An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Nitrates Action Programme - Ireland

Derogation Report 2020

Report for 2020 for the purposes of Articles 8 and 10 of the Commission Decision **2018/209/EU** *of* **08th February 2018** *granting a derogation requested by Ireland, pursuant to Council Directive 91/676/EEC.*

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1. Introduction

Regulations giving statutory effect to certain elements of Ireland's first Action Programme under the Nitrates Directive were enacted in 2005 i.e. the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2005 (S.I. No. 788 of 2005). These Regulations were subsequently replaced by S.I. No. 378 of 2006. The European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2009 (S.I. No. 101 of 2009) revised and replaced amending legislation made in 2006 and 2007. The 2009 Regulations provided for strengthened enforcement provisions and for better farmyard management. They also provided the legal basis for the operation of derogation under the Nitrates Directive (91/676/EEC), which was granted to Ireland by the European Commission on 22nd October 2007 (2007/697/EC), and subsequently amended on 24th February 2011 (2011/127/EU). The 2009 Regulations were replaced on 20th December 2010 by the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2010 (S.I. No. 610 of 2010). These Regulations were subsequently replaced by the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2014 (S.1. No.31 of 2014). The most recent legislation following the NAP Review in 2017 is the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2017 (S.I. 605 of 2017) which came into force on 1st January 2018.

The Commission Decision of 8th February 2018 permits the land application of up to 250 kilograms of nitrogen per hectare per year from livestock manure under certain conditions. Article 8 of the Commission Decision requires that maps showing information concerning approved derogations on a county basis be submitted annually to the Commission. Article 10 sets out the reporting requirements for the purposes of the Commission Decision. This report is submitted to address the requirements of Articles 8 and 10 and relates to operation of the derogation in Ireland during 2020.

2. Operation of the Derogation in 2020

The documentation associated with the administration of the Nitrates Derogation in Ireland in 2020 is shown in *Appendix 3*.

3. Applications

Summary of derogation applications 2007-2020

Year	2007	2008	2009	2010	2011	2012
Applications received	4,889	6,357	5,247	4,291	4,685	5,273
Applications approved	4,133	3,855	4,908	4,100	4,471	5,093

Year	2013	2014	2015	2016	2017	2018	2019	2020
Applications received	5,408	5,793	6,330	6,804	6,995	6,897	6,684	6,505
Applications approved	4,943	5,273	5,997	6,533	6,557	6,554	6,308	6,016

The 2020 application process resulted in applications from a total of 6,505 herdowners. Of these 263 were rejected and 226 were withdrawn, leaving 6,016 applications approved for derogation (a breakdown by county is given at *Appendix 2)*.

4. Description of Maps

Derogation Decision – Monitoring Requirements (a) maps showing the percentage of grassland farms, the percentage of livestock and the percentage of agricultural land covered by authorisations for each County, as well as maps on local land use, as referred to in Article 8(1);

Three maps have been prepared for the purpose of Article 8 of the Commission Decision (***Appendix 4 and attached as separate documents***); the maps are based on the numbers of approved applications in 2020.

Map 1: ***Percentage of holdings with grazing livestock encompassed by derogation in 2020 at county level.***

Map 1 categorises the number of derogation holdings as a percentage of the total number of holdings in the country with cattle and or sheep, on a county basis. Counties are categorised into one of four categories (less than 3%, between 3% and 5%, between 5% and 10% and greater than 10%).

Map 2: ***Percentage of grazing livestock units encompassed by derogation in 2020 at county level.***

Map 2 categorises the number of grazing livestock units (one grazing livestock unit = 85kgs N from cattle or sheep manure) on approved derogation holdings as a percentage of the total grazing livestock units in the country, on a county basis. Counties are categorised into one of four categories (less than 3%, between 3% and 5%, between 5% and 10% and greater than 10%).

Map 3: ***Percentage of net area encompassed by derogation in 2020 at county level.***

Map 3 categorises the total net area on approved derogation holdings as a percentage of the total net area in the country, on a county basis.

Derogation holdings accounted for 4.9% of the total number of holdings with cattle and or sheep in the country in 2020. 15.9% of the total number of grazing livestock units were on derogation holdings. Derogation holdings accounted for 9.6% of the total net area of the country in 2020. Table at Appendix 1 refers.

5. Controls

Farmers were obliged to submit a 2020 online Derogation application by 31st March 2020. (This was extended to the 24th April 2020)

Farmers who availed of the derogation facility in 2020 were required to submit fertiliser accounts by 31st March 2021 All of these accounts were subject to administrative checks.

5.1 Administrative checks

Administrative checks on applications/fertiliser accounts

A database of all derogation applications received was generated. The following administrative checks were undertaken:

- Derogation applicants' particulars were checked against the Department's Corporate Customer System (CCS) by means of the herd number supplied.
- Type of livestock on holding – checked that farmer had grazing livestock (consulted other Department databases).
- Declared area of holding checked re 80% grassland requirement.
- Compliance with the maximum limit of 250kg/N/ha/annum from grazing livestock manure;
- Quantities of livestock manure exported to other holdings (if applicable).
- Check if herd restricted.
- Deadline for receipt of completed Record of movement of organic fertiliser (Record 3) forms if applicable was 31st December 2020.
- Deadline for receipt of Short-Term Rental Grazing Agreement (Record 5) if applicable was 31st December 2020.

5.2 Results of administrative checks

Derogation Decision – Reporting Requirements - (g) an evaluation of the implementation of the conditions for the authorisations on the basis of the results of the administrative controls and field inspections referred to in Article 9(1) and (2);

The following is a breakdown of the numbers of derogation applicants and the results of administrative checks for 2020.

Numbers of derogation applicants and the results of administrative checks 2020

Number of applications	6,505
Number withdrawn	226
Number rejected	263
Number approved	6,016

5.3 Administrative Penalties (for breaches of Nitrates Regulations)

As part of our controls under the Nitrates Regulations, DAFM carries out a 100% check on all herdowners with livestock on an annual basis. This check requires compilation of the total kgs of Nitrogen (N) for every herd from the Animal Identification and Movement System (AIM), divided by the declared area under the Basic Payment System, to arrive at a kg/N per hectare figure for each herd. Herdowners in breach of the 170/250 kg per hectare limit incur penalties. The penalty levels for breaching the application limits of 170/250 kg of Nitrogen from livestock manure per hectare per annum on holdings are as follows:

Non-Derogation cases		Derogation cases	
Band	% Penalty	Band	% Penalty
>170 <=180	1%	<=300	5
>180 <=210	3%	>300	20
>210 <=250	5%		
>250	20%		

These percentage penalties are applied on EU funded direct payments schemes and Rural Development Programme measures, i.e. including Basic Payment Scheme, ANC and GLAS where applicable. This sanction is provided for in EU Regulations 1306/2013, 640/2014 and 809/2014 and is applied under the Terms and Conditions of the Direct Payment Schemes and Rural Development Programme measures.

In 2020, the number of farmers penalised for exceeding the Nitrogen limits in 2019 was 1,829. Of that 97 exceeded the 250 kg limit. Each farmer is entitled to appeal any sanction imposed to the Agricultural Appeals Office.

The details of final decision penalty letters that issued for the period 2007-2020 are outlined in the table below.

Year	2007	2008	2009	2010	2011	2012
No. of penalties issued	1,263	903	1,423	1,334	1,320	1,653

Year	2013	2014	2015	2016	2017	2018	2019	2020
No. of penalties issued	2,252	1,583	1,834	1,888	1,658	1,884	1,829	1,300*

* At the time of reporting 1,300 penalties have been issued to those who exceeded the limit of 170 kgs/N/ha in 2020. Work ongoing to continue to identify those who exceeded the limits in 2020.

5.4 2020 Field inspections

Derogation Decision – Reporting Requirements (h) a comparative analysis of controls of grassland farms in Ireland covered by authorisations and grassland farms in Ireland not covered by authorisations. The analysis shall include data on annual inspections, administrative checks, agricultural inspections in the context of cross-compliance arrangements and statistics on non-compliance.

A total of 338 farm inspections were carried out which complies with the 5% inspection requirement in 2020. A total of 23 herd owners will incur penalties as a result of these inspections, which will result in a deduction from their Basic Payment Scheme, Greening, YFS, Protein Aid, ANC, REPS, AEOS, GLAS, Organics and BDGP payments, where applicable.

Of these, 4 herdowners received a 3% penalty, 6 herdowners received a 5% penalty and 13 herdowners received a 20% penalty.

6. Overview of Methodologies, Monitoring and Results of the impact of the derogation granted in this Decision on water quality, as referred to in Article 8(2)

Derogation Decision – Reporting Requirements (b) the results of ground and surface water monitoring as regards nitrate concentrations, including information on water trends, both under derogation and non-derogation conditions as well as the impact of the derogation granted in this Decision on water quality, as referred to in Article 8(2);
(c) the results of soil monitoring as regards nitrogen and phosphorus concentrations in soil water and as regards mineral nitrogen in soil profile, both under derogation and non-derogation conditions, as referred to in Article 8(2);
(d) a summary and an evaluation of data obtained from the reinforced water monitoring referred to in Article 8(3);

Monitoring Programme

EU Member States are required to monitor the effectiveness of their Nitrates Regulations, under Article 5 (6) of the EU Nitrates Directive. Ireland has been monitoring the effectiveness of the NAP measures since 2008 in part through the Teagasc delivered Agricultural Catchments Programme (ACP), funded by the Department of Agriculture, Food and the Marine. The fourth cycle of the ACP was approved in November 2019 for a further four-year period to 2023, a cost of €2.5m per annum.

The Agricultural Catchments Programme

The Irish Agricultural Catchments Programme (ACP) was established in 2008 to:

i) monitor the effectiveness of the Good Agricultural Practice measures, initially for compliance with the Nitrates Directive (ND) and since 2014 with the Water Framework Directives (WFD),
ii) provide a scientific basis for policy review
iii) monitor derogation in Ireland.

The programme is a collaboration with over 300 farmers in six small river catchments in Ireland and has taken a whole catchment approach. By using the "nutrient transfer continuum" (Haygarth *et al.*, 2005) as a conceptual frame work an extensive monitoring programme of nutrient sources and hydro-chemo-metrics have been designed similarly across all six catchments (Figure 1) to understand how nutrients are lost from agricultural sources, how they can be mobilised and transferred via different hydrological pathways, how they are delivered to water and where there may be a negative impact on water quality and aquatic ecology. The whole catchment approach was agreed upon during the first phase of the programme by the ACP Expert Steering Group composed of internationally leading scientists and national policy makers.

Methodologies reflecting Irish Conditions

Given the unique typology and geographical circumstances and primarily grass based system of production, Ireland have implemented a "Whole Catchment Approach" to water monitoring as regards nitrate concentrations, including information on water trends, both under derogation and non-derogation conditions as well as the impact of the derogation granted in this decision on water quality, as referred to in Article 8(2). While Article 8 (2) specifies the requirement to report the results of ground and surface water monitoring, Ireland considers from a scientific perspective the approach adopted at a Catchment level reflects the true scientific reporting on water quality. This is due to Ireland's multi facet soil type which does not reflect the homogenous nature of soil type in other EU member states.

