within the more realistic ecological target values of 0.9 mg/l N for high ecological status and 1.8 mg/l N for good ecological status.

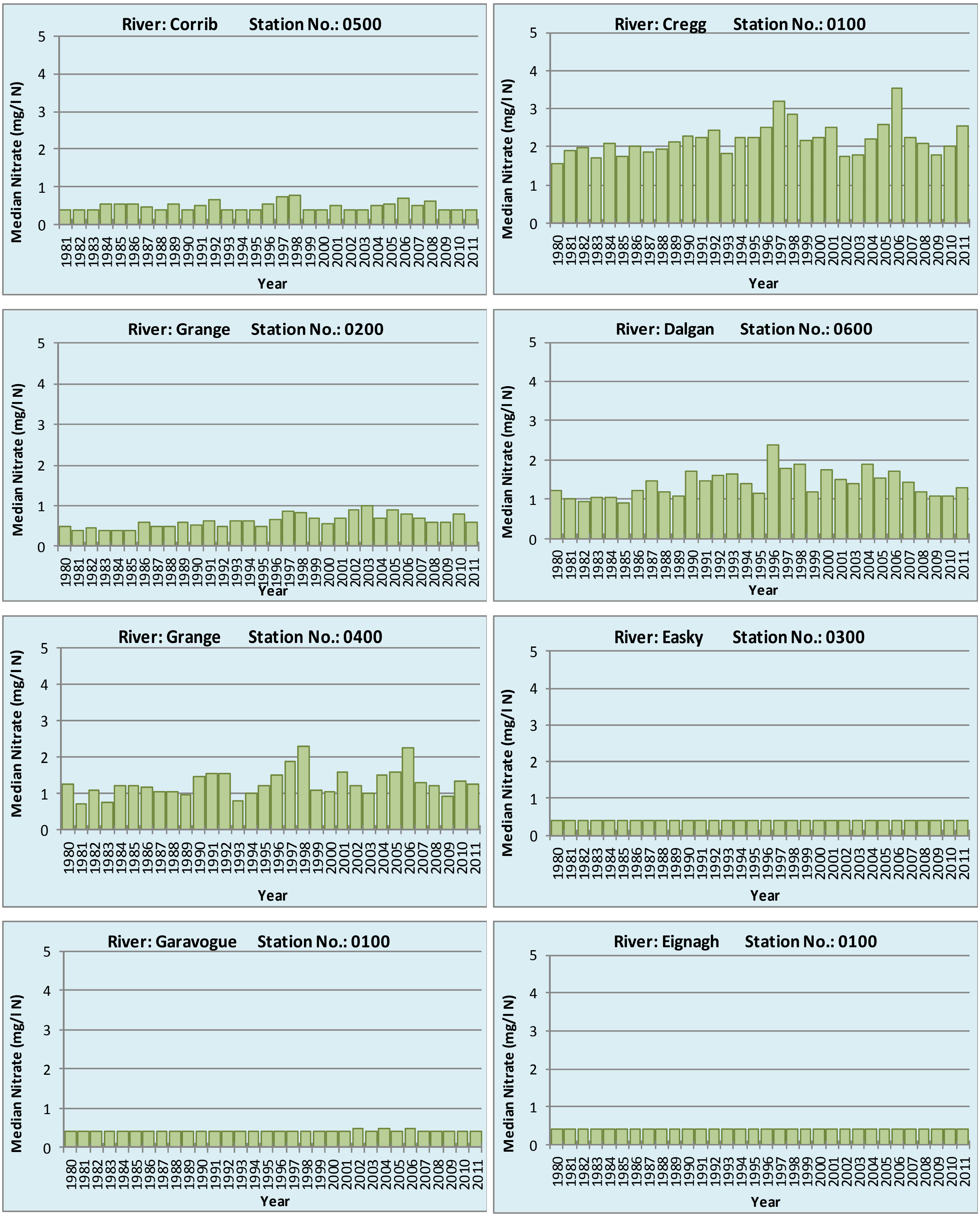

Figure 3.4. Long Term Trends for Nitrates in a selection of River Waters in the West of Ireland

Figure 3.5 shows the annual average nitrate concentration in 2011. Of the 262 stations monitored, 97.5% were high or good, with only 2.5% of moderate status (based on face value comparisons with the nitrates directive classification of water quality). This compares favourably with the south-east of Ireland in which only 43% were high or good, and 57% were moderate.

Over the period 1980 to the present, the laboratory reporting limit for nitrate has changed for a number of reasons. The current reporting limit is <0.4 mg/l N (i.e. values less than 0.4 mg/l N are reported as <0.4 mg/l N). For the purpose of this report, all values <0.4 mg/l N appear on the graphs as 0.4 mg/l N.

In relation to these graphs is important to point out the following:

- The median values displayed on the graphs are simply the median nitrate values for each year in question and can only be taken at face value.

- The number of samples taken from each station from year to year varied and some stations (e.g. salmonid stations) were sampled at a much higher frequency than other river stations due to legislative requirements.

- Samples were obviously taken at different times of the year but no account is taken of seasonal factors (e.g. rainfall) in preparing these graphs.

Other Physico-chemical Monitoring

Figure 3.6 shows the annual mean Dissolved Oxygen (DO) in rivers in Galway, Mayo & Sligo in 2011. Over 97% of sites in the West are of high status in relation to DO based on face value comparison of the 2011 annual means against the EQS.

Figure 3.7 shows the annual mean Biochemical Oxygen Demand (BOD) in rivers in Galway, Mayo & Sligo in 2011. Over 96% of sites in the West are of good or high status in relation to BOD based on a face value comparison of the 2011 annual means against the EQS.

Figure 3.8 shows the annual mean ammonia in rivers in Galway, Mayo & Sligo in 2011. Over 90% of sites in the West are of good or high status for ammonia based on face value comparison of the annual means against the EQS.

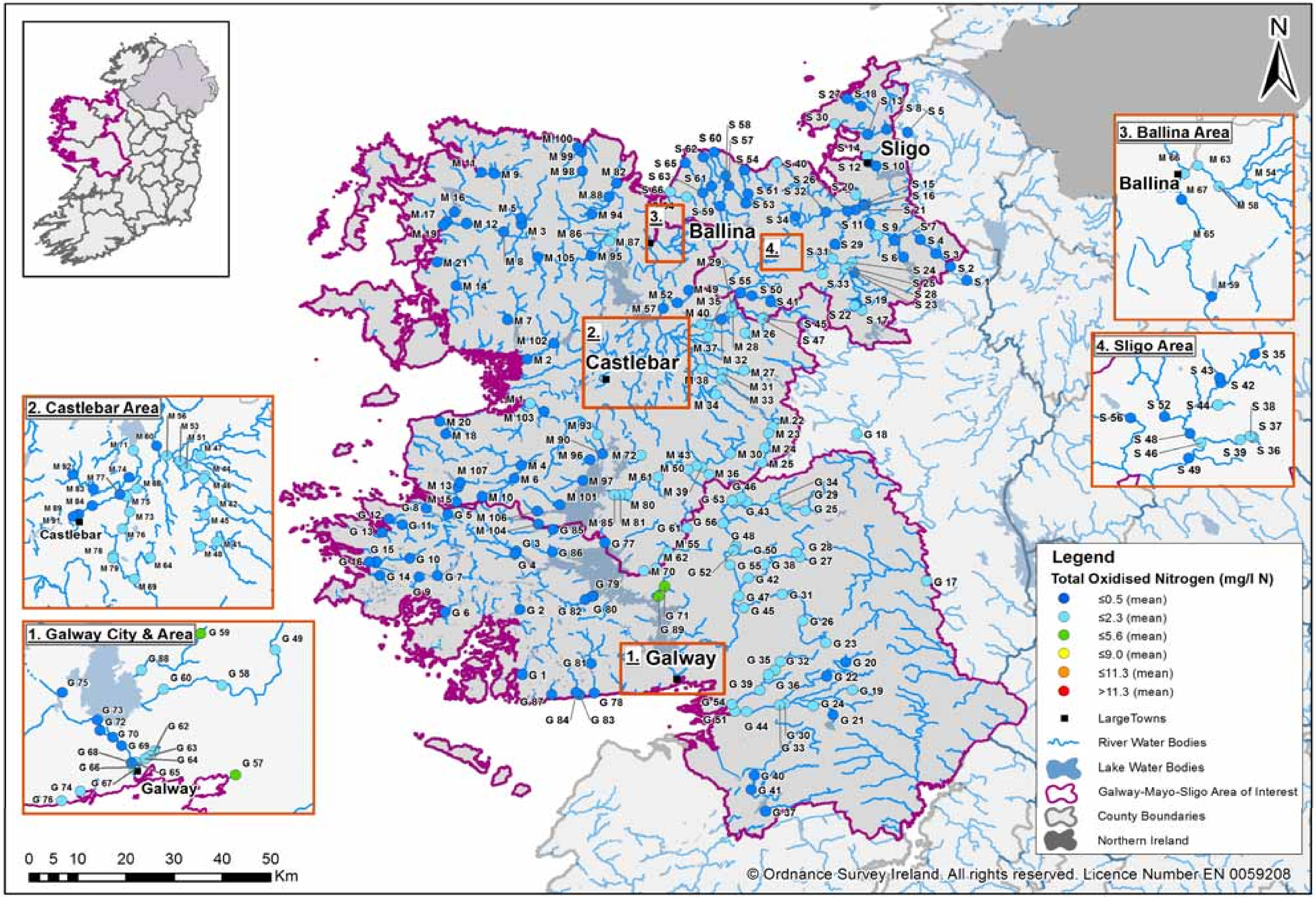

Figure 3.5 Annual mean Nitrate in Galway, Mayo and Sligo Rivers in 2011. See Appendix 1 for details of station codes

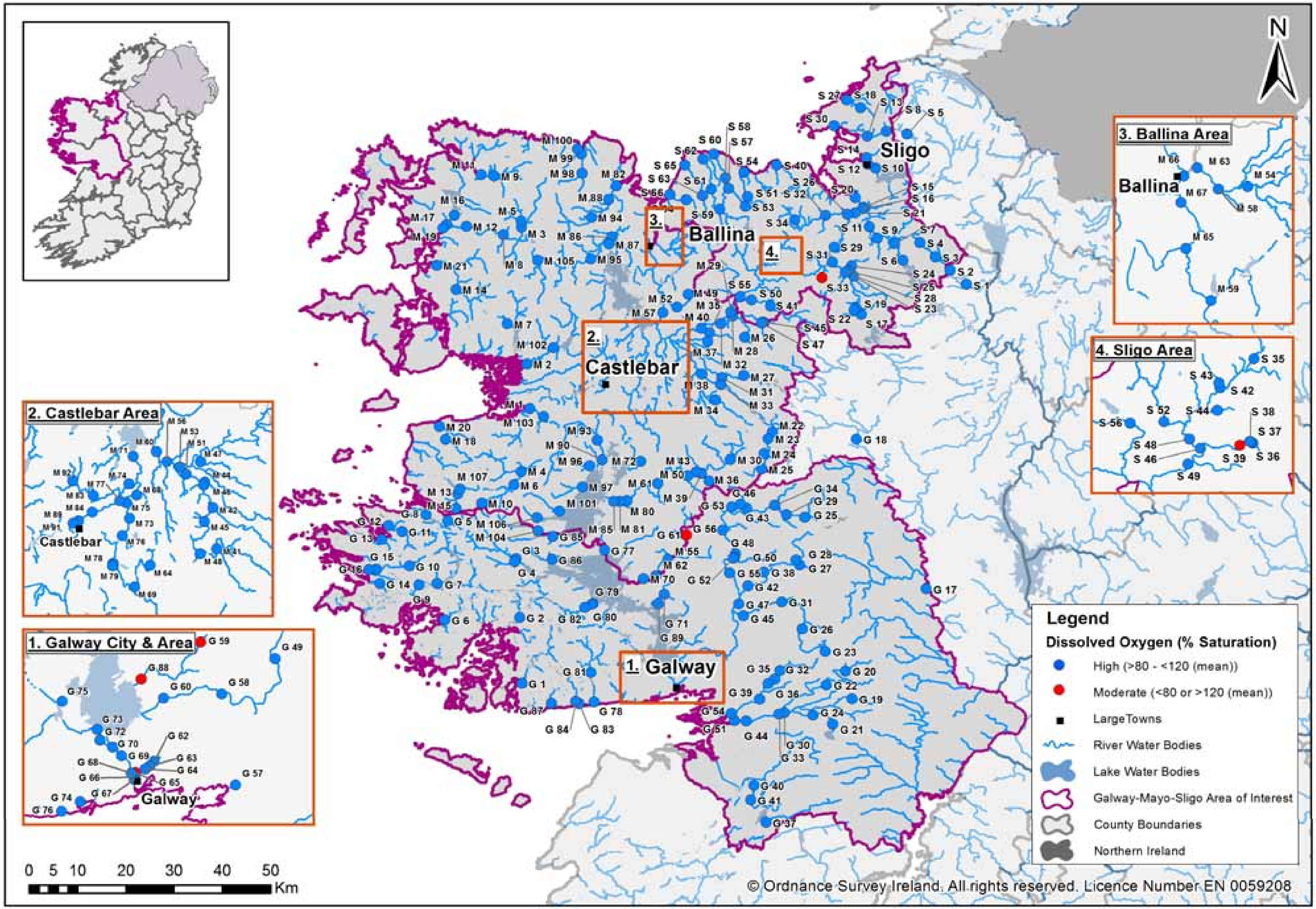

Figure 3.6 Annual mean DO (%Sat) in Galway, Mayo and Sligo Rivers in 2011. See Appendix 1 for details of station codes

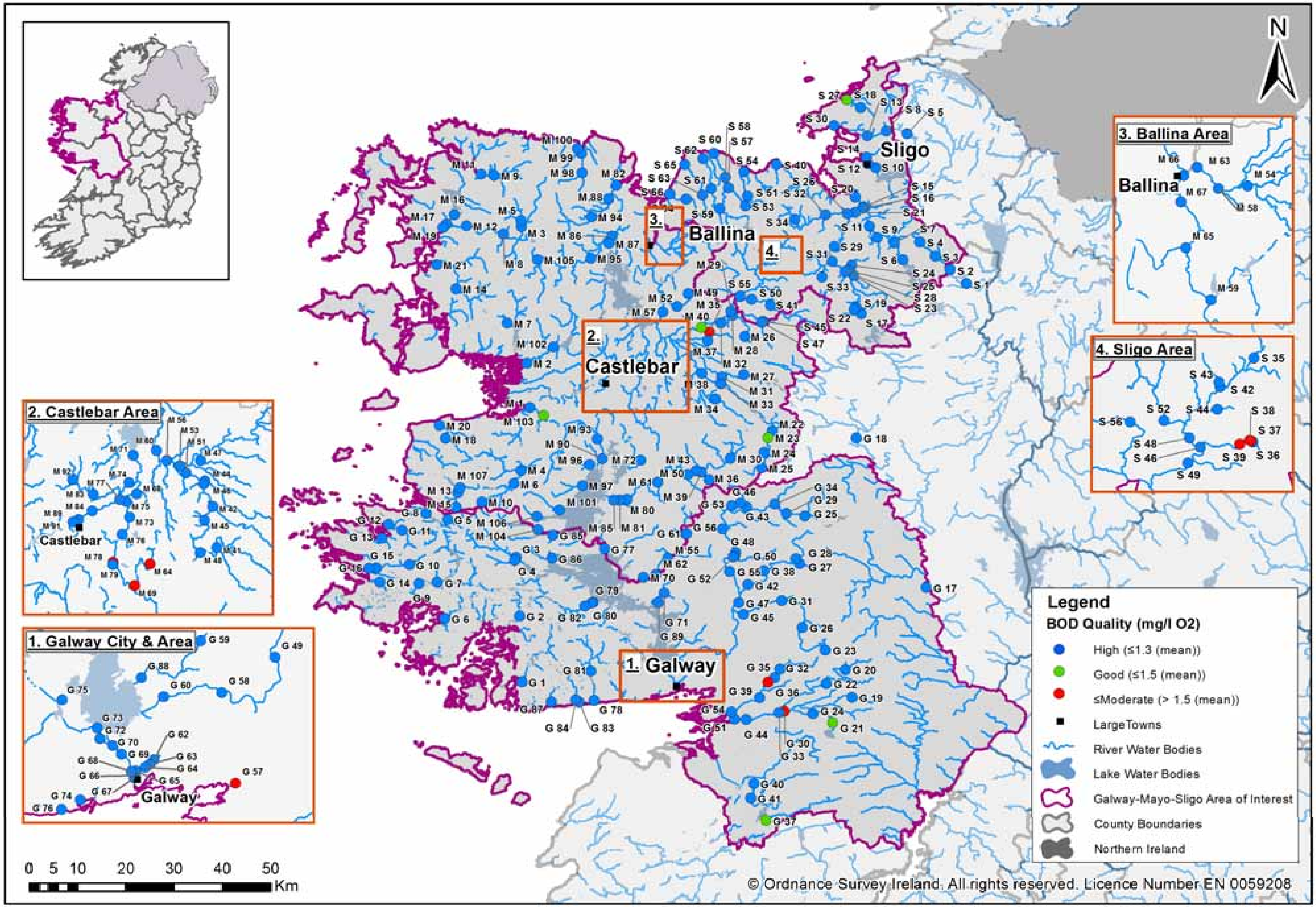

Figure 3.7 Annual mean BOD (mg/l O_2) in Galway, Mayo and Sligo Rivers in 2011. See Appendix 1 for details of station codes

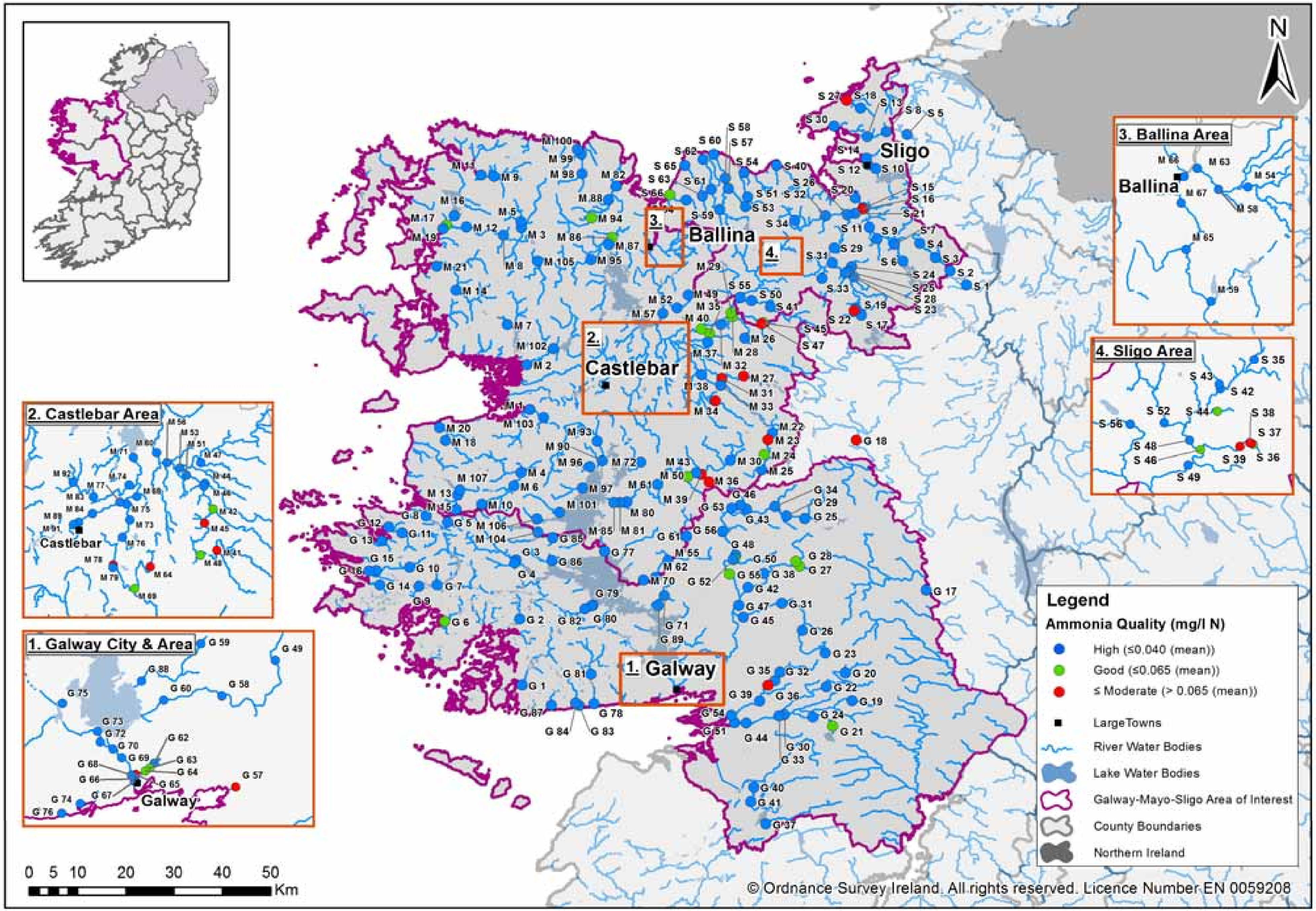

Figure 3.8 Annual mean Ammonia (mg/l N) in Galway, Mayo and Sligo Rivers in 2011. See Appendix 1 for details of station codes

Salmonid Rivers in the Region

The objective of this designation type is the maintenance of water quality for salmon and trout freshwater species and is legally backed by the European Communities (Quality of Salmonid Waters) Regulations, S.I. No 84 of 1988.

