Nitrates Directive

2015 Derogation Report[1] for Northern Ireland

in accordance with Article 10 of

Commission Decision 2007/863/EC

July 2016

Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

afbi Agri-Food and Biosciences Institute

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk

cafre College of Agriculture, Food & Rural Enterprise

[1] *Including maps in accordance with Article 8(1) of Commission Decision 2007/863/EC, as amended by Commission Decision 2011/128/EU and 2015/346/EU*

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1. INTRODUCTION

The Nitrates Directive (91/676/EEC) (the Directive) is currently implemented in Northern Ireland through the 2015-2018 Nitrates Action Programme (NAP) contained in the Nitrates Action Programme Regulations (Northern Ireland) 2014 (the 2014 NAP Regulations) and subsequent amending regulations[2]. From 2011-2014 it was implemented through the NAP contained in the 2010 NAP Regulations and subsequent amending regulations[3]. The Regulations limit the amount of nitrogen (N) from livestock manure that can be applied to land to 170 kg N/ha/year on all farms and are the responsibility of the Department of Agriculture, Environment and Rural Affairs (DAERA).

Most of the measures contained in the 2010 NAP Regulations were carried forward into the 2014 NAP Regulations. However, controls on some measures were revised and additional guidance[4] on the NAP was produced for farm businesses.

In 2007, the United Kingdom (UK), with regard to Northern Ireland, was granted derogation (until 31 December 2010) by Commission Decision 2007/863/EC (the 2007 Decision) to permit an increase in the amount of grazing livestock manure that may be applied to land from 170 kg N/ha/year up to a limit of 250 kg N/ha/year on grassland farms which meet certain criteria. After application and discussion with the Commission, derogation was renewed (until 31 December 2014) by Commission Decision 2011/128/EU (the 2011 Decision). Measures relating to the Decision were included in the 2010 NAP Regulations.

Following a further application and discussion with the Commission and a positive Member State vote at the EC Nitrates Committee in November 2014, derogation was renewed (until 31 December 2018) (Commission Decision 2015/346/EU – the 2015 Decision). Measures relating to the new Decision have been included in the 2014 NAP Regulations.

In accordance with the 2015 Decision, Northern Ireland must update and send to the Commission maps every year, showing the percentage of grassland farms, percentage of livestock and percentage of agricultural land covered by an individual derogation in each district of Northern Ireland, as well as maps of local land use.

Article 10 of the 2007 Decision requires that the results of monitoring be transmitted to the Commission annually, with a concise report on water quality and evaluation practice. The report shall also provide information on how the evaluation of the implementation of the derogation conditions is carried out through controls at farm level and include information on non-compliant farms based on results of administrative and field inspections.

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[2] The Nitrates Action Programme (Amendment) Regulations (Northern Ireland) 2015

[3] The Nitrates Action Programme (Amendment) Regulations (Northern Ireland) 2012

[4] Nitrates Action Programme 2015-2018 and Phosphorus Regulations Guidance Booklet https://www.daera-ni.gov.uk/sites/default/files/publications/dard/nap-2015-2018-and-phosphorus-regulations-guidance-booklet-final-may-2016.pdf

A first report for Northern Ireland (for 2007 and 2008) was submitted to the Commission in 2009 and since then a report has been submitted annually for the preceding year (with maps for the current year). Therefore, this report provides the annual report on implementation of the derogation in 2015 and maps for 2016.

2. MAPS

In 2016, 297 farm businesses out of approximately 25,6000 direct aid claimants (i.e. 1.2%) operated under an approved derogation in Northern Ireland, compared to 225 (i.e. 0.77%) in 2015. Table 1 shows the predicted grassland area and livestock manure loadings of farm businesses which applied to operate under the terms of the derogation in years 2009 to 2016.

Under the Water Framework Directive (2000/60/EC) (WFD), Northern Ireland shares three International River Basin Districts (IRBDs) with the Republic of Ireland and there is one River Basin District (RBD) entirely within Northern Ireland. In the 'UK Article 3 Report on the WFD' Northern Ireland was further subdivided into 31 sub-catchments which form the basis of the maps presented below.

2.1 Percentage of grassland farms covered by an individual derogation in 2016

The map in Figure 1 shows the percentage of grassland farm businesses by area who applied for an individual derogation in 2016, broken down by location of the land within the 31 sub-catchments. The highest percentage in any sub-catchment is 22.45% and across Northern Ireland this equates to 3.04% of grassland.

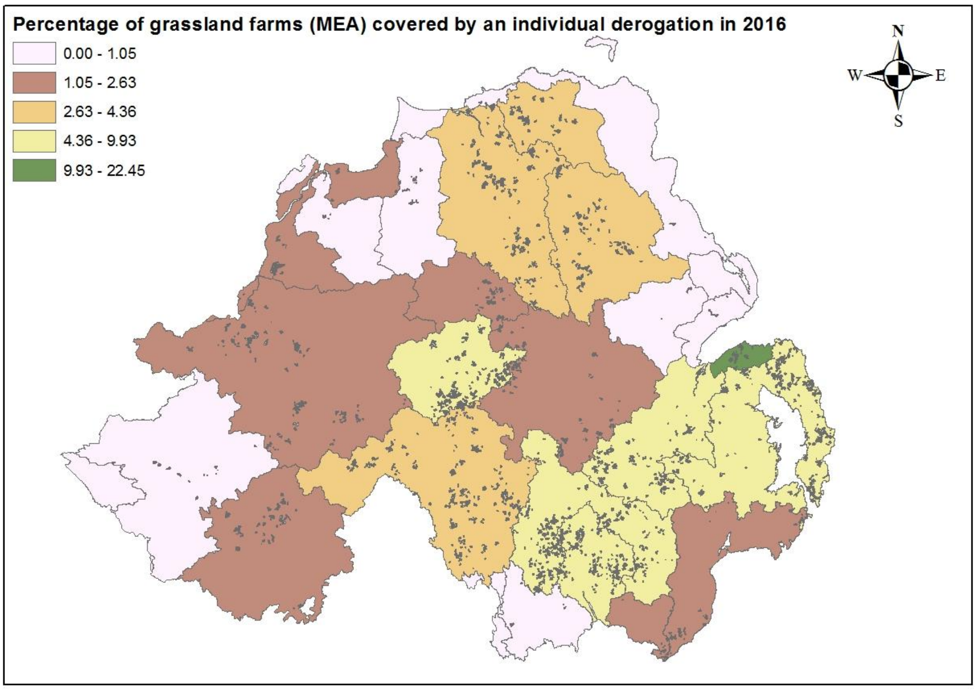

Figure 1: Percentage of grassland farms covered by an individual derogation 2016

2.2 Percentage of cattle livestock covered by an individual derogation in 2016

The map in Figure 2 shows the percentage of cattle livestock covered by, an individual derogation in 2016. This has been calculated on the basis of nitrogen (N) produced and is broken down by location of the farm business address within the 31 sub-catchments. The highest percentage in any sub-catchment is 33.12% and across Northern Ireland this equates to 5.50% of farms that control cattle livestock.

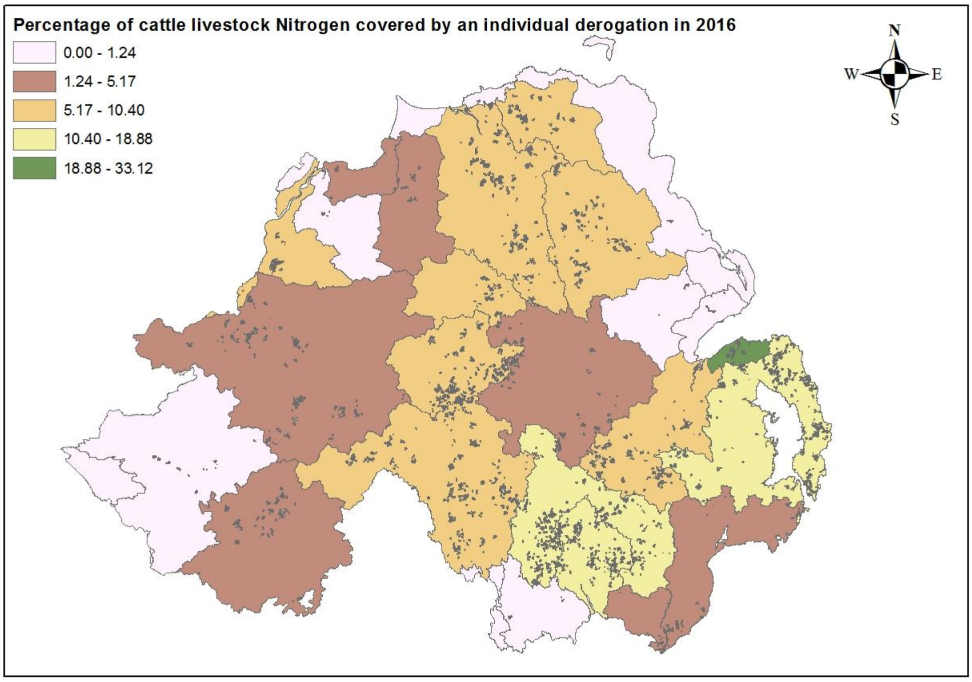

Figure 2: Percentage of cattle livestock covered by an individual derogation 2016

2.3 Percentage of agricultural land covered by an individual derogation in 2016

The map in Figure 3 shows the percentage of farm businesses that control agricultural land, who applied for an individual derogation in 2016, broken down by location of the farm business address within the 31 sub-catchments. The highest percentage in any sub-catchment is 16.48% and across Northern Ireland this equates to 2.48% of agricultural land.

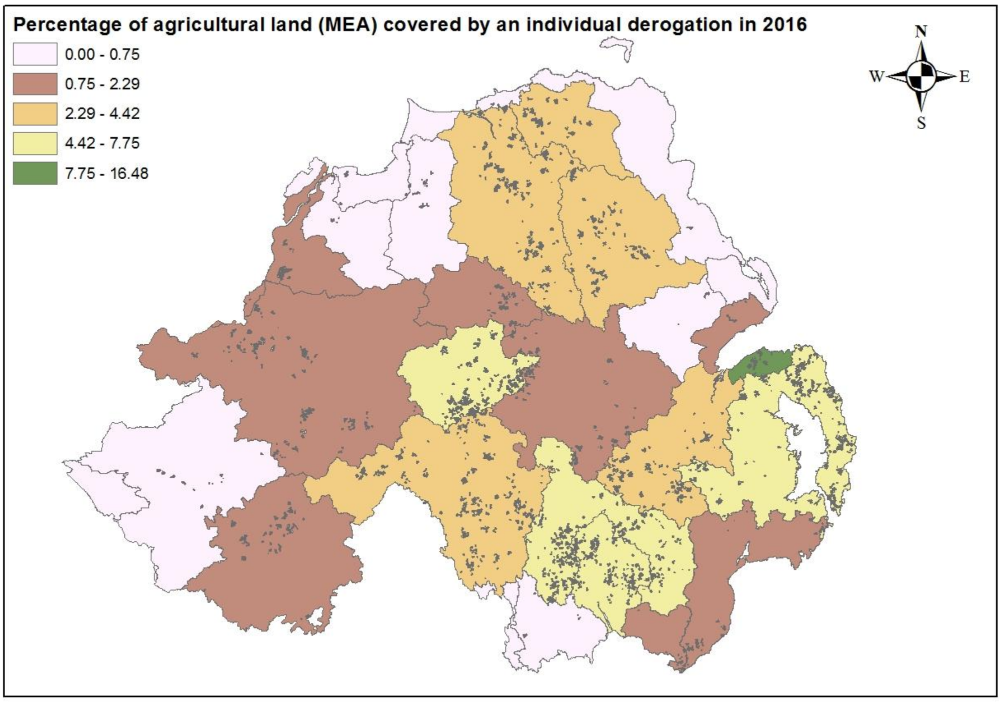

Figure 3: Percentage of agricultural land covered by an individual derogation 2016

2.4 Map of local land use for 2015

Agricultural land use in Northern Ireland is dominated by grassland farming systems. According to the Northern Ireland Agricultural Census (June 2015) (www.daera-ni.gov.uk/articles/june-agricultural-census-2015-results), managed grassland accounted for approximately 80% of a total agricultural area of 998,000 ha. Arable and other crops accounted for 5% of the total and rough grazing for 13%. The map in Figure 4 shows the declared land-uses across Northern Ireland.

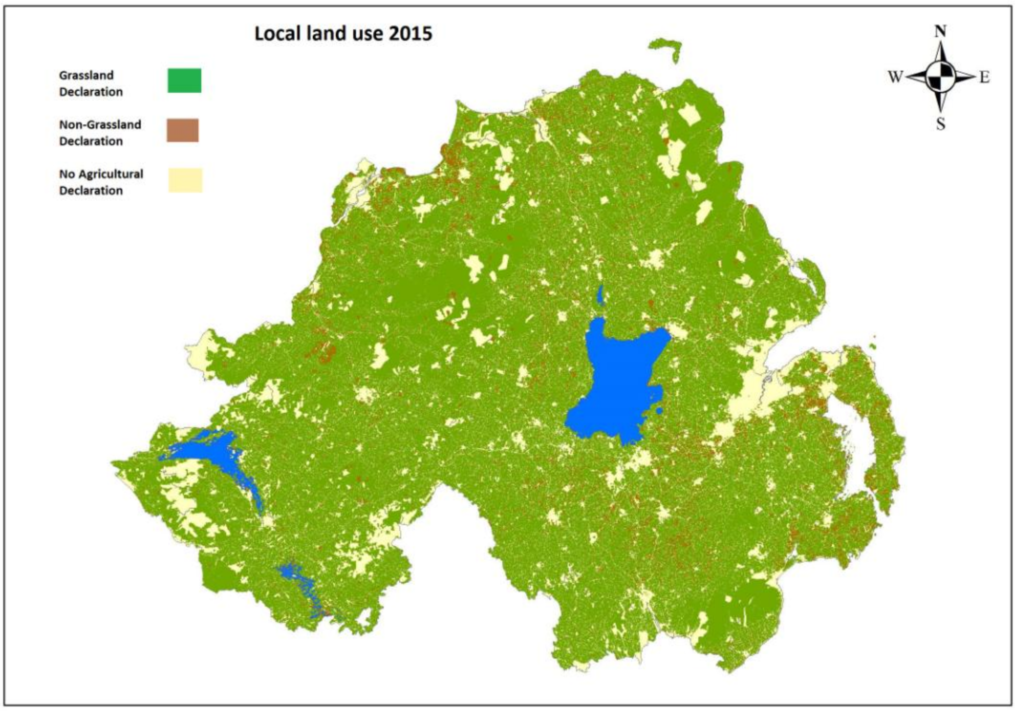

Figure 4: Map of local land use for 2015

Table 1: Predicted average (and minimum-maximum) grassland areas and livestock manure loadings of farm businesses which applied for derogation in years 2009 to 2016

Parameter	2009	2010	2011	2012	2013	2014	2015	2016
Grassland area (%)	97 (80-100)	97 (81-100)	98 (81-100)	97 (81-100)	98 (82–100)	98 (82–100)	98 (83–100)	98 (82–100)
Farm size (ha)	88 (11-515)	86 (11-263)	84 (11–261)	83 (14–260)	85 (14–280)	88 (14–272)	86 (10–370)	88 (7-334)
Total livestock manure nitrogen loading (kg N/ha/year)	203 (29-250)	201 (11-247)	206 (155–250)	204 (119–249)	205 (36–249)	205 (122–246)	205 (12–250)	213 (23-250)
Grazing livestock manure nitrogen loading (kg N/ha/year)	203 (29-250)	203 (11-247)	206 (195–250)	204 (119–249)	205 (36–249)	205 (122–246)	206 (12–250)	213 (23-250)

3. WATER QUALITY

In accordance with Article 10 of the 2007 Decision, the results of monitoring are transmitted to the Commission annually, with a concise report on water quality.