The approach adopted "Whole catchments approach"

The ACP has six catchments ranging in size from 4 – 30 km^2. These have been continually monitored since 2008 and were selected by a multi-criteria analysis (Fealy *et al.*, 2010) to represent intensively managed agricultural land on different physical settings and dominating land use, therefor different type of riskiness for N and P loss in terms of vertical drainage or lateral runoff risk (**Figure 1, Table 1**). Since both surface and groundwater bodies are deemed to be at risk for N and P transfers in Ireland, the catchment scale was chosen to include monitoring of surface and groundwater. Catchments allow monitoring of hydrologically isolated source areas which is suitable since the WFD operates on the scale of catchments and a catchment evaluation was also directed for Ireland by EU legislation (OJEC, 2007). The catchment size was further chosen to be large enough to encompass the range of hydrological conditions from headwaters to main river channel, allowing for normal N and P transformation and mobilisation processes to occur, and also to integrate the impacts of a realistic range of farm practices within a typical farming system (Wall *et al.*, 2011). Importantly the size was also chosen to be small enough to engage with all farmers in each catchment.

The biophysical and socio-economic data collection started in 2009 and include:

- **Surface water** in the catchment river outlets: river discharge (Q), Electrical Conductivity (EC), Temperature, Turbidity and nitrate-N, Total Reactive P (TRP), Total P (TP) and Total Organic Carbon (TOC, since 2018) concentrations (every 10-minutes)
- **Surface water** in multiple sites along the river networks: nitrate-N, TP, Total Dissolved P (TDP), TRP, Dissolved Reactive P (DRP), Dissolved Organic Carbon (DOC), EC, pH, Dissolved Oxygen (DO), Oxidation-Reduction Potential (ORP), Turbidity and metals (monthly)

- **Groundwater** in focused study sites: piezo-metric water level (every 30 minutes), and nitrate-N, TP, TDP, DRP, DOC, EC, pH, DO, ORP, Turbidity and metals sampled in multilevel monitoring wells (monthly)
- A **Weather** station is located centrally in each catchment, from which current data is publically available at www.acpmet.ie: Air Temperature, Soil Temperature, Relative Humidity, Rain, Solar Radiation, Wind Speed/direction for estimation of Potential Evapotranspiration (PET) (every 10-minutes) and additionally rain at higher ground (every 10-minutes)
- **Aquatic ecology** in multiple sites along the river networks: diatoms and macro invertebrates assessed (every May and September)
- **Soil** analysis at the field scale (every 4 years, maximum sampling unit 2 ha, to 0-10 cm depth): pH, liming requirement (LR), P, K, and Mg content
- **Land management data** supplied by the Department of Agriculture, Food and the Marine is added to more detailed information collected by advisors and data recorders
- **Socio economical and attitudinal surveys** of catchment farms have been compared and supplemented with data from the National Farm Survey (NFS).

Additionally each catchment has been surveyed for soil type, topography (LiDAR <1m) and geology (EM3/EM37, 2-D resistivity, seismic refraction and GPR on representative fields).

Knowledge exchange occurs frequently *via* the specialised farm advisors either one-to-one or in discussion groups. There are also public events and farm walks arranged, and research dissemination events are held annually.

Figure 1. The six catchments monitored within the Agricultural Catchments Programme.

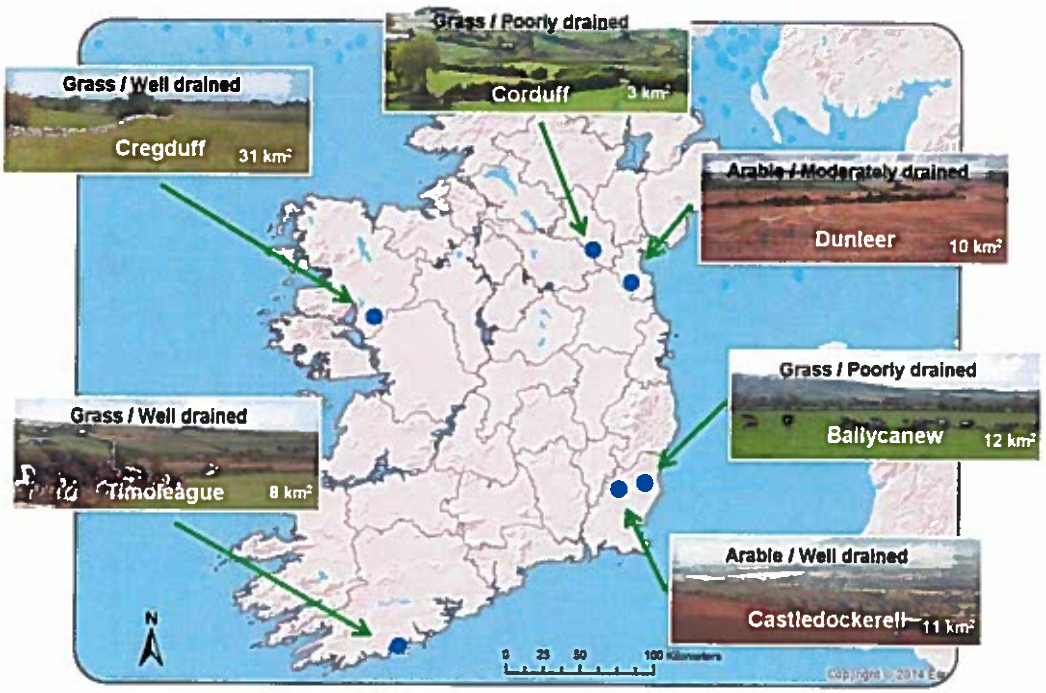


Table 1. Dominating catchments characteristics, annual average stocking rate (organic N load 2010-2018 and organic P load 2008-2014) and annual average river flow and nutrient load in the river (2010-2020).

Catchments characteristics				Annual organic inputs			Annual outputs			
Name	Land use	Soil drainage	Size [km²]	Rain fall [mm]	Stocking rate Org P [kg ha⁻¹]	Stocking rate Org N [kg ha⁻¹]	River flow [mm]	TRP [kg ha⁻¹]	TP [kg ha⁻¹]	NO_3-N [kg ha⁻¹]
Corduff	Grass	Poor	3	1056	12	87	562	0.18	0.31	7.9
Dunleer	Arable	Moderate	10	872	9	67	420	0.50	0.70	23.4
Ballycanew	Grass	Poor	12	1044	11	101	512	0.41	0.62	13.4
Castle dockerell	Arable	Well	11	1009	4	41	528	0.14	0.24	37.3
Timoleague	Grass	Well	8	1097	23	166	666	0.45	0.70	41.3
Cregduff	Grass	Well	31	1220	10	90	172	0.03	0.03	2.2

Comparing the Catchment Scale Approach

The annual total organic N loading in has clearly increased in the Timoleague catchment, which had the highest stocking rate throughout the period (**Table 1, Figure 2a**). In average Timoleague had 54% of the land in derogation (2010-2018) and 66% in 2018. There has also been an increase in stocking rate in Ballycanew with an average of 22% of the land in derogation and 30% in 2018. The lowest stocking rate was found in the Castledockerell catchment where 5% of the land was in derogation during the period.

Eleven-years of high frequency monitoring of N and P concentration in the catchments outlets showed that not only the magnitudes of concentrations but also the dynamics varied across the catchments. **The link between the percentage of land in derogation and the stream water concentration of NO_3-N was not clear, reflecting differences in soil type, land-use and meteorological factors which were evident at the catchment scale of the ACP (Figure 2b).** For example, Castledockerell catchment with the highest NO_3-N concentration in the stream water was the catchment with only 5% of the land in derogation. The physical setting overrides the source pressure (Jordan *et al.*, 2012; Mellander *et al.*, 2012a; Shore *et al.*, 2016). Despite catchments having similar organic N and P loading (**Table 1**) the water quality, in terms of N and P concentration, was very different in the catchment outlets (**Table 2**). There was a large difference in loss of nutrients to water due to soil drainage (Jordan *et al.*, 2012). Despite similar source loading Ballycanew catchment with poorly drained soils and a "flashy hydrology" had three times higher total P loss than the well-drained and mostly groundwater driven Castledockerell catchment (**Figure 3**) (Mellander *et al.*, 2015). However, also catchments with similar soil drainage can differ in nutrient loss due to processes associated to the soil chemistry as a controlling factor for P solubility. In the Timoleague catchment with iron rich soils there was more P loss to the stream via leaching to shallow groundwater (Mellander *et al.*, 2016; Dupas *et al.*, 2017). Iron rich soils have also been found to increase the loss of medium sized colloidal P (Fresne *et al.*, 2020). In another free draining catchment with calcium rich soils P was instead largely retained (Mellander *et al.*, 2012b; Mellander *et al.*, 2013). **So the research so far has highlighted the overriding importance of soil type, subsoil geology and groundwater hydrochemistry in controlling N and P loss to water.**

Figure 2 a) Stocking rate as annual total organic N per hectare in the whole catchments (2008-2018), and **b)** monthly average (antecedent moving average) nitrate-N concentration in the catchments river outlets monitored within ACP (2010-2020). The Water Framework Directive estuarine Environmental Quality Standard nitrate-N concentration 2.6 mg l^{-1} and the Drinking water standard 11·3 mg l^{-1} are marked as dashed lines.

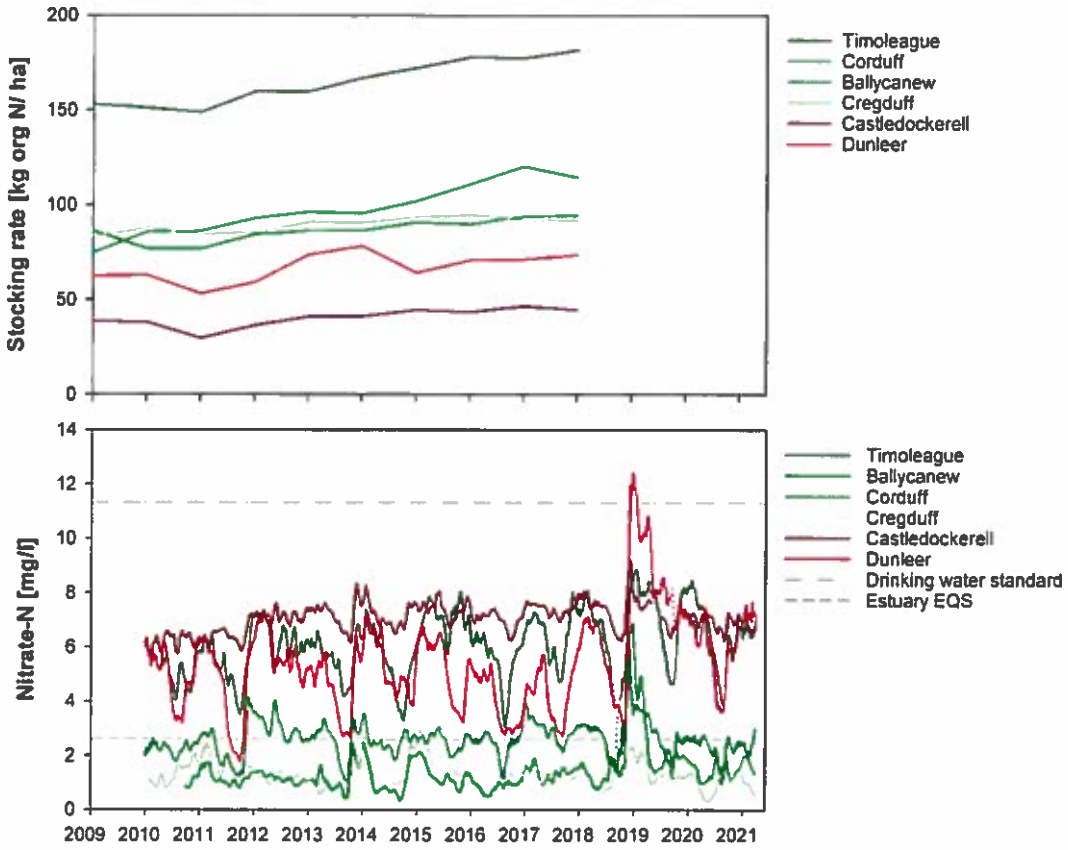
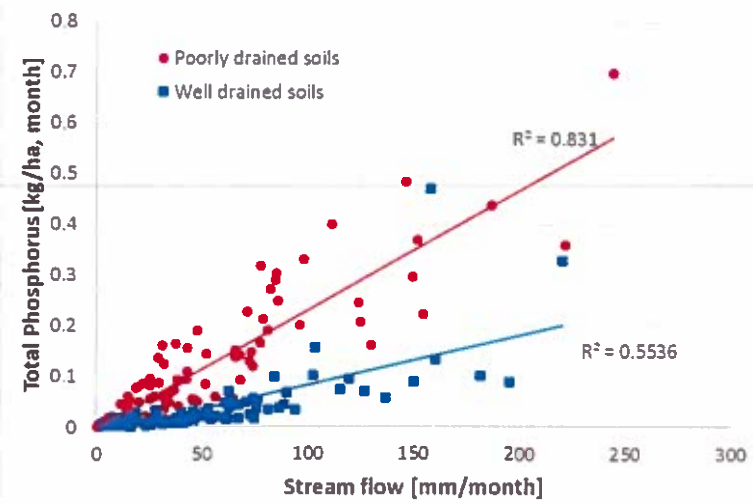