The 1988 directive defines freshwaters as being waters capable of supporting Salmon, Trout (*Salmo trutta*), Char (*Salvelinus*) and whitefish (*Coregonus*) and are to be designated as Salmonid waters.

The local authorities in Galway, Mayo and Sligo are responsible for the monitoring of salmonid rivers, and EPA Castlebar carries out this work on their behalf. The river that is designated as salmonid in Galway is the Corrib (stations 0100, 0200, 0300, 0400 and 0500) and these stations require monitoring on a monthly basis. In Mayo, the Castlebar 0500, Corroy 0200, Deel 0300, Glore 0200, Gweestion 0200, Manulla 0500, Moy stations 0500, 0700 and 1100, Mullaghanoe 0300, Spaddagh 0200, Trimoge 0500 and the Yellow (Foxford) 0200 are all designated salmonid rivers. In Sligo the Moy 0100 and the Owengarve 0200 are the only two designated salmonid rivers.

Compliance

In total, 246 samples were taken in 2011 and analysed to assess compliance with the Salmonid Regulations. There was 100% compliance with the following parameters: Temperature, pH, Ammonia, Non-ionised Ammonia, Copper and Zinc. The only exceedences were in relation to nitrite and their locations are given in table 3.1. The exceedences were relatively minor ones. Refer to Appendix 6 for further details of individual salmonid river station assessments.

Table 3.1 Exceedences of Salmonid Regulations in 2011 in the West of Ireland

River Name	River Station	Parameter	Limit	No. of Failures
Corrib	30C02-0400	Nitrite	0.05 mg/l N	1
Mullaghanoe	34M03-0300	Nitrite	0.05 mg/l N	2

Biological Monitoring of Rivers

Biological Monitoring

Biological monitoring is generally carried out on a three year cycle. The freshwater reaches of rivers and streams are surveyed from an upper 'survey limit' to their confluences with other rivers or to their tidal limit. The survey limit is a point in the headwaters above which biological sampling is impracticable, usually because of lack of flow or difficult access. Sampling sites are typically located at 5 km intervals with extra stations located in some reaches to reflect better the effects of point discharges or other known or potential pollution sources. The length of river channel in five principal water quality classes or ecological status categories is high, good, moderate, poor and bad is assessed at individual sampling points and then interpolated between sites in a systematic and standardised fashion having regard to typical or expected patterns of water quality recovery in rivers affected by waste discharges. Using channel distances provides a more representative picture of overall water quality due to the fact that there are more monitoring stations in the vicinity of pollution sources than elsewhere. The distance breakdown is provided on a river by river basis based on Q-Value. Where possible, chemical and biological sites coincide, although there are significantly more biological monitoring sites than chemical sites.

Biological Assessment

In the presence of pollution, characteristic and well-documented changes are induced in the flora and fauna of rivers and streams. Particularly well documented are the changes brought about by organic pollution in the macroinvertebrate community i.e., the immature aquatic stages of aerial insects (mayflies, stoneflies etc.) together with Crustacea (e.g. shrimps), Mollusca (e.g. snails and bivalves), Oligochaeta (worms) and Hirudinea (leeches). For the purposes of the EPA assessment procedure benthic macroinvertebrates have been divided into five Indicator Groups.

Relationships between water quality and macroinvertebrate community structure are usually described by means of a numerical scale of values. The EPA scheme of Biotic Indices or Quality (Q) Values and its relationship to WFD status is set out in table 3.2. Where a toxic effect is apparent or suspected the suffix '0' is added to the biotic index (e.g. Q1/0, Q2/0 etc.) and attention is sometimes drawn to siltation or atypical effects by appending an asterisk to the biotic index (e.g. Q1*, Q2* etc.). The Q-rating assessment has been adapted to meet the requirements of the WFD and to ensure it is comparable with methods used in other EU countries in a formal intercalibration programme and decision (2008/915/EC).

Table 3.2. WFD Status and corresponding Q-value

Q-Value	WFD Status	Pollution Status
Q5, Q4-5	High	Unpolluted
Q4	Good	Unpolluted
Q3-4	Moderate	Slightly Polluted
Q3, Q2-3, Q2	Poor	Moderately Polluted
Q1-2, Q 1	Bad	Seriously Polluted

In the overall assessment for WFD status at surveillance sites, in addition to macroinvertebrates, other biological elements, i.e. plants (macrophytes), algae (including diatoms) and fish as well as hydromorphological and chemical criteria, are taken into account.

The EPA and its predecessor organisations have been monitoring rivers in the West of Ireland using biological methods since the early 1970s, using essentially the same methodology. This allows for a long timeline for analysis of trends and changes in water quality over time. The results are available online at: http://www.epa.ie/whatwedo/monitoring/water/rivers/results/ in a variety of ways from maps to reports on individual stations. The results are broken down on a hydrometric area basis at http://www.epa.ie/QValue/webusers/. The Galway/Mayo/Sligo region is covered by hydrometric areas 25, 26, 29, and 30 to 35. The online reports are available within a short time after the biological surveys have been carried out during the summer months. An appendix with the results for individual rivers is provided as Appendix 7 (Biological River Survey Results). These reports provide long term trends and details of catchment characteristics. More detailed GIS data layers are also available from the EPA or RBD offices.

Table 3.3 provides a breakdown of river water quality status by county, based on the EPA's biological survey of rivers in the West of Ireland. Figure 3.9 provides the most recent WFD biological classification of rivers in the West of Ireland. Table 3.3 and Figure 3.9 show that over 77.4 % of 473 sites monitored are of Good or High status, 14.0 % at moderate status and 8.7% of sites at poor status or worse. The results in Table 3.4 show that there are now 49 polluted river sites in Galway, 40 in Mayo and 20 in Sligo to be dealt with. There are four seriously polluted river sites - two associated with Tubbercurry, one with Athenry and one industrial discharge at Laurencetown. The causes of pollution are relatively well characterised with a breakdown of the principal suspected causes of pollution available for the period 2007-2009.

Table 3.3. Number of river sites surveyed biologically in 2008-2011, showing county breakdown of ecological status based on macroinvertebrates (Q-Value).

Number of River Sites	Bad	Poor	Moderate	Good	High	Number of sites	High or Good
Galway	2	18	28	81	37	166	118
Mayo	0	11	26	125	58	220	183
Sligo	2	8	12	43	22	87	65
Total	4	37	66	249	117	473	366

Percentage breakdown	Bad	Poor	Moderate	Good	High		High or Good
Galway	1.2%	10.8%	16.9%	48.8%	22.3%		71.1%
Mayo	0.0%	5.0%	11.8%	56.8%	26.4%		83.2%
Sligo	2.3%	9.2%	13.8%	49.4%	25.3%		74.7%
Combined	**0.8%**	**7.8%**	**14.0%**	**52.6%**	**24.7%**		77.4%

Table 3.4. Number of polluted river sites with suspected cause of pollution for period 2007-2009.

Suspected Cause of Pollution	Galway	Mayo	Sligo	Totals	%
Agriculture	24	16	7	47	43%
Municipal	13	14	8	35	32%
Industrial	6	4		10	9%
Forestry	2	3	3	8	7%
Aquaculture	3			3	3%
Peat Harvesting		2		2	2%
Engineering works		1		1	1%
Hydromorphological			1	1	1%
Lake Effects			1	1	1%
Landfill	1			1	1%
Total	49	40	20	109	

High Quality Sites

Nationally the percentage of high quality (Q5 and Q4-5) sites almost halved in the 21 years between 1987 and 2008 with those attaining Reference Condition (Q5) down to 2%. The number of high status sites in the West of Ireland in the period 2007-2009 are shown below (Table 3.5):

Table 3.5. The number of high status sites in the West of Ireland in the period 2007-2009

County	Sites (2007-2009)
Galway	37
Mayo	58
Sligo	22

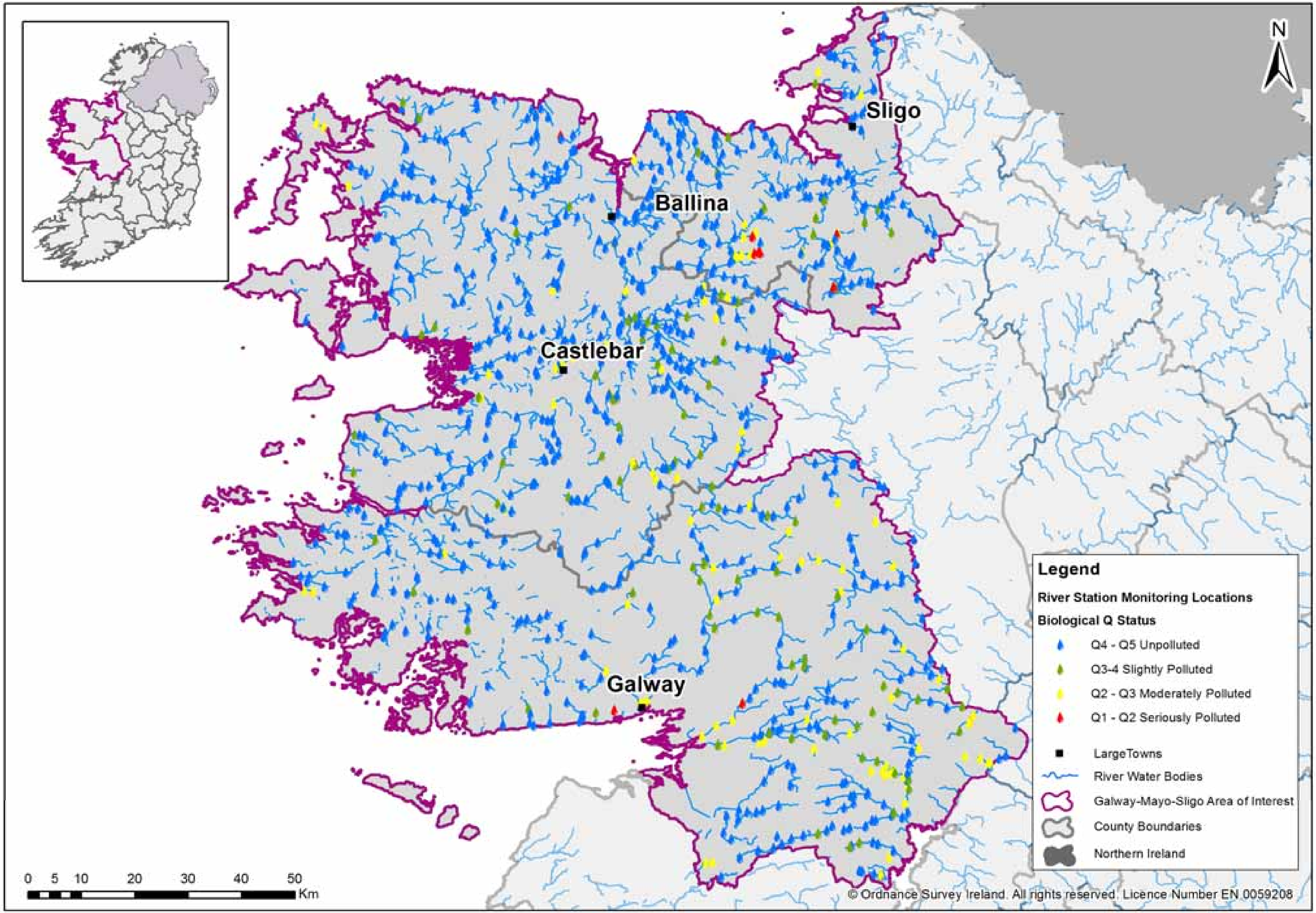

Figure 3.9 Biological Classification of Rivers in the West of Ireland.

Summary

In total, 473 sites in the West of Ireland were surveyed biologically between 2008 and 2011. Not all of the sites were of good or high status and 109 river sites have been identified as priority sites for tackling pollution. The counties and number of priority polluted sites are listed below (Table 3.6) and more details in relation to physico-chemical monitoring of the sites in each county are provided in the individual county tables in Appendix 2 of this report. More details of these priority polluted sites can be found in Table 2.1. A continued focus on investigative monitoring is required to confirm the causes of pollution at these sites and to allow for more targeted measures to be implemented in order to address the underlying cause of pollution.

Table 3.6. Counties and number of priority polluted sites

County	No of Priority Polluted Sites	% Priority Polluted Sites
Galway	49	29
Mayo	40	18
Sligo	20	23

Compared with the national average, the West would appear to be performing satisfactorily in general. For example in the period 2007-2009, over 80% of river channel in the West of Ireland were of good or high status, compared with 71% nationally. As expected the less densely populated areas of the country have a higher number of unpolluted sites. However, serious pollution continues on the Clarinbridge River, Tubbercurry Stream and Tubbercurry River, primarily due to poorly treated municipal wastewater. The wastewater treatment plant at Athenry (Co Galway) and Tubbercurry (Co Sligo) are subject to licensing by the EPA and compliance with the requirements of the licences along with investment in updating of these plants should lead to improvements in water quality at these sites in the future.

As discussed earlier, ortho-phosphate levels in almost 25% of the river sites were less than good while, nitrate levels in only 3% of rivers were less than good. The projected increase in primary output from the agriculture sector under *Food Harvest 2020*, will prove challenging in the context of meeting the objectives of the WFD within the required timeframes.

As well as having effects on the ecological status of rivers themselves, nutrient levels in rivers also affect the quality of the lakes and transitional and coastal waters they feed. A reduction in the total amount of nutrients delivered to lakes and transitional and coastal waters from rivers is a key focus of the WFD programme of measures.

LAKE WATER QUALITY

Physico-Chemical & Biological Monitoring

There are five surveillance and two operational monitoring lakes in County Sligo, 11 surveillance and 17 operational monitoring lakes located in County Galway and seven surveillance and 14 operational monitoring lakes located in County Mayo on the 2010-2012 WFD lake monitoring programme (Figure 4.1).

All lakes are sampled for the biological parameters – macrophytes and phytoplankton (chlorophyll) invertebrates and in the case of surveillance lakes, fish. They are also monitored for the following general physico-chemical parameters: alkalinity, total ammonia, conductivity, dissolved oxygen, nitrate, nitrite, pH, transparency, silica, temperature, total oxidised nitrogen (TON), total phosphorus (TP) and true colour. Additional parameters; calcium, chloride, sodium, potassium and magnesium are monitored for the 22 lakes on the acid lake network. The data is available in the appendices on a disk at the back of this report.

A number of lakes are also surface water abstraction points and in addition to physico-chemical monitoring, they are also monitored for metals and total and faecal coliforms. They provide water to the city of Galway, and towns such as Tuam and Loughrea; Achill, Ballina, Cong and Touramakeady in Mayo and include Lough Easky, Gill, Talt in Sligo

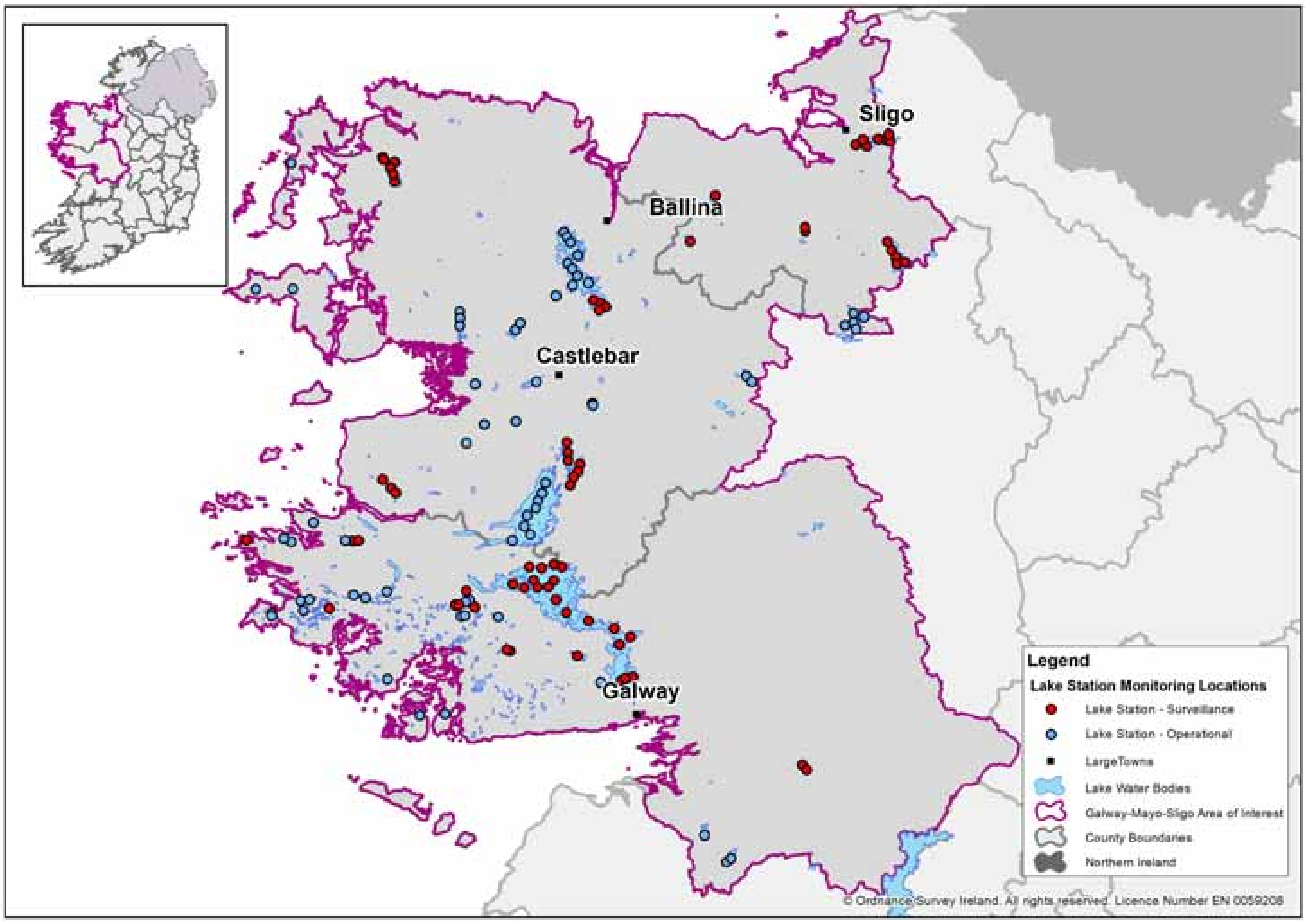

Figure 4.1 WFD surveillance and operational monitored physico-chemical sites in Counties Sligo, Galway and Mayo.

Assessment of Water Quality

Co. Sligo

The general physico-chemical (GPC), biological (BQE) and ecological status of WFD lakes in Sligo are presented in Table 4.1 for the periods 2007-2009 and 2008-2010. Ecological status remains unchanged for five of the seven lakes. Two lakes were of high status and three lakes were assigned good ecological status. Two lakes have changed status; Templehouse Lake has deteriorated from moderate to poor/bad status and Easky Lough has improved from good to high status. The current monitoring cycle has one more sampling year before a full update of status can be given. It is unlikely that status will improve for lakes assigned a moderate or worse status. Lakes currently assigned good or better may be of worse status.

Table 4.1 Status of WFD monitored lakes in County Sligo.

LAKE	2007-2009 Status for BQE	2007-2009 Status for GPC	2007-2009 Ecological Status	2008-2010 Rolling Status for BQE	2008-2010 Rolling Status for GPC	2008-2010 Ecological Rolling Status
Arrow	Good	Good	Good	Good	High	Good
Easky	Good	High	Good	High	High	High
Gara	Good	Good	Good	Good	Good	Good
Gill SO	Moderate	Good	Moderate	Moderate	Good	Moderate
Kilsellagh	Moderate	Good	Moderate	Moderate	Good	Moderate
Talt *Note 1*	Good	High	Good	High	High	Good
Templehouse	Moderate	Moderate	Moderate	Poor/Bad	Moderate	Poor/Bad

Note 1; Downgraded due to presence of alien species.

Trends in chlorophyll, nitrate (using total oxidised nitrogen as a surrogate) and total phosphorus are shown in Figures 4.2-4.4. Analyses of trends in chlorophyll is complicated by the presence of zebra mussel (*Dreissena polymorpha* L.) at a number of lakes which may or may not impact chlorophyll levels and /or total phosphorus levels, in addition to normal interannual fluctuations and climatic induced changes (weather).

In general, annual average chlorophyll levels are low (< 5 µg/l) in WFD monitored lakes in Sligo (Figure 4.2). Peaks in annual chlorophyll levels were noted in 2009 (Templehouse) and in 2010 in Gill, Talt and Arrow. Gill and Arrow both have populations of zebra mussel. Easky Lough is exhibiting an upward trend in chlorophyll levels. The remaining lakes have no discernible trend.