The following section provides information on the measured nitrate and phosphorus levels and evolution of water quality in rivers, streams, lakes and groundwaters over the period 2008 to 2015. Results are assessed both for Northern Ireland as a whole, and for the two [sub-] catchments (Lower Bann and Blackwater) where the concentration of derogated farms was highest in 2015 (high derogation catchments). Data are also presented for the Strangford and Ballinderry catchments (where the concentration of derogated farms was highest in the 2014 reporting period) for continuity with the previous derogation report submitted to the Commission in 2015.

In this report, comparisons of the mean annual average data for the period 2008-2011 (as reported in the Northern Ireland 2012 Nitrates Article 10 Report[5]) and the most recent annual average data for the current reporting year (2015) are presented. In each period, surface water data were only included where sufficient numbers of samples over the four years (2008-2011) and one year (2015) were available[6]. In the four-year (2008-2011) period groundwater data were only included where five or more groundwater samples were available for all monitoring sites. For the current reporting year (2015) all available groundwater data were included; consisting on average of two samples per monitoring site. Presentation of the four-year data set (2008-2011) as reported in the Northern Ireland 2012 Nitrates Article 10 Report provides continuity with other Nitrates Directive 91/676/EEC (ND) reporting requirements and it provides a clear message of how the water quality is evolving since the Article 10 Report for the period 2008-2011.

The results of a single year analysis must be treated with caution; due to the relatively low numbers of samples involved and possible variability due to climatic influences (for the purposes of this report, adjustments have not been made for weather or other varying annual effects). When considering the following results it should, therefore, be remembered that variations in annual precipitation or in seasonal patterns of rainfall can increase nutrient run-off and thereby potential nutrient input to surface waters. Average monthly precipitation for Northern Ireland for 2008-2011 was 86.2 mm and for 2015 was higher at 91.3 mm (source: Met Office).

In 2009, a revision of the surface freshwater monitoring network was carried out to broaden the coverage in Northern Ireland for Water Framework Directive (2000/60/EC) (WFD) monitoring for the six-year period 2009-2014. The revision also reduced the numbers of monitored sites from 579 to 528 whilst continuing to fulfil monitoring obligations

[5] Member States must report every four years to the Commission on the status of water quality in accordance with Article 10 of the Nitrates Directive (91/676/EEC). The 'Nitrates Directive Development Guidance Notes for Member States' issued in 2011, indicate that for the purposes of reporting, data may be averaged over more than one year. The UK 2012 Nitrates Article 10 Report was completed in November 2012 and data was summarised and presented for 2008-2011.

[6] Sufficient numbers of samples, for annual average, in the four-year period 2008-2011 were considered to be ≥20 samples and ≥10 for the current reporting year (2015).

under WFD, Freshwater Fish Directive (2006/44/EC) (FFD) and (ND). However, further financial constraints led to another revision of the network in 2010. The new approach incorporated monthly sampling at a reduced number of core sites (258) with the remainder of sites (270) monitored for two years within the six-year River Basin Plan cycle on a rolling programme basis (2009-2014). This meant that the average number of monthly samples analysed for nutrients was reduced from 579 to an average of 348 in each year. Changes to the monitoring programme were implemented in 2015 for the second cycle of the River Basin Management Plans (RBMP) through better targeting and by adopting a risk based approach to monitoring. Although WFD surveillance monitoring stations continue to be sampled monthly, the remainder of the stations are sampled on a quarterly basis, i.e. four samples per year. In 2015, the average number of monthly samples analysed for nutrients is 157 with a further 368 stations monitored quarterly.

Groundwater quality in Northern Ireland is assessed in accordance with NIEA's groundwater monitoring programme through the collection of water samples from boreholes and springs that are mostly owned and operated by third parties. The public water supply provider in Northern Ireland (NI Water Ltd) does not currently utilise groundwater with the exception of Rathlin Island, a small island off the north coast of Northern Ireland. Hence, NIEA rely mostly on third party owned boreholes and the co-operation of land/property owners to continue sampling from their groundwater sources for the chemical/nutrient monitoring. This means that the composition of the ground water monitoring network can change due to businesses closing or changing their groundwater usage and in addition datasets for trend assessments are often small. The monitoring network consists mainly of industrial boreholes where groundwater is utilised for manufacturing or food/drinks production. A small number of springs or boreholes purpose-installed by NIEA, which are purged prior to sampling, are also monitored. The selection of groundwater monitoring sites to date has been based on a pressure-pathway assessment of the groundwater bodies and the availability of potential monitoring points.

3.1 Nitrate concentrations in surface freshwater

In the period 2008-2011, NIEA monitored nitrate concentrations at 622 surface freshwater monitoring stations across Northern Ireland. The annual average nitrate concentration at these stations was 5.1 mg NO_3/l. In 2015, nitrate concentrations were monitored at 156 surface freshwater stations (common with those freshwater stations monitored in the previous reporting period 2008-2011) giving an annual average nitrate concentration of 4.5 mg NO_3/l.

Table 2: Annual average nitrate concentrations (based on number and % of monitoring stations) of surface freshwater across Northern Ireland, 2008-2011 and 2015

Average nitrate concentration (mg NO_3/l)	**Northern Ireland**	
	2008-2011 (622 stations)	**2015 (156 stations)**
0–9.99	89.4% (556)	92.3% (144)
10–24.99	10.5% (65)	7.7% (12)
25–39.99	0.2% (1)	0
>40	0	0

Table 3: Annual average nitrate concentrations (based on number of monitoring stations) of surface freshwater in the high derogation catchments, 2008-2011 and 2015

Average nitrate (mg NO_3/l)	**Ballinderry Catchment**		**Strangford Catchment**		**Lower Bann Catchment**		**Blackwater Catchment**	
	2008-11 (20 sites)	**2015** (20 sites)	**2008-11** (16 sites)	**2015** (14 sites)	**2008-11** (36 sites)	**2015** (6 sites)	**2008-11** (34 sites)	**2015** (5 sites)
0–9.99	65% (13)	80% (16)	68.8% (11)	71.4% (10)	86.1% (31)	83.3% (5)	91.2% (31)	100% 5
10–24.99	35% (7)	20% (4)	31.2% (5)	28.6% (4)	13.9% (5)	16.7% (1)	8.8% (3)	0
25–39.99	0	0	0	0	0	0	0	0
>40	0	0	0	0	0	0	0	0

In 2008-2011, 106 of the monitored surface freshwater stations were located in the four catchments with the highest proportion of derogated farms and an annual average nitrate concentration of 7.2 mg NO_3/l was recorded. In 2015, 45 stations were monitored in these catchments with an annual average concentration of 7.2 mg NO_3/l. Table 2 shows annual average nitrate concentrations in surface freshwater across Northern Ireland in 2008-2011 and 2015 based on the number and percentage of stations monitored. Table 3 shows the average nitrate concentrations in surface freshwater in the four high derogation catchments in 2008-2011 and 2015 based on the number and percentage of stations monitored. Figure 5 shows the distribution of nitrate in surface freshwater across Northern Ireland and the high derogation catchments in 2015. Average nitrate concentrations in 2015 were generally low across Northern Ireland, with 100% of surface water stations below 25 mg NO_3/l.

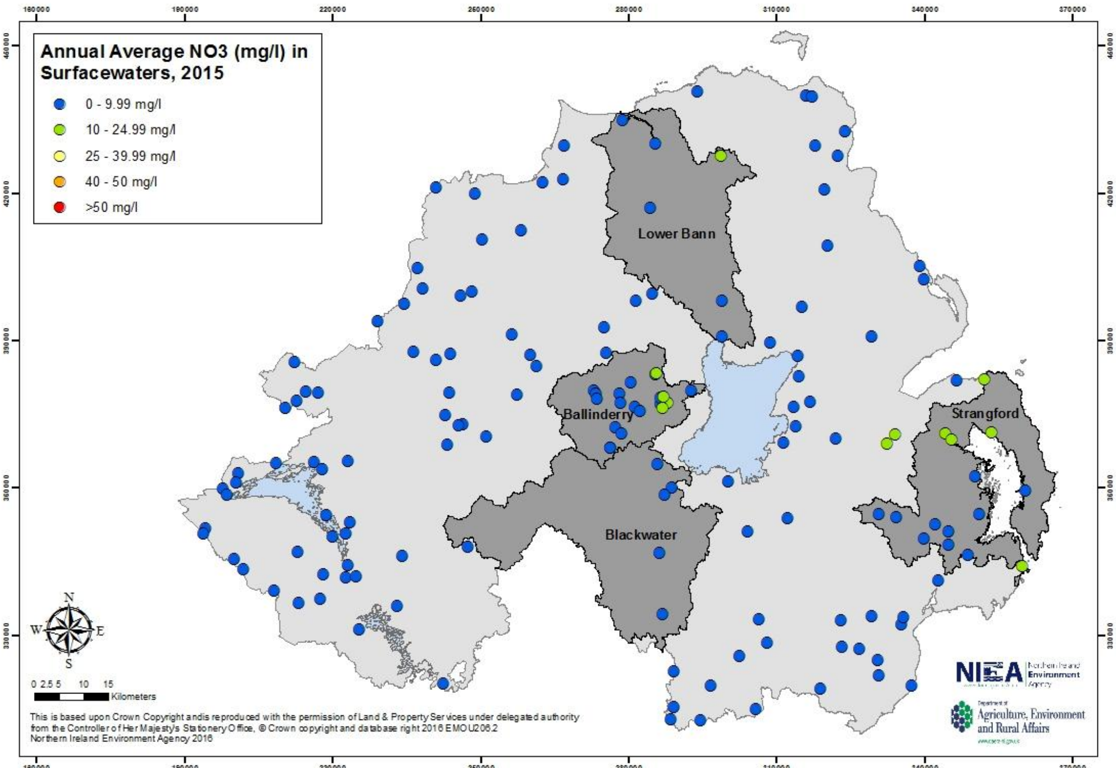

Figure 5: Distribution of annual average nitrate concentrations at surface freshwater stations in 2015

Nitrate concentration trends in Table 4 and Figure 6 indicate that the annual average nitrate concentrations in common surface freshwater stations across Northern Ireland were generally stable or decreasing (99% of stations) between the two reporting periods. For the high derogation catchments, nitrate concentration trends indicate a decrease or stabilisation of annual average concentration at 100% of monitoring stations in the four catchments between the two reporting periods. The single surface water site showing an increase (River Lagan at Stranmillis Weir) had a low baseline (<11 mg/l annual average nitrate concentration) and the increase was <1.5 mg/l.

Further long term trend analysis of nitrate data based on common sampling points over the period 2008–2015 is currently in progress for reporting under Article 10 of the ND. Stations across Northern Ireland showing increasing trends in nitrate will be subject to targeted action. Further investigations and actions in these catchments will be implemented as part of targeted catchment projects under WFD in the RBDs. This will include engagement with the sewerage undertaker, home owners and farmers in the local areas, to follow up actions arising from reported pollution incidents and improve water protection.

Table 4: Change in average nitrate concentrations (based on % and number of common monitoring stations) of surface freshwater across Northern Ireland and in the high derogation catchments, between 2008-2011 and 2015

Difference in average nitrate concentration (mg NO_3/l) 2008-2011 – 2015	% and number of common monitoring stations		
	Decrease[1]	**Stable[2]**	**Increase[3]**
Northern Ireland (149 Stations)	24.8% (37)	74.5% (111)	0.7% (1)
Ballinderry Catchment (20 Stations)	65% (13)	35% (7)	0
Strangford Catchment (14 Stations)	36% (5)	64% (9)	0
Blackwater Catchment (3 Stations)	0	100% (3)	0
Lower Bann Catchment (6 Stations)	50% (3)	50% (3)	0

Difference is assessed by change in concentration – [1]Decrease ≤ -1 mg/l, [2]Stable -1 to +1 mg/l, [3]Increase ≥ +1 mg/l

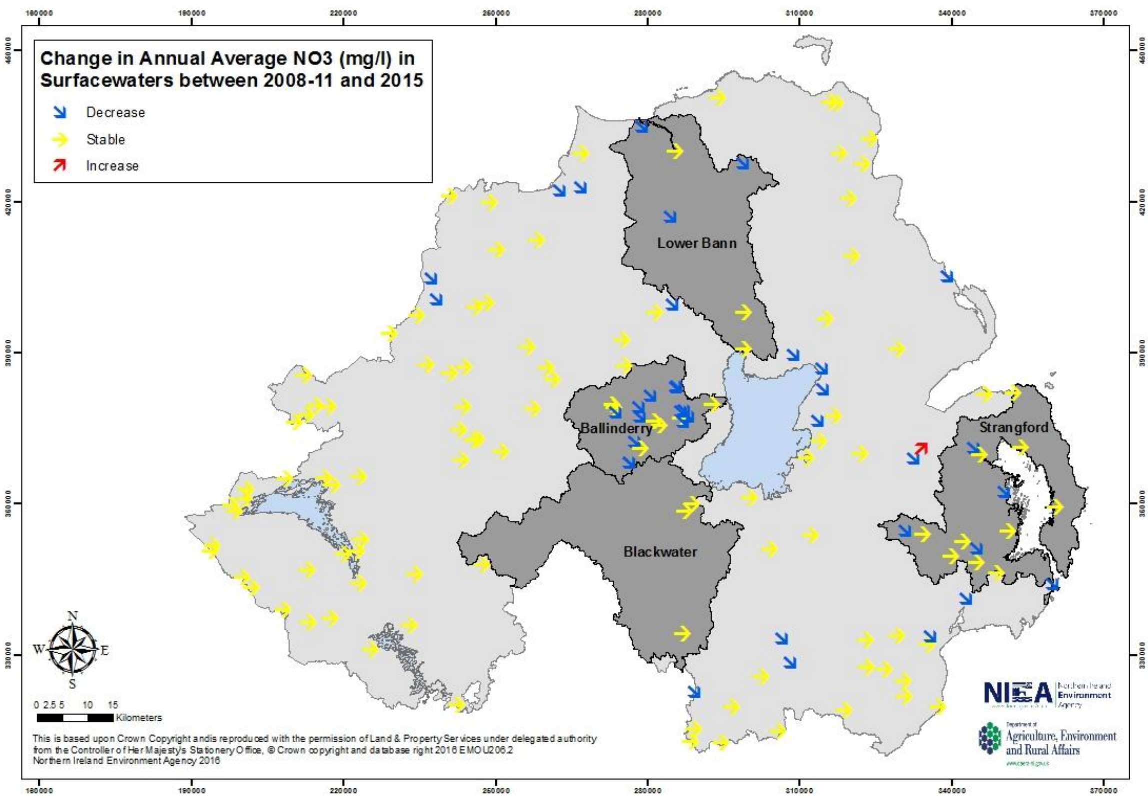

Figure 6: Change in annual average nitrate concentrations at surface freshwater stations between 2008-2011 and 2015

3.2 Nitrate concentrations in groundwaters

In the period 2008 to 2011, NIEA monitored nitrate concentrations at 71 groundwater monitoring sites across Northern Ireland, comprised of sites from the regional groundwater monitoring network. The average nitrate concentration was determined at 58 of the 71 sites, where sampling frequency was sufficient (five samples or more) to include the monitoring sites in the assessment. The average nitrate concentration at the 58 sites in 2008-2011 was 6.77 mg NO_3/l. In 2015, nitrate concentrations were monitored at 53 groundwater sites across Northern Ireland giving an average concentration of 5.9 mg NO_3/l.