Figure 3. Monthly Total P mass load as a function of river flow in two catchments with contrasting soil drainage and hydrology but with similar P loading (from Mellander et al., 2015)



The controls of nutrient loss

The Irish agricultural landscape is heterogeneous in terms of its physical setting and even within smaller meso-scale catchments, such as those monitored within the ACP, there can be a large variability in soil types and the factors controlling both N and P transfer pathways and the transformation processes (such as topography, soil and bedrock properties – mainly permeability).

Leaching of N is not a steady state process and there are many factors controlling NO_3-transport and transformation in the unsaturated zone (Fenton *et al.*, 2011; Jahangir *et al.*, 2012). Such factors include both static (e.g. soil and bedrock type, thickness and permeability) and dynamic factors (e.g. climate, soil moisture deficit, depth to water table) which are spatially and temporally variable across any farming landscape (Huebsch *et al.*, 2015; Mellander *et al.*, 2018; Fenton *et al.*, 2017). The N removal capacity varied highly between and within two of the catchments monitored within ACP (McAleer *et al.*, 2017). At the catchment scale there was a poor link with the surplus NO_3-N leached to the groundwater and the concentrations of NO_3-N monitored in the catchment river outlet.

For example, in one of the catchment monitoring sites the NO_3-N concentration in the shallow groundwater locally reached highly elevated levels of 23.9 mg/L as the result of a ploughing and pasture reseeding event. This was however not detected in the river due to the locally high N removal capacity and likely also due to mixing of deeper groundwater with lower NO_3-N concentrations (Mellander *et al.*, 2014). That catchment further had significantly lower NO_3-N concentrations than an intensively managed Arable catchment on similar physical setting in Brittany (Dupas *et al.*, 2017). Amplified cycles of weather can largely influence N loss to water and the influence is different within the agricultural landscape due to the physical and chemical settings (Mellander *et al.*, 2018). Therefore, a reduction in N surplus can enable N load transfer to groundwater to decrease over time leading to improvements in water quality in some areas after hydrologic and biogeochemical time lags (including immobilisation, attenuation capacity) are considered (*e.g.* NO_3^- improvements in free draining soils and ammonium (NH_4^+) improvements in poorly drained soils). In heavier textured soils emissions along other pathways (e.g. gaseous emissions) must also be considered and conversion of NO_3^- to NH_4^+ which can be lost to surface water along intercepting artificial drainage systems.

Expected water quality improvement as the results of mitigation measures may be delayed for groundwater due to variable drainage amounts and delayed responses of NO_3^- in deep aquifers (Fenton *et al.*, 2011). In meso-scale catchments a positive response occurred from 1 to 10 years after decreased N surpluses were achieved, with the response time broadly increasing with catchment size (Melland *et al.* 2018). However, it took from 4 to 20 years to confidently detect the effects in water body monitoring systems. Such time lag may be a useful indicator to reveal the hydrogeological links between the

agricultural pressure and water quality state, which is fundamental for a successful implementation of any water protection plans (Kim et al., 2020).

Table 2. Annual average flow-weighted mean nutrient concentration in the rivers of the catchments outlets and inter-annual trend (Mann-Kendal method for 2010-2020).

	Annual average concentration			Inter-annual trend		
Name	**TRP [mg l^{-1}]**	**TP [mg l^{-1}]**	**NO3-N [mg l^{-1}]**	**TRP**	**TP**	**NO3-N**
Corduff	0.031	0.053	1.39	Probably increasing	No trend	Increasing
Dunleer	0.122	0.170	5.39	Probably increasing	Probably increasing	No trend
Ballycanew	0.079	0.120	2.59	Increasing	Increasing	No trend
Castledockerell	0.028	0.047	7.05	Stable	No trend	Probably increasing
Timoleague	0.068	0.105	6.12	Increasing	Increasing	Increasing
Cregduff	0.016	0.023	1.31	No trend	Stable	Stable

Sub-catchments approach

Due to the apparent influence of the complexity of many soil types, as well as a range of agronomic intensities existing even within meso-scale catchment, the ACP has taken on a sub-catchment approach. The two hydrologically contrasting catchments with a high percentage of land in derogation (Timoleague and Ballycanew) were divided into 8 sub-catchments (*ca.* 1 km^2) corresponding to the water quality monitoring sites along the river network. Sub-catchments dominated by land in derogation and with minimum amount of land in derogation were selected for comparison of nutrient concentrations in the stream water.

In Ballycanew, the catchment with mostly poorly drained soils, the percentage of land in derogation was not reflected in the NO_3-N or in the Total Reactive Phosphorus (TRP) concentrations monitored in the stream water of the sub-catchments, despite a large difference in the percentage of land in derogation (**Figure 4, Table 4**). Two sub-catchments (T2 and M1) substantially increased in the percentage of land in derogation in 2014 (from 0 to 46% and 11 to 57% respectively). That sharp increase was not detected in the stream water of those sub-catchments.

However, in Timoleague catchment, with mostly freely drained soils, the sub-catchment with higher percentage of land in derogation had higher concentrations of NO_3-N and TRP in the stream water (**Figure 5, Table 5**).

Table 4. Proportion of land in derogation in the Ballycanew catchment, average Nitrate-N concentration and average total Reactive Phosphorus (TRP) for the period 2010-2018.

	Out	M5	M6	M1	T2
Derogation [%]	34	3	0	39	27
Nitrate-N [mg l^{-1}]	2.60	3.40	3.04	2.36	3.23
TRP [mg l^{-1}]	0.077	0.041	0.042	0.047	0.020

Table 5 Proportion of land in derogation in the Timoleague catchment, average Nitrate-N concentration and average total Reactive Phosphorus (TRP) for the period 2010-2018.

	Out	M5	T1A
Derogation [%]	80	12	80
Nitrate-N [mg l^{-1}]	5.97	4.24	5.73
TRP [mg l^{-1}]	0.066	0.025	0.078

Figure 4. a) The Ballycanew catchment with sub-catchments. Land under derogation in 2018 is coloured red **b)** monthly average nitrate-N concentration (antecedent moving average) in the catchments stream outlet (black line) and in the stream by the sub-catchments with low proportion of land in derogation (green symbols) and high proportion of land in derogation (red symbols) based on monthly grab samples.

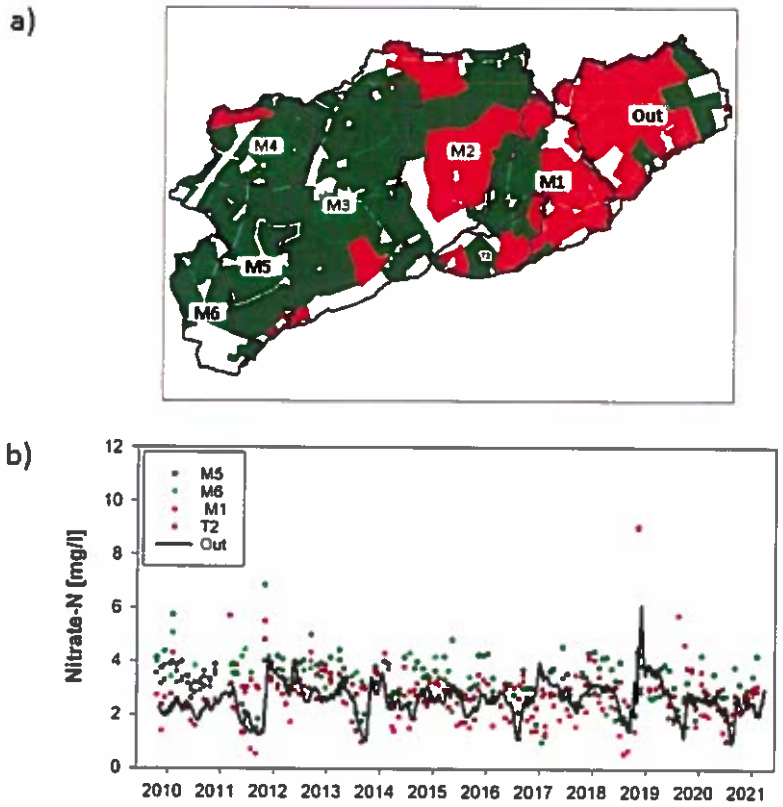
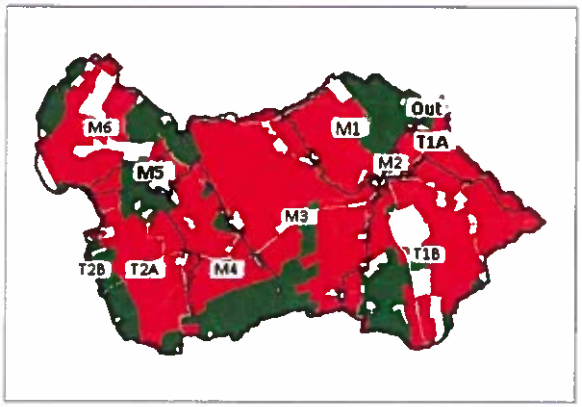
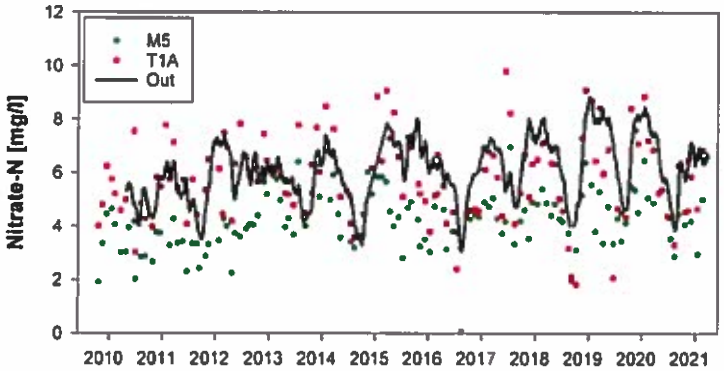


Figure 5. a) The Timoleague catchment with sub-catchments. Land under derogation in 2018 is coloured red **b)** monthly average nitrate-N concentration (antecedent moving average) in the catchments stream outlet (black line) and in the stream by the sub-catchments with low proportion of land in derogation (green symbol) and high proportion of land in derogation (red symbol) based on monthly grab samples.

a)



b)



Water quality trends

Both agronomic and weather drivers influenced the nutrient concentrations in the river outlets (Table 2). In some catchments there were inter-annual increasing trends. There could also be inter-seasonal increasing or decreasing trends that influenced or counteracted the inter-annual trends (Mellander and Jordan, 2021).