Annual average nitrate levels are low (< 3.5 mg/l NO_3). An overall trend of declining nitrate levels was observed at all lakes between the years 2007 and 2010. However, 2011 average values were elevated in most lakes compared to 2010 values (Figure 4.3).

Annual average total phosphorus rarely exceeded 0.025 mg/l P. An overall trend of declining total phosphorus was observed at all lakes between the years 2007 and 2010 most notably in Templehouse and Kilsellagh. However, 2011 levels were elevated compared to 2010. Templehouse, Gill and Gara are notable for their elevated TP values compared to the other Sligo lakes (Figure 4.4).

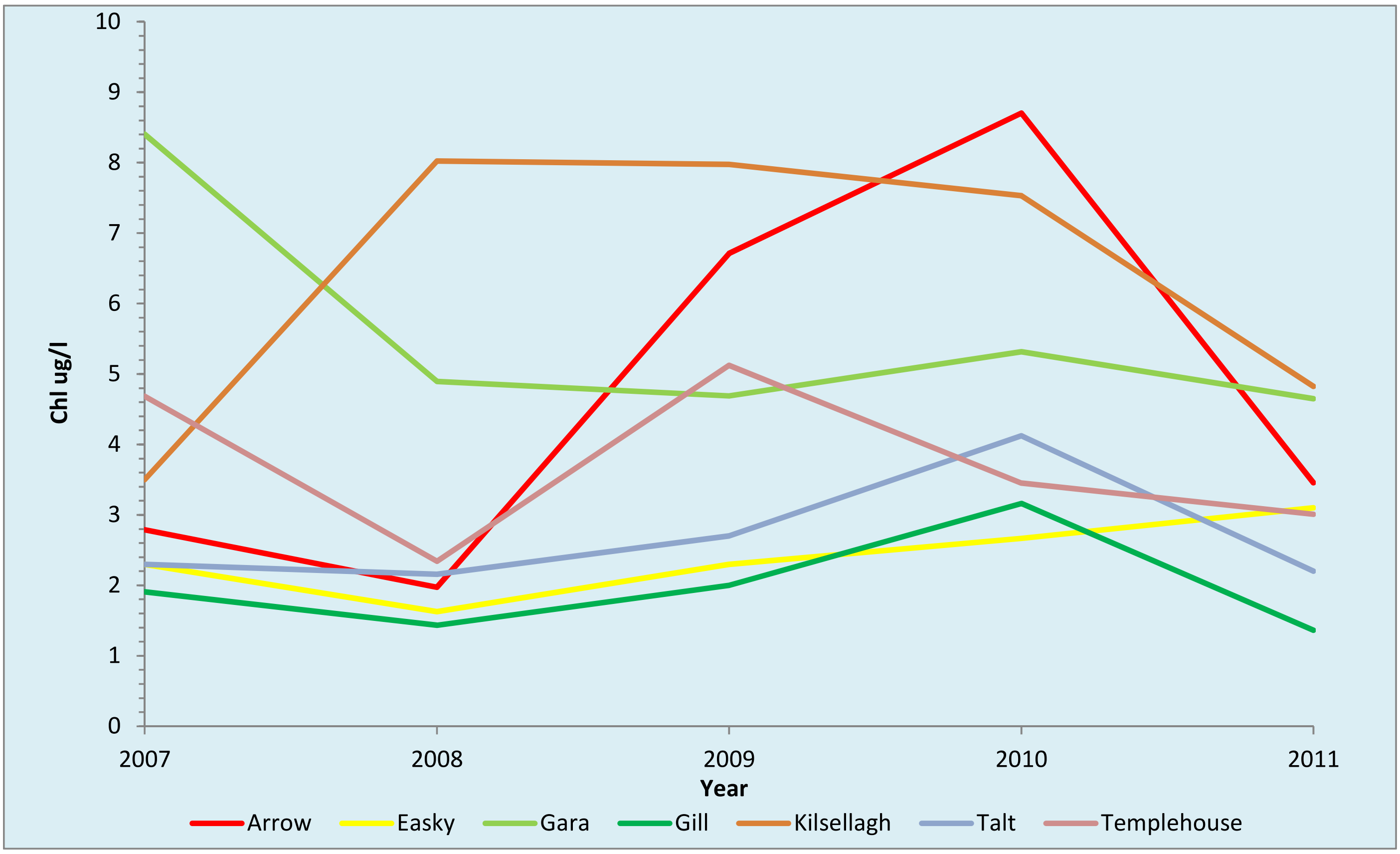

Figure 4.2 Trends in annual mean chlorophyll in WFD monitored lakes in County Sligo 2007-2011

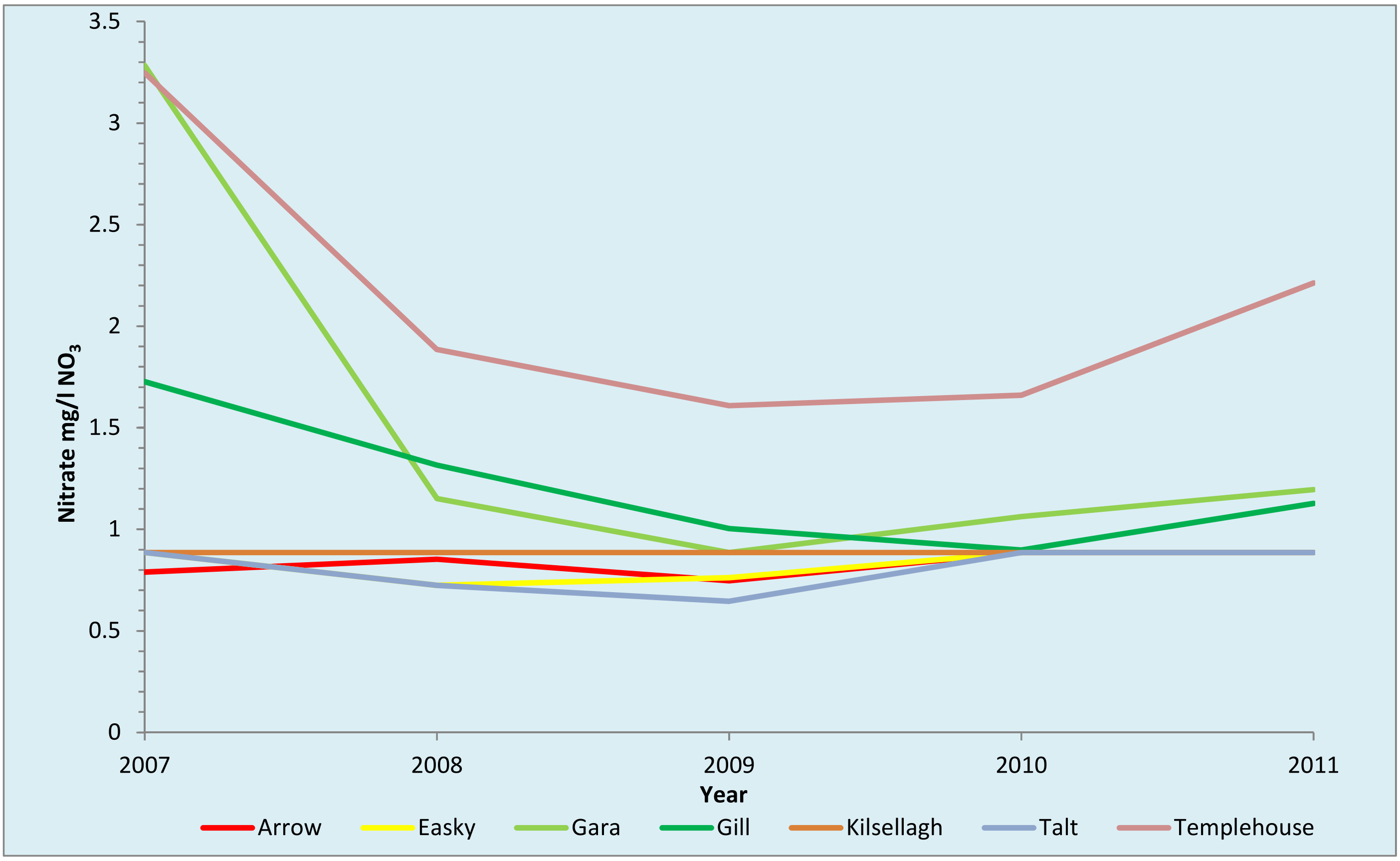

Figure 4.3 Trends in annual mean nitrate (using total oxidised nitrogen as a surrogate) in WFD monitored lakes in County Sligo 2007-2011.

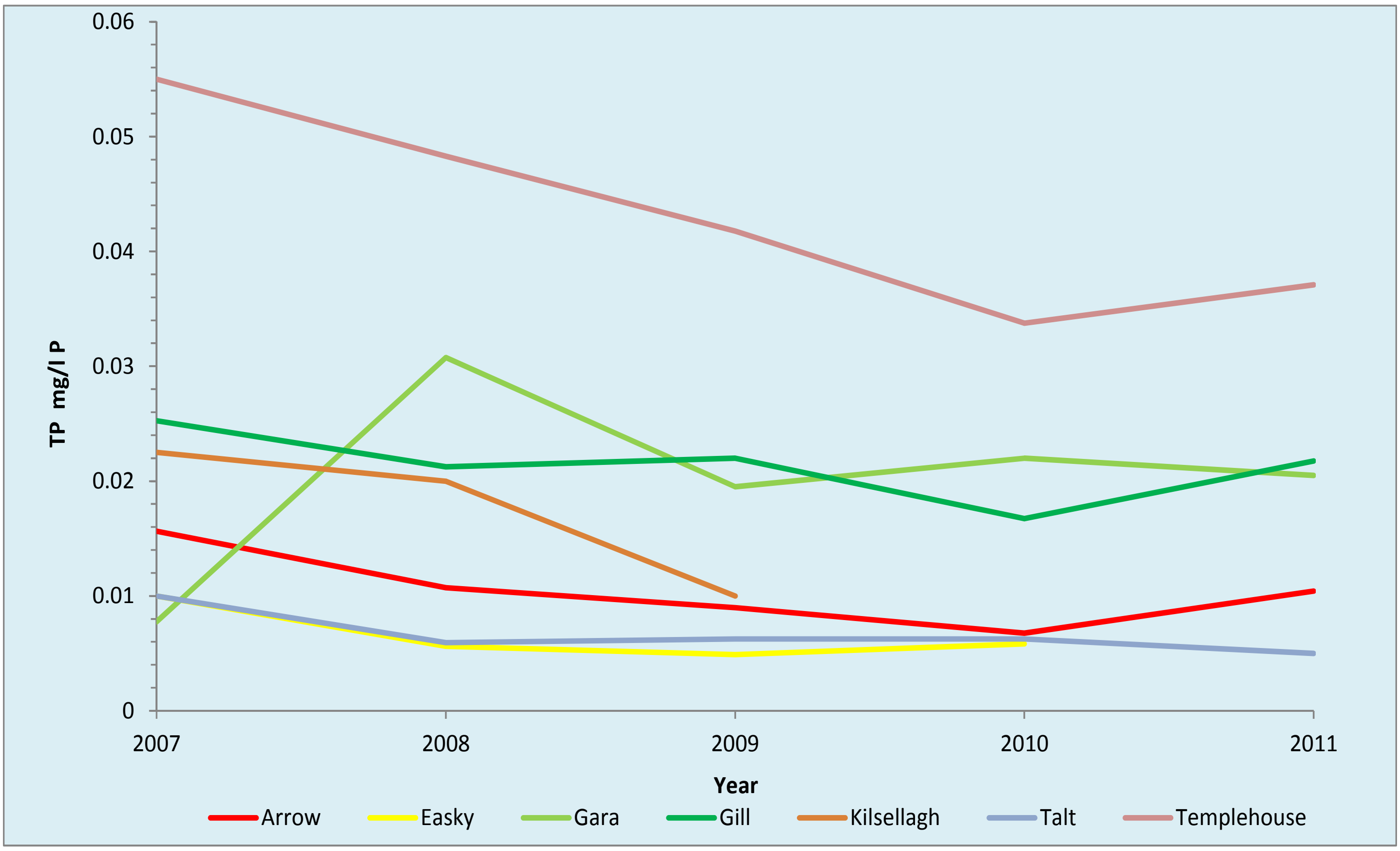

Figure 4.4 Trends in annual mean total phosphorus in WFD monitored lakes in County Sligo 2007-2011.

Co. Galway

The general physico-chemical (GPC), biological (BQE) and ecological status of WFD Lakes in Galway are presented in Table 4.2 for the periods 2007-2009 and 2008-2010. Ecological status remains unchanged for 20 of the 27 lakes with continuous data for the period 2007-2010. Eight lakes were assigned high status and 12 lakes were assigned good status. Five lakes; Aughrusbeg, Ballyquirke, Corrib Lower, Ross and Tully have deteriorated in status and two lakes; Ballynahinch and Corrib Upper have improved.

One additional lake, Cutra was added to the programme in 2010. Based on two years of data, it was assigned good status. However, the monitoring cycle has one more sampling year before a full update of status can be given.

Trends in chlorophyll, total phosphorus and nitrate (using total oxidised nitrogen as a surrogate) and total phosphorus are shown in Appendix 8. Analyses of trends in chlorophyll are complicated by the presence of zebra mussel (*Dreissena polymorpha* L.) on Loughs Corrib and Ross which may or may not impact chlorophyll levels and /or total phosphorus levels. This is in addition to normal interannual fluctuations and climatic induced changes (weather).

Annual average chlorophyll levels were usually less than 10 µg/l but many lakes recorded values less than 5 µg/l. The latter exhibited the least interannual variation and tended to be the high status lakes. Nearly all lakes exhibited a dip in the annual average values in 2008. Some lakes are exhibiting an upward trend subsequent to 2008; Aunwillan, Ballynakill, Illauntrasna, Lettercraffoe, Nambrackmore and Rea (Figure 4.5). In most cases, the subsequent values have not exceeded the 2008 value. Tully, Beaghcauneen and Ballyquirke are notable for their comparably higher annual values but also the variable nature of their chlorophyll trends.

Table 4.2 Status of WFD monitored lakes in County Galway.

LAKE	2007-2009 Status for BQE	2007-2009 Status for GPC	2007-2009 Ecological Status	2008-2010 Rolling Status for BQE	2008-2010 Rolling Status for GPC	2008-2010 Ecological Rolling Status
Anaserd	High	High	High	High	High	High
Anillaun	High	High	High	High	High	High
Ardderry	Good	Good	Good	Good	Good	Good
Aughrusbeg	Good	Good	Good	Poor/Bad	Moderate	Poor/Bad
Aunwillan	Good	High	Good	Good	High	Good
Ballynahinch	Good	High	Good	High	High	High
Ballynakill	Good	Good	Good	Good	Good	Good
Ballyquirke	Moderate	Good	Moderate	Poor	Good	Poor
Beaghcauneen	High	Good	Good	Good	Good	Good
Bofin GY	High	High	High	High	High	High
Corrib Lower	Moderate	Good	Moderate	Poor/Bad	High	Poor/Bad
Corrib Upper	Moderate	High	Moderate	Good	High	Good
Cutra					Good	Good
Derryclare	High	High	High	High	High	High
Enask	High	High	High	High	High	High
Fadda	High	High	High	High	High	High
Illauntrasna	High	Good	Good	Good	Good	Good
Kylemore	Good	High	Good	Good	High	Good
Lettercraffoe	Good	Good	Good	Good	Good	Good
Loughaunore	Good	High	Good	Good	High	Good
Maumwee	High	High	High	High	High	High
Nahasleam	High	High	High	High	High	High
Nambrackmore	High	Good	Good	High	Good	Good
Pollacappul *Note 1*	High	High	Good	High	High	Good
Rea	High	Good	Good	Good	High	Good
Ross	Moderate	Good	Moderate	Poor/Bad	Good	Poor/Bad
Shindilla *Note 1*	High	Good	Good	High	High	Good
Tully	Good	Good	Good	Moderate	Good	Moderate

Note 1: Downgraded from high status to good by hydromorphology.

Annual average nitrate levels are low (< 2.5 mg/l NO_3) in WFD monitored lakes in Galway. Similar to chlorophyll, a dip in annual nitrates concentrations was observed in most lakes in 2008 but this was most likely associated with a change in the level of detection with some exceptions; Ross, Corrib Upper and Lower which are hydrologically linked (Figure 4.6). The trends are remarkably similar for the remaining lakes except Lough Rea which is groundwater fed. There is currently no environmental quality standard for TON/nitrates.

Trends in annual average total phosphorus were highly variable. Loughs Aughrusbeg, Nambrackmore, Beaghcauneen and Tully, were notable for their highly variable trends in mean annual TP in addition to having relatively higher values compared to other Galway lakes (Figure 4.7). Total phosphorus appears to be increasing in these lakes with the exception of Nambrackmore. Many lakes exhibited a rise in average annual values in 2008, but some did not such as; Aughrusbeg, Beaghcauneen, Ardderry, Ballyquirke, Ballynakill, Corrib Upper and Lower and Lough Rea. Most lakes subsequently experienced a dip in annual average values in 2009, except Ballynakill, Ballyquirke, Aunwillan, Illauntrasna and Lough Rea. In general most lakes in Galway have a relatively stable annual mean TP. No lake appears to have a background level of less than 0.005 mg/l P. Annual values exceeding the interim good/moderate boundary (0.025 mg/l P) put a lake at risk of not achieving good status for general physico-chemical status.

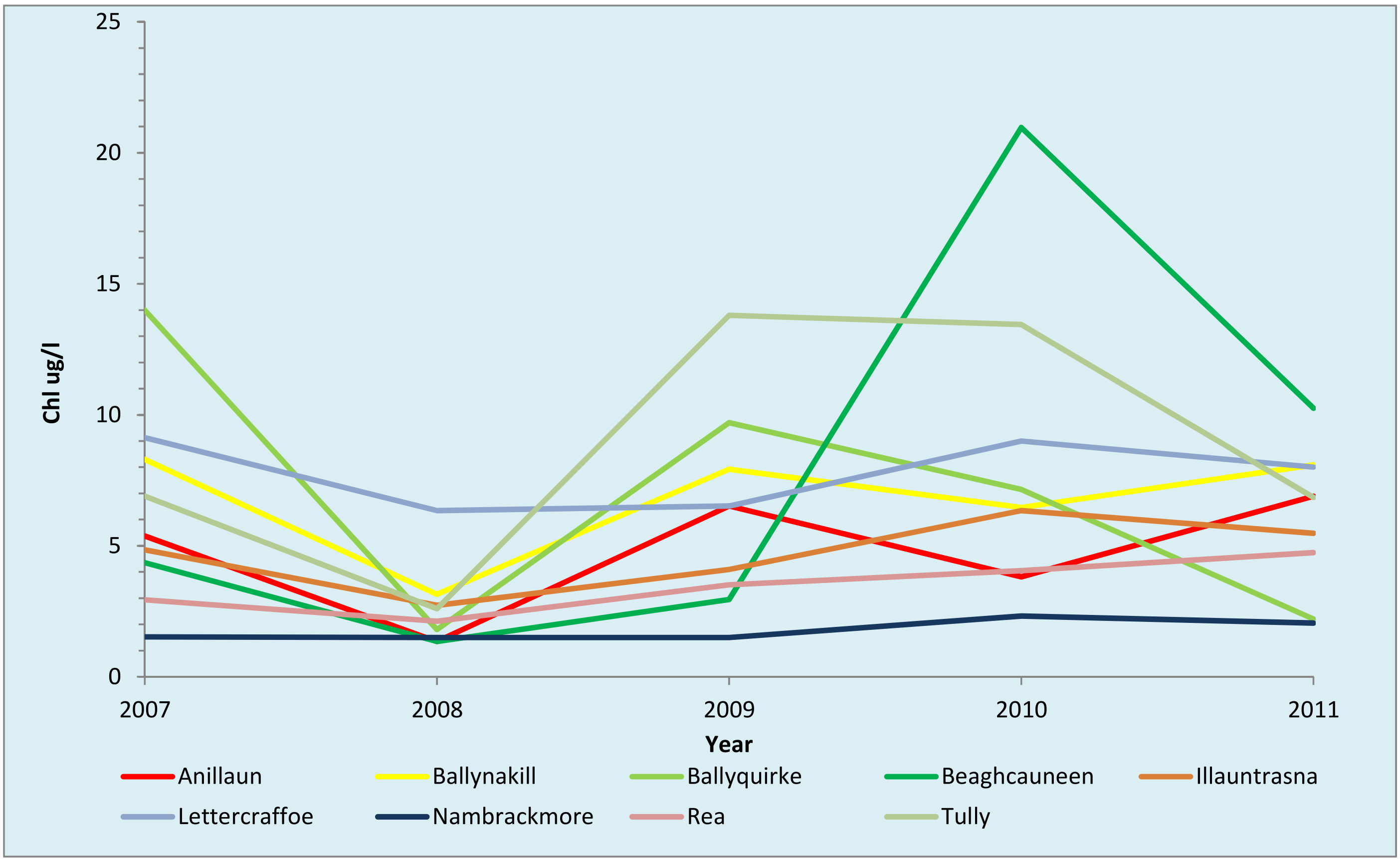

Figure 4.5 WFD monitored lakes in County Galway with increasing trends in annual average chlorophyll for the period 2007-2011.