In 2008-11, 15 of the monitored groundwater sites were located in the high derogation catchments (Ballinderry, Blackwater, Lower Bann and Strangford) and an average concentration 9.9 mg NO_3/l was recorded. In 2015, 22 of the monitored groundwater sites were located in the high derogation catchments and an average concentration of 9.3 mg NO_3/l was recorded. This higher average value for the high derogation catchments is due mainly to two monitoring sites in the Strangford catchment (one monitoring site in the Ards groundwater body, the other monitoring site in the Belfast East groundwater body), as discussed below. Table 5 shows the average nitrate concentrations in groundwater across Northern Ireland and in the high derogation catchments for 2008–2011 and 2015. Figure 7 shows the distribution of nitrate in groundwater across Northern Ireland and in the four catchments in 2015.

Table 5: Average nitrate concentrations (based on number of monitoring sites) of groundwater across Northern Ireland and in the high derogation catchments with the highest proportion of derogated farms, 2008-2011 and 2015

catchment	groundwater body	Average nitrate concentration (mg NO_3/l)	0-24.99	25–39.99	40–50	>50
Northern Ireland		2008-2011 58 sites	55	3	0	0
		2015 53 sites	51	1	0	1
Ballinderry	Cookstown	2008-2011 2 sites	2	0	0	0
		2015 4 sites	4	0	0	0
	Moneymore	2008-2011 1 site	1	0	0	0
		2015 1 site	1	0	0	0
Blackwater	Aughnacloy	2008-2011 3 sites	3	0	0	0
		2015 6 sites	6	0	0	0
	Moygashel	2008-2011 1 site	1	0	0	0
		2015 2 sites	2	0	0	0
Lower Bann	Coleraine-Kilrea	2008-2011 3 sites	3	0	0	0
		2015 3 sites	3	0	0	0
Strangford	Ards Peninsula	2008-2011 1 site	0	1	0	0
		2015 1 site	0	1	0	0
	Belfast East	2008-2011 4 sites	3	0	0	1
		2015 5 sites	4	0	0	1

Average nitrate concentrations in groundwater across Northern Ireland were generally low, with 55 of the 58 sampling points at less than 25 mg NO_3/l in 2008-2011 compared with 51 out of 53 sampling points at less than 25 mg NO_3/l in 2015. Average nitrate concentrations in the Ballinderry, Blackwater and Lower Bann catchments in 2015 were generally low with all of the monitoring sites below 25 mg NO_3/l. In 2015 four of the six monitoring sites in the Strangford catchment were also below 25 mg NO_3/l, but one monitoring site (Ards groundwater body) had an average concentration between 25 and 40 mg/l. Another site (Belfast East groundwater body), added to the monitoring network in 2011, had an average concentration >50 mg/l in 2015. The Ards site is situated in an area of intensive horticultural activity and its selection was based on the local hydrogeology. A now disused borehole in the vicinity (100 m from the current monitoring site) had previously also exhibited high nitrate concentrations, often >50 mg/l. This borehole was monitored from 2001 to 2006; i.e. prior to implementation of the derogation decision and the nearest derogated land is over 4 km from the current borehole. Monitoring frequencies at the anomalous sites will be increased to observe concentrations and any possible trends in more detail. Further investigations and actions at the two anomalous sites will be implemented as part of the targeted catchment projects in the North Eastern RBD under WFD. This will include engagement with the horticultural sector and other land users in the local areas.

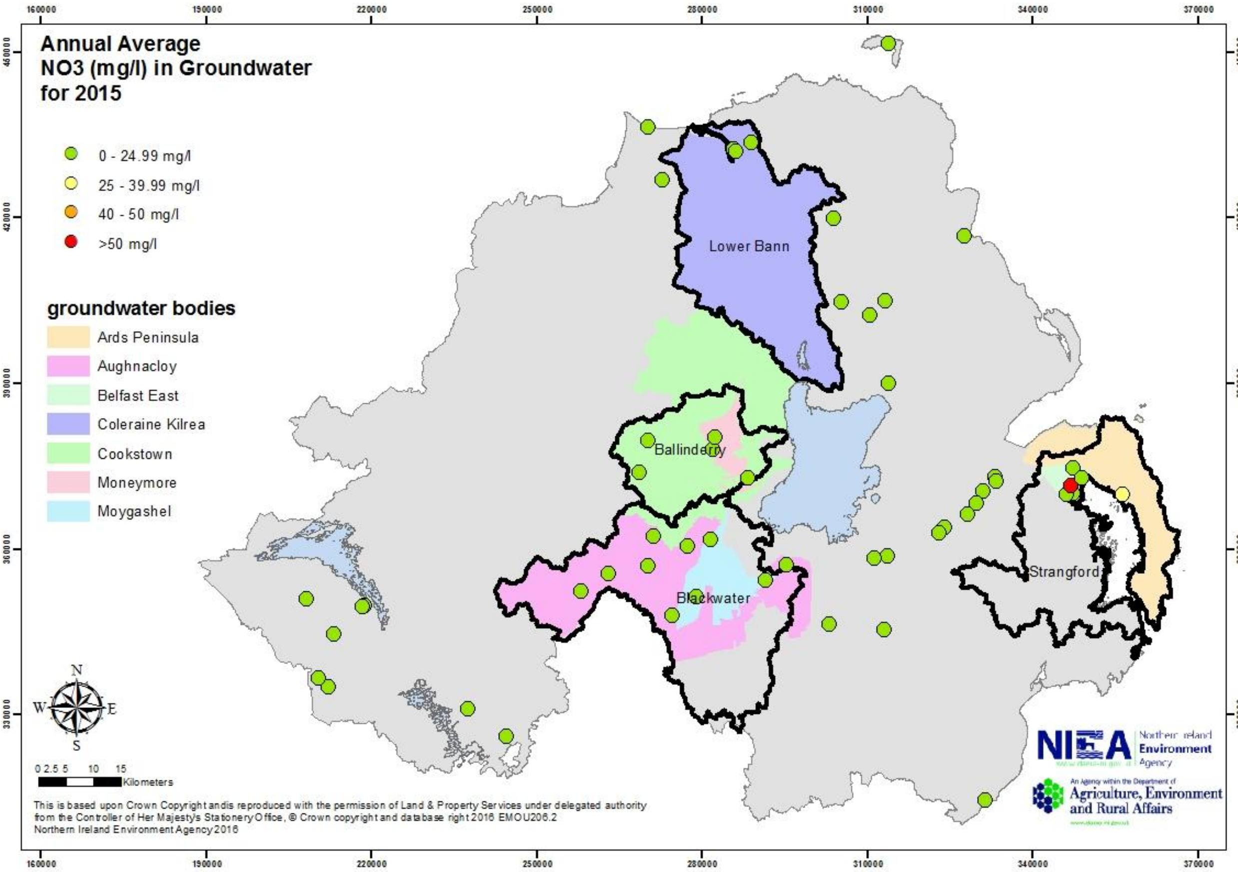

Figure 7: Distribution of annual average nitrate concentrations at groundwater stations in 2015. High Derogation Catchments are labelled and outlined with black line. Sampled groundwater bodies within these catchments are coloured according to legend

Nitrate concentration trends in groundwaters across Northern Ireland, in Table 6, indicate a decrease or stabilisation in three of the four high derogation catchments in 2015 compared to 2008-2011. The parts of the two groundwater bodies (Ards groundwater body and Belfast East groundwater body) within the Strangford catchment both show increases with the range of +1 to +5 mg/l. For the trend assessments averages of the groundwater body parts within each catchment are compared from the 2008-2011 and 2015 time periods.

Table 6: Change in average nitrate concentrations (based on averages per groundwater body part in each catchment) across Northern Ireland and in the high derogation catchments, between 2008-2011 and 2015

Catchment	**groundwater body**	**Difference in average nitrate concentration (mg NO_3/l)**	**> -5**	**-1 to -5**	**-1 to +1**	**+1 to +5**	**> +5**
Northern Ireland					•		
Ballinderry	Cookstown				•		
	Moneymore				•		
Blackwater	Aughnacloy				•		
	Moygashel				•		
Lower Bann	Coleraine-Kilrea		•				
Strangford	Ard Peninsula					•	
	Belfast East					•	

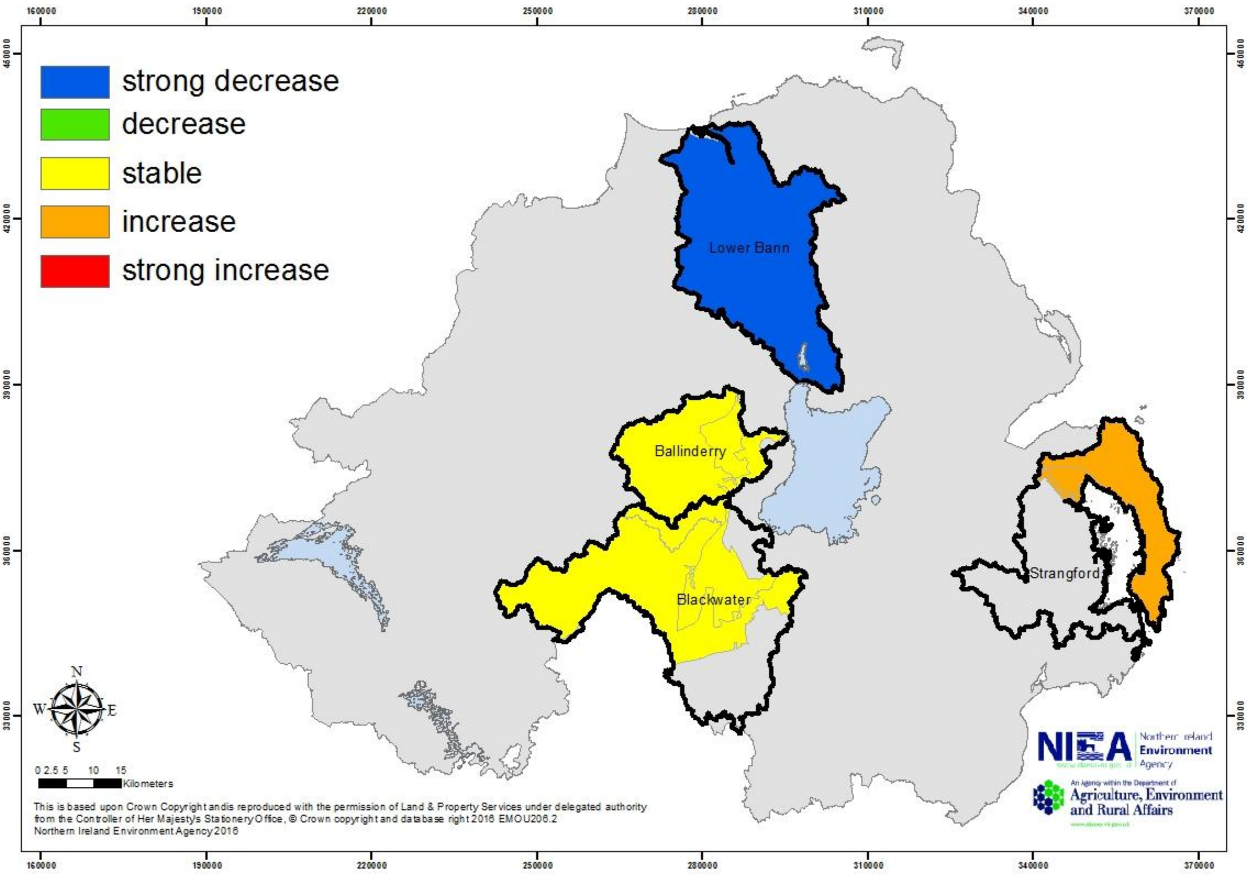

Figure 8: Changes in nitrate concentration averages per groundwater body part in each catchment between the periods of 2008-2011 and 2015

3.3 Eutrophic indicators - phosphorus concentrations in rivers and streams

Since the adoption of the WFD, methodologies for assessment of eutrophication in rivers and lakes have changed. Historically, waters were assessed for trophic status using guidance issued by the UK authorities in 2002. Under the current WFD methodology, as outlined in guidance by the European Commission (2009), freshwater bodies are assessed for trophic status using WFD standards for both phosphorus (P) and biological indicators. For the purposes of this report P is considered on its own and without the supporting biological parameters normally required to classify status. To be consistent in the approach and for temporal comparative purposes Northern Ireland has assessed data from 2008-2015 using type specific WFD P standards.

In the period 2008-2011, NIEA monitored annual soluble reactive phosphorus (SRP) concentrations at 534 surface freshwater river stations across Northern Ireland. The annual average P concentration at these sites was 56 µg SRP/l. In 2015, SRP concentrations were monitored at a reduced number of sites - 127 surface freshwater river stations (common with those monitored in 2008-2011), also giving an annual average P concentration of 56 µg SRP/l.

In 2008-2011, 40 of the monitored surface freshwater monitoring stations were located in the four catchments with the highest proportion of derogated farms and an average phosphorus concentration of 85.8 µg SRP/l was recorded. In 2015, the same 40 stations were also monitored in these catchments with an annual average concentration of 84.9 µg SRP/l. Table 7 shows the WFD status based on the average SRP concentrations in rivers and streams across Northern Ireland for 2008-2011 and 2015.

Table 7: WFD status based on annual average soluble reactive phosphorus (SRP) concentrations (based on % and number of common monitoring stations) of surface freshwater in rivers and streams across Northern Ireland, 2008–2011 and 2015

WFD Class	Northern Ireland	
	2008-2011 (127 Stations)	2015 (127 Stations)
High	78 (61.4 %)	72 (56.7 %)
Good	28 (22 %)	37 (29.1 %)
Moderate	19 (15 %)	15 (11.8 %)
Poor	2 (1.6 %)	3 (2.4 %)
Bad	0	0

Table 8 shows the WFD status based on the annual average SRP concentrations of surface freshwater monitoring stations in rivers and streams in the high derogation catchments in 2008-2011 and 2015. Figure 9 shows the distribution of WFD status based on annual average SRP concentrations across Northern Ireland and the four catchments in 2015.

Annual average SRP concentrations across Northern Ireland in 2015 were generally low, with 85.8 % of sampling points classed as High or Good status compared with 83.4 % in the period 2008-2011 (Table 7). Average SRP concentrations in the Ballinderry catchment were also generally low, ranging from 11.9 to 90.7 µg SRP/l in 2008-2011 and 18.1 to 80.9 µg SRP/l in 2015, with all sites classed as High or Good status in the most recent reporting period. Average concentrations in the Strangford catchment ranged from 19.3 to 381 µg

SRP/l in 2008-2011 and 26.7 to 350 µg SRP/l in 2015. Results show that in 2008-2011, two monitoring stations in this catchment were classed as High or Good status. In 2015, this had improved as four sites were classed as High or Good status. Average SRP concentrations in the Lower Bann catchment were generally low, ranging from 14 to 59.6 µg SRP/l in 2008-2011 and 23 to 47.3 µg SRP/l in 2015, with all sites classed as High status in the most recent reporting period. Average concentrations in the Blackwater catchment ranged from 37.7 to 168 µg SRP/l in 2008-2011 and 44.5 to 199 µg SRP/l in 2015, with no change in the number of sites classed as High, Good or Moderate status between reporting periods (Table 8 and Figure 9).