In the Timoelague catchment there was a high annual organic N loading with an increase from 134 to 182 kg ha^{-1} in 2008-2018 (**Figure 2a**) but there was no statistically significant temporal trend found in the groundwater NO_3-N concentration during 2010-2017 (McAleer *et al.*, in prep). In the Castledockerell catchment, which was dominated by spring barley, there was a low annual organic N loading with a minor increase from 35 to 45 kg ha^{-1} from 2008-2018, and there was a higher groundwater NO_3-N concentration with a positive trend during 2010-2017 (McAleer *et al.*, in prep). It was found that factors such as N application, soil moisture deficit and soil/bedrock permeability explained 60-80% ($P<0.0001$) of the nitrate occurrence in the groundwater suggesting that it was not possible to separate agronomic factors from meteorological ones. Despite having lower sources the Castledockerell catchment had high NO_3-N concentrations in both groundwater and surface water due to a combination of free draining soils, lower drainage and tillage management practices (McAleer et al., in prep).

Meteorological impacts on water quality

Changes occurring to rainfall intensity and soil temperature patterns were found to be important drivers of nutrient mobility in soils (Mellander and Jordan, 2021). In 2018 a nation-wide drought caused a build-up of a large soil N pool due to poor grass growth and enhanced soil N mineralisation. That pool of N was flushed out and transferred to the stream in the large rain events in November causing elevated NO_3-N concentrations. The influence of this weather extreme was clearly seen in the ACP catchments where the monthly average NO_3-N concentrations increased in all catchments and in Dunleer catchment exceeded the WFD drinking water standard threshold concentration of 11.3 mg l^{-1} **(Figure 2B)**. The daily average NO_3-N concentration also exceeded the WFD threshold in the Ballycanew catchment which in other times has a relatively low NO_3-N concentration. The long-term shifts in weather patterns and more occurring weather extremes, as expressed by the North Atlantic Oscillation index, was found to influence both N and P concentration in the ACP catchments and in similar sized (ca. 10 km^2) agricultural catchments in Norway and Brittany (Mellander *et al.*, 2018). The response was different for catchments with different physical and chemical settings. There were also impacts to pollution patterns of extreme weather including short periods of rain induced nutrient flux that exceeded average annual mass loads in these catchments, and drought influences on point source pollution (Mellander and Jordan, 2021). Small point-source may significantly elevate P concentrations during an ecological sensitive period (Shore *et al.*, 2017).

Sediment Impact

Excessive sediment can significantly impact the condition of freshwater habitats, resulting in a deterioration of water quality. Sediment can have a greater impact on freshwater insects (key indicators of water quality) than both N and P concentrations.

Meso-sale catchments with low permeability exported larger suspended sediment yields than those with high permeability. Where arable land occurred on low permeability soils, the highest sediment export was recorded. High inter-annual variability resulted from rainfall fluctuations. The results indicate that catchment soil erosion risk can be classified according to soil drainage characteristics and land use type (Sherriff *et al.*, 2019). Suspended sediment export from five of the six ACP catchments was low compared to values for the UK and mainland Europe. This was attributed to greater density of landscape features such as hedgerows and drainage ditches which reduced field sizes, and act as natural mitigation measures (Sherriff *et al.*, 2015). Assessment of the provenance of suspended sediments highlighted that field topsoils, channel banks/sub-surface soils and roads were the dominant contributors to suspended sediments in the ACP catchments and contrasted between catchments *e.g.* grassland catchments dominated by low permeability soils with extensive sub-surface and surface drainage primarily exported

sediment originating from channel banks due to delivery of high velocity flows from up-catchment drained hillslopes (Sherriff *et al.*, 2018).

Both soil drainage type and season have a significant influence in structuring macroinvertebrate communities. Poorly-drained catchments were most impacted, with communities dominated by pollution-tolerant taxa (O hUallachain, 2019). Sediment was found to be a more pervasive stressor on freshwater ecosystems than N or P, with high sediment cover levels having the greatest negative impact on macroinvertebrate communities (Davis *et al.* 2018, 2019)

Quantifying N and P losses from derogation and non-derogation farms

The current phase of the programme has been expanded to include monitoring of soil solution and groundwater N and P concentrations from a number of sites within farms in the Timoleague catchment with increasing nutrient loading. The sites are being selected based on annual N loading. The monitoring which will be continuous from autumn 2021 will provide data to support the requirements of the Derogation in Ireland. The objective of the work is to monitor and report on soil solution, surface water and groundwater on selected derogation and non-derogation farms, which can then be modelled to quantify N and P loss to water from derogation and non-derogation farms by the programme catchment science modeller.

Currently the soil science team are scoping sites for the co installation of Drain Gauge Passive Capillary Lysimeters and ceramic cups arrays within a commercial grazing field. A mixed method approach is being used to increase the coverage of instrumentation in the paddock and thus get as representative assessment and N and P leached from an *in situ* grazing scenario. The installation will be completed at two sites in 2021, a low N loading and a high derogation level N loading. This will be conducted over the summer of 2021 and monitoring will begin thereafter. Additional sites with differing N loadings will be added in 2022 for monitoring.

Catchment Modelling

The ACP has established a comprehensive set of modelling objectives, which are designed to complement and expand upon the goals of the overall program. These objectives are to: (1) to select/develop/ adapt a catchment model(s) which best suit the programme; (2) to model N/P/ C losses from derogation and non-derogation farms; (3) to up-scale the findings of the ACP to larger catchments, river basin districts, and the national level; (4) to test environmental impacts of future agricultural, regulatory, and climate scenarios; and (5) to carry out collaborative modelling initiatives with other modelling groups and dissemination activities.

The selected modelling approach will simulate N/P/C fluxes across the soil-water-atmosphere system, and must be capable of representing the key physical characteristics and land-use practices in Ireland. There are a wide range of potential candidate models which are being explored which may be well suited to provide a baseline modelling approach (e.g. HYPE, SWAT, HSPF, INCA). These models have existing functionality that suit many of the needs of the program, and the potential for further development and adaptation to extend their functionality to meet additional needs. Regardless of the baseline approach(s) selected, in order to upscale ACP results to larger spatial scales, models will need to be capable of functioning across a wide range of spatial scales, ranging from the scale of field (~2ha), to the farm scale, and up to the large catchments and national scale. This is likely to necessitate the adoption of a multi-model approach, utilizing different models across different spatial scales, to adequately simulate processes across scales without excessive predictive uncertainty. For example, to effectively simulate agricultural scenarios, we will need to be able to represent field-scale changes in land-cover / land-use, such as agricultural BMPs, which may need to be approached using varying methods depending upon the scale considered. In addition to working across spatial scales, we will also need representation of fluxes over long temporal scales, in order to simulate agro-environmental measures in conjunction with regulatory and longer-term climate projections. This is particularly important for the study sites of the ACP, where previous research has shown that the impact of weather systems may override mitigation measures, and that there may be a significant lag time (years to decades) between the implementation of measures and detectable changes in N and P fluxes.

To help meet the wide-ranging modelling goals of the ACP project, we are actively working with and establishing new connections with national and international research groups, to benefit from their accumulated experience and expertise. In particular, by working with expert modelling groups from research partners, we can work with them to test additional models and research hypotheses beyond our core 'in house' modelling efforts. This will bring added-value to the extensive data collected by the program, by simultaneously evaluating models which may utilized to meet ACP goals and helping to validate existing models using the unique long-term high frequency datasets collected by the program.

In addition in 2021, The Department of Agriculture, Food and the Marine (DAFM) requested Teagasc to model the impact (environmental and economic) of a number of farm nitrogen mitigation measures in order to inform policy of the best current and potential actions to deliver the catchment based nitrate load reduction estimated by the EPA.

This is published and available at;

2021 - The Impact of Nitrogen Management Strategies within Grass Based Dairy Systems - Teagasc | Agriculture and Food Development Authority[1]

Greenhouse gas and carbon sequestration

The baseline data collection in the ACP has in its current phase been extended to align with the Water Framework Directive (WFD) and include measurements of greenhouse gas (GHG), ammonia emissions, and soil carbon sequestration across the catchments.

Eddy covariance towers have in 2020 been deployed in two of the catchments to provide *in situ*, high resolution (10 Hz) measurement of carbon dioxide, water vapour and methane in air (more are to be installed later in the year). There are two additional eddy covariance towers planned for installation in 2021, one at advanced site planning and the other at an early planning stage. The main objectives is to examine the long-term GHG fluxes for arable and grassland, and examine how soil drainage, management practices, land-use change and climatic drivers impact on the magnitude of GHG fluxes. Monitoring of ammonia will also be conducted at the catchment scale and samplers will be spatially distributed to provide a representative concentration of ammonia within a specific catchment.

Soil Organic Carbon will be quantified in chronosequences at each tower site to ≥ 0.5 m depth. The combined soil-core analysis with EC flux measurements approach will help to quantify how much carbon is transferred from plants to Soil Organic Matter and provide insights to the mechanisms of carbon stabilisation in agricultural soils.

Knowledge exchange and Stakeholder engagement

Four agricultural advisors in the programme provide a service to all farmers with land in the six catchments, numbering just over 300. Most contact with clients is one-to-one, through on-farm visits, office consultations or phone calls and deal with all aspects of the farm business including farm husbandry & production, financial performance and schemes & regulatory compliance. Discussion groups attended by farmers from the catchments are also facilitated by the catchment's advisors. This can be a very effective and efficient method of knowledge transfer (KT), but it is important to be aware that not all farmers are members of such groups. Farmer engagement in the ACP would not be at the level it is if the advisory services were limited to catchment science and water quality issues. The good advisor / client relationship is reflected in the number of ACP farms that have facilitated research through siting of monitoring and experimental sites, and some farmers have suggested research topics applicable to the NAP review. In

[1] 2021 - The Impact of Nitrogen Management Strategies within Grass Based Dairy Systems - Teagasc | Agriculture and Food Development Authority

addition, the broad focus of the advisory service facilitates the collection of environmental, economic and production data from the farms, which is used by researchers in the programme.