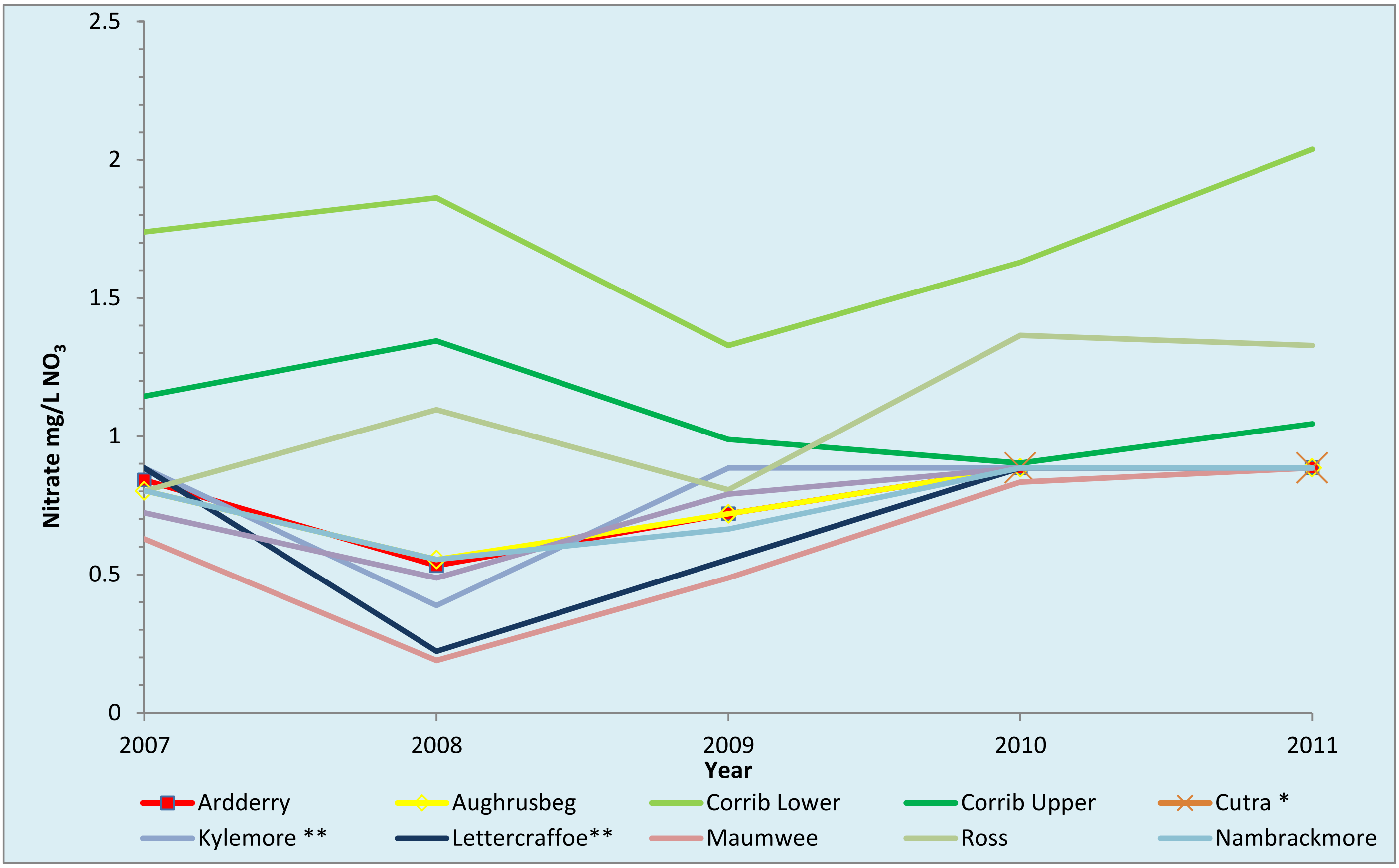

Figure 4.6 Trends in annual average nitrate (using total oxidised nitrogen as a surrogate) in a selection of WFD monitored lakes in County Galway 2007-2011.* level of detection <0.89 mg/L ** level of detection different in 2008 resulting in a perceived decline.

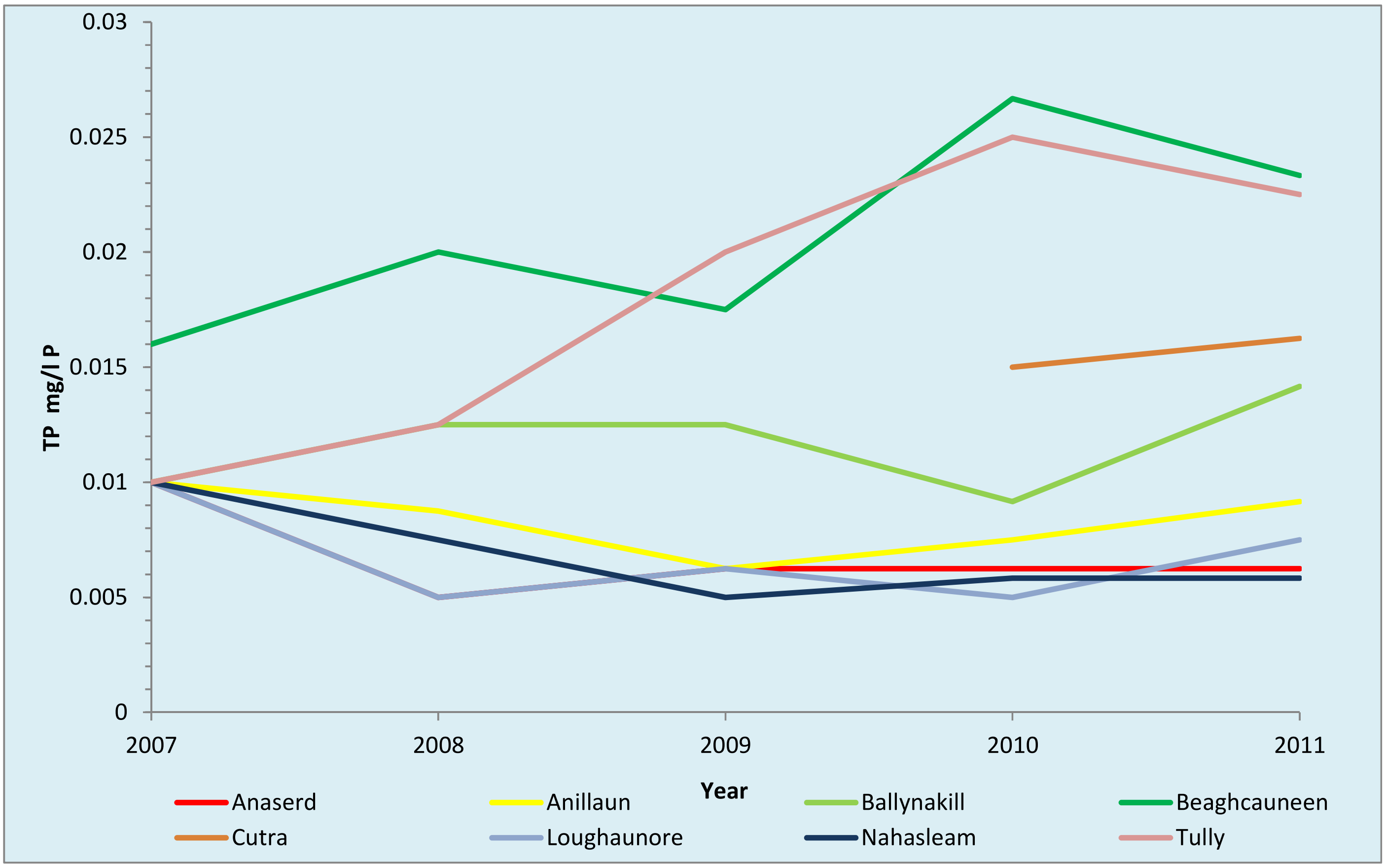

Figure 4.7 WFD monitored lakes in County Galway with increasing trends in annual mean total phosphorus for the period 2007-2011.

Co. Mayo

The general physico-chemical (GPC), biological (BQE) and ecological status is presented in Table 4.3 for the periods 2007-2009 and 2008-2010. Ecological status remains unchanged for 13 of the 18 lakes with continuous data for the period 2007-2010. Nine lakes were assigned good ecological status and four were assigned moderate ecological status. Five lakes have changed status; Carrowmore Lough has deteriorated from good to moderate status, Cullaun Lough has deteriorated from moderate to poor/bad status and Moher Lough has deteriorated from high to good status. Two lakes have improved in status; Cross Lough has gone from poor to moderate status and Levally lough has improved from moderate to good status. Three new lakes were added to the programme in 2010. Based on two years of data, two lakes were assigned to the ecological status categories poor/bad, and a single lake is currently assigned moderate status. However, the monitoring cycle has one more sampling year before a full update of status can be given. It is unlikely that status will improve for lakes assigned a moderate or worse status. Lakes currently assigned good or better may be of worse status.

Mayo has a high proportion of good status lakes. Two high status lakes were downgraded to good based on hydromorphology and due to the presence of alien species. The biological status and general physico-chemical status is in agreement for two lakes. Physico-chemical status determined the status of three lakes. Biological status determined the status of the remaining four lakes.

The status of three of the moderate status lakes Ballin, Knappabeg, and Lannagh is driven by macrophytes and chlorophyll, but Ballin also failed the interim phosphorus standards whilst the other two lakes are fast approaching the standard cut-off. Of the remaining moderate status lakes, Cross was moderate for both chlorophyll and total phosphorus, Carrowmore was moderate status for chlorophyll and Keel for macrophytes.

Fish determine the status of the two poor/bad status lakes; Cullin and Urlaur because the fish community is significantly different to that of reference. There is no other evidence of serious enrichment provided by other elements. It is difficult to ascertain what measures can be adopted to improve the fish status of these two lakes.

Trends in chlorophyll, nitrate (using total oxidised nitrogen as a surrogate) and total phosphorus are shown in Appendix 8. Analyses of trends in chlorophyll is complicated by the presence of zebra mussel (*Dreissena polymorpha* L.) at Loughs Conn, Cross, Cullin, Lannagh and Mask which may or may not impact chlorophyll levels and /or total phosphorus levels. This is in addition to normal interannual fluctuations and climatic induced changes (weather).

In general, annual average chlorophyll levels are rarely greater than 5 µg/l in Mayo lakes. Seven lakes, Cross, Ballin, Aille, Carrowmore, Lannagh, Knappabeg, and Levally have recorded annual average chlorophyll levels > 10 µg/L over the past five years (Figure 4.8). The highest chlorophyll good/moderate boundary is 10.94 µg/l. It is notable that several lakes experienced a peak in annual average chlorophyll levels in 2008 followed by a declining trend. Of particular note are Cross, Ballin, Lannagh and Knappabeg. Chlorophyll levels although low appear to be increasing in Lough Carra. Most lakes have low interannual variation, reflecting their high or good status.

Annual average nitrate levels are low (< 2.5 mg/l NO_3) in WFD monitored Mayo lakes (Figure 4.9). A peak in annual concentrations was observed in some lakes in 2008 and in others in 2009 with nearly all lakes exhibiting an increasing trend in 2011. Overall trends are difficult to discern due to the high interannual variation.

Table 4.3 Status of WFD monitored lakes in County Mayo

LAKE	2007-2009 Status for BQE	2007-2009 Status for GPC	2007-2009 Ecological Status	2008-2010 Rolling Status for BQE	2008-2010 Rolling Status for GPC	2008-2010 Ecological Rolling Status
Acorrymore	Good	High	Good	Good	High	Good
Aille	Good	Good	Good	Good	Good	Good
Ballin	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Beltra				High	High	High
Carra	Good	Good	Good	Good	High	Good
Carrowmore	Good	Good	Good	Moderate	Good	Moderate
Conn	Good	High	Good	Good	High	Good
Cross	Poor	Moderate	Poor	Moderate	Moderate	Moderate
Cullin	Moderate	Good	Moderate	Poor/Bad	Good	Poor/Bad
Doo note 1	High	Good	Good	High	High	Good
Feeagh	Good	High	Good	Good	High	Good
Glencullin	High	Good	Good	High	Good	Good
Keel	Moderate	Good	Moderate	Moderate	Good	Moderate
Knappabeg	Moderate	Moderate	Moderate	Moderate	Good	Moderate
Lannagh	Moderate	Good	Moderate	Moderate	Good	Moderate
Levally	Moderate	Good	Moderate	Good	Good	Good
Mask note 2	Good	High	Good	High	High	Good
Mask Upper					High	High
Moher	High	High	High	High	Good	Good
Washpool	High	Good	Good	High	Good	Good
Urlaur				Poor/Bad	High	Poor/Bad

Note 1: Rolling status downgrade due to hydromorphology
Note2: Rolling status downgrade due to alien species

Annual total phosphorus levels rarely exceed 0.02 mg/l P. There were notable peaks in annual total phosphorus levels in 2008 in some lakes (Ballin, Carrowmore and Doo). Increasing levels in annual total phosphorus were evident in Carrowmore, Keel, Knappabeg and Moher. A decreasing or stable trend was observed at Loughs Acorrymore, Aille, Ballin, Conn, Cullin, and Feeagh. Ballin, Cross, Knappabeg and Lannagh are notable for their relatively high levels of TP compared to other lakes in Mayo (Figure 4.10).

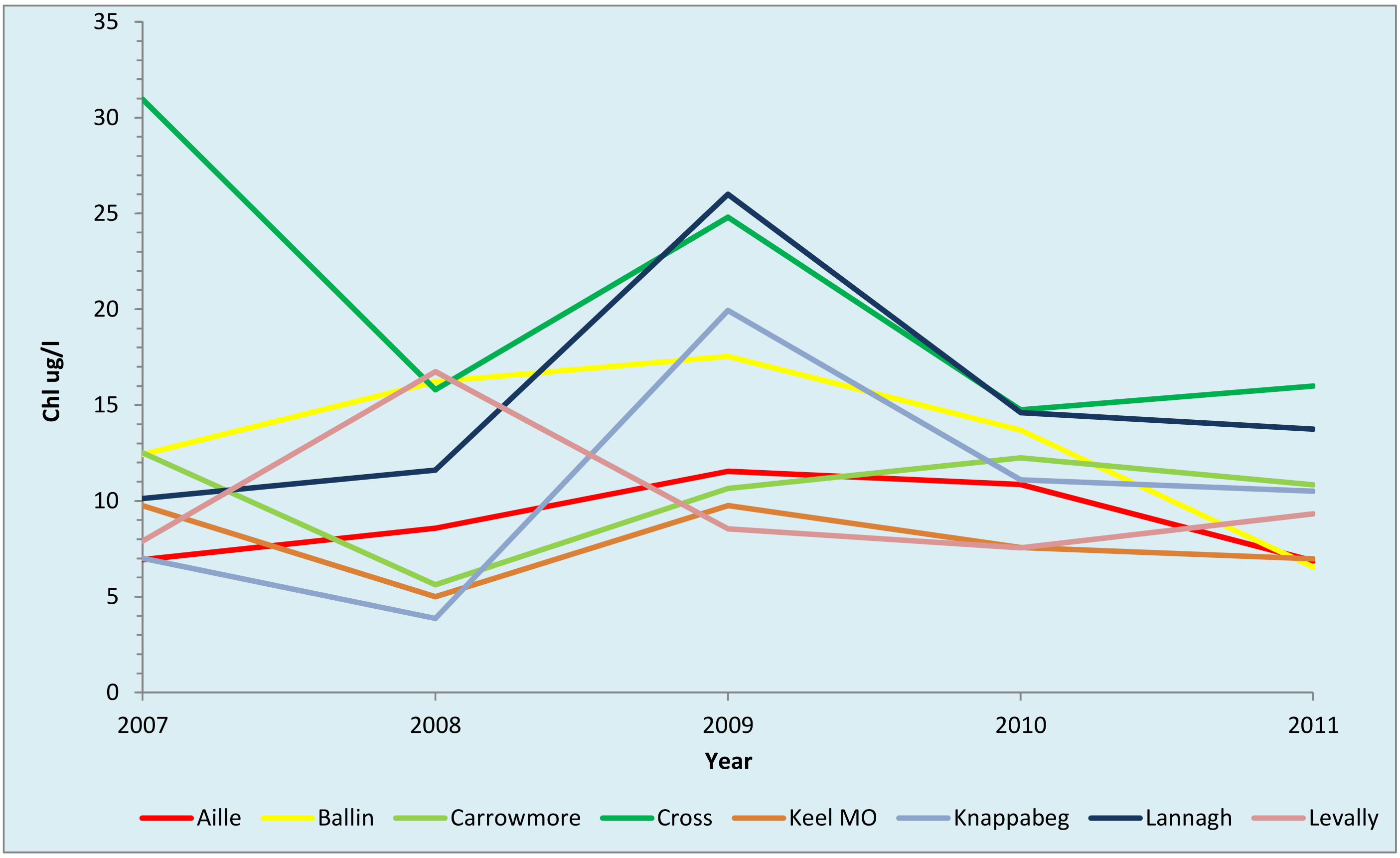

Figure 4.8 WFD monitored lakes in County Mayo which recorded annual mean chlorophyll values of 10 µg/l or more during the period 2007-2011.

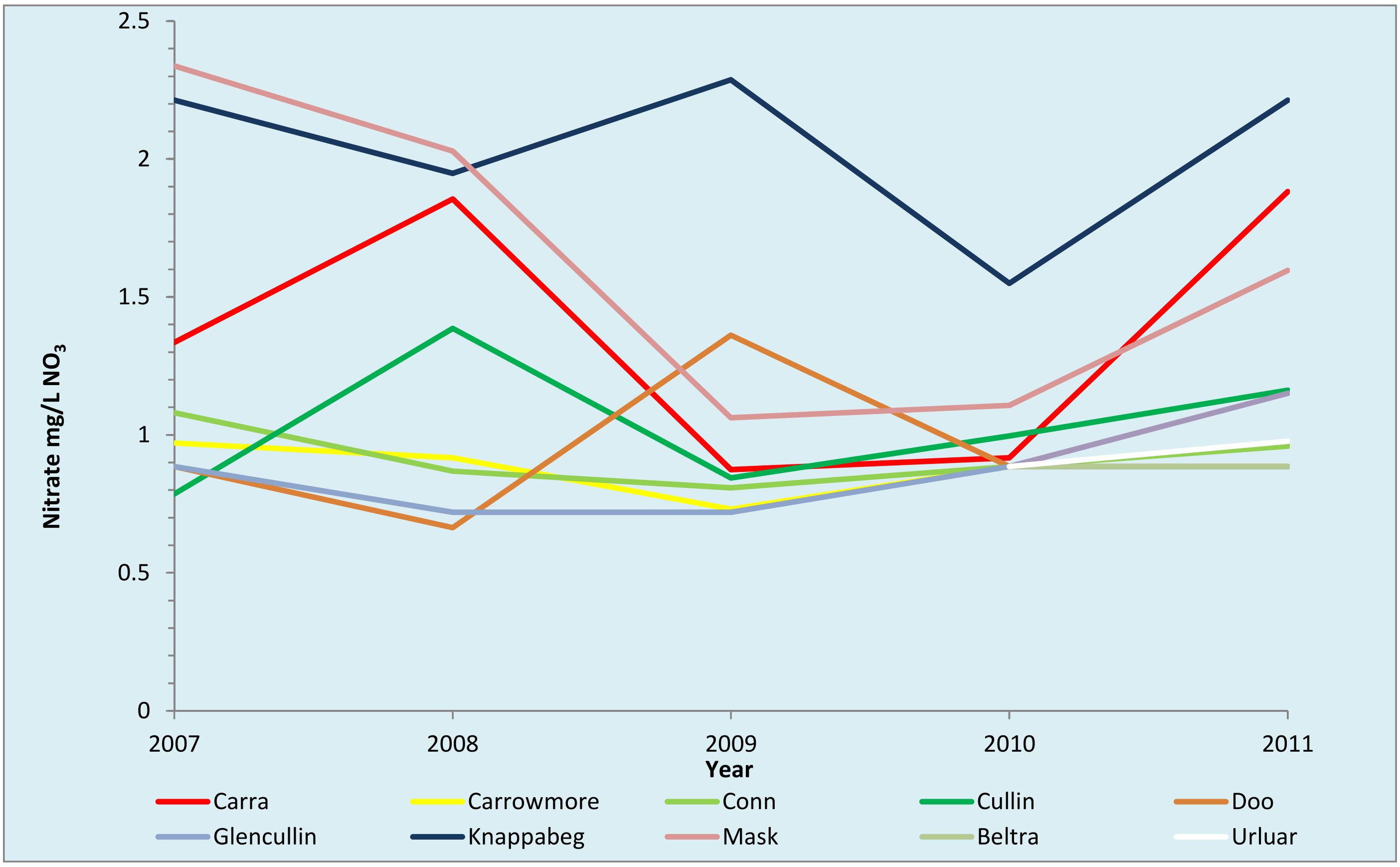

Figure 4.9 Trends in annual mean nitrate (using total oxidised nitrogen as a surrogate) for a selection WFD monitored lakes in County Mayo 2007-2011.