Table 8: WFD status based on annual average soluble reactive phosphorus (SRP) concentrations (based on number of common stations) of surface freshwater in rivers and streams in the high derogation catchments, 2008-2011 and 2015

WFD Class	**Ballinderry Catchment** (19 sites)		**Strangford Catchment** (13 sites)		**Lower Bann Catchment** (5 sites)		**Blackwater Catchment** (3 sites)	
	2008-2011	**2015**	**2008-2011**	**2015**	**2008-2011**	**2015**	**2008-2011**	**2015**
High	63.2% (12)	36.8% (7)	7.7% (1)	7.7% (1)	60% (3)	100% (5)	33.3% (1)	33.3% (1)
Good	31.6% (6)	63.2% (12)	7.7% (1)	23.1% (3)	40% (2)	0	33.3% (1)	33.3% (1)
Moderate	5.2% (1)	0	76.9% (10)	61.5% (8)	0	0	33.3% (1)	33.3% (1)
Poor	0	0	7.7% (1)	7.7% (1)	0	0	0	0
Bad	0	0	0	0	0	0	0	0

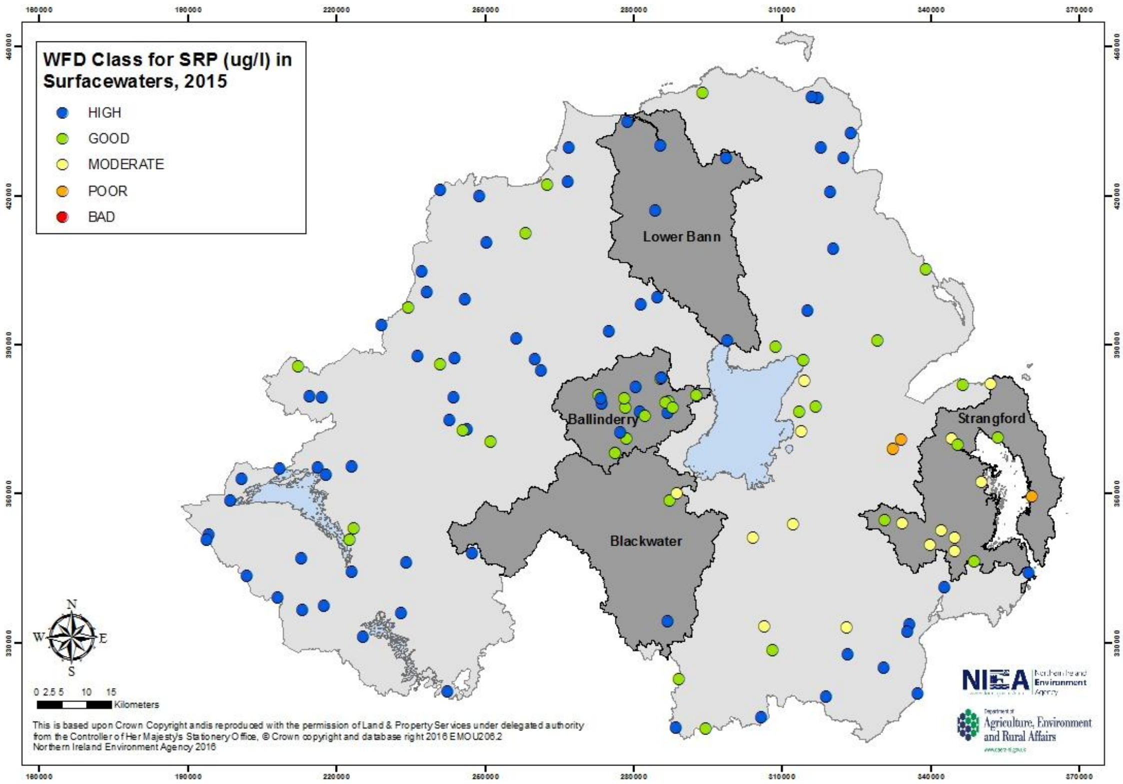

Figure 9: Distribution of WFD status based on the annual average SRP concentrations at surface freshwater stations in rivers and streams in 2015

Trends in annual average SRP concentration shown in Table 9 and Figure 10 indicate a decline or stabilisation at 100% of common surface freshwater monitoring stations in rivers and streams between 2008-2011 and 2015 across Northern Ireland. However, some changes in concentrations did occur which led to changes in WFD status at individual sites. 11.8% (15 sites) deteriorated by one class for WFD P status. 80.3% (102 sites) remained stable in WFD P status and 7.9% (10 sites) exhibited an improvement in class between the two reporting periods. As previously highlighted, these results should be treated with a degree of caution as natural variation in nutrient concentration is expected year to year due to seasonal and climatic changes. All monitoring stations showing higher concentrations of SRP or decline in WFD status for P will be subject to further investigations and actions as part of the relevant targeted catchment projects under WFD for each of the RBDs. This will include engagement with the sewerage undertaker, home owners and farmers in the local areas, to follow up actions arising from reported pollution incidents and improve water protection. Further long term trend analysis of SRP data based on common sampling points over the period 2008–2015 is currently in progress for reporting under Article 10 of the Nitrates Directive.

Table 9: Change in average soluble reactive phosphorus concentrations (based on % and number of common monitoring stations) of surface freshwater in rivers and streams across Northern Ireland and in the high derogation catchments, between 2008-2011 and 2015

Difference in average Soluble Reactive Phosphorus concentration (µg NO_3/l) 2008-2011 – 2015	**% and number of common monitoring stations**		
	Decrease[1]	**Stable[2]**	**Increase[3]**
Northern Ireland (127 Stations)	0.7% (1)	99.2% (126)	0
Ballinderry Catchment (19 Stations)	0	100% (19)	0
Strangford Catchment (13 Stations)	7.7% (1)	92.3% (12)	0
Blackwater Catchment (3 Stations)	0	100% (3)	0
Lower Bann Catchment (5 Stations)	0	100% (3)	0

Difference is assessed by change in concentration – [1]Decrease ≤ -50 µg/l, [2]Stable -50 to +50 µg/l, [3]Increase ≥ +50 µg/l

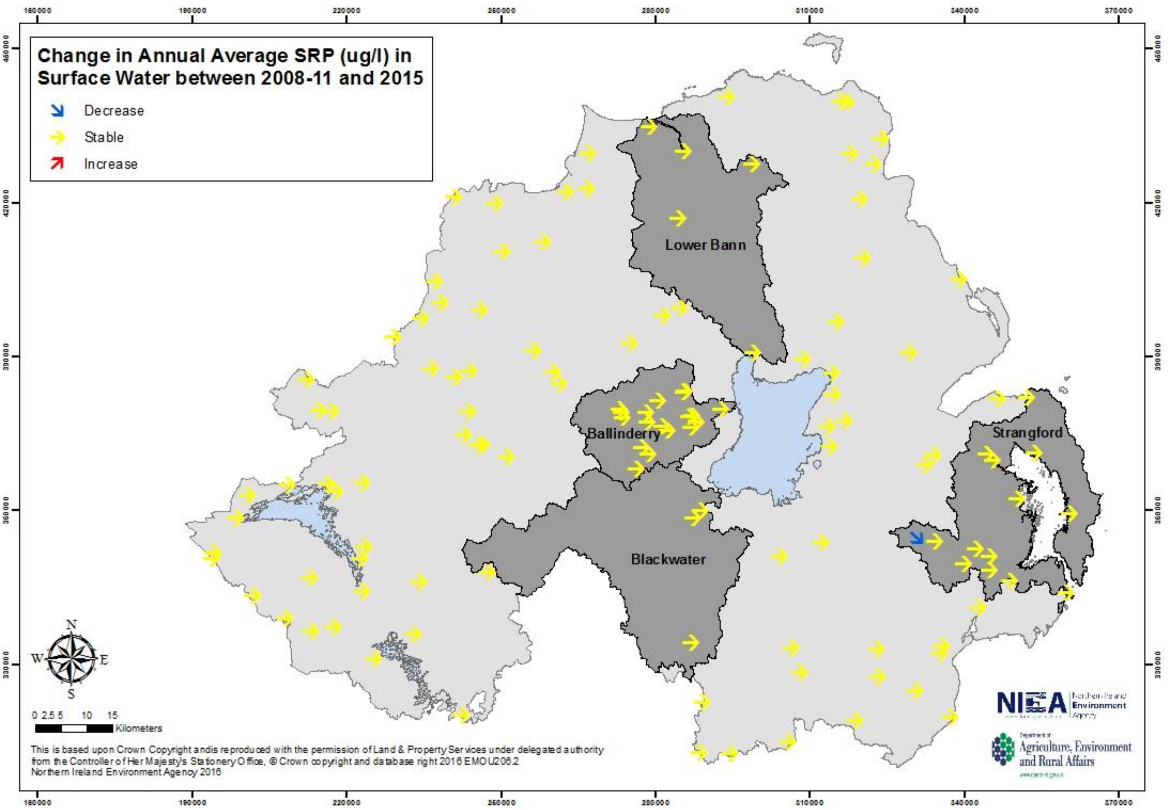

Figure 10: Change in annual average soluble reactive phosphorus (SRP) concentrations in surface water between 2008-2011 and 2015

3.4 Eutrophic indicators - phosphorus concentrations in lakes

For the purposes of this report total phosphorus (TP) is considered on its own as a eutrophication indicator and without the supporting data on chlorophyll-α and biology normally required to classify under the WFD.

In the WFD classification period 2009-2011, NIEA monitored annual TP concentrations at 28 WFD lake and reservoir monitoring stations (Lower Lough Erne is divided into two water bodies) across Northern Ireland, including those with a surface area greater than 50 ha (known as surveillance lakes) and a number selected for intercalibration purposes. In 2015, the lake surveillance network comprised of 21 ≥50 ha lakes. The smaller lakes (≤50 ha) that were previously monitored in the period 2009-2011 for intercalibration purposes are no longer monitored on a monthly basis and therefore are not included in this report. The annual average TP concentration for the 21 common surveillance stations was 65 µg TP/l for the period 2009-2011 and 72 µg TP/l for 2015.

Table 10 and Figure 11 show that in 2015, eight lakes and reservoirs were classed as High or Good WFD status whilst 13 were classed as Moderate, Poor or Bad WFD status. Although there has been no change from 2009-2011 in the number of lakes classed as High or Good status, Lough Mourne showed an improvement in WFD TP class between the two reporting periods (Poor to Moderate TP status). Two lakes (Lough Neagh and Portmore Lough) were classed as Bad WFD TP status in both 2009 and 2015. Three lakes exhibited deterioration in TP status between the two reporting periods – Lough Melvin deteriorated from High to Good, Lower Lough Erne at Devenish deteriorated from Moderate to Poor and Portmore Lough deteriorated from Poor to Bad TP status. Lough Beg (Poor status) and Lough Neagh (Bad status) are in the Lower Bann derogated catchment and Clea Lake (Poor status) is in the Strangford derogated catchment. All lakes exhibiting eutrophic conditions will be subject to further investigations and actions as part of the relevant RBD programme of targeted catchment projects under WFD.

Table 10: WFD status based on average total phosphorus (TP) concentrations (based on number of common monitoring stations) of WFD surveillance lakes and reservoirs across Northern Ireland, 2009-2011 and 2015

WFD TP Class	Northern Ireland	
	2009-2011 (21 stations)	2015 (21 stations)
High	6	5
Good	2	3
Moderate	4	4
Poor	8	7
Bad	1	2

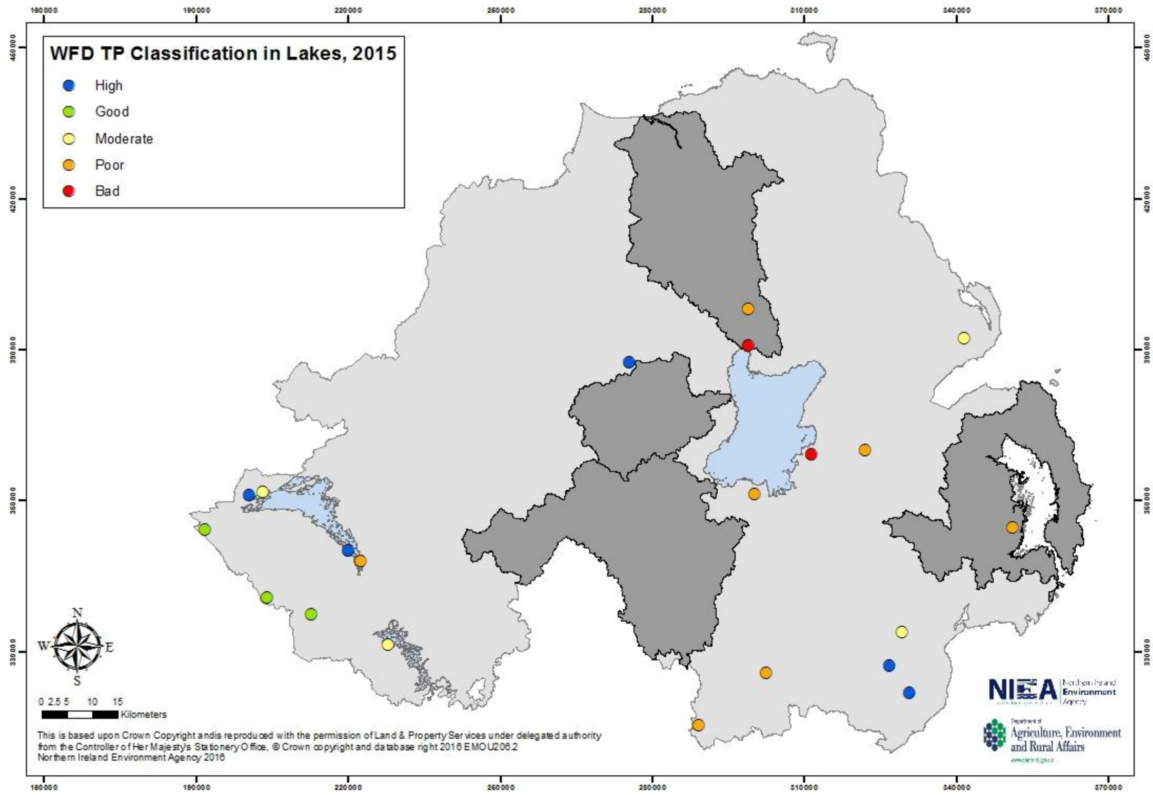

Figure 11: Distribution of WFD status based on annual average total phosphorus (TP) concentrations in surveillance lakes and reservoirs in 2015

4. SOIL MONITORING

To meet the requirements of Article 8(2) of the 2015 Derogation Decision, a detailed monitoring program is being set up. It will provide relevant soil P data for modelling P losses from derogated and non-derogated farms on the main soil types of Northern Ireland and information on farming practices etc on derogated and non-derogated farms.

A pair of sub-catchments has been identified in the Upper Bann River Catchment (Figure 12). One sub-catchment has a significant proportion of derogated farmland and the other has no derogated farmland (Figure 13), in which There are a total of 713 fields and all will be soil tested.

In accordance with Article 8(2) of the 2015 Derogation Decision, the most important soil profile types in Northern Ireland, i.e. Gleys (57%), and also the most important Hydrology of Soil Types (HOST) classes (17-24) particularly 24, i.e. soils developed on slowly permeable material (54%), are well represented within this pair of sub-catchments. The requirement to monitor soils on farms with *"levels of intensity and fertilisation practices"* typical for Northern Ireland has also been fulfilled by having two contrasting small sub-catchments with either some or no derogated farmland.