The agricultural advisors also disseminate results of the programme to the wider farmer audience and other stakeholders. Visiting farmer discussion groups are regularly hosted by the ACP across all six catchments. Ideally, the group will visit a catchment with a similar context to their own farms, thus ensuring a focused and topical discussion. Other KT activities include presentations to visiting third level college courses, agricultural students, farmer courses, policy agencies and researchers. During the COVID-19 lockdown, staff continued disseminating findings from the ACP using webinars and online platforms. Farmer's derogation training courses and a "Catchments Month" on Teagasc's signpost webinar series are examples of such activity. Scientific journals, popular press, radio interviews, Twitter and You-tube videos also continued to be used to transfer knowledge form ACP research.

Summary

The influence of derogation in Ireland has been assessed at a small catchment scale by detailed water quality monitoring of surface and groundwater bodies in intensively managed and agricultural catchments with different physical setting. Ireland has a large variety of soil types and geology. The heterogeneous physical settings largely influence the nutrient transfer pathways and the associate transformation process along the pathways. At the scale of the ACP catchments these settings can override the source pressure causing a poor link between nutrients leaving the root zone and nutrients monitored in the stream water. The percentage of land in derogation within a catchment was not reflected in the water quality in the streams. In the catchment with most land in derogation and with a gradual increase in annual organic N loading there was no increase in NO_3-N concentration in groundwater. In the catchment with no derogation and only minor increase in organic N loading there was an increase in the NO_3-N concentration in groundwater. A clear weather signal in both N and P concentration has been found in streams in the Irish ACP catchments and in other catchments in NW Europe. At the sub-catchment scale (ca. 1 km^2), of a freely drained catchment, there was a higher NO_3-N and TRP concentrations in the sub-catchment with a higher proportion of land in derogation. In a catchment with poorly drained soils the percentage of land in derogation in sub-catchments was not reflected in the stream water. Sediment can have a greater impact on key indicators of water quality than N and P concentrations. The heterogeneous physical settings and landuse also largely influence the suspended sediment transfer. The fourth phase of the ACP includes detailed farm-scale experiments and monitoring of N and P concentrations in soil solutions and groundwater on derogation and non-derogation farms.

Key messages

- Ireland's landscape is heterogeneous in terms of factors controlling N and P transfer pathways, transformation processes and timing of delivery
- The influence of soil type, subsoil and geology on nutrient loss to water can override source pressures. At the meso-scale catchment (*ca.* 10 km^2) the link between nutrients source pressures and nutrients monitored in the stream water was not clear
- Weather changes can override temporal trends of agronomic pressures
- The influences of weather shifts were different for different physical settings. Both long-term weather shifts and short-term offsets need consideration
- Sediment can have a greater impact on key indicators of water quality than N and P
- Site specific information is required to implement appropriate measures
- ACP will monitor N and P concentrations in soil solutions and groundwater on derogation and non-derogation farms
- The ACP will combine monitoring of water quality, greenhouse gases, ammonia, soil C sequestration and socio economy all in one programme, in order to facilitate sustainable farming practices.
- ACP will use high temporal resolution water quality data from meso-scale catchments together with spatially high resolution data from the national data to scale-up to regional and national scale.

7. Conclusion

In 2020 the Department of Agriculture, Food and the Marine received a total of 6,505 derogation applications before the closing date; of these, 263 were rejected; 226 were withdrawn giving a total of 6,016 that were approved for derogation.

Irelands proactive policy approach to further reducing the impact of agriculture on the environment

2020

Ireland works collaboratively across both Government Departments and their agencies to collectively protect water quality in Ireland. The Department of Housing, Planning and Local Government (DHPLG) is the lead authority for the Nitrates regulations (SI 605 2017) and the Department of Agriculture, Food and the Marine implements and operates the Nitrates Derogation (SI 65 2018)(as amended). Teagasc both a

research and advisory level is actively researching and promoting mitigation measures for farmers and the Environmental Protection Agency (EPA) is responsible for monitoring and reporting environmental indicators.

A review of Ireland's nitrates derogation[2] was undertaken in 2019 conducted to examine further opportunities for derogation farmers to improve efficiencies and continue to reduce their environmental footprint with regard to water, climate and air quality. It was conducted against the background of derogation farms being a very significant intensive cohort and the increasing area being farmed under the derogation. Furthermore, recent EPA reports have highlighted deterioration in water quality and increasing greenhouse gas and ammonia emissions.

Following this review, recommendations in relation to how derogation farmers can improve their nutrient use efficiency and environmental footprint were presented. These recommendations were translated into environmental measures through the enactment of new legislation through Statutory Instrument 40 2020. The new measures are aimed at further strengthening the protection of water and attaining optimum soil fertility that is consistent with both efficient agricultural production and effective water quality protection.

In addition in 2021, The Department of Agriculture, Food and the Marine (DAFM) requested Teagasc to model the impact (environmental and economic) of a number of farm nitrogen mitigation measures in order to inform policy of the best current and potential actions to deliver the catchment based nitrate load reduction estimated by the EPA.

This is published and available at;

2021 - The Impact of Nitrogen Management Strategies within Grass Based Dairy Systems - Teagasc | Agriculture and Food Development Authority[3]

[2] https://www.agriculture.gov.ie/ruralenvironmentsustainability/environmentalobligations/nitrates/

[3] 2021 - The Impact of Nitrogen Management Strategies within Grass Based Dairy Systems - Teagasc | Agriculture and Food Development Authority

Appendix 1

Ireland: Nitrates Derogation 2020

Derogation as percentage of whole country

2020	% of whole country
Number of holdings with grazing livestock	4.98%
Number of grazing livestock units	15.90%
Total net area	9.61%

Appendix 2

Ireland: Nitrates Derogation, 2020

Nitrates Derogations 2020: Applications by County

County	Number of holdings who applied for derogation
Carlow	89
Cavan	94
Clare	50
Cork	2,077
Donegal	91
Dublin	1
Galway	141
Kerry	336
Kildare	66
Kilkenny	497
Laois	237
Leitrim	2
Limerick	329
Longford	15
Louth	78
Mayo	41
Meath	165
Monaghan	279
Offaly	131
Roscommon	18
Sligo	18
Tipperary	822
Waterford	372
Westmeath	62
Wexford	382
Wicklow	79
Total	**6,505**

Appendix 3 – *Provided as separate documents*

Documentation relating to Nitrates Derogation in 2020

Terms and Conditions 2020

Fertiliser Accounts 2019

Note 1 – *farmers were obliged to make on-line applications in 2020*

Note 2 - ***2020 Nitrates Derogation Fertiliser Plan: New or Amended Plan***

Where a new or amended Fertiliser, Plan is submitted in 2020, only a plan produced by either the Teagasc online Nutrient Management Plan programme (eNMP) or the Farmeye Nutrient Management Plan programme was acceptable.

Appendix 4 – *Provided as separate documents*

Maps

Map 1: *Percentage of holdings with grazing livestock encompassed by Derogation in 2020 at county level*

Map 2: *Percentage of grazing livestock units encompassed by Derogation in 2020 at county level*

Map 3: *Percentage of net area encompassed by derogation in 2020 at county level*

Appendix 5 – *Provided as separate document*

EPA Report **"Water quality monitoring report on nitrogen and phosphorus concentrations in Irish waters 2020[4]"**

(e) the results of the surveys on local land use, crop rotations and agricultural practices referred to in Article 8(4);
(f) the results of the model-based calculations of the magnitude of nitrate and phosphorus losses referred to in Article 8(5);

4

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

FERTILISER ACCOUNTS 2019

ACCOUNTS MUST BE SUBMITTED ONLINE ON OR BEFORE 24TH APRIL 2020

NO PAPER APPLICATION WILL BE ACCEPTED. DEROGATION WILL BE WITHDRAWN IF ACCOUNTS ARE NOT RECEIVED ON TIME.

RECEIPTS AND DOCKETS must be **RETAINED ON THE HOLDING** and be available for inspection on request.
Do not leave any sections blank, enter "nil return" if appropriate.

HERD NO:								

NAME: _____

ADDRESS: _____

SIGNED: _____ DATED: _____

Chemical Fertilisers coming onto your holding (Imported) or being sent out of it (Exported)

Date (Details of Opening Stocks, Purchases, Sales & Closing Stock)	Name/Address of supplier/receiver	Type of Fertiliser			Quantity (tonnes)	Kgs of N	Kgs of P
		N % (i)	P % (ii)	K % (optional)	(iii)	(i)x (iii) x 10	(ii)x (iii) x 10
Opening Stocks 01/01/19							
Purchases *Moved onto holding*	**Name/Address of supplier (i.e. Co-op or other Supplier)**						
Sales *Moved off holding*	**Name/Address of receiver**						
Closing Stocks 31/12/2019							
					Total kgs of chemical nitrogen and phosphorus used (Opening Stock + Purchases – Sales – Closing Stock)		

Soiled Water: (Specify method of application of soiled water): _____

Total amount of slurry spread using LESS in 2019 (in M³): _____

Concentrated Feedstuffs:
Quantity of concentrated feedstuffs fed in **2018** to grazing livestock on the holding: _____tonnes (full amount)

Derogation for Ireland pursuant to EU Council Directive 91/676/EEC concerning the Protection of Waters against Pollution caused by Nitrates from agricultural sources

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

2020 Nitrates Derogation Terms and Conditions

Closing Date for Applications
24th April 2020

Before completing the online application, please familiarise yourself with the terms and conditions of the Nitrates Derogation as outlined below.

Failure to comply with these terms and conditions will result in the rejection of the Nitrates Derogation for 2020 and will be considered in subsequent applications.

Cross Compliance breaches, including exceeding the 250 kg N/ha limit, will be notified to Basic Payment Scheme (BPS) and are subject to the BPS penalty schedule. All related documents and FAQ are available at:
https://www.agriculture.gov.ie/ruralenvironmentsustainability/environmentalobligations/nitrates/nitratesderogation/2020nitratesderogation/

Reminder: 2019 fertiliser accounts must be submitted ONLINE no later than April 24th, 2020 for those who applied for a Nitrates Derogation in 2019

The Nitrates Derogation Review has introduced further requirements for derogation farmers who must

1.
- Adopt a farm scale liming programme from 2020.

- Use low emission slurry spreading (LESS) equipment for all slurry spread after April 15th, 2020.

-Reduce the crude protein in concentrate feed for grazing livestock with a maximum of 16% crude protein permissible between April 1st and September 15th, 2020.

2. Derogation farmers must also:
-Exclude commonage/rough grazing from the derogation allowance of 250 kg N/ha

-Participate in an approved environmental training course by the end of 2021.

- Participate in grassland management requirements from 2020, including grass measuring and annual grass production recording.

- Alternatively, if derogation farmers haven't the required skills to undertake this measure, they must participate in grassland management training which must be completed by the end of 2021.

- Incorporate Clover in any newly reseeded swards on derogation 2020.

- Adopt at least one measure from the All Island Pollinator Plan on order to enhance biodiversity on farms.

NITRATES DEROGATION 2020
TERMS AND CONDITIONS

Please read the eligibility criteria and the conditions below carefully before making an application to ensure that you are eligible for a derogation and that you can meet all the conditions in full during the current year.