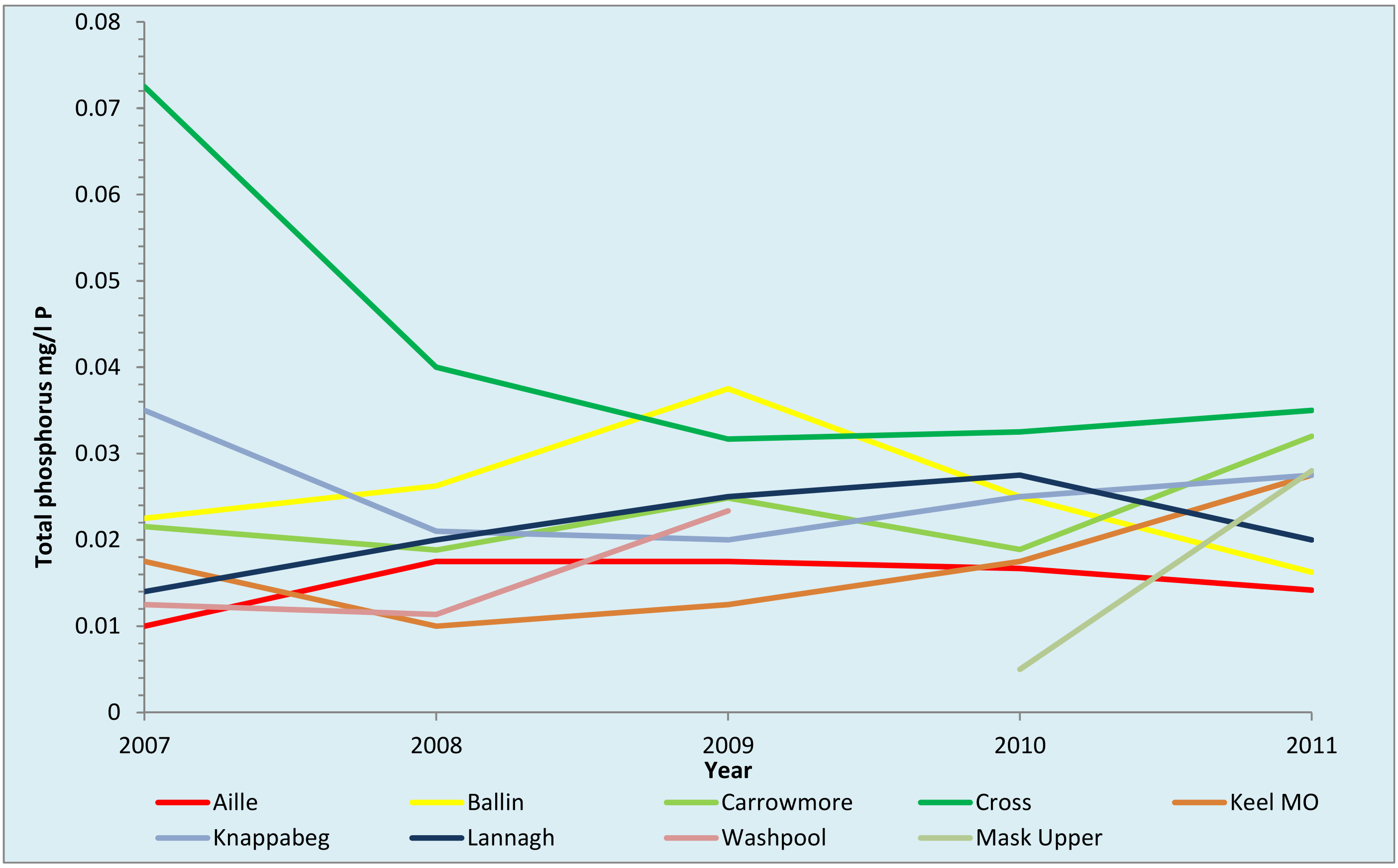

Figure 4.10 Trends in annual mean total phosphorus for a selection of WFD monitored lakes in County Mayo 2007-2011.

Average Phosphate Quality in WFD monitored lakes in Counties Mayo, Sligo and Galway in 2011 is seen in Figure 4.11. Average Total Oxidised Nitrogen in WFD monitored lakes in Counties Mayo, Sligo and Galway in 2011 is seen in Figure 4.12.

Summary

Co. Sligo

The upward trend in chlorophyll levels in Easky Lough is a cause for concern although values were low. Templehouse, Gill and Gara are also a cause for concern due to their elevated TP values compared to the other Sligo lakes. The challenges facing Sligo lakes are to maintain high and good status lakes, improve less than good status lakes and control the spread of zebra mussel and other alien species. The threats to water quality are agriculture and septic tanks but, in some instances identification of pressures is not easily established as in the case of Lough Easky.

Co. Galway

Similar trends in chlorophyll and nitrates were observed, but trends were mixed for the TP. However, Aughrusbeg, Tully and Beaghcauneen stand out as lakes to be concerned about, because of high and/or increasing levels of TP. Increasing levels of chlorophyll, although low, would be a cause of concern in Lough Rea. Most of the lakes in Galway are of good or high status and the challenge is to maintain status. There are few pressures in Galway, but diffuse pollution from agriculture and septic tanks, and in some instances point sources pose a threat.

Co. Mayo

Ballin, Cross, Knappabeg and Lannagh are notable for their relatively high levels of TP compared to other lakes in Mayo. In addition, they also tend to have the highest chlorophyll levels. The challenge is to maintain good or high status lakes and to improve the few moderate and poor/bad status lakes to good ecological status by 2015. The elevated levels and rising trend for total phosphorus and chlorophyll in some lakes is a cause of concern. The main pressures appear to be diffuse pollution from agriculture and septic tanks resulting in nutrient enrichment.

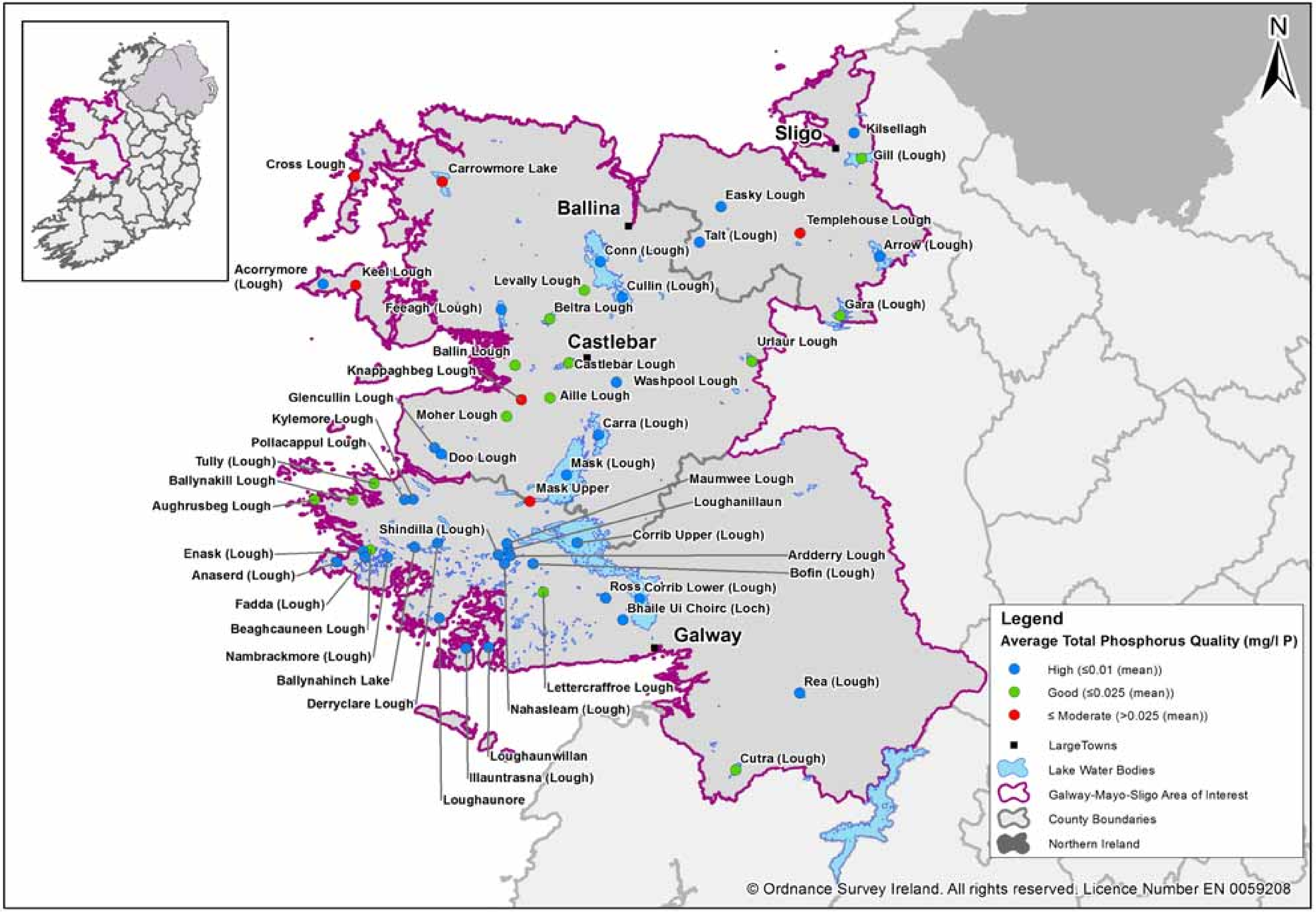

Figure 4.11 Total Phosphorus Quality in WFD monitored lakes in Counties Mayo, Sligo and Galway in 2011.

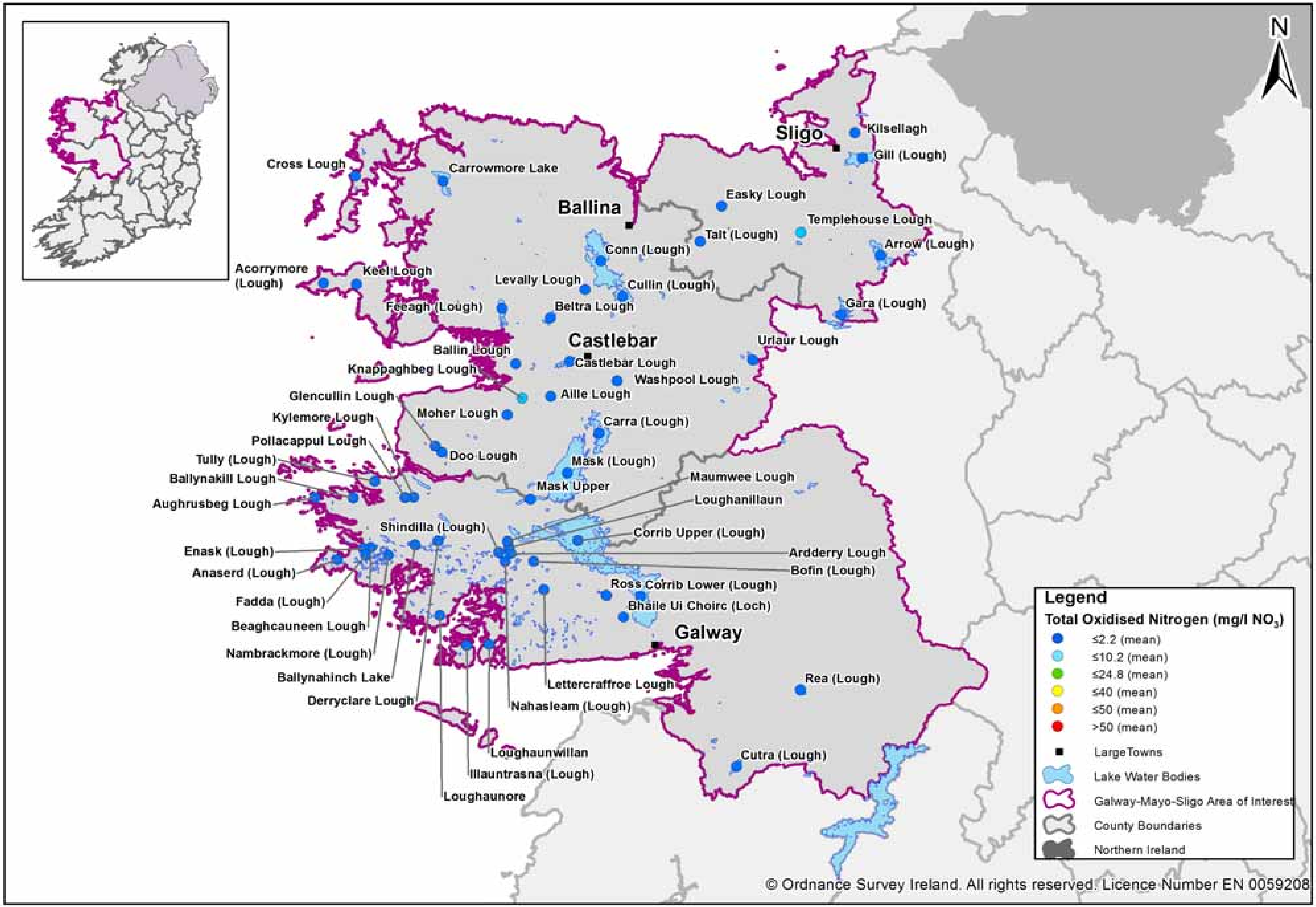

Figure 4.12 Annual Average Total Oxidised Nitrogen in WFD monitored lakes in Counties Mayo, Sligo and Galway in 2011.

GROUNDWATER QUALITY

Groundwater, which originates from rain that soaks into the ground, is an important natural resource in Ireland. It flows through and is stored in the fractures in bedrock and the pore spaces of sand and gravel deposits. In the past, the focus was on its use as drinking water; however under the WFD there is an increased emphasis on the environmental quality of groundwater, as well as its value as a potable water supply. Groundwater plays an essential role in the hydrological cycle and is critical for maintaining river levels and surface water ecosystems.

In Ireland, approximately 26% of the public and private drinking water supply is from groundwater. Most of the private group schemes and small supplies are reliant on groundwater and many have inadequate, or no treatment. Therefore, it is critical that groundwater is protected to maintain the quality of drinking water and ensure the water is safe to drink.

Physico-Chemical Monitoring

In 2011, the Environmental Protection Agency's groundwater monitoring programme included 30 monitoring locations in Counties Galway, Mayo and Sligo. The breakdown of these groundwater monitoring points is presented in Table 5.1.

Table 5.1: Number of groundwater monitoring points in 2011

County	Number of Groundwater Monitoring Points
Galway	15
Mayo	12
Sligo	3

These sites were monitored for a variety of physico-chemical and microbiological parameters. Nitrate and phosphate, two of the main indicators of anthropogenic pollution, were measured and these are discussed in more detail in this chapter.

Assessment of Water Quality

Nitrate in Groundwater

In general the average nitrate concentration at groundwater monitoring locations in Counties Galway, Mayo and Sligo is relatively low when compared to the national average nitrate concentration. Figure 5.1 shows the locations and the associated average nitrate concentrations in 2011 for groundwater monitoring points in Counties Galway, Mayo and Sligo. Figure 5.2 summarises the average yearly nitrate concentrations from 2007-2011 for the groundwater monitoring programme in Counties Galway, Mayo and Sligo.

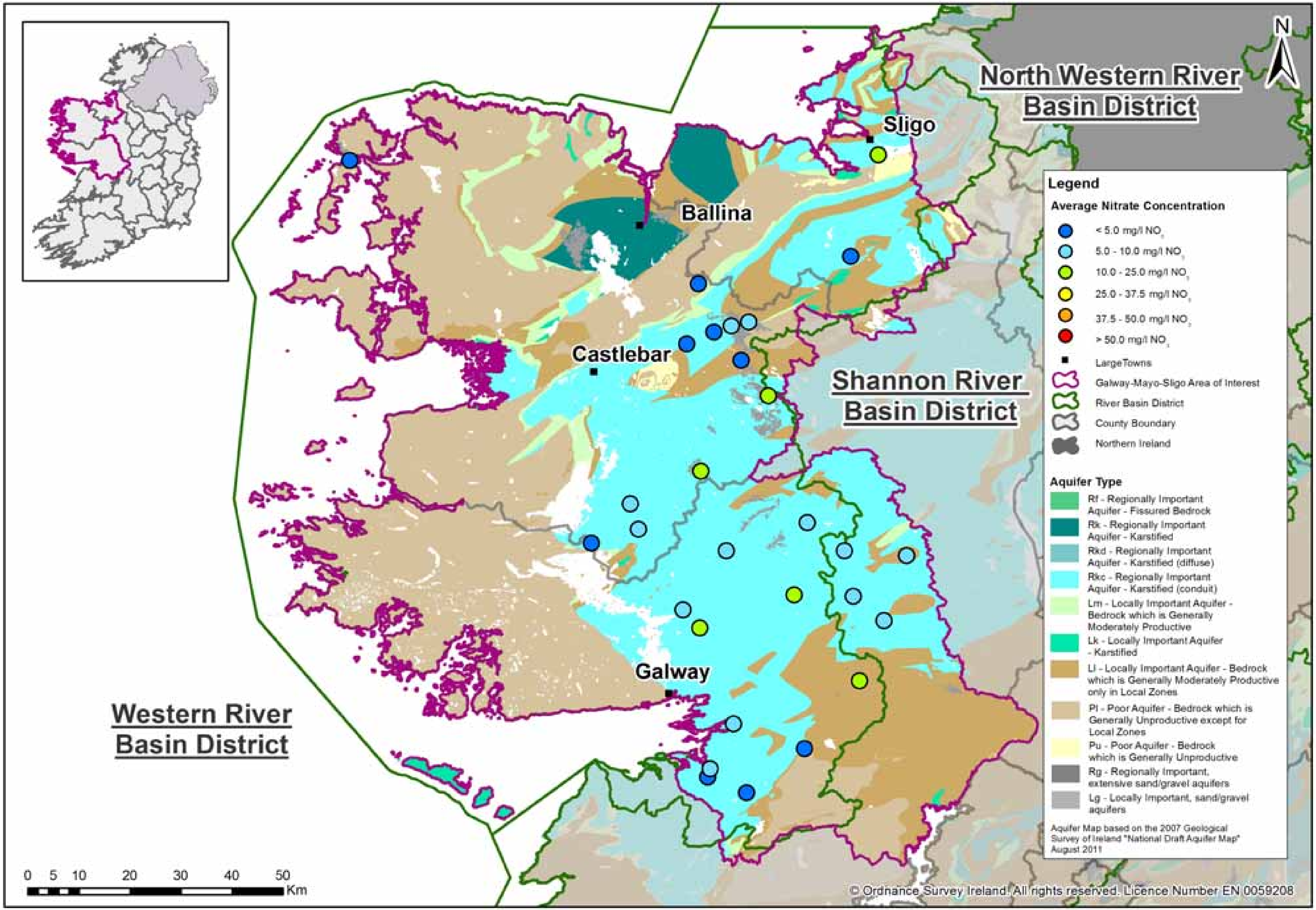

Figure 5.1: Average Nitrate Concentrations in Counties Galway, Mayo and Sligo in 2011. Source: *EPA (A. Mannix and M. Craig)*

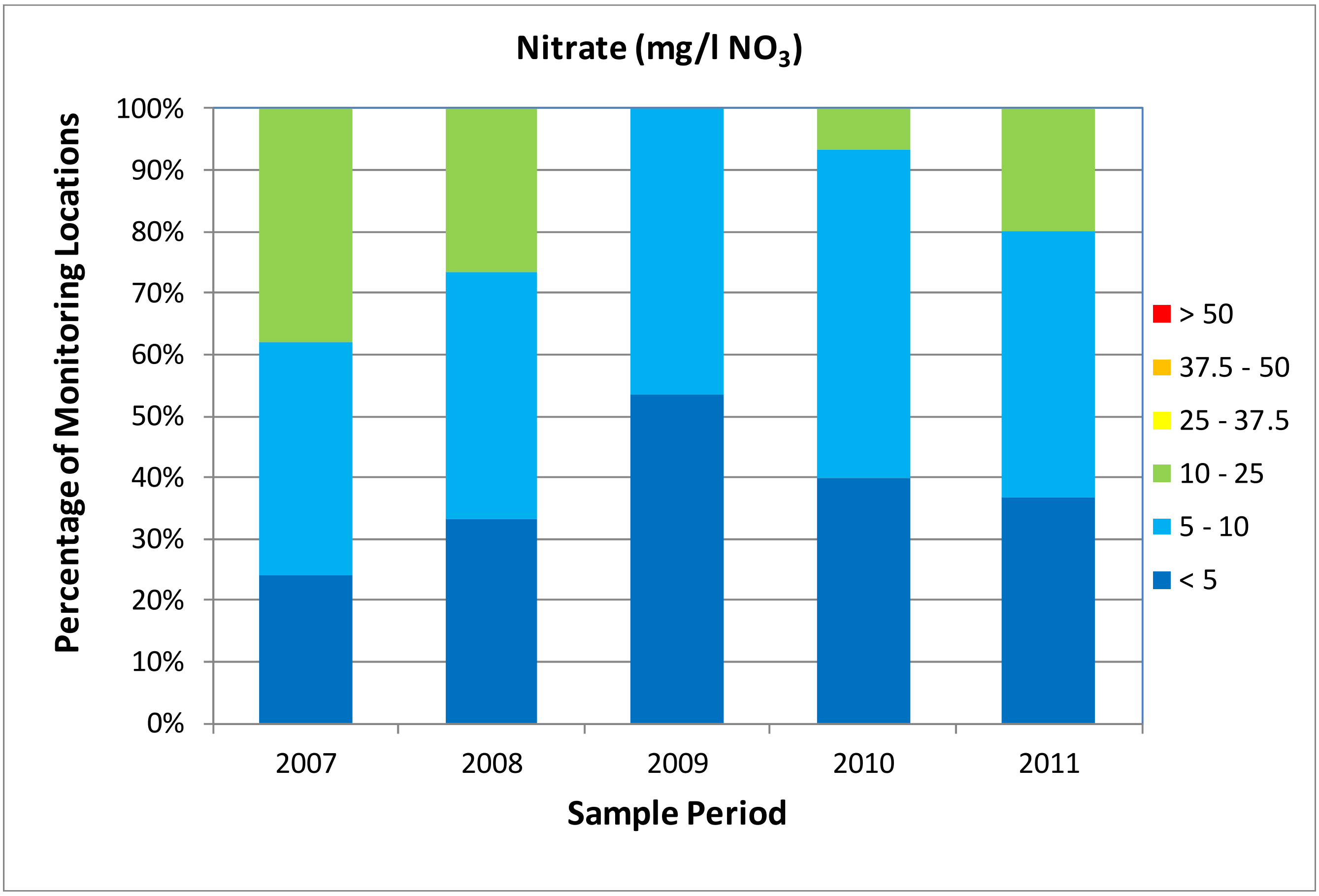

Figure 5.2: Average mean Nitrate Concentrations in Groundwater in Counties Galway, Mayo and Sligo. Source: *EPA (A. Mannix and M. Craig)*

There was a noticeable decrease in the average nitrate concentration in 2009 which can be attributed to, amongst other factors, dilution caused by the above average levels of rainfall that year. This was followed by an increase in nitrate concentrations in 2010 and 2011. However, the average nitrate concentration at groundwater monitoring locations in Counties Galway, Mayo and Sligo has decreased over the period 2007-2011. The average nitrate concentration did not exceed the Irish WFD Threshold Value concentration of 37.5mg/l NO_3 at any monitoring location in Counties Galway, Mayo and Sligo in the period 2007-2011, with the average concentration being less than 13mg/l NO_3 at all monitoring locations.