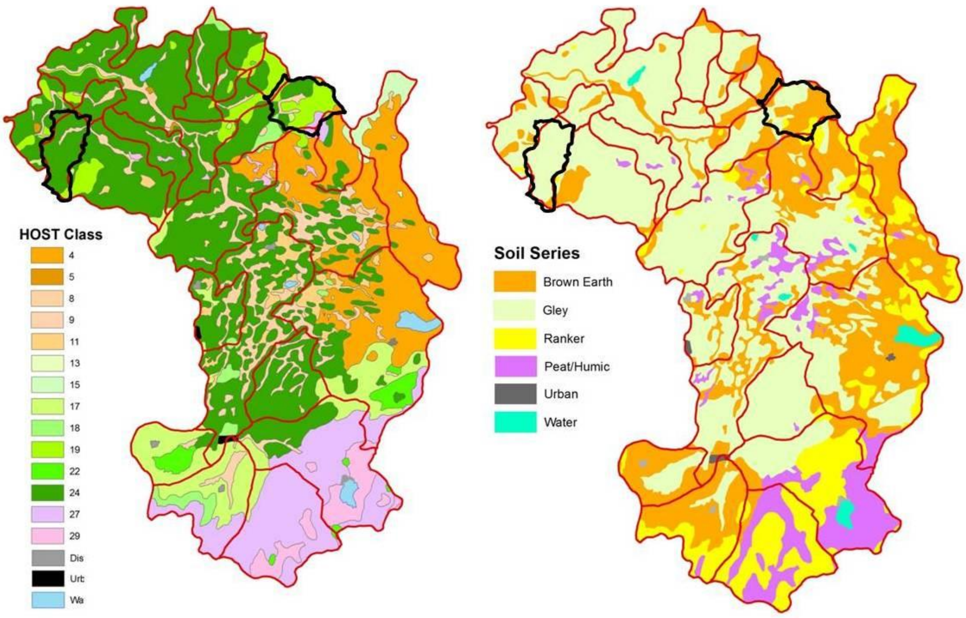

Figure 12 Maps of the Upper Bann River Catchment indicating soil types and Hydrology of Soil Types (HOST) classifications present in selected pairs of derogated and non-derogated sub-catchments.

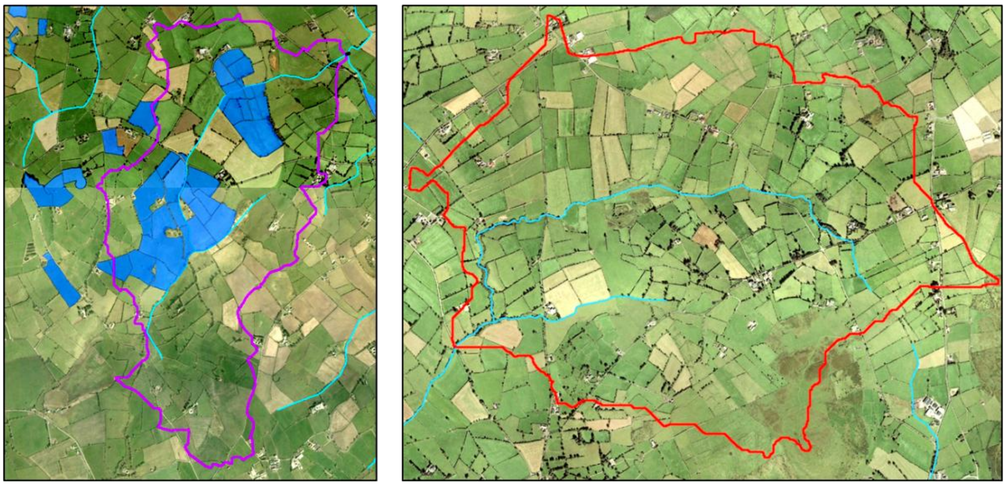

Figure 13 'Derogated' (UB03) and Non-derogated (UB15) sub-catchments in the Upper Bann (UB) catchment with derogated farmland coloured blue.

Because of the time needed to identify these sub-catchments and to obtain farmer agreements and participation in 2015 and early 2016, data collection will commence in the autumn of 2016.

4.1 Nitrogen and Phosphorus concentrations in soil water under derogated and non-derogated conditions

As indicated above, soil monitoring will commence in the autumn of 2016, and hence there are no data to report on in the current reporting period. However, soil monitoring data for 289 fields in the derogated (UB03) sub-catchment in Upper Bann will be available for reporting in June 2017 covering the 2016-2017 derogation period. Thereafter, in the autumn of 2017, soil monitoring will be conducted on the remaining 549 fields in the non-derogated (UB15) sub-catchment, and this data will be available for reporting in June 2018 covering the 2017-2018 derogation period.

Article 8(2) of the 2015 Derogation Decision requires assessments to be made of N and P concentrations in soil water, to facilitate model-based estimates of nitrate and P losses from farms benefiting from derogation. However, these assessments are not considered to be appropriate in grassland situations for the following reasons.

The procedures for measuring N (*nitrate and ammonium*) and P (*SRP and total P*) concentrations in soil water (*solution*) are both difficult and problematic necessitating either vacuum plate extraction of soil solutions from individual intact soil cores, or the installation of ceramic suction cups in soil profiles to collect soil water/solution samples in situ. In commercial farming situations the ceramic cup apparatus can easily be damaged by farm machinery or livestock.

Furthermore, obtaining representative samples of soil solution is difficult because of preferential flow pathways which form along root channels or crevices allowing some downward flowing water to bypass the samplers (Ryan *et al*., 2006). An additional difficulty is the fact that the soil water samples collected by either technique are point-specific, since they are taken from single points within a field. Consequently, to allow for the high degree of spatial heterogeneity in N and P concentrations across grassland fields

(Cuttle *et al*., 2001; McCormick *et al*, 2009), scores of points would have to be sampled, and this would simply not be cost-effective or practicable.

Temporal heterogeneity is also a problem, as nutrient levels in soil solution are subject to appreciable short-term fluctuations, owing to rainfall dilution etc (Magid & Neilsen, 1992). Assessments of N and P concentrations in soil water therefore, do not provide a basis for predicting mean annual N and P losses to water at field and farm scales on grassland farms in Northern Ireland.

The factor most responsible for 'poor' water quality in Northern Ireland is P mobilisation from farmland into freshwater ecosystems and the resultant upsurge in algal growth in this P-limited rather than N-limited environment (Parr & Smith, 1976; Gibson & Stevens, 1979).

Consequently, to assess the impact of derogation on water quality, primary emphasis will be placed on quantifying the risk of P loss, rather than N loss, from farmland. In this regard, researchers in New Zealand have demonstrated that soil Olsen-P, which provides a measure of legacy soil P, is significantly correlated with both dissolved reactive phosphorus (DRP) and total P concentrations in overland flow from grassland sites on a broad range of soil types (McDowell *et al*., 2003).

Importantly, this soil parameter (*Olsen-P*) can be measured on bulked subsamples of soil (*0-75 mm depth*) easily collected from multiple locations across whole fields, as opposed to the single point locations associated with measurements of soil water P concentrations, thus minimising problems owing to spatial heterogeneity in soil P - as noted above. Moreover, Olsen-P assessments appear to be temporally quite stable (Shi *et al*., 2002).

In addition, the bulked soil samples could also be analysed for $CaCl_2$- P, which can provide a proxy estimate of DRP concentration in soil sub-surface flow (McDowell *et al*., 2003). These complementary soil P assessments, together with information and data on soil hydrology and connectivity, and on farm nutrient management practices, will then be used to model and compare P losses from derogated and non-derogated farms.

N is rarely limiting to algal growth in freshwater bodies in Northern Ireland (Parr & Smith, 1976; Gibson & Stevens, 1979), and mean nitrate concentrations in surface and ground waters in almost all cases are well below the EU maximum admissible limit for drinking water (Northern Ireland NAP Review Report, 2014). However, modelling N losses from derogated farmland is still important to ensure that derogation measures are effective in preventing any deterioration in water quality attributable to N losses linked to farming.

As outlined above, soil N assessments are both problematic and poorly related to N loss by leaching or runoff. Therefore, information and data on soil type, soil hydrology and connectivity, and details of farming practices will be used to model and compare N losses from derogated and non-derogated farms.

In summary, soil Olsen-P and $CaCl_2$-P concentrations will be monitored in soils instead of P concentrations in soil water, and that in the absence of suitable soil N metrics, model estimates of nitrate loss from farms will be based primarily on soil typology and hydrology plus local climatic and farm management information.

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4.2 Mineral nitrogen (N) in soil profile under derogated and non-derogated conditions

As indicated above, data collection will commence in the autumn of 2016, and hence there are no results to report for the 2015-2016 reporting period. However, as outlined below, measurements of mineral N will not be made, but rather estimates of nitrate loss from farms will be modelled based on soil typology and hydrology plus local climatic and farm management information. The latter information will be available in early 2017 to allow the modelling to proceed. It is anticipated, though, that full results from modelling of potential for nitrate loss from derogated land will be available to report in June 2018.

Assessments of mineral N in soil profiles, which involve the collection of deep soil cores (*up to 900 mm depth*), each of which is separately analysed for mineral N, and the periodic soil N assessments to be made on derogated farms as specified in Article 5(6) of the 2015 Derogation Decision are not appropriate for predicting N losses to water from grassland for the following reasons:-

a) They provide only a snap-shot in time of the amounts of mineral N present in soil, and it is known that mineral N pools fluctuate appreciably over time owing to a number of competing loss processes, and not just nitrate leaching/runoff. Lysimeter studies in Northern Ireland at the Hillsborough farm research site show that when chemical N inputs to grassland exceed 300 kg N ha^{-1} yr^{-1}, losses of nitrate from soil significantly exceed the amounts released into ground or drainage waters almost certainly because of gaseous (denitrification) N losses (Mills, 1997), which can be substantial (*i.e. > 70 kg N* ha^{-1}) on NI grassland (Jordan, 1989). It is also worth noting that researchers in Ireland failed to find any relationship between mineral N concentrations in grassland soils and nitrate concentrations in ground waters (Humphrey's *et al*., 2008).

b) Because soil cores (*0-900 mm*) taken to assess mineral N in soil profiles are collected at single points within fields, the N values obtained are point-specific. Consequently, large numbers of cores must be collected and analysed to accommodate the high degree of spatial heterogeneity in soil mineral N supply and formation (Murphy *et al*., 2013) across fields, particularly in grazing situations (Cuttle *et al*., 2001; Hutchings *et al*., 2007), but also under cutting management (Bailey *et al*., 2001) - and this would not be cost-effective or practicable.

Therefore, model estimates of nitrate loss from farms will be made based on soil typology and hydrology plus local climatic and farm management information instead of mineral N assessments in soil profiles.

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5. REINFORCED WATER MONITORING

5.1 Summary of results from reinforced water monitoring in agricultural catchments in proximity to most vulnerable water bodies

As outlined above, because the new derogation monitoring work will not commence until later in 2016, and because the reinforced monitoring conducted under the previous derogation was suspended two years ago (see below), there are no results to report in the current reporting period (2015-2016). Renewed monitoring will commence in the autumn of 2016, and preliminary results for at least part of the hydrological year should be available for reporting in June 2017 covering the 2016-2017 derogation reporting period. Thereafter, the results for each complete hydrological year will be reported annually.

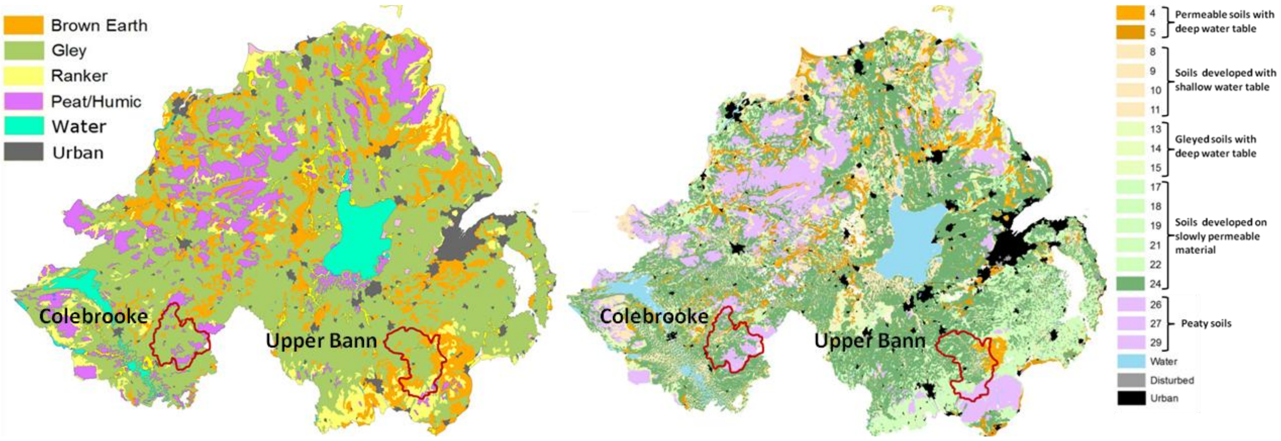

Figure 14 (a) General soil profile types in NI, and **(b)** General Hydrology of Soil Types (HOST) classes in NI

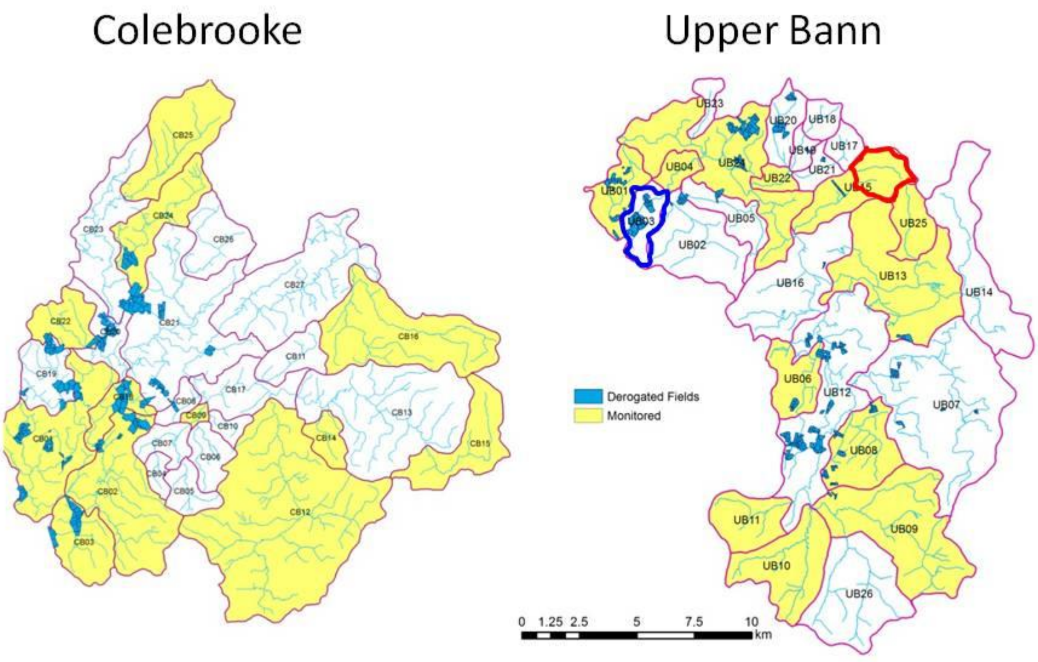

Figure 15 Colebrooke and Upper-Bann Catchments showing locations of sub-catchments (in yellow) for renewed water chemistry monitoring, locations of derogated fields (in blue), and also the locations of 'small' 'derogated' (blue outline) and non-derogated sub-catchments (red outline) for comprehensive monitoring of surface waters, ground waters, soils and nutrient inputs-outputs.

The new amplified program of nutrient monitoring is due to commence in the autumn of 2016 in 24 previously monitored sub-catchments in the Upper Bann and Colebrooke; 12 sub-catchments in each catchment (Figure 15). This will provide evidence for the 2016-2017 annual derogation report and subsequent annual reports under Article 8(3) and Article 10(4) of the 2015 Derogation Decision.

The revised program will attempt to address limitations with respect to resolution and precision evident in the 2009-2014 sampling program, in which bi-monthly sampling failed to produce consistent evidence of increases or decreases in N and P concentrations in rivers either annually or seasonally thus limiting our ability to assess the efficacy of derogation measures.

In assessing changes in P loss from headwater catchments Bieroza *et al*. (2014) and Burt *et al*. (2011) argued that discrete sampling programmes (*fortnightly to monthly resolution*) would be able to detect long term trends (>10 years), but that identification of significant shorter term changes would require high frequency monitoring of stream P concentrations (*sub-hourly continuous/hydrological event sampling resolution*).