ELIGIBILITY CRITERIA

- You must be farming a holding that is at least 80% grass.
- You must have grazing livestock – derogation is only available in respect of grazing livestock.
- You must make an annual **ONLINE** application to the Department in the format specified and no later than 24th April 2020. No postal applications will be accepted.
- **You must not import livestock manure even in processed form.**
- You must accept the terms and conditions contained herein before submitting your application.
- You shall adhere to all legislative requirements.
- You must have sufficient storage for all livestock manure, soiled water and silage effluent.
- **You must participate in an approved environmental training course by 2021.**

DEFINITIONS

(a) "Grassland farms" means holdings where 80% or more of the agricultural area available for manure application is grass.
(b) "Grazing Livestock" means cattle (with the exclusion of veal calves), sheep, deer, goats and horses.
(c) "Grass" means permanent grassland or temporary grassland (temporary implying leys of less than four years).
(d) "Parcel" means an individual field or a group of fields, homogenous regarding cropping, soil type and fertiliser practices.
(e) "Commonage" means land farmed in common, that typically encompasses hill/mountain land that is used for extensive grazing purposes.
(f) "Rough Grazing" means land that is used for extensive grazing purposes, typically due to the presence of features which make mechanical operations difficult. For example out-cropping rock or scrub.

DETAILED CONDITIONS

Nutrient Management

1. The amount of livestock manure from grazing livestock applied to the land each year on grassland farms, including by the animals themselves, shall not exceed the amount of manure containing 250 kg N/ha, subject to the conditions laid down in the paragraphs below.

2. **Commonage and rough grazing will not be eligible** for the derogation allowance of 250 kg N/ha. Chemical fertiliser calculations on commonages/rough grazing will be limited to the ≤170 kg N/ha allowances.

3. The total nitrogen inputs shall not exceed the foreseeable nutrient demand of the considered crops, shall account for the supply from the soil, and shall not exceed the maximum fertiliser rates applicable to the farm, established in the Nitrates Action Programme.

4. Total nitrogen application shall be differentiated based on stocking rate and grassland productivity.

5. A Nutrient Management Plan (NMP) or fertiliser plan must be kept for the holding describing the crop rotation of the farmland and the planned application of manure and other fertilisers. This must be submitted online to the Department along with your application before April 24th

2020 unless you submitted a plan to the Department in 2017, 2018 or 2019 that remains applicable for 2020.

6. Where a new or amended NMP is submitted in 2020, only a plan produced by the **Teagasc Online Nutrient Management Plan** programme or the **FarmEye Nutrient Management Plan** programme is acceptable.

7. A plan in relation to the farm shall be amended and submitted online no later than seven days following any changes in agricultural practice on the holding to ensure consistency between the plan and actual agricultural practice. All associated documentation e.g. soil analysis results, farm map, farmyard sketch should also be submitted online.

8. You must submit a **Farm Map** clearly indicating the location of individual fields and the soil sample locations so that these can be identified in the NMP

9. A reduction in the crude protein in concentrate feed for grazing livestock with a maximum **of 16% crude protein** permissible between April 1st and September 15th, 2020. This information will be included in feed concentrate records farmers submit annually.

10. 2019 fertiliser accounts must be submitted ONLINE no later than 24th April 2020 for those who applied for nitrates derogation in 2019.

11. The application, the NMP, the fertiliser accounts and other supporting documentation may be subject to control by the competent authority.

12. The NMP shall include at least the following:

    a) The crop rotation plan, which must specify the area (hectares) of parcels with grass and parcels with other crops including a map indicating the location of individual parcels;
    b) The number of livestock, a description of the livestock housing and manure storage system, including the volume of manure storage available **and a fully labelled farmyard sketch**;
    c) If a fully labelled farmyard sketch was submitted online in either 2017, 2018 or 2019 and it is still applicable in 2020 this will be sufficient.
    d) A calculation of manure nitrogen and phosphorus produced on the holding;
    e) The amount, type and characteristics of manure delivered outside the farm or to the farm;
    f) The foreseeable nitrogen and phosphorus crop requirements for each parcel;
    g) The results of **soil analysis** related to nitrogen and phosphorus soil status;
    h) The nature of the fertilisers to be used;
    i) A calculation of nitrogen and phosphorus from manure over each field;
    j) A calculation of nitrogen and phosphorus application from chemical and other fertilisers for each field;

Soil testing and management

1. NMPs must be based on results of soil analysis dated after September 15th 2016.

2. To participate in the **P Build up** programme while in derogation soil analysis must comply with conditions re OM sampling as set out in Article 16 (3)(d) of the Regulation. You must attend a P Build up training by an approved FAS advisor.

3. Soil analysis shall be performed for the holding at least every four years for each homogeneous area of the holding, with regard to crop rotation and soil characteristics. At least one analysis per **five hectares** of land is required.

4. **New applicants** who do not have soil analysis results must assume P Index 3 for 2020 but soil sample analysis, in respect of crop year 2021, must be available and the NMP amended accordingly and submitted online to the Department before **31st March 2021**.

5. **Short term rented** land which does not have current valid soil analysis results must assume P Index 4 for 2020.

Manure and slurry spreading

1. Livestock manure shall not be spread in the autumn i.e. from 1 August to 30 October before grass cultivation.

2. **From the 15th of April, 2020 all slurry applied must be by way of LESS equipment.** The total amount of slurry in m^3 spread in 2019 must be entered on the on-line application. New applicants who did not use LESS equipment in 2019 should enter zero.

3. A derogation holding must have sufficient storage for all livestock manure produced during the closed period, soiled water and silage effluent produced on the holding.

Grassland management

1. Derogation farmers **must record through appropriate software technology the grass produced annually on the farm** from 2020 however if derogation farmers haven't the required skills to undertake this measure, they must undertake training in grassland management which must be completed by the end of 2021.

2. **Clover must be incorporated when reseeding swards** on derogation farms.

3. The adoption of a **farm scale liming programme** is required from 2020 on derogation farms. The details of the liming programme are to be provided in the NMP.

4. Temporary grassland shall be ploughed in spring (i.e. from 1 February to 30 April).

5. Ploughed grass on all soil types shall be followed immediately by a crop with high nitrogen demand.

6. Crop rotation shall not include leguminous or other plants fixing atmospheric nitrogen (except in the case of clover in grassland with less than 50% clover and other leguminous plants that are under sown with grass).

Biodiversity

1. All farmers in derogation must adopt **at least one measure** from the following list of actions from the All Island Pollinator Plan;

a) Leave at least one mature Whitethorn/Blackthorn tree within each hedgerow.

b) Hedgerows shall be maintained on a minimum 3-year cutting cycle.

c) Cut in rotation rather than all at once as this will ensure some areas of hedgerow on your farm will always flower.

BY SUBMITTING AN APPLICATION FORM, YOU ARE DECLARING THAT:

(A) YOU HAVE READ AND UNDERSTOOD THE ABOVE CONDITIONS,

(B) YOU MEET THE ELIGIBILITY CONDITIONS FOR A DEROGATION AND

(C) YOU WILL FARM IN ACCORDANCE WITH THE DETAILED CONDITIONS HEREIN IN THE CURRENT YEAR.

LEGAL BASIS AND IMPORTANT INFORMATION

S.I. No 605 of 2017, European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2017, S.I. 65 of 2018, European Union (Good Agricultural Practice for the Protection of Waters) (Amendment) Regulations 2018 and SI 40 of 2020, European Union (Good Agricultural Practice for the Protection of Waters) (Amendment) Regulations 2020 S.I. No 31 of 2014, European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 continues to apply for soil test requirements only, in cases where soil samples taken prior to 01/01/2018 are still valid. Other related schemes have their own legal basis, as outlined under their own Terms and Conditions.

The Nitrates Derogation is available to grassland farms on an individual basis. The derogation applies only to grazing livestock on the holding. Farmers who wish to avail of the derogation will have to make an annual application and farm in accordance with a NMP and the conditions set out below.

The derogation allows the application of a higher amount of livestock manure than that provided for in the Nitrates Regulations (where the limit is 170kg N/ha/annum) subject to certain conditions. Successful applicants will be able to apply livestock manure in excess of 170kg/ha/annum in accordance with their NMP and up to a maximum of 250kg/ha/annum. If your stocking rate exceeds 250kg N/ha/annum, you must consider alternative arrangements such as exporting some of the livestock manure to ensure the stocking rate does not exceed 250kg N/ha/annum. Please note that derogation farmers must have sufficient storage for all livestock manure produced during the closed period, soiled water and silage effluent produced on the holding.

Nitrogen and Phosphorus Statements are available online each year at http://www.agfood.ie to farmers who, in the previous year (a) had cattle recorded on the Department's AIM system and (b) made application under the Basic Payment Scheme. The Statement sets out the quantities of nitrogen and phosphorus produced **by your cattle** during the previous year. This will give you a clear indication of your livestock manure nitrogen status. It will also help you to plan for the year ahead and to decide if you need to apply for a derogation.

Remember that the statement will show the nitrogen and phosphorus produced by **cattle only**, so if you have other livestock on your farm (such as sheep, pigs, poultry, horses, etc) you will need to work out the N and P that they produced and add this to the figure for cattle to get the total figure.

FARM ADVISORY SYSTEM

Under Article 13 of Council Regulation (EC) No. 1782/2003 each Member State is required to establish an approved Farm Advisory System (FAS) to advise farmers on land and farm management. The advice shall cover at least the Statutory Management Requirements (SMRs) and the Good Agricultural and Environmental Conditions (GAEC) referred to in Chapter 1 of the Regulation (Cross-compliance). Participation by farmers is voluntary.
Ireland has an advisory system in place and the full listing is available at: https://www.agriculture.gov.ie/farmerschemespayments/farmadvisorysystem/

DATA PROTECTION NOTICE

The Department of Agriculture, Food and the Marine complies with all requirements under Data Protection and Freedom of Information legislation, more information on DAFM's policy can be found here: https://www.agriculture.gov.ie/dataprotection/informationondataprotection/ and also in the Terms & Conditions for the Basic Payment Scheme 2020.

Information specific to the personal data being collected by Nitrates Division

The following data is specific information in relation to the personal data processed for the purposes of ensuring compliance with the Nitrates Regulations. The Department of Agriculture, Food & the Marine's general data protection policy should be read in conjunction with this document and can be viewed here: https://www.agriculture.gov.ie/dataprotection/informationondataprotection/

Specified purpose

The personal data sought from you, or previously furnished by you, is required for the purpose of complying with the Nitrates Regulations, audit, evaluation purposes, cross compliance controls, controls relating to the legislation underpinning cross compliance and all Rural Development measures, as required by Article 65 of Commission Implementing Regulation (EU) 809/2014. Also personal information may be released under the terms of the relevant Data Protection legislation in force and the Freedom of Information Act 2014. Failure to provide all the personal data required to facilitate the processing of the application; including data testing, under the scheme will result in DAFM being unable to further process the application. Failure to provide certain information which you are required to provide under the Terms and Conditions of the schemes may result in the necessity to repay monies already paid under the schemes, or in sanctions being applied under these schemes. You should consult the Terms & Conditions and Specification of the schemes in this regard.

Sanctions for failure to comply with the Nitrates Regulations are provided for in EU Regulations 1306/2013, 640/2014 and 809/2014 and are applied under the Terms and Conditions of the Direct Payment Schemes and Rural Development Programme measures.

The Department may also use data provided for the purposes of facilitating the processing of an application for participation in other related schemes operated by the Department of Agriculture, Food and the Marine or for the purposes of updating information on the relevant databases held by the Department in connection with these schemes. Each scheme has its own legal basis as outlined under their own Terms and Conditions.