Phosphate in Groundwater

Figure 5.3 shows the locations and the associated average phosphate concentrations in 2011 for groundwater monitoring points in Counties Galway, Mayo and Sligo. Figure 5.4 summarises the average yearly phosphate concentrations from 2007-2011 for the groundwater monitoring programme in Counties Galway, Mayo and Sligo.

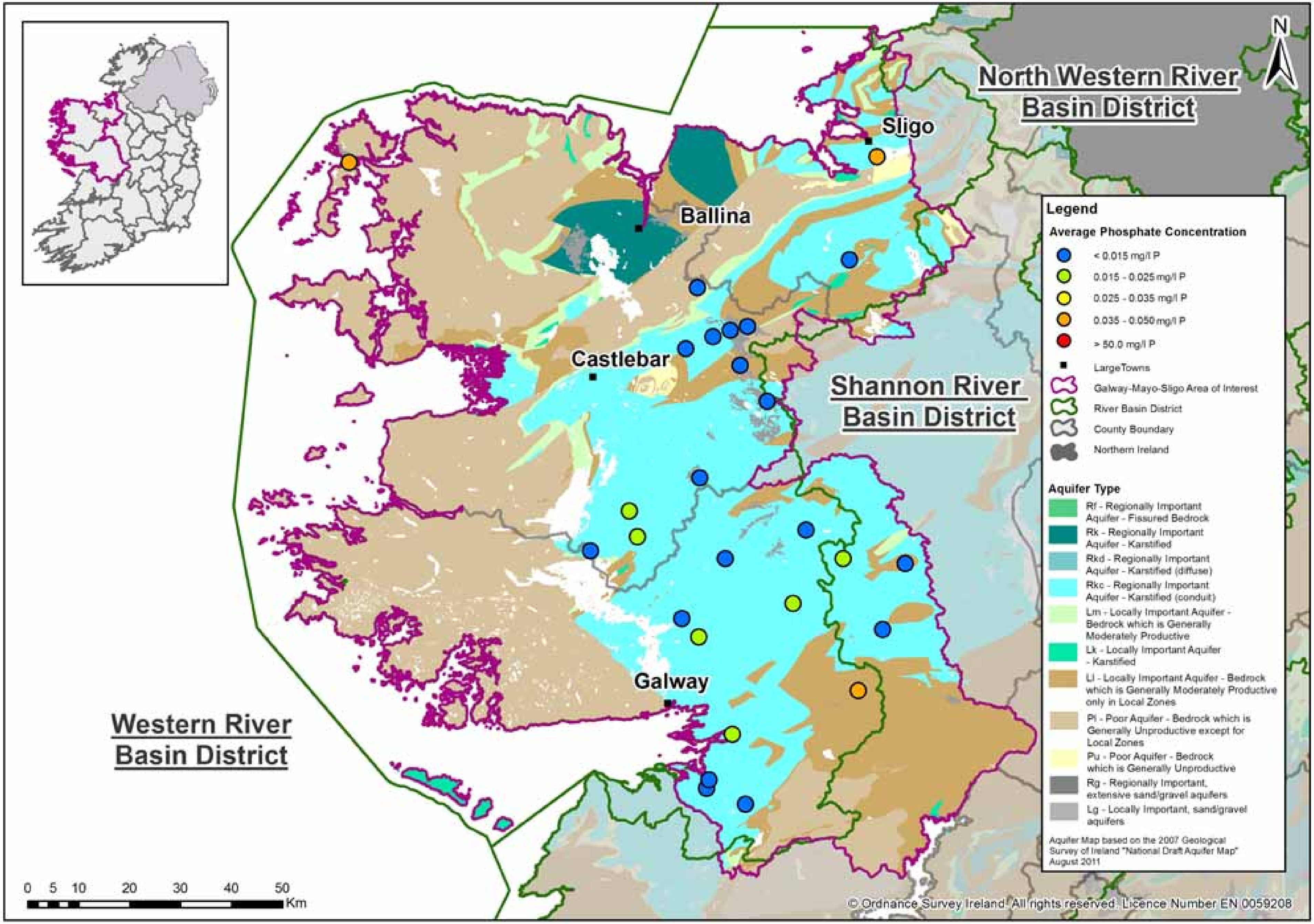

Figure 5.3: Average Phosphate Concentrations in Counties Galway, Mayo and Sligo in 2011. Source: *EPA (A. Mannix and M. Craig)*

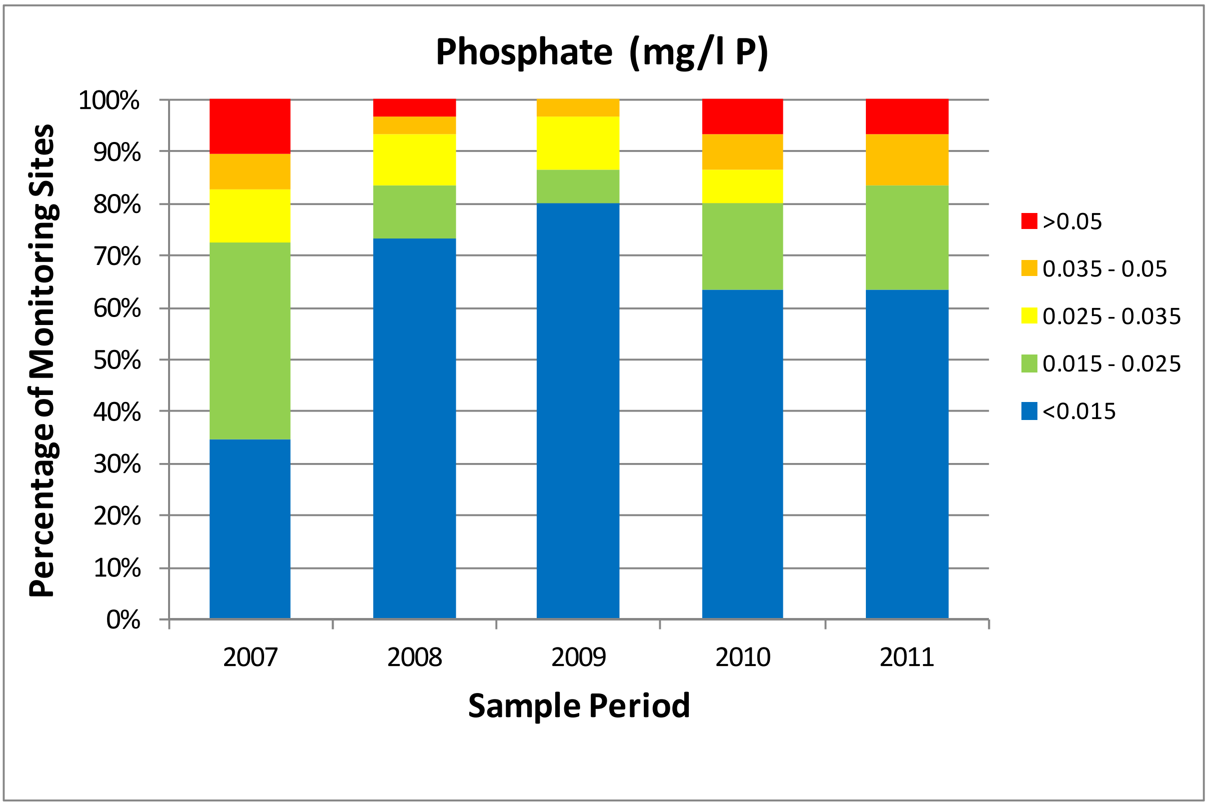

Figure 5.4 Average Phosphate Concentrations in Groundwater in Counties Galway, Mayo and Sligo. Source: *EPA (A. Mannix and M. Craig)*

The Irish WFD Threshold Value concentration of 0.035mg/l P should be considered when assessing the contribution of phosphate in groundwater to rivers. The majority of the regionally important karst groundwater bodies in Counties Galway, Mayo and Sligo are classified at poor chemical status under the WFD because of groundwater contributions of phosphate to rivers that are less than good status. As with the nitrate concentrations in Counties Galway, Mayo and Sligo there was a noticeable decrease in the average phosphate concentration in 2009, which can be attributed to, amongst other factors, dilution caused by the above average levels of rainfall that year. The proportion of monitoring locations with an average phosphate concentration >0.035mg/l P increased in 2010 (four sites) and 2011 (five sites). In 2011, 83.3% of monitoring locations in Counties Galway, Mayo and Sligo had average concentrations <0.025mg/l P and only two monitoring locations had an average concentration >0.050mg/l P. Overall, there has been a general decrease in phosphate concentrations over the period 2007-2011.

Other Parameters

In 2011, faecal coliforms were detected at 26 of the 30 sites monitored in Counties Galway, Mayo and Sligo. Many of these were not one off detections at sites with 48% of the samples taken having faecal contamination. This relates to the vulnerable nature of the groundwater in these counties, with shallow subsoils and exposed rock in many areas. Between 2007 and 2010, monitoring was undertaken to assess the impacts of diffuse pollution from pesticides and organic carbon compounds, including hydrocarbons. The Drinking Water Standard for pesticides (0.01µg/l) was exceeded in 16 out of 18,722 groundwater samples taken nationally, and there were no organic carbon compound exceedences. In future, a less intensive risk based monitoring programme will be put in place for these chemicals (McGarrigle *et al*, 2010).

Sources of Pollutants

While in general it is unlikely that the impact from point sources, such as mines, quarries and landfills, will have a significant effect on an entire groundwater body (McGarrigle *et al*, 2010), there is one groundwater body in County Galway classified at poor chemical status for the WFD because of contamination from historic mining activities. Diffuse sources of pollution include nutrient pressures from agricultural activities and domestic wastewater treatment systems (especially nitrates and phosphates), and agrochemicals.

Summary

In many Irish rivers, more than 30 per cent of the flow is derived from groundwater, rising to 90 per cent in periods of low flow. Therefore the quality of groundwater can have a major impact on the quality of river water. Nitrate concentrations in Counties Galway, Mayo and Sligo are relatively low. Large areas of Counties Galway, Mayo and Sligo are at poor status due to contribution of phosphate from groundwater to surface water bodies. There has been a general decrease in phosphate concentrations over the period 2007-2011. However, the slight increase in nitrate and phosphate concentration since 2009 highlights the importance of continuing with programmes of measures to ensure that overall nutrient loss to groundwater of nitrates and phosphates is minimised. Continued improvements in the understanding of the interactions between groundwater and surface water are very important to maximise the effectiveness of any programmes put in place.

TRANSITIONAL / COASTAL WATERS

Physico-chemical & Biological Monitoring

The EPA has been monitoring and assessing the estuarine and coastal status of Irish waters since the early 1990s. Following the introduction of the Water Framework Directive (WFD) the monitoring programme has intensified and the EPA now monitors 120 water bodies up to four times per year, once in the winter and three times during the summer period. In addition to more traditional eutrophic-status monitoring, such as nutrient and oxygen concentrations, the assessment now covers a wide range of biological elements such as seaweeds, phytoplankton and seagrass. This holistic ecological assessment is an essential part of the WFD and, in conjunction with the Marine Institute and Inland Fisheries Ireland Fisheries programmes, a comprehensive overview of the ecological status of Ireland's tidal waters can now be provided.

The transitional and coastal waters of the Western RBD cover an area of just over 4,700 km^2 representing the largest area of saline waters of all the RBDs. This is broken down into 98 waterbodies comprising partially mixed estuaries (e.g. the Moy estuary), transitional lagoons (e.g. the Loch an tSaile, Kinvarra Bay Lagoons), tidally mixed and seasonally stratified coastal waters (e.g. Inner Clew Bay and the Western Atlantic Seaboard, respectively). A subset of these waterbodies are assessed for WFD ecological status and for trophic status under the EPA`s Trophic Status Assessment Scheme (EPA, 2009).

Transitional and coastal water bodies are monitored for the following parameters: salinity, temperature, pH, transparency, DO, BOD, Total Oxidised Nitrogen (TON), Ammonia, dissolved inorganic nitrogen (DIN), o-phosphate and chlorophyll a.

The Trophic Status Assessment Scheme (TSAS) has been developed to capture the cause-effect relationship of the eutrophic process and considers the following:

- Enrichment of waters by nutrients (dissolved inorganic nitrogen and phosphorus)
- Accelerated algal growth (chlorophyll and opportunistic macroalgae)
- Undesirable disturbance (oxygen status)

By assessing the results of analysis of DO, BOD, o-phosphate and DIN, in summer and winter, a trophic status is assigned.

Priority substances are also monitored and details of this programme, undertaken by the Marine Institute, are available at http://hdl.handle.net/10793/635

Assessment of Water Quality

Compared to national figures, the rivers in the Western RBD contribute relatively low loadings of nitrogen to the marine environment. Data from the 2010 OSPAR Riverine Inputs to the Maritime Area assessment show that average loadings of nitrogen from the Corrib and Moy Rivers are 2,000 tonnes, compared to a national average of 3,400 tonnes. This represents less than 3.5% of the national total.

In terms of point sources, four of the ten largest waste water treatment plants in the Western RBD discharge directly to tidal waters, the largest discharges being from Sligo UWWTP and the Galway City agglomeration. Improvement in the trophic status of both these receiving waters has been seen since the implementation of these facilities. Previously the trophic status of both the Garavogue Estuary and the Corrib Estuary was Intermediate (see EPA TSAS assessment for 2001-2005) and in this assessment both areas are now classed as unpolluted.

Of the 19 estuarine and coastal water bodies in the Western RBD assessed in the period 2009-2011 all but two were classified as unpolluted. This compares favourably with the national average and shows the highest percentage of unpolluted waterbodies for any RBD (Table 6.1). The only areas to be classified as Intermediate are the Ballysadare Estuary, where oxygen supersaturation and elevated phytoplankton growth have been seen in recent years, and the Moy Estuary where elevated growths of green macroalgae are a cause of concern.

Table 6.1. Trophic Status of Western and National waterbodies

Trophic Status	Western (%)	National (%)
Eutrophic	0	10
Potentially Eutrophic	0	5
Intermediate	10	35
Unpolluted	90	50

In terms of ecological status, as defined under the Water Framework Directive, of the 28 water bodies assessed, six were found to be 'moderate or worse', 13 were 'good', and nine were 'high'. The areas at less than good WFD status included two Lagoons (Kinvarra Bay lagoons and Lough Muree), two transitional waters (Moy Estuary and Ballysadare Estuary) and one coastal water (Killary Harbour). Moderate status in Killary Harbour is based on benthic invertebrate which were affected by a large phytoplankton bloom in 2005. Recovery from this event is yet to show up in the classification.

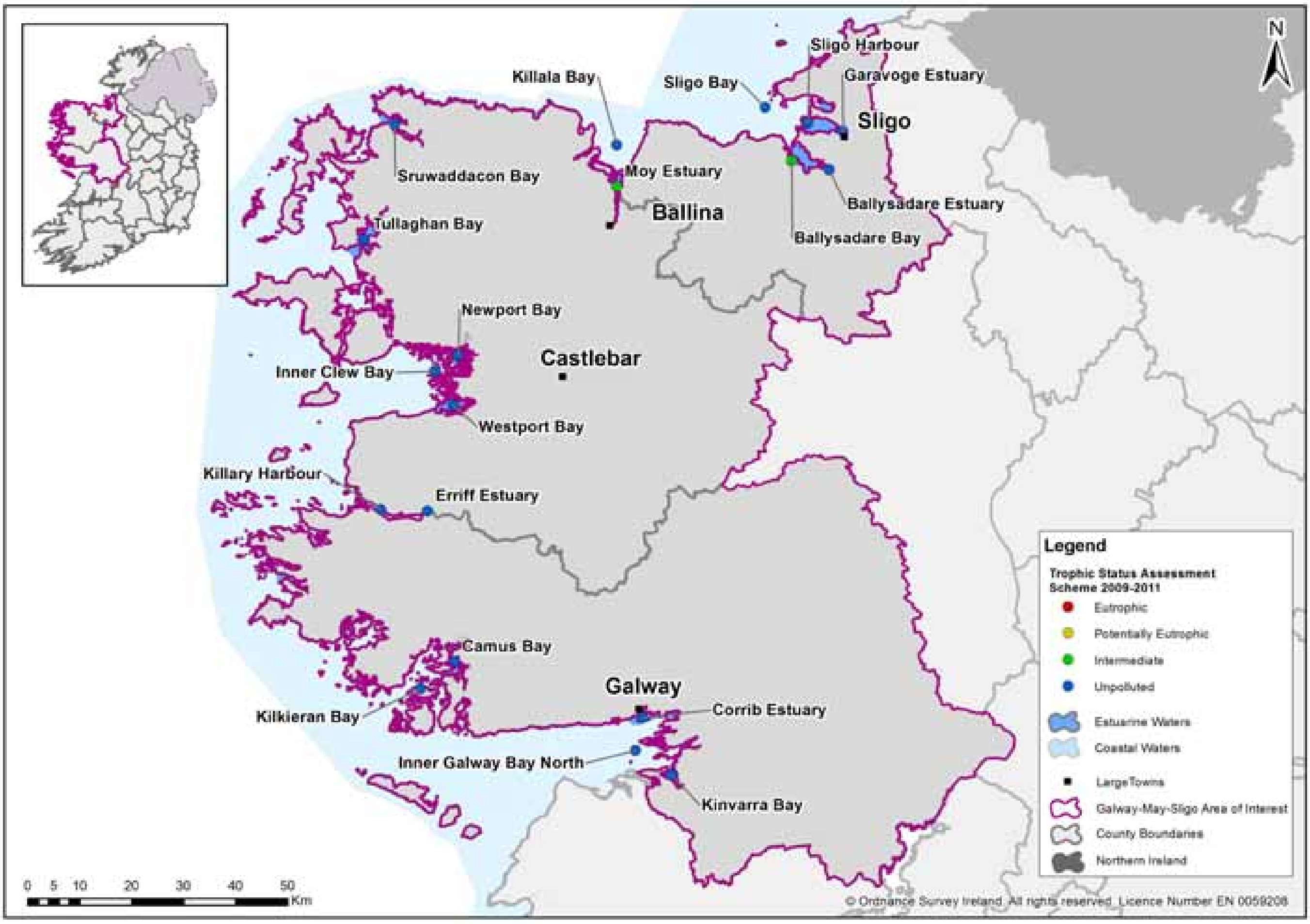

Figure 6.1 Trophic Status of Western RBD 2011

Bathing Waters

In 2011, 36 bathing waters were monitored in Co. Galway (including Galway city), Co. Mayo and Co. Sligo, almost a quarter of all of the 135 bathing areas nationally. Monitoring of bathing waters is the responsibility of the relevant local authority and sampling must be undertaken at regular intervals during the bathing season which runs from June 1st to September 15th each year.