Declines in N and P concentrations in streams in the Colebrooke and Upper Bann catchments between 1990 and 2009, largely as a result of controls on agricultural point source pollution, were sufficiently pronounced that statistically significant trends were evident. In contrast, between 2009 and 2014 the rates of decline in N and P concentrations were much smaller and hence more difficult to detect at fortnightly sampling intervals.

Therefore, in the new program, bi-monthly sampling will be supplemented with targeted storm flow event sampling. Event sampling will capture periods when diffuse losses are dominant and counter the bias of routine grab sampling towards low flows in which point source signatures are more prevalent particularly in the ‘flashy’ hydrological regimes in Irish rivers.

Furthermore, in two additional contrasting small sub-catchments (*for comprehensive monitoring*) in the Upper Bann, one containing about 20% derogated farmland (derogated) and the other none (non-derogated) (Figure 15), both routine grab sampling and storm flow event sampling will be conducted.

Groundwater monitoring is a key requirement under Article 8 of the 2011 Derogation Decision for Northern Ireland, and is currently carried out by NIEA. Currently, NIEA are monitoring one borehole in the Colebrooke catchment and one in the Upper Bann catchment. To increase spatial resolution and focus on potential agricultural impacts on groundwater status, in the two contrasting sub-catchments in the Upper Bann catchment, a baseline survey will be undertaken in the autumn of 2016 to identify wells and springs suitable for sampling. Potential threats to water quality in each well/spring will be noted during sampling. Following an initial monitoring round, a sub-set of wells/springs will be identified and monitored annually, thereafter, from 2017 onwards.

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6. LAND USE AND AGRICULTURAL PRACTICE ON DEROGATED FARMS

6.1 Land use, cropping and agricultural practice on derogated farms

Agricultural holdings account for approximately 74% of Northern Ireland's land area, with 93% of the agricultural area being grassland. 89% of farms are classified as being mainly grazing livestock using EU farm classification typology. Farm businesses operating under approved derogation in 2015 followed this pattern. Grazing and non-grazing livestock and crops are detailed in Table 11.

Table 11: Farming activity on farm businesses operating under derogation in 2015

Farm Type	Number of farm businesses 2015	Percentage of derogated farms 2015
Cattle	120	57
Cattle and sheep	37	17.5
Cattle and poultry	8	4
Cattle, sheep and poultry	6	3
Cattle and pigs	1	0.5
Cattle and crops	37	18
Total:	**209**	**100**

Of the 37 farms with crops, 28 grew a single crop and the remaining 9 grew multiple crop varieties. Land areas on individual farms ranged from 0.59 to 37.22 ha. Crops are summarised in Table 12.

Table 12: Crops on farm businesses operating under derogation in 2015

Crop	Number of farm businesses 2015	Land area (ha)
Spring wheat	12	90.31
Winter wheat	11	89.48
Maize	3	34.82
Spring barley	10	75.8
Winter barley	4	33.28
Potatoes	2	0.89
Spring oats	3	9.38
Oats/ peas	1	0.59
Other	3	16.83
	Total land area:	**351.38**

7. MODELLING

7.1 Results of model-based calculations of nitrate and phosphorus losses from derogated farms

As indicated above, data collection to support model-based calculation of nitrate and P losses from derogated farms will not commence until later in 2016, and hence there are no results to report for the 2015-2016 reporting period. As outlined below, it is anticipated that by June 2017, the modelling approaches will have been tested and validated under Northern Ireland conditions. Results of model-based calculations of nitrate and P losses from derogated farmland will probably not be available to report until June 2018.

Once relevant soil and farm nutrient management data have been collected from farms in the derogated and non-derogated pair of sub-catchments in the Upper Bann Catchment (Figure 15) along with early results of water quality monitoring, an advanced export coefficient modelling approach will be used at farm-scale on selected derogated and non-derogated farms in each sub-catchment. It is expected that the FARM Scale Optimisation of Pollutant Emission Reductions (FARMSCOPER) decision support tool (Gooday *et al*., 2014), or an equivalent type of model, will be used to estimate diffuse losses of P, N and sediment from individual farms and to identify the potential impacts of mitigation measures.

FARMSCOPER was specifically developed and tested for use within England and Wales, and hence some modifications may be required for its application within Northern Ireland, specifically in relation to soil typologies and climatic zones contained in the model. In England and Wales three soil types were selected to cover the main pathways for pollutant transfer: (1) free-draining permeable soils, (2) impermeable soils artificially drained for arable cultivation; and (3) impermeable soils drained for either arable/grassland cultivation. These may require modification for a Northern Ireland context with implementation of the *Phosphorus and Sediment Yield Characterisation in Catchments (PSYCHIC*), *National Environment Agricultural Pollution (*NEAP-N) and *MANure Nitrogen Evaluation Routine (*MANNER) models to generate area-weighted pollutant losses for each soil typology and climatic zone.

FARMSCOPER allows farms to be specified individually and the pollutant losses and potential efficacy of a range of 70 mitigation approaches to be assessed (Newell Price *et al*., 2011), with economic costs calculated as an option if desired. The most recent development (FARMSCOPER 3) allows for up-scaling through use of multiple farm-scale simulations to produce results at catchment or sub-catchment scales. The outputs of the model will provide estimates of nutrient exports from farms as well as identifying the most effective measures for mitigating these losses (Gooday *et al*., 2014).

However, to target measures cost-effectively within farms, identification of potential hotspots of nutrient loss, i.e. critical source areas (CSAs), is required. This can be achieved by modelling the hydrological connectivity of the farms following the source-pathway-receptor approach (Haygarth *et al*., 2005) and employing a methodology such as SCIMAP (Reaney *et al*., 2011), which when combined with soil P data for each field should be able to identify fields on farms that pose the greatest risk to water quality and where mitigation measures should be focused.

Catchment scale modelling of land use practice impacts will also be attempted utilising Soil and Water Assessment Tool (SWAT) (Arnold *et al*., 2012) or the Source Apportionment Geographic Information System (SAGIS) modelling framework (Comber *et al*., 2013) to model N and P contributions from multiple sources within the Colebrooke catchment (*and also in the Upper Bann Catchment – budget permitting*).

Having derogated and non-derogated farms within both main river catchments and high frequency storm flow event sampling in the contrasting three small sub-catchments will facilitate up-scaling of the modelling of nutrient losses from farm to catchment scale. Results of soil P analyses (Olsen-P) from derogated farms, under Article 5(6) of the 2015 Derogation Decision, will be used to assess the overall impact of derogation on P losses from farmland across Northern Ireland.

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8. COMPLIANCE WITH THE DEROGATION CONTROLS FOR 2015 AND 2016

8.1 Derogation controls in Northern Ireland

NIEA, on behalf of DAERA, is the competent authority for enforcement of the NAP legislation in Northern Ireland. In accordance with Article 4 of the 2015 Decision, the 2014 NAP Regulations require farmers in Northern Ireland who wish to benefit from derogation to submit an annual application to the NIEA by 1 March for that calendar year. NIEA have 28 days from receipt to make a decision on whether to grant or refuse the application.

The Regulations also require farmers in Northern Ireland to prepare and keep a fertilisation plan for the calendar year in accordance with Article 5 of the 2015 Decision. This must be available on derogated farms no later than 1 March of that calendar year.

Additionally, in accordance with Article 5 of the 2015 Decision, the Regulations require farmers in Northern Ireland to submit fertilisation accounts to NIEA for the previous calendar year by 1 March of the following year. Therefore, applications for derogation must be accompanied by the fertilisation account for the previous year, where relevant.

8.2 Compliance with the derogation controls

Compliance with the Decisions is assessed in three key ways:-

1. administrative checks of derogation applications for the current calendar year;
2. on-farm inspections of records from previous years, current fertilisation plans, farm facilities and fields; and
3. administrative checks of fertilisation accounts for the previous calendar year.

8.2.1 *Administrative checks of 2016 derogation applications*

In 2016, there were 297 approved derogation applications and seven refused applications. These were refused for the following reasons: (four were received after 1 March 2016 deadline; two were over the 250 kg N/ha/yr limit and 1 did not have 80% grassland).

8.2.2 *2015 On-farm inspections*

In accordance with the 2007 Decision (valid (as amended in 2015) until the end of 2018), at least 5% of derogated farms must be selected for on-farm inspections. In 2015, a total of 226 farmers had received approval for derogation from NIEA. (Originally 230 farm businesses were considered to be operating under approved derogation in 2015, however four farms provided evidence to NIEA that they could comply with 170 kg N/ha/yr limit and were withdrawn). Twelve of these farms (5.3%) were selected for on-farm inspections. During inspection derogated farms are assessed against all of the NAP and Derogation requirements.

Tables 13 and 14 indicate the findings of on-farm inspections of farms operating under an approved derogation in 2015. There was one non-compliance detected on each of two farms (out of 12 inspected). These were due to mismanagement of storage facilities for silage effluent and insufficient livestock manure storage capacity.

Table 13: Breach type and frequency from derogation inspections, 2015

Breach Description	Number of breaches
Insufficient storage capacity	1
Management of storage facilities	1
TOTAL	**2**

Table 14: Breach severity from derogation inspections, 2015

Breach Description	Number of breaches
HIGH	1
LOW	1
TOTAL	**2**

8.2.3 *Administrative checks of fertilisation accounts for 2015*

In 2015, a total of 230 farmers had approved derogations. Four of these farm businesses withdrew in year, one farm merged business with another derogated farm and one farm has failed to submit a fertilisation account to date. In addition sixteen farmers provided evidence to NIEA that they had operated below the 170 kg N/ha/year limit. Of these 16 farms, four failed to submit fertilisation accounts by 1 March 2015. Of the remaining 208 farms, 99.5% of fertilisation accounts for the calendar year 2015 were received by NIEA on or before 1 March 2016.

Table 15 shows the finalised results of administrative checks on the 208 fertilisation accounts submitted in 2016 for the calendar year 2015. Compliance with the rules has improved compared to 2015. Targeted training and amended guidance for 2015–2018 relating to the new Nitrates Action Programme 2014 Regulations should assist compliance levels. A total of 8 non-compliances were detected in the accounts of 8 farm businesses. Non-compliance was mostly aligned to the P balance, grazing livestock N loading of greater than 250 kg N/ha in 2015 and application of chemical fertiliser to grassland. NIEA continues to engage with colleagues in the Department and stakeholder groups regarding these non-compliances.

Table 15: Compliance of fertilisation accounts for 2015

Measure Description	Average (min-max)	Number of Breaches
80 % grassland	98 (80– 100)	0/208
Total grazing livestock N (up to 250 kg N/ha/year)	216 (170–302)	2/208
Total livestock manure N loading (170 kg N/ha/year non-grazing + 250 kg N/ha/year grazing)	216 (170–252)	See above

Measure Description	Average (min-max)	Number of Breaches
Total chemical N fertiliser usage on grassland (not to exceed 272 or 222 kg N/ha/year for dairy or other farms respectively)	175 (0–277)	1/208
Total chemical N fertiliser usage on land other than grassland (not to exceed crop requirement)	145 (0–225)	0/34*
Phosphorus balance up to 10 kg P/ha/year	5 (-12–18)	5/208
No, partial or late records	N/A	1/208

**Statistics based on 34 farms which had land other than grassland and which used chemical N fertiliser.*

Table 16: Predicted and observed statistical values (verified for land area) for farm businesses which operated under derogation in 2015

Average (min-max)	Predicted from applications 2015	Fertilisation accounts 2015
Grassland area (%)	98 (83–100)	98 (80–100)
Farm size (ha)	86 (10-370)	86 (13–333)
Total livestock manure N loading (kg N/ha/year)	205 (12–250)	216 (170 - 252)
Grazing livestock manure N loading (kg N/ha/year)	206 (12–250)	216 (170–302)
Chemical N fertiliser usage (kg N/ha/year)	N/A	175 (0–277)
Phosphorus (P) balance (kg P/ha/year)	N/A	5(-12-18)

Table 16 shows statistics for observed values for the 208 farm businesses that submitted fertilisation accounts for the calendar year 2015. The values are calculated (using land areas verified through cross-checks with other data sources) from information supplied in the fertilisation accounts. Observed values are compared, where possible, to predicted values from the initial 230 approved derogations. Fertilisation accounts which have produced outlying values are likely to be examined further and the farm business may be more likely to be subject to an on-farm inspection (due to a higher environmental risk rating).

9. GUIDANCE AND TRAINING TO SUPPORT THE DEROGATION

9.1 Nitrates derogation guidance

In 2015 DARD and DOE, (now a combined singular Department – DAERA) jointly produced updated guidance for the revised 2015-2018 NAP to support implementation of the nitrates derogation. In January 2016, all farm businesses which had a derogation in 2015 received an updated Fertilisation Account booklet, a Phosphorus Balance workbook, a Fertilisation Plan booklet, an application form for 2016 and a letter reminding them to submit their Fertilisation Account for 2015 by 1 March 2016 and also to submit their application form for 2016 by the same date if they wished to continue to have a derogation.

9.2 Nitrates derogation training

In 2015 the College of Agriculture, Food and Rural Enterprise (CAFRE) within the previously named DARD (now DAERA) continued to provide a wide range of support and training on the NAP for farmers in Northern Ireland. Farmers operating under derogation in 2015 were supported by CAFRE Dairy Development Advisers on a one to one basis as and when requested.

9.3 Other training associated with Nitrates Action Programme

Other training related to the NAP and Nitrates Derogation that took place in 2015-2016 included 32 courses on Nitrates and Nutrient Management with 576 farmers attending.

9.4 Farm nutrient management calculators

As described in the previous report, CAFRE has lead responsibility for the development and maintenance of a suite of five on-line calculators designed to help farmers to manage their farms to comply with various aspects of the NAP Regulations. The calculators are available on the DAERA web-site at: www.daera-ni.gov.uk. The calculators continue to be well used and Table 17 shows the number of unique users for each of the on-line versions of the calculators at April 2016.

Table 17: User numbers for on-line calculators

Calculator	Number of users at June 2015
Livestock Manure Nitrogen Loading	2,753
N Max for Grassland	327
Crop Nutrient Recommendation	814
Phosphorus Balance	199
Livestock Manure Storage	872

Please note some of the numbers reported have reduced and this is due to the server being changed during 2015 and records had to start over again from July 2015.

9.5 Other communication methods

In 2015-2016 DARD (now DAERA) issued technical information in the form of a number of press articles and management notes through various channels including the agricultural press, Departmental e-newsletter and the Farm Advisory System Newsletter to update farmers on water quality and nutrient issues, promote the nitrates derogation and nutrient management planning. These articles are also published on DAERA's website along with frequently asked questions, NAP regulation and derogation information booklets, and booklets for derogation fertilisation plans, accounts and worksheets.

DAERA continues to highlight the NAP regulations, including nitrates derogation, at a variety of agricultural shows, events and meetings. For example, in meetings held by the CAFRE Dairy Development Advisers in January and February 2016 they clearly remind farmers about the need to meet the 1 March 2016 deadline for submission of their Fertilisation account and next year's derogation application.

10. RESEARCH PROJECTS

In order to underpin the implementation of the Directive and the action programme measures in Northern Ireland, DARD (now DAERA) commissioned AFBI to carry out a range of research projects during the period 2008-2012. Some of the research was undertaken in accordance with Articles 8.2-8.6 of the 2007 Derogation Decision for the UK, granting derogation for intensive grassland systems, and is still on-going. Further research in support of the 2015-2019 derogation and NAP has also been commissioned by DAERA. A summary of key findings from on-going research, and details of new research projects, are provided in this section.