Legal basis

The current legislation for Data Protection in Ireland is the Data Protection Act 1988 as amended by the 2003 Data Protection Act, The Data Protection Act 2018 and The General Data Protection Regulations (EU 2016/679).

Recipients

Information provided to Nitrates Division will be shared, with other divisions within the Department, for the purposes of processing other related scheme applications in a timely and efficient manner.

When you submit information to Nitrates Division, some of your personal data will be made available to other Government Departments/Agencies/Local Authorities, but only where there is a valid legal basis to do so. The purpose of this sharing of data is for audit, evaluation purposes, cross compliance controls, controls relating to the legislation underpinning cross compliance and all Rural Development measures, as required by Article 65 of Commission Implementing Regulation (EU) 809/2014. Also personal information may be released under the terms of the relevant Data Protection legislation in force and the Freedom of Information Act 2014.

Information will be shared within the Department for the purposes of monitoring and evaluating CAP as per the Regulations (EU Reg 1306/2013) in accordance with the Data Protection legislation in force. Personal data may be used for statistical, research and analysis purposes in some circumstances, but will only be done so in compliance with the Data Protection legislation in force. Data used for such purposes will be pseudonymised (masked) or anonymised, as appropriate, to protect the security and

confidentiality of the data. The use of the data in this way may facilitate the Department in informing policy decisions into the future, which would benefit the Irish farmer and the Agriculture Sector.
The Department is also currently obliged by law to provide information concerning applicants in response to requests received from the Office of the Revenue Commissioners, An Garda Síochana, and other bodies, in accordance with Section 8 of the Data Protection Acts 1988 and 2003. The introduction of the General Data Protection Regulation in May 2018, and any further national Data Protection legislation, may change the requirements and the legislative basis for such requests.
As part of this requirement to comply with the Nitrates Regulations, you may be requested by the Department or relevant agents acting on its behalf, to supply data in relation to your participation to other Schemes, and facilitate on-farm inspections/assessments, where required for the purpose of assessment, verification, evaluation or research purposes as provided for under the Regulations (EU Reg 1306/2013). Not to supply such information may invalidate/cancel your application or incur sanctions in those schemes.

Transferred outside the EU
Information provided in relation to the Nitrates Regulations is not currently transmitted outside of the EU.

Retention Period
The data submitted in support of the application by the data subject will be retained by DAFM only as long as there is a business need to do so in line with the purposes for which it was collected.
After this time, it will be marked for destruction and will be destroyed in line with internal guidelines or guidelines for destruction received from the National Archives Office or associated permissions received from them.

Data provision being statutory or contractual obligation
The data provided for this purpose is being requested on a statutory basis under the Nitrates Regulations and Irish legislation (S.I. 605 of 2017, S.I. 65 of 2018 & S.I. 40 of 2020).

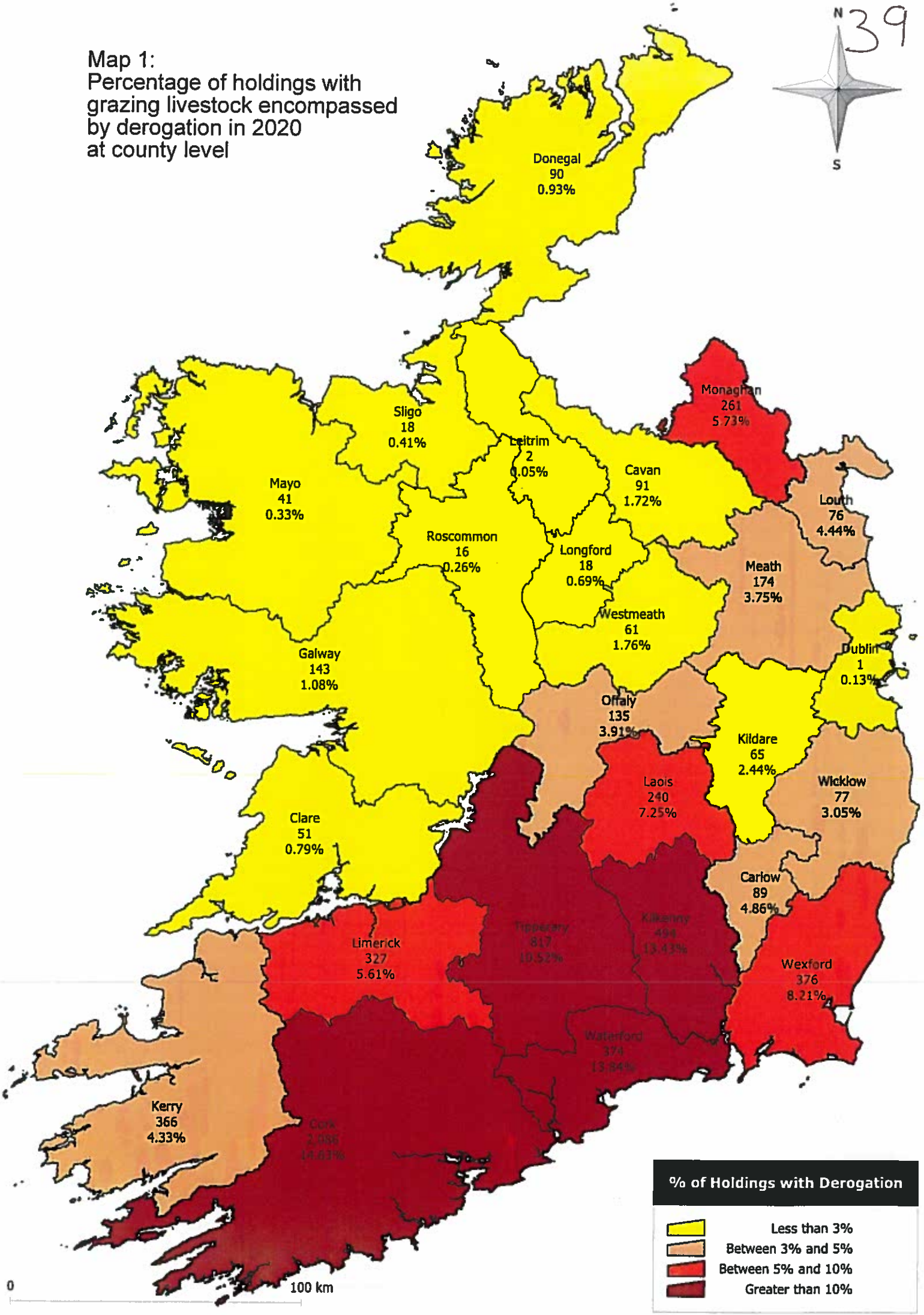
Automated Decision Making
Personal data provided to Nitrates Division will be processed automatically for the purpose of the efficient running of the scheme.
Automated decision making will also be used for the purposes of selecting participants for inspection in accordance with the regulations (EU Regulations 1306/2013 & 809/2014, S.I. 605 of 2017, S.I. 65 of 2018 & S.I. 40 of 2020).

Information from Third Party
Your personal data in relation to Nitrates records may be obtained from another party that submits information to Nitrates Division, this includes (but is not exhaustive) for example in a declaration submitted by them of a transaction regarding the movement of livestock manure, the temporary movement of animals or the short term rental of land in line with this Department's requirement to ensure compliance with the Nitrates Regulations and associated legislation. In circumstances where this Department did not gather your personal data you are still entitled to exercise your rights in relation to this personal data and the details on how to exercise individuals rights are detailed here https://www.agriculture.gov.ie/dataprotection/informationondataprotection/

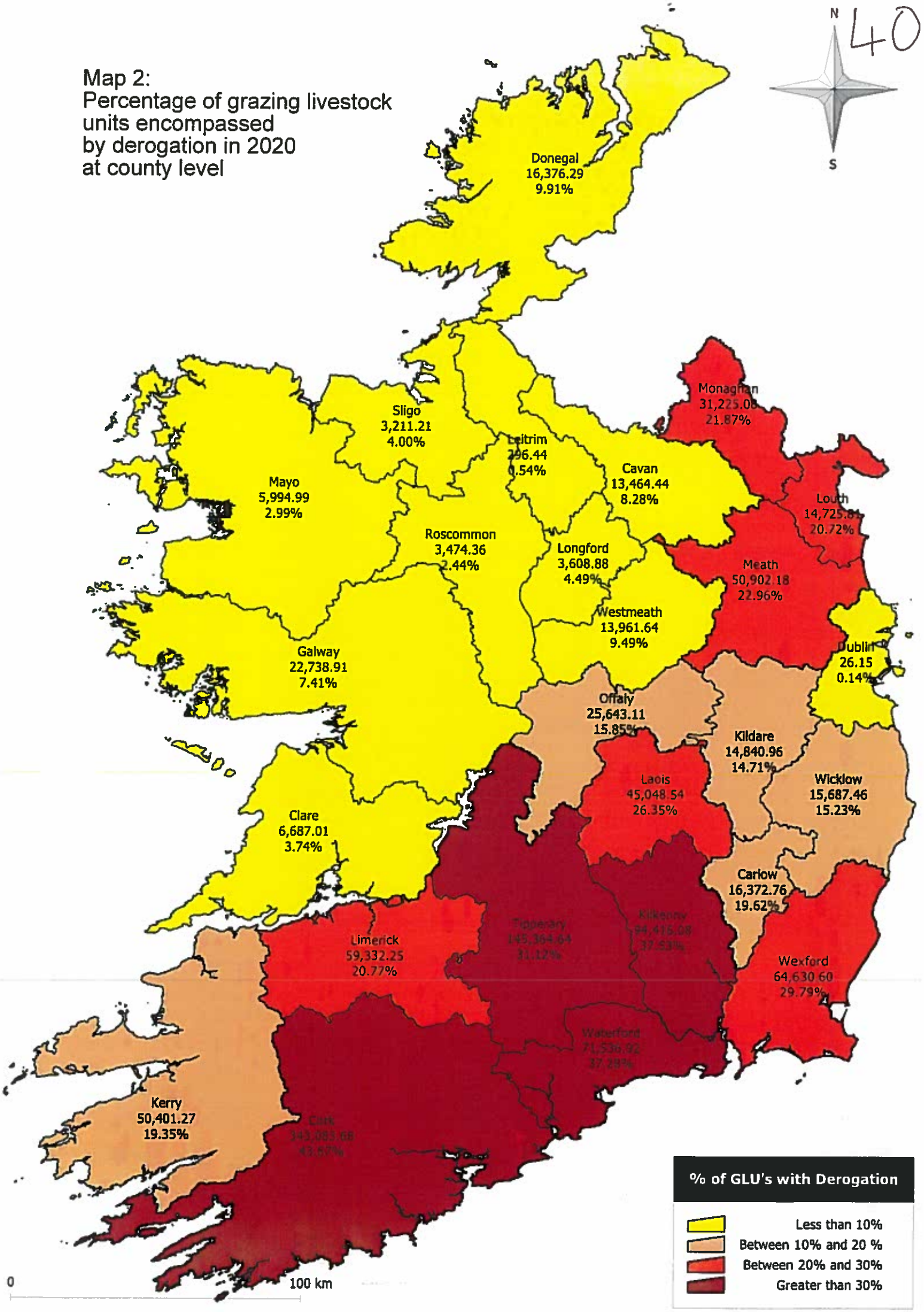
Technical information on data collected:
Technical information on the cookies used on our Department's website is available here.