A new Bathing Water Directive (2006/7/EC) was transposed into Irish law in 2008 (S.I. 79 of 2008) and will replace the existing regulations (S.I. 155 of 1992) on 31st December 2014. This new Directive sets tight microbiological standards for two new parameters - intestinal enterococci (IE) and *E.Coli*. Previous assessments were based on Total and Faecal coliforms and some physico-chemical measurements. In the meantime, transitional arrangements are in place and from 2011 the new microbiological parameters are being monitored. At present bathing waters are classified as good, sufficient or poor. From 2015,

microbiological assessments will be used to add a further category of excellent. A classification of sufficient will be required for all bathing waters by 2015.

Results for the bathing waters for the three County Council areas and Galway City for the 2011 bathing season are provided in Table 6.2 and Figure 6.2. These show that 35 of the 36 designated bathing areas (97.2%) achieved at least "sufficient" status (compared with 98.5% of all sites in the country). 29 of the 36 sites (80.5%) achieved "good" status (compared with 83% nationally). In Co. Mayo, all of the bathing waters met the stricter guideline values equating to good status. In 2011, Galway city added two new beaches; Ballyloughane and Grattan Road. Sligo County Council also designated two additional beaches; Streeda and Dunmoran while Mayo County Council added Carrowniskey beach, Louisburgh, but delisted Silver Strand Louisburg due to its isolation and limited bathing numbers.

Overall bathing water quality in the area continues to be of a very high standard. Clifden beach was the only beach closed to bathing having exhibited poor water quality status since 2005. Monitoring is continuing and is expected to improve significantly following redevelopment of the nearby wastewater treatment plant. The principal source of impact on this beach remains the municipal wastewater treatment facility. This has now been licenced by EPA (Discharge Licence No. D0198-01). Upgrading is scheduled for completion by end 2013 and is expected to yield significant improvements in water quality. In Galway City, the urban beaches remain prone to periodic pollution from surface run-off in particular. E.Coli failures at Ballyloghnane, Grattan Road and Mullaghmore exceeded the guideline value of 100 cfu/100ml on several occasions but all exceedences were well below the mandatory standard of 2000 cfu/100ml. In Galway City, Silverstrand Beach had one exceedence for Intestinal Enterococci at just over the guideline value of 100 cfu/100ml.

Summary

The estuaries and coastal water of the Western RBD are generally of good environmental status. This is reflected in both the trophic status of the waterbodies and by their ecological status as defined under WFD. Only two waterbodies are currently showing any signs of eutrophication with the Ballysadare Estuary breaching assessment criteria for oxygenation criteria and the Moy showing signs of elevated growth. The Ballysadare Estuary was previously classified as unpolluted, so it now requires a close watch to ensure no further deterioration. It must be noted, however; that monitoring in this area has increased compared to previous reporting cycles and any potential trend requires further investigation.

Investment in wastewater treatment infrastructure had shown some improvement in the trophic status of key estuaries in the Western RBD with both Galway and Sligo now being classed as unpolluted for trophic status and good status under WFD. On a national scale, 15% of water bodies are classed as potentially eutrophic or eutrophic. The Western RBD compares very favourably with only 10% of waterbodies showing any signs towards eutrophication and none being classified as eutrophic.

While phosphorus is the limiting nutrient for plant growth in freshwater, nitrogen is considered limiting in saline waters. Point sources of pollution from Waste Water Treatment Plants and diffuse sources from agriculture (mainly tillage) are significant contributors to the nutrient loadings, and consequent eutrophication of transitional and coastal water bodies in the West.

As with lakes, reduction in nutrient loadings from rivers is critical in improving the status of Ireland's transitional and coastal waters. On a national scale there has been a reduction in eutrophic water bodies since the mid-1990s and an increase in unpolluted water bodies.

In relation to bathing water, all sites in the West were classified as good or sufficient in 2011, with the exception of Clifden in County Galway. In the West, 81% of sites were classified as being of good status, this compares with 83% good sites nationally. While the majority of western bathing waters meet the current minimum standards, the stricter criteria in Directive 2006/7/EC will require local authorities to make even greater efforts to improve the water quality and tackle potential sources of pollution.

Table 6.1 Bathing Water Quality in Co. Galway, Mayo, Sligo in 2011

Responsible Local Authority	Bathing Area	Water Quality Status 2011	Compliance with mandatory/guide values		
			E. Coli.		IE
			Mandatory	Guide	Guide
Galway County Council	An Trá Mór, Coill Rua, Indreabhán	Good	√	√	√
	Loughrea Lake	Good	√	√	√
	Bathing Place at Portumna	Good	√	√	√
	Céibh an Spidéil	Good	√	√	√
	Cill Mhuirbhigh, Inis Mór	Good	√	√	√
	Clifden Beach	Poor	X	X	X
	Goirtín, Cloch Na Rón	Good	√	√	√
	Trá na bhForbacha, Na Forbacha	Sufficient	√	√	X
	Trá na mBan, An Spidéal	Good	√	√	√
	Trá an Dóilín, An Ceathrú Rua	Good	√	√	√
	Trá Chaladh Fínis, Carna	Good	√	√	√
	Traught, Kinvara	Sufficient	√	√	X
Galway City Council	Ballyloughane Beach	Sufficient	√	X	√
	Grattan Road Beach	Sufficient	√	X	√
	Salthill Beach	Good	√	√	√
	Silverstrand Beach	Sufficient	√	√	X
Mayo County Council	Bertra Beach, Murrisk	Good	√	√	√
	Carrowmore Beach, Louisburgh	Good	√	√	√
	Carrowniskey, Louisburgh	Good	√	√	√
	Dugort Beach, Achill Island	Good	√	√	√
	Dooega Beach, Achill Island	Good	√	√	√
	Elly Bay, Belmullet	Good	√	√	√
	Golden Strand, Achill Island	Good	√	√	√
	Keel Beach, Achill Isl.	Good	√	√	√
	Keem Beach, Achill Isl.	Good	√	√	√
	Ross Beach, Killala	Good	√	√	√
	Louisburgh, Old Head Beach	Good	√	√	√
	Mullaghroe Beach, Belmullet	Good	√	√	√
	Mulranny Beach	Good	√	√	√
	Rinroe Beach, Carrowtigue	Good	√	√	√
	Clare Island, Louisburgh	Good	√	√	√
Sligo County Council	Dunmoran Beach	Good	√	√	√
	Enniscrone Beach	Good	√	√	√
	Mullaghmore Beach	Sufficient	√	X	√
	Rosses Point Beach	Good	√	√	√
	Streedagh Beach	Good	√	√	√

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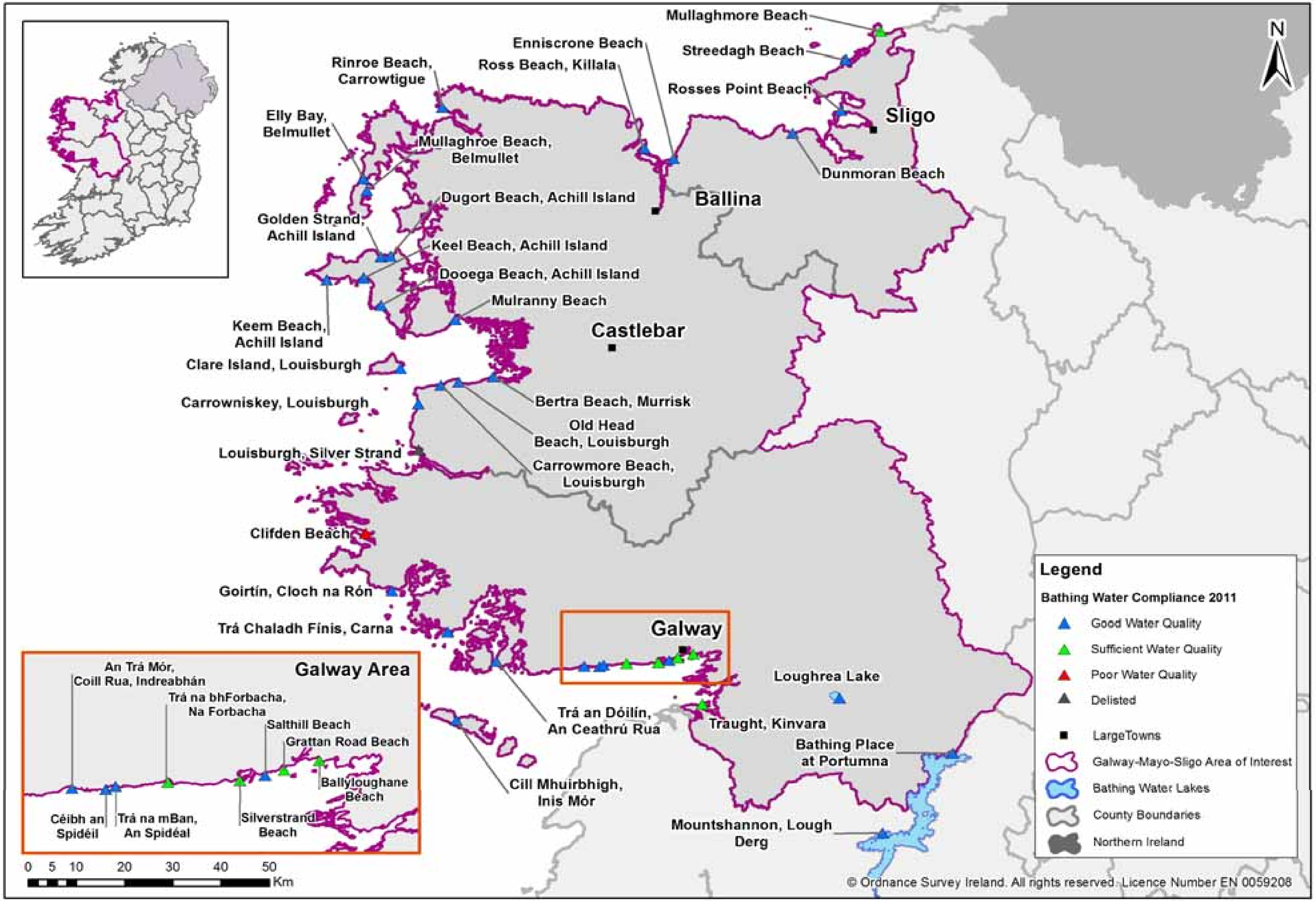

Figure 6.2. Bathing Waters in Co. Galway, Co. Mayo and Co. Sligo, 2011.

SUMMARY AND ASSESMENT

The Water Framework Directive requires that by 2015 the following be achieved:

- Prevent Deterioration of Water Bodies
- Achieve good status for all water bodies
- Reduce Chemical Pollution
- Achieve water related protected area objectives.

Monitoring of rivers, lakes, groundwaters and transitional and coastal waters in the West indicates that while there have been welcome improvements in some areas, work remains to be done in others, particularly in addressing point source pollution from Waste Water Treatment Plants and diffuse pollution from agriculture and septic tanks.

One of the aims of this report is to present an assessment of progress towards meeting the objectives of the WFD as set out in the respective River Basin Management Plans. In the period 2007-2009, 82% of river channel in the Western RBD achieved at least good status, compared with 84% in the period 2004-2006. The target for 2021 is to have 100% of river bodies in the Western RBD achieving at least good status. This will be a significant challenge for all concerned. The Western RBD continues to be ranked as one of the most unpolluted districts, however serious pollution continues on the Clarinbridge River, Tubbercurry Stream and Tubbercurry River due to poorly treated municipal waste.

Rivers

In the period 1998-2009 in the West, the percentage of unpolluted river channel has remained stable at over 80% and those classed as moderately polluted have decreased from 7% to 5%. While this reduction is a welcome improvement, approximately 20% of river channels remain of less than good status. In the period 2007-2009, over 70% of monitored river water bodies in the Western RBD were of high or good status, compared with 52% nationally.

Phosphate levels in rivers appear to have stabilised in recent years, but in some cases are still at a level that is greater that "good status" as classified by the WFD.

Tackling pollution at these sites and in their upstream catchments may also lead to improvements in the quality of groundwater, lakes and transitional and coastal waters.

Lakes

Lakes in the West are a mix of high, good, moderate or poor status and it will be a challenge for the moderate and poor status sites to meet the required standard of good status by 2015, particularly those of which are currently classed as poor. Another challenge will be to maintain existing high and good status sites and preventing any deterioration. Increasing chlorophyll and total phosphorus levels are cause for concern in some lakes and it is thought that diffuse pollution from agriculture and septic tanks seems to be at the heart of the problem.

Groundwaters

Groundwaters in the West have low levels of nitrate, and phosphate levels have decreased overall in the period 2007-2011. In 2011, 83% of samples taken in the West of Ireland contained <0.025mg/l phosphorus. However, faecal contamination of groundwaters is an issue, with 48% of samples taken in 2011 containing faecal coliforms. This may however be more related to the hydrogeological characteristics of the area rather than being a reflection of increased agriculture or septic tank density.

The close relationship between groundwater and surface waters needs to be fully appreciated in order to holistically address nutrient levels in all water bodies.

Transitional and Coastal Waters

Transitional and coastal waters in the West of Ireland have the lowest levels of nutrient loadings from rivers nationally. Despite the fact that four of the ten largest WWTP's in the Western RBD discharge directly into tidal waters, 90% of water bodies remain unpolluted. In terms of ecological status, as defined under the Water Framework Directive, of the 28 water bodies assessed, only six were found to be 'moderate or worse'.

Overall, bathing water quality in the West of Ireland in 2011 is high. However from 2015, more stringent criteria will be in place, which will require even greater efforts by local authorities to improve water quality and tackle sources of pollution.

Urban Waste Water Discharges

Municipal waste water discharge is one of the main sources of pollution in Irish rivers and the control of these discharges is critical in the protection of water bodies. The main effects of pollution from municipal sources is nutrient enrichment, and to a lesser extent excessive siltation. These two effects lead to decreased biodiversity in our rivers, and excessive weed and algal growth.

While there have been some improvements in the quality of rivers affected by municipal waste water pollution, there are still problem areas. The Tubbercurry River in Sligo is polluted, due to the ineffective waste water treatment plant. It is anticipated that the upgrade of this treatment plant and its associated sewerage network will lead to improved quality in the river. Investments in waste water treatment plants should have a marked beneficial effect on the quality of the rivers they discharge to as they come on-stream.

Diffuse Discharges

Diffuse discharges – mainly from agriculture and septic tanks are more difficult to address than point sources. In the Western RBD, unsewered properties account for 3% of the Nitrate and 7% of the Phosphorus load going to surface waters.

Nutrients from septic tanks are a significant issue. In 2009, the EPA published a new binding Code of Practice to provide guidance on the provision of waste water treatment and disposal systems for new single houses. For existing unsewered properties, improvements are required regarding the operational performance, maintenance and monitoring arrangements of septic tanks and other on-site treatment systems serving such properties. It is hoped that these requirements will ensure environmentally sustainable rural development, protecting vulnerable ground waters, including drinking water supplies.

Legislation through the Nitrates Directive (SI 101 of 2009) is the main measure for addressing agricultural pollution. These regulations also provide statutory support for good agricultural practice to protect waters against pollution. There have been improvements in agricultural pollution in recent years, but a significant portion of farms nationally may be non-compliant with the Nitrates Regulations. Effective inspection and enforcement regime is needed to ensure full compliance. The risk-based approach adopted by Local Authorities in conjunction with the Department of Agriculture, Fisheries and Food, for farm inspections is welcomed as an efficient way of tacking this problem.

Forestry

In both Galway and Mayo, over 56,000 hectares are covered by forestry (approximately 10% of the land area) and in Sligo just over 21,000 hectares are covered by forestry (approximately 12% of the land area). Pressures exerted by forestry include artificial acidification of waters arising from the presence of coniferous afforestation on acid-sensitive soils; and nutrient enrichment and siltation and sedimentation impacts from forestry operations. Many of these afforested areas are located in sensitive salmon and trout spawning catchments, such as the Owenriff, underpinning the need for adequate control on forestry operations in sensitive areas. The impact of forestry on water quality continues to be an issue of concern in the Western RBD.

Conclusion

While water quality in the Western RBD is better than in other RBDs in Ireland, it still faces significant challenges in achieving the targets of the Water Framework Directive. The biggest threat to water quality in the West is from excessive nutrients in particular from agricultural activities and from municipal wastewater treatment plants. Other activities identified as contributing to poor water quality include industrial discharges and wastewater from unsewered properties. Improvements in collection systems and reduction of nutrient discharges should lead to an improvement in the status of all water bodies in the West.

The projected increased output under *Food Harvest 2020*, as well as the removal of the dairy quota at the end of 2015 will provide significant challenges in managing the quality of all water bodies, and achieving the aims of the Water Framework Directive in the West.

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APPENDIX 1. RIVER STATION CODES (with 2011 annual mean values and grid references)

Galway

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
G1	RS31C010100	99.00	0.50	0.015	0.008	0.20	97815.17	226412.12
G2	RS31S010570	98.00	0.70	0.018	0.006	0.20	97337.29	240359.06
G3	RS30B010200	94.50	0.50	0.015	0.008	0.20	96578.20	252767.68
G4	RS30F010100	97.00	0.50	0.015	0.008	0.20	96324.15	252131.11
G5	RS32B040100	100.00	0.50	0.015	0.017	0.20	82395.05	260764.72
G6	RS31O020300	97.00	0.50	0.046	0.006	0.20	81853.65	239789.17
G7	RS31R010500	97.00	0.50	0.015	0.013	0.20	80235.85	247474.82
G8	RS32C040040	96.00	0.50	0.038	0.008	0.20	77916.71	262073.27
G9	RS31R010600	97.00	0.50	0.015	0.009	0.20	76517.89	247166.36
G10	RS32O030100	100.00	0.50	0.015	0.014	0.20	74473.13	251197.72
G11	RS32D010100	97.00	0.50	0.015	0.008	0.20	72966.50	258492.37
G12	RS32D010200	99.00	0.50	0.015	0.008	0.20	70205.66	259697.00
G13	RS32T010100	98.00	0.70	0.015	0.018	0.20	68800.33	256785.22
G14	RS32B070100	95.50	1.18	0.034	0.014	0.20	68353.65	247464.42
G15	RS32O030200	101.00	0.50	0.015	0.011	0.20	67625.09	250460.06
G16	RS32O030300	100.00	0.50	0.015	0.014	0.20	66085.87	250412.79
G17	RS26S071100	89.00	1.00	0.019	0.030	0.80	181610.43	246363.84
G18	RS26S070300	93.00	1.20	0.076	0.031	0.80	167100.49	278032.93
G19	RS29C031000	94.00	1.10	0.029	0.038	0.60	166233.52	223160.99
G20	RS29R010100	95.00	0.70	0.021	0.029	0.50	164864.15	229011.53
G21	RS29K010100	92.00	1.50	0.061	0.028	0.30	162238.98	217795.88
G22	RS29R010200	97.00	1.00	0.015	0.029	0.50	160925.73	226086.04
G23	RS30A010028	87.40	0.80	0.036	0.040	0.95	160706.96	233170.87
G24	RS29K010200	97.00	1.10	0.040	0.176	1.20	158089.19	219706.37
G25	RS30S010025	89.00	0.50	0.015	0.030	1.70	156427.72	261489.60
G26	RS30A010100	95.40	0.62	0.024	0.036	0.78	155933.22	237913.17
G27	RS30G020200	85.00	0.50	0.050	0.038	1.60	155338.12	251455.08
G28	RS30L070100	83.00	0.70	0.054	0.036	1.40	154647.67	252475.31
G29	RS30S010100	90.00	0.50	0.015	0.027	1.20	152609.83	262060.71
G30	RS29R010500	93.00	1.80	0.015	0.042	0.90	152165.69	220239.93
G31	RS30A010300	89.40	0.70	0.015	0.041	1.64	151670.92	243628.02
G32	RS29C020050	99.00	0.70	0.025	0.022	0.95	151293.08	229121.03
G33	RS29K010400	98.00	0.70	0.019	0.057	0.90	151124.40	219933.48
G34	RS30S010300	96.00	0.70	0.015	0.029	1.30	150223.35	263996.51
G35	RS29C020200	101.00	0.70	0.021	0.026	1.00	150211.10	227295.22
G36	RS29C020300	98.00	1.70	0.248	0.053	1.50	148849.69	226319.32
G37	RS29O011000	96.00	1.40	0.025	0.005	0.14	148355.13	197130.40
G38	RS30G020400	88.00	0.70	0.033	0.038	1.60	147980.62	249906.79
G39	RS29C020400	93.00	1.10	0.028	0.033	1.40	147057.84	223078.00
G40	RS29C010200	95.00	0.70	0.024	0.017	0.30	145894.17	204952.67
G41	RS29C010100	92.00	0.70	0.024	0.017	0.20	145258.29	201868.79
G42	RS30G020600	81.00	0.70	0.025	0.035	1.60	144647.05	246957.18
G43	RS30S010400	90.00	0.50	0.015	0.029	1.20	144381.97	263466.54
G44	RS29K010600	106.00	0.80	0.015	0.020	0.80	144266.15	218437.76