10.1 Project 0618 - Monitoring the effectiveness of the nitrates action programme for Northern Ireland (On-going research)

Under Article 8.6 of the 2007 Derogation Decision for the UK, and as part of monitoring the effectiveness of the NAP for Northern Ireland, a representative soil sampling scheme (RSSS) has been operated by AFBI since 2004, to identify the impact of the NAP on soil fertility in Northern Ireland, especially on soil Olsen-P. In the RSSS, 500 grassland fields across Northern Ireland are sampled, 100 per year, on a five-year rolling basis. The fields selected were located on intensively stocked, but non-derogated farms (operating at near to the 170 kg N/ha manure loading limit).

Comparing the mean Olsen-P concentrations (in the 0-75 mm soil layer and the complete A horizon) across all sites in the first five-year period (2004-2008) with those in the second five-year period (2009-2013), revealed small but significant ($P \leq 0.02$) increases in soil Olsen P with time, in both the 0-75 mm soil layer (41.69 mg Olsen-P l^{-1} for 2009-2013 compared to 40.19 mg Olsen-P l^{-1} for 2004-2008) and the A horizon (39.19 mg Olsen-P l^{-1} for 2009-2013 compared to 35.06 mg Olsen-P l^{-1} for 2004-2008). Although statistically significant, the increases are small in real terms and likely to be of minimal environmental significance. Analysis of the latest paired RSSS samples (100 sites, sampled in 2014-2015 compared with the same sites sampled in 2009-2010) indicate no significant change in soil Olsen-P status.

AFBI also operate a 5 km grid survey to monitor soil quality across Northern Ireland. The sample points are located at 5 km Ordnance Survey grid intersections, and identify over 600 sites which include all major land cover types and agricultural land uses within Northern Ireland. The sites were originally sampled in 2004-2005 with a view to a 10-year resample cycle, which was carried out in 2014-2015.

Analysis of change between 2004-2005 and 2014-2015 with reference to average Olsen-P concentrations in each Index P range (based on the initial index P values in 2004/2005), indicates specific contrasting trends. Mean Olsen-P concentrations for soils initially identified within soil Olsen-P Index ranges 0 and 1, increased between 2004-2005 and 2014-2015. In contrast it was found that soils initially within the soil P Index 4+ bracket, decreased significantly, with mean values falling from 65.1 mg Olsen-P l^{-1} to 55.1 mg Olsen-P l^{-1} in the 0-75 mm soil layer and from 67.6 mg Olsen-P l^{-1} to 62.9 mg Olsen-P l^{-1} in the A horizon. It would appear, therefore, that over the past 10 years, less P has been applied to land already over-supplied with this nutrient.

Subject to securing of funding, continuation of the sampling programme will allow further monitoring of soil P concentrations so any emerging trends can be identified and mitigation action taken if necessary.

10.2 Project 9420 – UK Environmental Change Network: Freshwater (On-going research)

Project 9420 monitors water quality in Lough Erne and Lough Neagh, the two largest lakes in Northern Ireland. The overall aim of the project is to provide long term and standardised data on Lough Neagh and Lough Erne with respect to nutrients and eutrophication. To date, only results up until 2011 can be reported, results since then will be reported in June 2017 at the end of the next reporting period.

Lough Neagh

The long-term dataset (40 years) for Lough Neagh was examined for changes in chlorophyll-α, zooplankton density and nutrient concentrations over a period of generally increasing water temperatures. The time series spanned a period of nutrient enrichment, toxic algal blooms and a recent reduction in chlorophyll-α. Data were examined for evidence of long-term trends over the whole 40-year time period and for each season. Investigating long-term trends for each season revealed the most significant time periods for change in each water quality parameter.

A generally decreasing trend was evident for chlorophyll-α in the Lough between 1993 and 2011 with the most prominent trends in spring and summer (11 $\mu g\ l^{-1}$ and 22 $\mu g\ l^{-1}$ differences in mean values respectively). An increasing trend in water temperature was most evident in spring and autumn. The observed recent decrease in chlorophyll-α concentration did not correspond to decreases in SRP or TP concentration; both increased over the same period. Cyclopoid (a type of zooplankton) density also increased.

Figure 16 shows the general increase in nutrients in the Lough, this is despite the fact that our Environmental Change Network results have shown that nutrient input to the Lough has been generally decreasing since 2003. These results support the hypothesis that there is significant contribution of nutrients from internal sources within the Lough. The increase in temperature has consequences for the impact of nutrient inputs and the lake ecology.

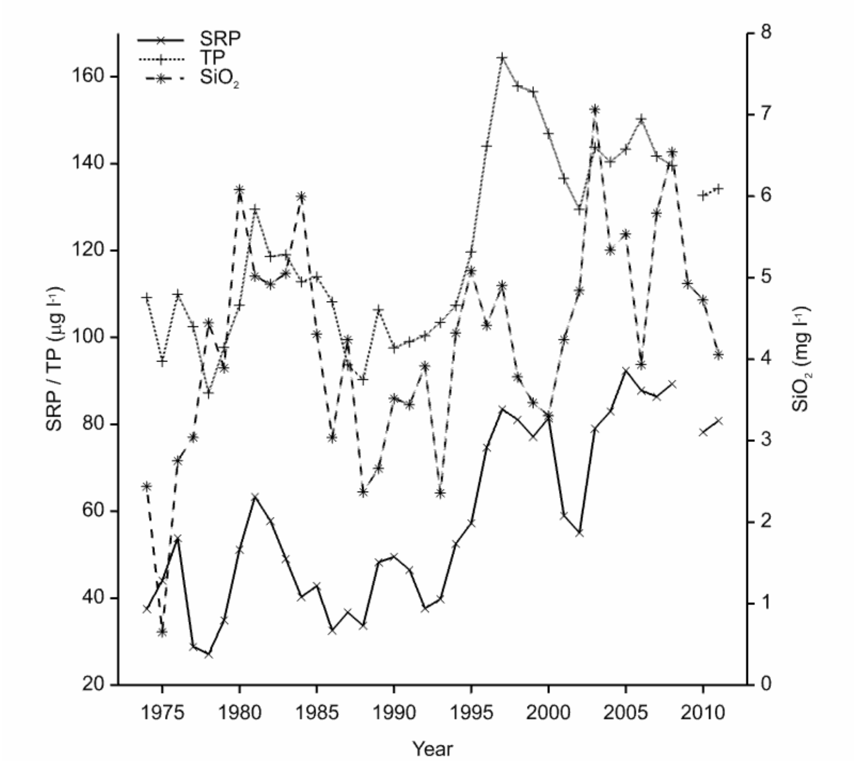
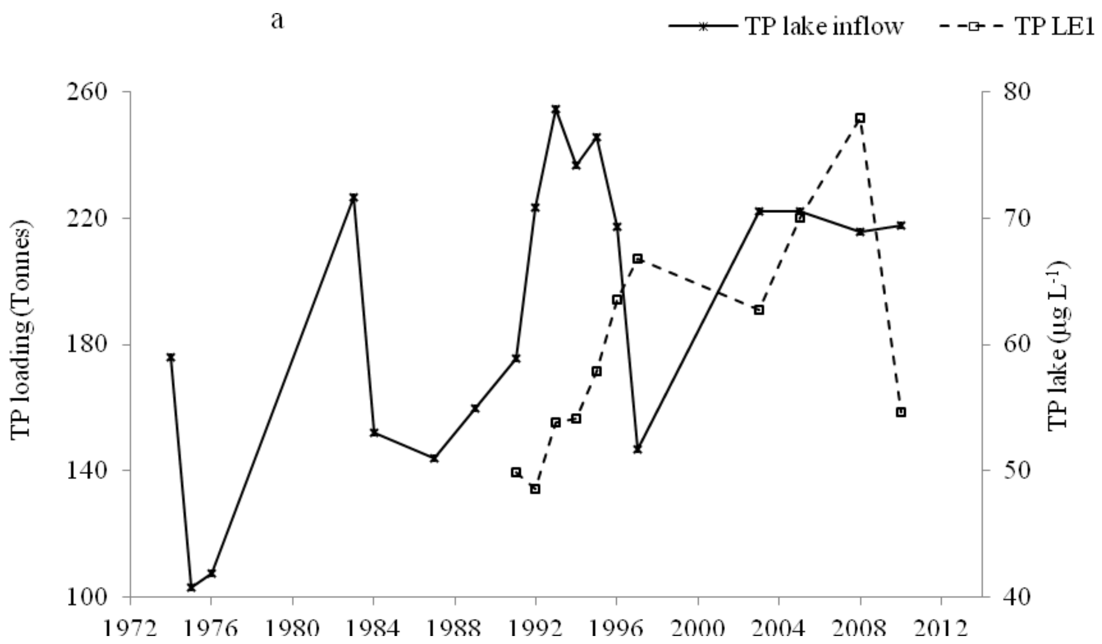


Figure 16: Time series of soluble reactive Phosphorus (SRP), total Phosphorus (TP) and dissolved silica in Lough Neagh 1974 to 2011.

Lough Erne

In Lough Erne we analysed the annual input of TP and total oxidised Nitrogen (TON) to Lower Lough Erne from Upper Lough Erne, along with the annual mean concentrations at sample site LE1 in Lower Lough Erne. The input of TP did vary considerably from year to year as a result of higher discharges in wet years (e.g. 1983, 1993-1995), but, overall, there was an approximately 25% increase in input from 160 to 200 tonnes a year over the 1975 to 2010 period. Although the TP results for the lake water cover a shorter period, the concentration did increase over the 1991 to 2010 period, from approximately 50 to 65 µg L^{-1} (Figure 16).



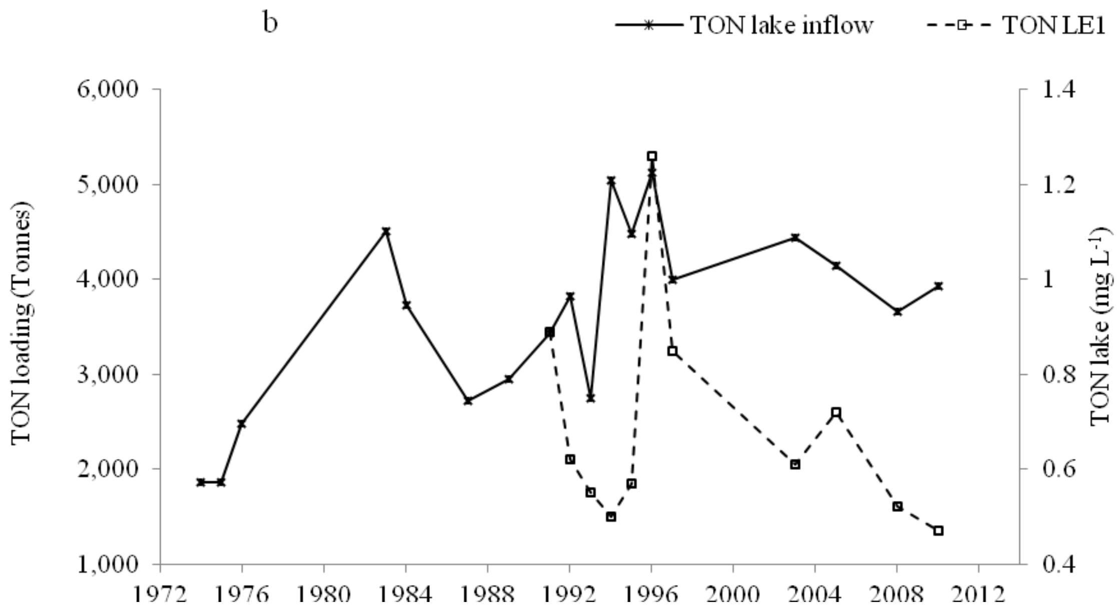


Figure 17: Variation of annual nutrient input from Upper Lough Erne to Lower Lough Erne over the 1975 to 2010 period, along with the annual mean concentration at site LE1 on Lower Lough Erne for (a) total phosphorus (TP lake) and (b) total oxidized nitrogen (TON lake).

The TON annual input also varies from year to year according to discharge and there was a general increase of approximately 40% from 3,000 to 4,200 tonnes per year over the period, a larger increase than was found for TP. The TON concentration in the lake was variable, particularly from 1991 to 1996, but it then decreased over the 1997 to 2010 period, by approximately 50% from 1.0 to 0.5 mg N L-1 (Figure 17).

These results show that there was a difference in the response of TP and TON in Lower Lough Erne to the increasing inputs; while the lake water TP concentration increased, as would be expected from increasing input, the TON concentration decreased, at least over the period for which there are results, 1991 to 2010 (Figure 17). As the TP concentration in the lake increased from 50 to 65 µg L-1, biological productivity is very likely to have also increased, resulting in the assimilation of TON (mainly nitrate) to support the additional production and so a reduction in the lake water TON concentration. The increased productivity, as implied by the reduced TON concentration may have been even greater as the reduction in TON took place even though the TON load to the lower lake increased by approximately 40%. Commonly, an increase in the lake water chlorophyll-α concentration is the usual biological response to higher nutrient concentrations and there is some support for this up to 1997, although after this date the response is confounded in Lough Erne by the impact of the introduction of the invasive alien zebra mussel (Figure 18).

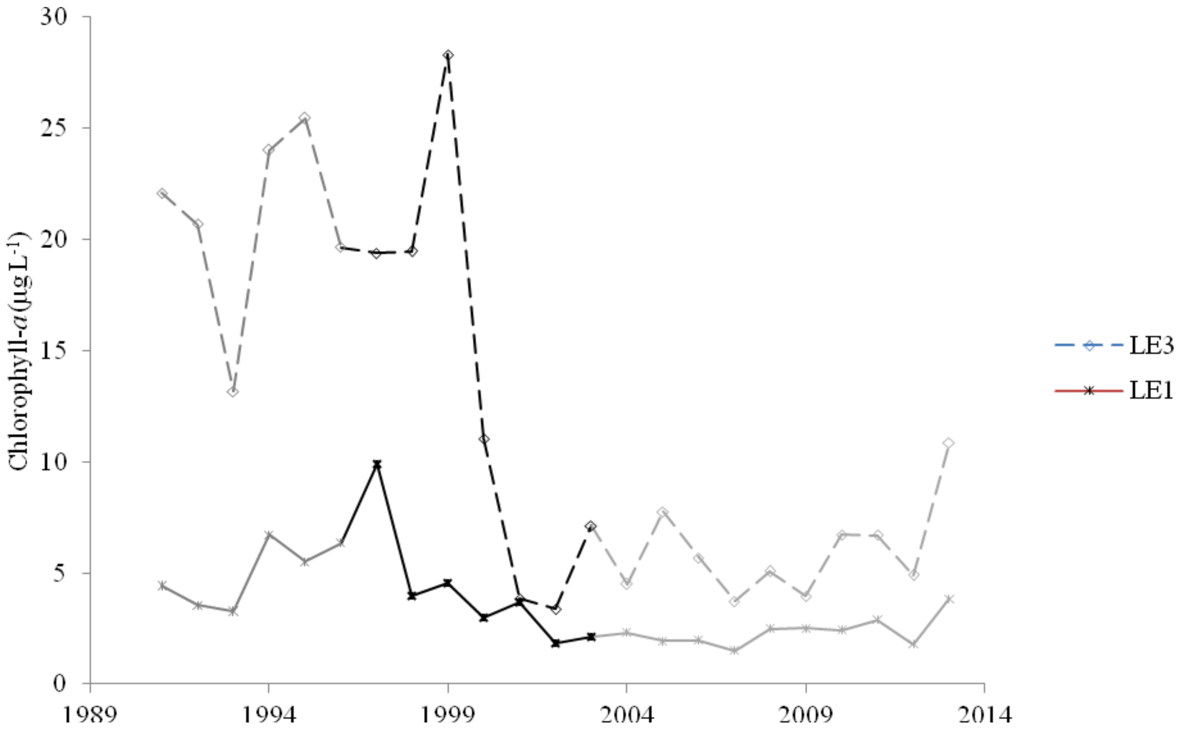


Figure 18: Variation of the mean annual chlorophyll-α concentration from 1991 to 2013 at sites LE1 and LE3 in Lower Lough Erne. Three time periods are shown that indicate the impact of the roach (1991 to 1996), impact of the zebra mussel Dreissena polymorpha (1997 to 2003) and selective recovery of impacted zooplankton (2004 to 2013).