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
G45	RS30A010500	101.30	0.84	0.017	0.028	1.46	143694.66	240726.30
G46	RS30D010600	94.00	0.70	0.036	0.030	1.40	143159.70	264250.25
G47	RS30C010800	95.00	0.90	0.032	0.033	1.30	142725.50	243149.70
G48	RS30C010500	90.00	0.65	0.019	0.040	1.30	142093.21	253778.96
G49	RS30C011000	92.00	0.60	0.030	0.043	1.60	141916.57	236354.17
G50	RS30N010300	83.00	0.50	0.044	0.051	2.30	141893.35	252974.62
G51	RS29K010700	94.00	0.70	0.015	0.024	1.10	141882.53	218518.29
G52	RS30C010650	89.00	0.70	0.030	0.041	1.60	141617.24	252833.46
G53	RS30C010100	89.00	0.65	0.024	0.041	1.20	141288.30	263693.26
G54	RS29C020500	101.00	0.70	0.024	0.040	1.80	141251.77	220046.79
G55	RS30C010700	87.00	0.80	0.060	0.045	1.50	140891.48	249785.25
G56	RS30C010300	89.00	0.50	0.021	0.040	1.28	139430.70	258746.32
G57	RS29C050400	85.00	1.90	0.116	0.130	2.60	138463.09	225155.42
G58	RS30C011200	93.00	0.70	0.029	0.044	1.70	137261.91	233237.21
G59	RS30C030100	78.00	0.50	0.015	0.047	2.60	135389.94	237858.59
G60	RS30C011300	92.00	1.00	0.022	0.027	1.10	132172.79	232847.29
G61	RS30B020100	79.00	0.80	0.029	0.038	1.10	131914.85	257707.34
G62	RS30T010100	98.00	0.70	0.028	0.014	0.60	131330.71	227241.25
G63	RS30T010200	89.00	0.70	0.050	0.027	0.80	130952.97	226844.62
G64	RS30T010300	85.00	0.70	0.063	0.026	0.90	130574.86	226581.73
G65	RS30T010500	76.00	1.20	0.120	0.028	0.90	129728.83	226269.80
G66	RS30C020500	98.00	0.70	0.021	0.012	0.50	129645.70	225872.80
G67	RS30C020600	98.00	0.70	0.028	0.022	0.60	129625.12	225636.00
G68	RS30C020460	99.00	0.90	0.020	0.012	0.50	129372.24	226210.73
G69	RS30C020400	83.00	1.20	0.032	0.034	0.40	128509.64	227732.43
G70	RS30C020300	100.00	0.60	0.019	0.011	0.40	127726.36	228521.24
G71	RS30H010200	84.00	0.50	0.021	0.048	3.00	127336.99	245218.74
G72	RS30C020200	102.00	0.50	0.016	0.010	0.30	126631.11	229115.10
G73	RS30C020100	93.00	0.60	0.023	0.013	0.30	126372.30	230092.31
G74	RS31B010300	96.00	0.80	0.015	0.043	1.70	124903.48	223675.95
G75	RS30B140100	94.00	0.50	0.033	0.024	0.35	123324.82	232574.73
G76	RS31B020600	99.00	0.50	0.015	0.027	0.60	123251.24	222795.96
G77	RS30C060300	99.00	0.60	0.019	0.018	0.40	114966.87	254562.25
G78	RS31O010200	99.00	0.90	0.015	0.012	0.20	112733.00	222482.57
G79	RS30O020200	97.00	0.50	0.026	0.016	0.20	112517.22	243231.01
G80	RS30O020190	100.00	0.60	0.015	0.015	0.20	112247.72	243140.27
G81	RS31O010100	95.00	1.30	0.015	0.014	0.20	112142.31	228709.30
G82	RS30O020100	100.00	1.00	0.022	0.011	0.20	110854.78	242471.14
G83	RS31P010100	99.00	0.50	0.015	0.008	0.20	109717.89	222082.79
G84	RS31O040300	99.00	0.70	0.024	0.012	0.20	108975.62	222622.34
G85	RS30C050100	97.00	0.50	0.015	0.017	0.20	104235.38	257442.39
G86	RS30D020200	96.00	0.70	0.015	0.009	0.20	104046.38	252587.09
G87	RS31C020100	99.00	0.50	0.015	0.006	0.20	103908.86	222198.88
G88	RS30C030300	79.00	0.50	0.021	0.046	2.30	130237.00	234557.00
G89	RS30H010300	91.00	0.50	0.015	0.043	2.70	126103.00	243184.00

Mayo

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
M1	RS32C050300	98.00	0.90	0.015	0.024	0.60	99417.68	284466.11
M2	RS32N010190	100.00	0.60	0.015	0.011	0.20	98862.22	293855.70
M3	RS33O040050	101.00	0.90	0.019	0.012	0.20	97699.47	322764.74
M4	RS32E010100	99.00	0.50	0.015	0.014	0.20	97648.28	271119.68
M5	RS33S030150	99.00	1.00	0.019	0.013	0.20	97619.71	324018.80
M6	RS32E010200	97.00	0.50	0.025	0.015	0.20	96146.95	268314.80
M7	RS32G030100	87.00	0.80	0.028	0.017	0.20	94802.35	302324.64
M8	RS33O040200	100.00	0.80	0.015	0.015	0.20	93942.60	321178.24
M9	RS33G010050	100.00	0.80	0.015	0.019	0.20	92083.94	333551.96
M10	RS32E010300	101.00	0.50	0.015	0.011	0.20	89473.81	264501.26
M11	RS33G010100	99.00	0.90	0.015	0.025	0.20	89358.91	333789.97
M12	RS33O040300	101.00	1.00	0.015	0.014	0.20	86307.82	322900.98
M13	RS32B010100	100.00	0.50	0.015	0.007	0.20	84523.68	266405.72
M14	RS33O010020	102.00	0.50	0.015	0.010	0.20	84146.51	309619.68
M15	RS32B010200	100.00	0.50	0.015	0.007	0.20	84139.05	263380.52
M16	RS33M030100	98.00	1.10	0.023	0.008	0.20	83778.88	325260.85
M17	RS33M030200	97.00	1.20	0.041	0.010	0.20	82157.97	323259.13
M18	RS32B030100	100.00	0.50	0.017	0.014	0.20	81962.81	277952.08
M19	RS33O040500	99.00	1.10	0.024	0.009	0.20	81460.78	322572.70
M20	RS32B030150	96.00	0.50	0.021	0.020	0.20	80757.72	280663.66
M21	RS33O010100	102.00	0.70	0.015	0.012	0.20	80107.53	314685.80
M22	RS30D010100	93.00	0.90	0.038	0.036	1.10	149684.97	279479.42
M23	RS30D010200	92.00	1.50	0.145	0.040	1.50	148811.09	278093.15
M24	RS30D010300	96.00	0.80	0.063	0.036	1.50	148045.55	274902.08
M25	RS30D010400	93.00	0.60	0.040	0.034	1.40	147532.16	271672.99
M26	RS34S020060	99.00	0.80	0.015	0.024	1.00	143997.84	299531.97
M27	RS34T010200	95.00	1.30	0.085	0.037	0.90	143788.89	291449.39
M28	RS34S020100	99.00	1.30	0.047	0.035	1.00	141481.40	303995.78
M29	RS34M030300	95.00	1.00	0.041	0.035	0.80	141132.15	304868.27
M30	RS30R010030	95.00	0.70	0.025	0.031	1.10	141014.68	273662.93
M31	RS34T010300	97.00	1.00	0.068	0.039	0.80	139265.50	290925.89
M32	RS34M020500	95.00	0.90	0.017	0.027	0.40	139018.95	302368.92
M33	RS34G020100	99.00	0.80	0.038	0.029	1.10	138996.51	289493.10
M34	RS34Y020250	95.00	1.20	0.088	0.031	0.80	137928.38	286291.22
M35	RS34S050200	98.00	1.60	0.047	0.040	1.90	136654.81	300471.68
M36	RS30B030100	89.60	0.90	0.085	0.055	0.80	136639.94	269183.61
M37	RS34S030100	94.00	0.80	0.028	0.031	1.10	136343.75	298631.71
M38	RS34G020200	99.00	0.70	0.015	0.027	1.00	135070.94	291732.11
M39	RS30B030200	87.00	0.90	0.094	0.056	1.70	134977.27	270789.97
M40	RS34S050300	99.00	1.40	0.042	0.038	1.50	134971.29	301405.82
M41	RS34Y020300	98.00	0.90	0.068	0.027	0.70	134729.14	286717.87
M42	RS34P010300	95.00	1.10	0.065	0.032	0.60	134201.25	292657.10
M43	RS30R010200	94.00	0.60	0.029	0.035	1.20	133936.43	271033.42
M44	RS34T010500	102.00	0.80	0.015	0.026	0.80	133024.70	296389.33
M45	RS34P010260	95.00	1.30	0.073	0.031	0.60	133004.27	290679.45
M46	RS34G030100	104.00	0.70	0.033	0.028	0.90	132911.50	295935.89
M47	RS34S030200	100.00	0.70	0.017	0.029	0.90	132430.53	299299.28
M48	RS34P010100	93.00	1.00	0.063	0.036	0.60	132393.41	285983.32

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
M49	RS34Y010100	99.00	1.10	0.026	0.022	0.20	132307.35	308563.31
M50	RS30R010250	96.00	0.70	0.049	0.035	1.30	132144.01	270221.82
M51	RS34G030200	99.00	0.70	0.023	0.029	0.80	130399.95	297538.22
M52	RS34Y010200	100.00	1.10	0.015	0.025	0.20	129967.59	305902.96
M53	RS34M020650	96.00	1.00	0.029	0.037	0.70	129464.06	298558.87
M54	RS34B080400	93.00	0.80	0.018	0.032	1.08	128854.46	318078.46
M55	RS30B020200	80.75	0.65	0.023	0.042	1.60	128048.32	252616.41
M56	RS34M020700	98.00	1.00	0.017	0.034	0.60	127620.99	299329.69
M57	RS34M020800	97.00	1.00	0.015	0.024	0.40	127033.00	304729.04
M58	RS34G010100	97.00	0.60	0.024	0.033	0.70	126940.32	317918.73
M59	RS34C070600	96.00	0.60	0.015	0.029	0.30	126452.78	310464.32
M60	RS34M020750	96.00	1.20	0.028	0.027	0.50	126207.28	300770.66
M61	RS30R010400	96.00	0.70	0.023	0.034	1.20	125922.90	268623.40
M62	RS30B020300	89.00	0.50	0.015	0.041	1.70	125601.24	249105.18
M63	RS34G010200	99.00	0.80	0.028	0.032	0.70	125555.89	319333.20
M64	RS34L040200	83.00	1.90	0.066	0.065	0.90	125297.47	284320.21
M65	RS34C060200	84.00	0.70	0.032	0.038	1.20	124804.31	313939.16
M66	RS34M021100	97.00	0.80	0.015	0.023	0.70	124676.14	318772.63
M67	RS34M021000	97.00	1.00	0.018	0.024	0.50	124475.27	317019.33
M68	RS34C010400	94.00	1.00	0.023	0.034	0.80	123360.34	294477.97
M69	RS34M010100	87.00	1.90	0.048	0.034	0.80	123074.87	281168.26
M70	RS30B020400	87.00	0.50	0.015	0.040	1.70	123022.74	248542.64
M71	RS34C010500	92.00	0.80	0.025	0.030	0.60	122863.74	300050.53
M72	RS30C090100	87.00	0.80	0.018	0.040	1.60	122455.09	273325.16
M73	RS34M010400	93.00	1.20	0.032	0.031	0.90	122368.29	291103.77
M74	RS34C050200	99.00	1.30	0.028	0.021	0.20	122286.68	296091.66
M75	RS34M010500	97.00	0.80	0.016	0.030	0.90	121936.84	293360.16
M76	RS34M010300	89.00	1.30	0.032	0.031	1.00	121323.29	288623.34
M77	RS34C010300	97.00	1.20	0.028	0.027	0.50	120995.17	293680.15
M78	RS34M010225	87.00	1.60	0.128	0.043	1.00	120024.79	284572.71
M79	RS34M010200	87.00	1.00	0.033	0.033	1.00	119971.73	284262.38
M80	RS30R010600	92.00	0.90	0.015	0.031	1.00	119542.70	264943.01
M81	RS30R010700	94.00	0.90	0.023	0.035	1.50	118121.16	264822.46
M82	RS34C030300	100.00	1.00	0.031	0.028	0.30	117358.59	331448.60
M83	RS34C050100	99.00	0.90	0.026	0.022	0.20	117214.93	294388.64
M84	RS34C010200	93.00	1.30	0.018	0.020	0.30	117072.94	292025.42
M85	RS30R010950	92.00	0.90	0.018	0.033	1.40	116851.40	264835.76
M86	RS34S060400	93.00	1.10	0.054	0.050	1.00	116478.95	320754.23
M87	RS34D010300	96.00	1.00	0.020	0.021	0.60	115808.01	319151.54
M88	RS34C030200	100.00	0.90	0.027	0.023	0.23	115774.44	328606.43
M89	RS34C010180	94.00	1.30	0.028	0.024	0.40	115130.22	290738.99
M90	RS30A020300	90.00	0.97	0.023	0.018	0.50	114432.26	273591.85
M91	RS34C010100	92.00	1.20	0.026	0.020	0.40	114349.13	290406.87
M92	RS34C050030	100.00	0.80	0.015	0.017	0.20	114329.33	296524.53
M93	RS30A020200	94.00	0.80	0.019	0.019	0.62	113461.73	277749.47
M94	RS34C030100	99.00	1.10	0.043	0.016	0.23	112226.18	324804.65
M95	RS34D010100	98.00	0.90	0.019	0.023	0.20	112095.44	316017.92
M96	RS30S020400	97.00	0.80	0.015	0.022	0.20	111921.82	272397.33
M97	RS30G010300	101.00	0.60	0.015	0.023	0.20	110344.03	267904.87

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
M98	RS33B010100	97.90	0.96	0.023	0.018	0.23	110314.68	334110.84
M99	RS33B010200	98.00	0.80	0.025	0.022	0.23	110140.55	338213.85
M100	RS33G020200	100.00	1.00	0.023	0.024	0.20	109331.34	339229.40
M101	RS30O010200	99.00	0.70	0.015	0.006	0.20	105629.23	262758.90
M102	RS32N010020	98.00	0.60	0.018	0.010	0.20	104385.39	297280.37
M103	RS32C050100	91.00	1.40	0.018	0.031	0.40	102282.97	282744.91
M104	RS30F030100	97.00	0.50	0.015	0.006	0.20	101101.53	258636.15
M105	RS34D010010	98.00	1.00	0.015	0.019	0.20	101084.21	315758.72
M106	RS30S030100	101.00	0.50	0.015	0.008	0.20	100933.56	261427.38
M107	RS32G050080	100.00	0.50	0.015	0.010	0.20	84959.76	267494.42

Sligo

		2011 annual mean values					Grid References	
Reference	Station ID	DO % Sat	BOD mg/l O_2	Ammonia mg/l N	o_PO_4 mg/l P	TON mg/l N	Easting	Northing
S1	RS26F020400	91.00	0.80	0.020	0.033	0.30	189975.34	310673.94
S2	RS26F020200	97.00	1.20	0.015	0.029	0.30	186571.56	313712.56
S3	RS26F020080	87.00	1.00	0.025	0.041	0.40	183545.16	316455.17
S4	RS26F020050	93.00	1.30	0.028	0.032	0.20	180323.85	319494.65
S5	RS35D010100	99.00	0.50	0.015	0.022	0.20	177693.00	342346.26
S6	RS35U010100	98.00	0.70	0.015	0.020	0.20	176788.52	315760.11
S7	RS35U010200	86.00	0.70	0.015	0.023	0.20	175029.99	319241.18
S8	RS35D040200	98.00	0.50	0.015	0.017	0.20	173375.51	342953.90
S9	RS35D110800	93.00	0.80	0.036	0.033	0.70	171455.63	320419.53
S10	RS35G010100	96.00	0.50	0.015	0.021	0.20	171113.29	335211.33
S11	RS35U010400	95.00	1.00	0.015	0.031	0.30	169840.26	322821.39
S12	RS35G010200	97.00	0.60	0.015	0.022	0.20	169518.87	335977.20
S13	RS35D040300	96.00	0.50	0.015	0.022	0.20	169376.12	341907.64
S14	RS35W010300	101.00	0.50	0.019	0.028	0.60	169279.22	337384.94
S15	RS35U010600	91.00	1.00	0.028	0.029	0.40	168633.85	326926.40
S16	RS35O060900	99.00	1.30	0.077	0.041	0.50	168463.04	326657.88
S17	RS35O060025	101.00	0.80	0.019	0.033	0.70	168138.78	304319.56
S18	RS35G040100	101.00	0.50	0.015	0.033	0.20	167967.69	347912.20
S19	RS35O060050	97.00	0.80	0.024	0.032	0.40	167126.59	305661.03
S20	RS35B050100	102.00	0.94	0.015	0.032	0.51	166915.25	328966.37
S21	RS35O060700	97.00	0.80	0.015	0.029	0.50	166873.76	325762.79
S22	RS35G050200	96.00	1.20	0.076	0.038	1.10	166709.42	305290.99
S23	RS35O060200	92.00	0.90	0.035	0.034	0.50	166612.36	312348.30
S24	RS35B040100	101.00	0.80	0.025	0.043	0.68	166168.89	314580.13
S25	RS35O060250	90.00	1.00	0.039	0.040	0.60	165463.95	313535.62
S26	RS35O010400	98.00	0.80	0.015	0.019	0.20	165300.87	325491.12
S27	RS35G040200	97.00	1.50	0.095	0.036	0.50	165113.04	349544.90
S28	RS35C010600	94.00	0.90	0.033	0.034	0.60	164856.18	313245.21
S29	RS35O060500	88.00	0.90	0.024	0.031	0.50	162585.54	318551.10
S30	RS35D120800	92.00	0.60	0.015	0.042	0.70	162515.63	344122.12
S31	RS35O060400	87.00	0.90	0.034	0.038	0.60	162153.55	315391.06
S32	RS35O010200	100.00	1.30	0.015	0.023	0.20	160745.86	325232.04
S33	RS35B080200	72.00	0.50	0.019	0.039	1.00	160050.52	312079.74
S34	RS35O010030	99.00	0.90	0.015	0.026	0.20	154405.37	324307.46

		2011 annual mean values					Grid References	
Reference	**Station ID**	**DO % Sat**	**BOD mg/l O_2**	**Ammonia mg/l N**	**o_PO_4 mg/l P**	**TON mg/l N**	**Easting**	**Northing**
S35	RS34M020050	98.00	0.70	0.022	0.015	0.20	152303.88	319410.16
S36	RS34T030300	84.00	0.60	0.041	0.065	2.00	152215.28	311890.70
S37	RS34T030400	87.00	2.00	0.473	0.117	2.00	152044.95	311987.47
S38	RS34T030500	88.00	2.00	0.429	0.111	1.90	151935.04	312038.14
S39	RS34T020050	78.00	3.30	0.793	0.209	1.70	151078.14	311706.95
S40	RS35D100600	95.00	0.80	0.026	0.039	1.10	150617.65	335865.68
S41	RS34O030100	99.00	1.00	0.021	0.028	0.30	149371.37	306085.58
S42	RS34M020100	97.00	0.70	0.016	0.017	0.40	149339.11	316800.25
S43	RS34M040100	101.00	0.50	0.015	0.012	0.20	149253.50	317228.05
S44	RS34C120400	102.00	0.50	0.044	0.037	0.80	149099.60	314818.83
S45	RS34B120300	94.00	0.90	0.050	0.036	0.80	147820.22	302694.38
S46	RS34T020200	96.00	1.00	0.048	0.087	1.20	147604.22	311410.85
S47	RS34C280100	100.00	0.70	0.096	0.044	0.90	147506.51	302477.51
S48	RS34M020300	99.00	1.10	0.032	0.021	0.30	146674.84	312264.76
S49	RS34M020400	102.00	1.00	0.038	0.029	0.40	146525.12	310022.01
S50	RS34O030200	99.00	1.10	0.022	0.029	0.30	145393.69	307411.15
S51	RS35D060050	99.00	0.60	0.015	0.012	0.20	144568.05	329177.16
S52	RS34O010100	102.00	0.80	0.015	0.019	0.20	144443.13	313782.08
S53	RS35B090100	101.00	0.60	0.015	0.008	0.20	144165.45	327136.27
S54	RS35D060200	101.00	0.90	0.016	0.025	0.40	143846.52	334344.25
S55	RS34E010300	98.00	0.50	0.015	0.025	0.20	143090.38	308076.52
S56	RS34E010100	99.00	0.60	0.015	0.017	0.20	141484.74	313674.36
S57	RS35B090500	101.00	0.80	0.015	0.012	0.20	140616.02	331000.71
S58	RS35E010100	100.00	0.80	0.015	0.020	0.20	140001.33	333155.42
S59	RS35G030100	99.00	0.80	0.026	0.014	0.30	138824.06	326540.98