10.3 Project 16/4/03 – Monitoring, modelling and mitigation of N and P losses from land to water under derogated and non-derogated conditions in the Colebrooke and Upper Bann Catchments (New Research)

The Overall Objectives of the monitoring/modelling programme are to provide scientific evidence to:-

1. Meet the additional/amplified monitoring and reporting requirements of Articles 8 and 10 of the 2015 Derogation Decision.
2. Identify and validate strategies which minimise N and P losses to water, optimise farm productivity and reduce variable costs on ruminant livestock farms.

These Objectives will be addressed in four Work Packages (**WPs**):-

WP 1 – Surface Water Sampling

In compliance with Article 8(3) of the 2015 Derogation Decision, monitoring of chemical water quality (nutrients) in streams in 12 sub-catchments in each of the Upper Bann (UB) and Colebrooke (CB) catchments, which ceased in 2014, will be reinstated at bi-monthly frequencies, This will be supplemented with targeted storm flow event sampling to improve resolution and precision of sampling - c.f. the 2009-2014 monitoring program.

Bi-monthly and seasonal hydrological event sampling for nutrients will also be conducted in two contrasting sub-catchments (*one containing* a significant proportion of derogated *farmland and the other containing only non-derogated farmland*) within the UB catchment. Samples will also be analysed for a range of tracers to help determine the contributions of rural septic tank outflows to P loads.

WP 2 – Groundwater Sampling

Groundwater monitoring is a key requirement under Article 8 of the 2015 Derogation Decision. A baseline survey within the pair of UB sub-catchments (*but if necessary extended to include other sub-catchments*) will be undertaken to identify, in consultation with landowners, wells and springs suitable for sampling. Potential threats to water quality in each well/spring will be noted during sampling. After an initial monitoring round, a sub-set of wells/springs will be identified and monitored annually.

WP 3 – Soil Sampling, Farm Data Collection & Nutrient Management Advice

To provide relevant soil P data for modelling P losses from derogated and non-derogated farms on the main soil types of Northern Ireland in accordance with Article 8(2) 2015 Derogation Decision, and information on farming practices etc on derogated and non-derogated farms in accordance with Article 8(4) of the 2015 Derogation Decision, a sampling/data collection scheme will be conducted.

In the pair of UB sub-catchments (*one sub-catchment with a significant proportion of derogated farmland and the other with no derogated farmland*), all fields (*713 in total*) will be soil tested for Olsen-P and Calcium Chloride extractable P ($CaCl_2$-P). A 1 m resolution Light Detection And Ranging (LiDAR) digital terrain model (DTM) will be applied to help identify potential Critical Source Areas (CSAs) for P loss within sub-catchments. For whole farms in each sub-catchment (*33 in total – 10 dairy and 23 Beef & Sheep*), information and data on nutrient imports and exports will be collected to calculate annual farm N and P surpluses, and concentrate feeds, silages and manures analysed.

For the 10 dairy farms, in addition to this, records of fertiliser and manure application to fields will be maintained annually, and twice yearly, samples of manures and concentrate feeds will be collected and analysed for N and P to help quantify nutrient cycling and flows within these farming systems.

For the first two years, the 10 dairy farmers will not be given any nutrient management advice but simply allowed to continue with their normal nutrient management practices, to allow assessments of baseline conditions to be made for each sub-catchment in terms of farm P balances, mean soil Olsen-P concentrations, breakdowns of farmland in different soil P index ranges and water chemistry and biology.

In year three, farmers will be offered nutrient management and nutrient budgeting advice including recommendations for Nitrogen Phosphorus Potassium (NPKs) fertiliser on fields, for manure usage and avoidance of potential CSAs, and for the amounts and P contents of concentrates fed to help evaluate the impact of these measures on water quality in succeeding years (>10 years).

WP 4 – Modelling of Nutrient Losses from Farmland

In compliance with Article 10 of 2015 Derogation Decision, nitrate and P losses from derogated farmland will be modelled using soil-P and farm-gate N and P balance information together with the results of chemical water quality monitoring in the sub-catchments using a 'source-pathway-receptor' approach.

An export coefficient modelling approach will be applied to estimate diffuse losses of P and N from individual farms. Soil P distribution data for farms of different intensities will then be used together with known breakdowns of farming intensities within catchments to scale-up model estimates of P loss to catchment scale.

Catchment scale modelling will be attempted to model N and P contributions from multiple sources and to assess the overall impact of derogation on nutrient losses from farmland across Northern Ireland.

10.4 Project 16/4/01 – Management of manure nutrients for sustainable grass-based dairy production in Northern Ireland (New Research)

The Overall Objective of the project is to:-

> Evaluate the potential for restrictions on concentrate-P inputs and manure processing plus export, to facilitate continuous application of dairy manures or manure/digestate liquid fractions to grassland soils whilst simultaneously reducing risk of P loss to water (*by lowering soil Olsen-P and reducing 'run-off-vulnerable'-P*) plus maintaining farm productivity.

To help achieve the Overall Objective there will be four Specific Objectives:-

1. Determine how soluble and insoluble P fractions in dairy cow slurries relate to farm P balances and contribute to Olsen-P accumulation in soil.
2. Assess the efficiency of screw-press mechanical separation for partitioning P (N, Potassium (K) and Sulphate (S)) in dairy slurries (*of differing initial Dry Matter (DM) contents*) and anaerobic digestates, with or without Magnesium Chloride ($MgCl_2$) pre-treatment to precipitate struvite ($NH_4MgPO_4 \cdot 6H_2O$).
3. Assess the plant availability of P, K and S in liquid fractions of separated dairy slurries, anaerobic digestates and dairy slurries with a wide range of P concentrations.
4. Seek to identify cost-effective strategies with the potential to optimise soil P status on farms with different levels of P surplus, without completely halting manure application to high P soils or compromising grass or milk production.

The above objectives will be pursued in four complementary work packages (**WPs**)

WP1 – Relationship of manure P fractions to farm P surplus and contributions of manures to 'crop-available'- and 'run-off-vulnerable'-P in soil

Samples of dairy manures will be collected from 10 dairy farms in the sister DAERA Evidence and Innovation (E&I) project (***Research Supporting the NAP and Derogation***) and from a range of benchmarked dairy farms (>50) with different concentrate usages, levels of milk production per cow, and farm P surpluses, to potentially provide manures with total P concentrations ranging from 2.5 g P/kg Dry Matter (DM) to 9.5 g P/kg DM, and from farms with P surpluses ranging from -5 kg P/ha/yr to +35 kg P/ha/yr.

These samples (*plus the solid and liquid fractions of separated dairy slurries and digestates, with or without Magnesium Chloride ($MgCl_2$) pre-treatment, from **WP2***) will be analysed for total P (N, K and S) contents and then subjected to a modified Hedley extraction procedure to fractionate P into water-soluble plus bicarbonate-, hydroxide- and acid-soluble fractions. Samples of silage and concentrates will be collected from farms and analysed for P etc and information on feed usage and milk yields obtained to enable calculation of P concentrations in dairy cow whole diets during confinement, and also whole year and winter period farm P balances. Multivariate regression analysis will be used to determine relationships between whole year and winter farm P surpluses (*and winter dietary P levels*) and manure P fractions of differing solubility and hence differing run-off potentials.

Samples of each manure (*and also the liquid fractions of separate dairy slurries and digestate, with and without $MgCl_2$ pre-treatment, from **WP2***) will be mixed with soils of low (Index 1), optimum (Index 2) and high P (Index 3) status (*but of similar type, hydrology and parent material*), to supply equal rates of total P; a mono-ammonium phosphate treatment will also be included to permit a comparison with inorganic fertiliser P. The soils will be incubated at 12°C (to replicate spring soil temp conditions) for 12 weeks. Samples will be taken after six and 12 weeks and analysed for Olsen-P as an indicator of crop-available P, and for water and $CaCl_2$-P as indicators of P run-off potential. The results will be used to assess the relative contributions of fertiliser P and manures (*from farms with differing P surpluses*) to 'crop-available'- and 'run-off-vulnerable'-P in soil.

WP2 – Efficiency of screw-press partitioning of P in dairy manures and digestate

Dairy cattle slurries with a range of DM contents will be separated by screw press to determine the effect of slurry DM content on nutrient partitioning. Separator efficiencies (*plus energy costs etc*) for partitioning of DM, N, P, K and S will be calculated for solid and liquid fractions.

The effects of screw press screen size and feedstock flow rate on partitioning of DM, N, P, K and S contents will then be examined for dairy cattle slurry of known DM content, and for anaerobic digestate derived from dairy cow slurry co-digested with grass silage from the AFBI Anaerobic Digester plant.

The effects of $MgCl_2$ pre-treatment of dairy cattle slurry and anaerobic digestate feedstock to precipitate struvite prior to screw-press separation will be examined to assess the effectiveness (*and costs*) of this strategy in increasing P partitioning to solid fractions in the different feedstock.

WP3 – Plant availability of P, K and S in separated dairy manures and digestate

A pot experiment will be established to evaluate the plant availabilities of P, K and S in slurry samples from representative benchmark dairy farms and in liquid fractions of screw-press separated slurries and digestate (*with and without struvite precipitation*), relative to P, K and S supplied as inorganic fertiliser. The trial will be conducted using a sandy loam (*Index 1 for P and K and low in S*), and with perennial ryegrass as the indicator crop. Plants will be established for six weeks and cut, and then liquid manures and fertilisers applied to the surface of pots for two subsequent harvests. DM yields and nutrient off-takes will be evaluated at each harvest and results for manure treatments compared with those for the fertiliser control (*response curves*) to assess relative availabilities of P, K and S in the different manures and manure liquid fractions and digestate.

WP4 – Strategies to optimise soil P status without detriment to productivity

Results from work packages **WP1**, **WP2** and **WP3**, will be interrogated to determine if specific combinations of concentrate P restriction and slurry/digestate processing can be identified for farms with different P surpluses and concentrate usage that would permit recycling of manures or manure liquid fractions to grassland of high P status, whilst simultaneously reducing concentrations of 'run-off-vulnerable'-P in soil without compromising grass production (*i.e. by maintaining adequate inputs of P and some manure K and S to help meet crop requirements, and reducing the need for expensive inorganic K additions*). Case study cost-benefit analyses will be conducted to determine the most appropriate strategies for different intensities of dairy enterprise.

10.5 Project 16/4/02 – Quantification of phosphorus release from sediments in Lough Neagh and factors affecting the recovery of water quality (New Research)

The objective of this project is to determine the extent to which historically accumulated internal nutrients drive the current chemical and ecological status of Lough Neagh, and provide timescales for recovery. We will also characterise P input from the catchment.

The focus of the work will be on nutrients (N and P), the internal loading of P from the lake sediments and the delay in chemical recovery that results from internal loading. A number of sediment cores will be taken from the Lough. Sediment chemistry, in particular the different P fractions present in the core, will be analysed in AFBI. The chemistry results obtained will be used to develop the Lough Neagh model.

Currently water quality management is through nutrient reduction measures in the catchment; however, reduction of P/N loading may not lead to an immediate improvement in lake water quality due to internal loading. While P release from anoxic sediments is well studied and can be predicted accurately, P release from oxygenated sediments is less well understood, especially in Lough Neagh.

Many parameters potentially influence P release from oxygenated sediments such as temperature, pH, oxygen levels and the presence of N. Nitrate in lake water helps maintain iron in an oxidised state, which increases the sediment binding capacity of P. Since nitrate entering the lake has decreased, it is possible that this has influenced sediment P release. An objective of this project will be to assess the impact of nitrate reductions from the catchment on the lake. We will estimate the time scale of meeting nutrient and biological targets. This will help us meet nutrient management requirements under environmental legislation.

11. CONCLUSION

In 2016, 297 farm businesses out of approximately 25,600 direct aid claimants (1.2 %) in Northern Ireland are operating under an approved derogation, compared to 230 (0.77 %) in 2015.

WATER QUALITY

Nitrate concentrations in Northern Ireland surface freshwaters remain relatively low, with the average nitrate concentration for all monitoring stations below 25 mg NO_3/l in 2015. Surface freshwater nitrate concentration trends indicated a decrease or stability at 99% of sites across Northern Ireland between 2008-2011 and 2015.

Groundwater nitrate concentrations across Northern Ireland are also generally low with 51 of the 53 stations below 25 mg NO_3/l in 2015. Average nitrate concentrations in three of the four high derogation catchments (Ballinderry, Blackwater and Lower Bann) were generally low with all of the monitoring sites below 25 mg NO_3/l in 2015. Four of the six groundwater sites in the Strangford catchment were also below 25 mg NO_3/l, but one site (Ards groundwater body) had an average concentration between 25 and 40 mg/l. Another site (Belfast East groundwater body) had an average concentration >50 mg/l in 2015. Nitrate concentration trends in groundwater across Northern Ireland indicate a decrease or stabilisation in three of the four high derogation catchments in 2015 compared to 2008-2011. The parts of the two groundwater bodies (Ards groundwater body, Belfast East groundwater body) within the Strangford catchment both show increases within the range of +1 to +5 mg/ l.

P concentrations were assessed using current WFD standards for rivers and lakes. For P in rivers, this showed a large majority of stations (85.8% overall) classed as either High or Good status. However, in the middle and eastern parts of Northern Ireland the majority of catchments were classed as Moderate status. A comparison of phosphorus classes in the four high derogation catchments showed higher P concentrations in the Strangford catchment compared with the Ballinderry, Upper Bann and Blackwater catchments. As for nitrates, the general trend was for a decrease or stability in overall P levels across Northern Ireland between 2008-2011 and 2015. This trend was similar in the high derogation catchments.

Lakes continue to exhibit poorer classification based on P concentrations with 13 of the 21 classed as moderate or poorer status in 2015. However, the overall trend between 2008-2011 and 2015 in lakes was largely stable.

ADVISORY SUPPORT

As in previous years, DARD (now DAERA) delivered a number of training and advisory events for farmers across Northern Ireland and provided information and guidance to farm businesses using a wide range of media, including one to one advice for derogated farms, where requested. Updated guidance documents on the NAP 2015-2018 and derogation workbooks were published. There was also a continued uptake of Departmental on-line calculators designed to help farmers comply with various aspects of the NAP Regulations.

COMPLIANCE

Compliance observed during on farm inspections of selected derogated farms in 2015 was similar to 2014, with one non-compliance found on each of two farms, (out of 12 inspected). Administrative checks on the fertilisation accounts for the calendar year 2015 indicated a slightly higher rate of compliance compared to 2014, with most non-compliances being attributable to the P balance. DAERA continues to review training delivery and provide information for farmers to help address these non-compliances.

RESEARCH AND MONITORING

To underpin the implementation of the Directive and the action programme measures in Northern Ireland, alongside on-going research commissioned by DARD (now DAERA), AFBI has been commissioned to carry out a range of new research projects. A summary of key findings from the on-going research, plus details of new research projects are given at section 10.

A new amplified monitoring programme is being set up to meet the additional monitoring requirements of the 2015 Derogation Decision. The data collected from the programme will provide evidence for the 2016-17 annual derogation report. The new programme will help to protect vulnerable water bodies and will demonstrate our continued commitment to making progress on water quality issues.