NITRATES SECTION
DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE
JOHNSTOWN CASTLE ESTATE
WEXFORD.
Y35 PN52 Ph: 053 916 3444; Email: nitrates@agriculture.gov.ie

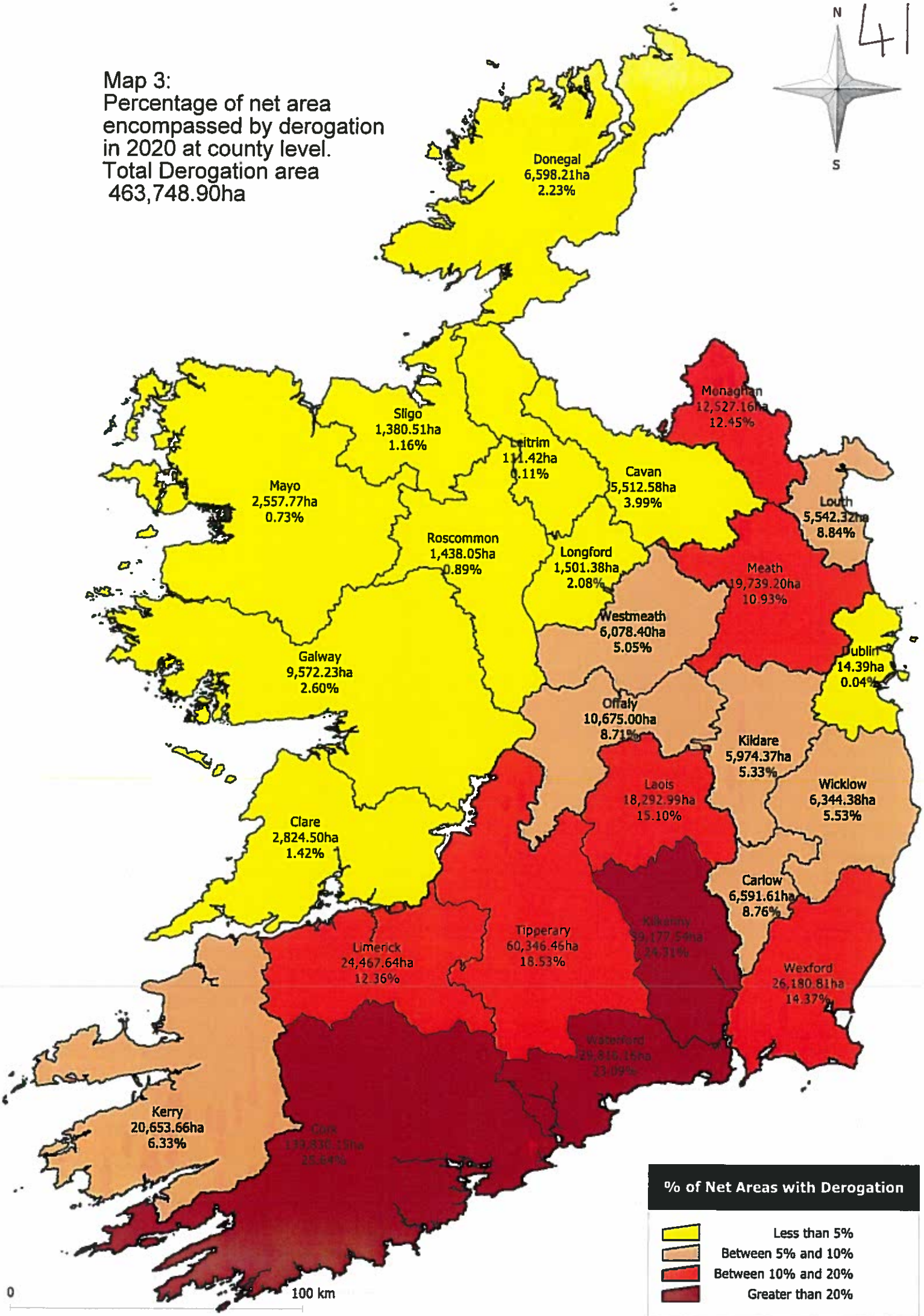
Map 1:
Percentage of holdings with grazing livestock encompassed by derogation in 2020 at county level



Map 2:
Percentage of grazing livestock units encompassed by derogation in 2020 at county level



Map 3:
Percentage of net area encompassed by derogation in 2020 at county level.
Total Derogation area
463,748.90ha



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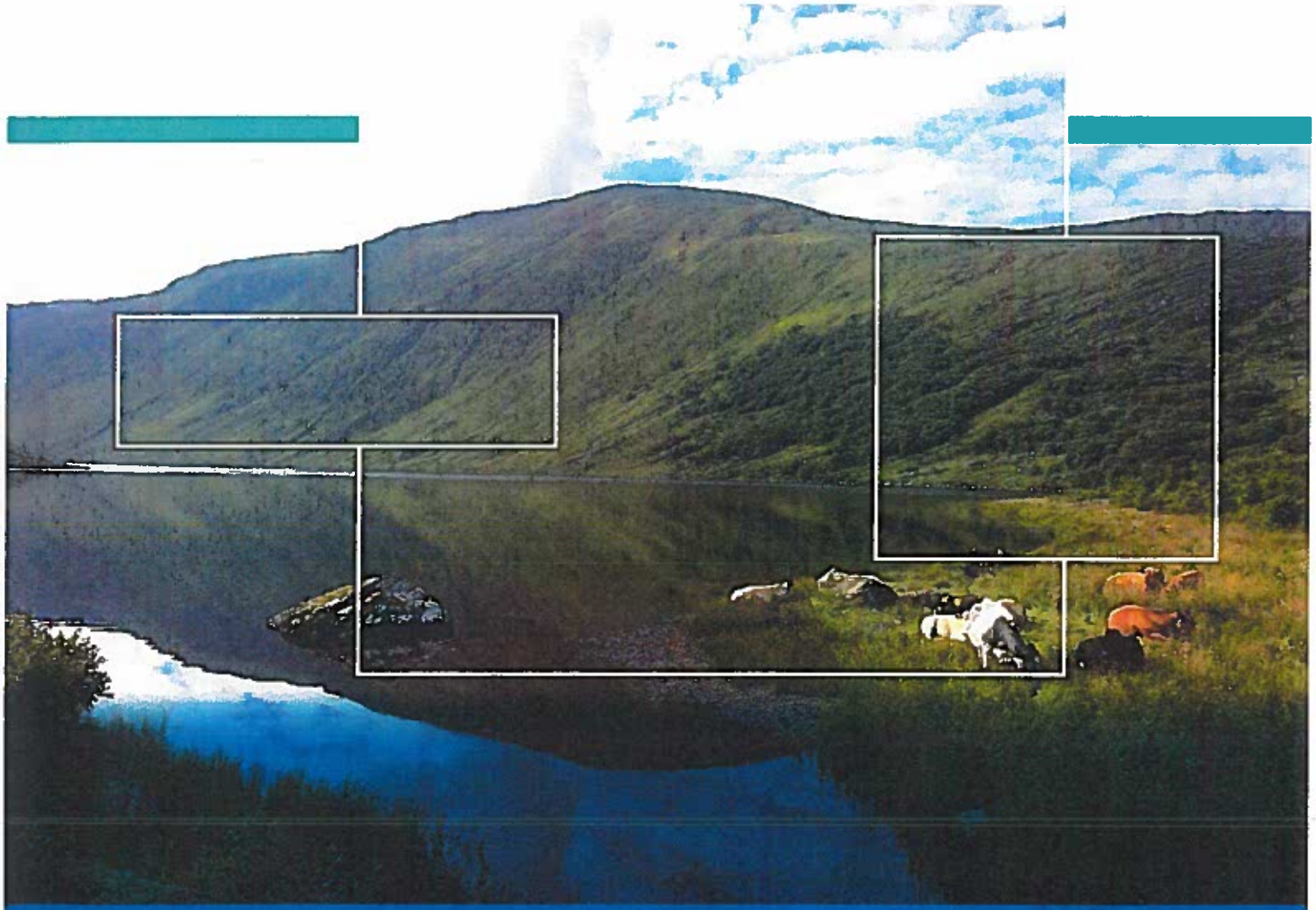
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil



Water quality monitoring report on nitrogen and phosphorus concentrations in Irish waters 2020

ENVIRONMENTAL PROTECTION AGENCY

The EPA is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: *Implementing regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.*

Knowledge: *Providing high quality, targeted and timely environmental data, information and assessment to inform decision making.*

Advocacy: *Working with others to advocate for a clean, productive and well protected environment and for sustainable environmental practices.*

Our responsibilities include:

Licensing

- Large-scale industrial, waste and petrol storage activities;
- Urban waste water discharges;
- The contained use and controlled release of Genetically Modified Organisms;
- Sources of ionising radiation;
- Greenhouse gas emissions from industry and aviation through the EU Emissions Trading Scheme.

National Environmental Enforcement

- Audit and inspection of EPA licensed facilities;
- Drive the implementation of best practice in regulated activities and facilities;
- Oversee local authority responsibilities for environmental protection;
- Regulate the quality of public drinking water and enforce urban waste water discharge authorisations;
- Assess and report on public and private drinking water quality;
- Coordinate a network of public service organisations to support action against environmental crime;
- Prosecute those who flout environmental law and damage the environment.

Waste Management and Chemicals in the Environment

- Implement and enforce waste regulations including national enforcement issues;
- Prepare and publish national waste statistics and the National Hazardous Waste Management Plan;
- Develop and implement the National Waste Prevention Programme;
- Implement and report on legislation on the control of chemicals in the environment.

Water Management

- Engage with national and regional governance and operational structures to implement the Water Framework Directive;
- Monitor, assess and report on the quality of rivers, lakes, transitional and coastal waters, bathing waters and groundwaters, and measurement of water levels and river flows.

Climate Science & Climate Change

- Publish Ireland's greenhouse gas emission inventories and projections;
- Provide the Secretariat to the Climate Change Advisory Council and support to the National Dialogue on Climate Action;
- Support National, EU and UN Climate Science and Policy development activities.

Environmental Monitoring & Assessment

- Design and implement national environmental monitoring systems: technology, data management, analysis and forecasting;
- Produce the State of Ireland's Environment and Indicator Reports;
- Monitor air quality and implement the EU Clean Air for Europe Directive, the Convention on Long Range Transboundary Air Pollution, and the National Emissions Ceiling Directive;
- Oversee the implementation of the Environmental Noise Directive;
- Assess the impact of proposed plans and programmes on the Irish environment.
- Environmental Research and Development
- Coordinate and fund national environmental research activity to identify pressures, inform policy and provide solutions;
- Collaborate with national and EU environmental research activity.

Radiological Protection

- Monitoring radiation levels and assess public exposure to ionising radiation and electromagnetic fields;
- Assist in developing national plans for emergencies arising from nuclear accidents;
- Monitor developments abroad relating to nuclear installations and radiological safety;
- Provide, or oversee the provision of, specialist radiation protection services.

Guidance, Awareness Raising, and Accessible Information

- Provide independent evidence-based reporting, advice and guidance to Government, industry and the public on environmental and radiological protection topics;
- Promote the link between health and wellbeing, the economy and a clean environment;
- Promote environmental awareness including supporting behaviours for resource efficiency and climate transition;
- Promote radon testing in homes and workplaces and encourage remediation where necessary.

Partnership and networking

- Work with international and national agencies, regional and local authorities, non-governmental organisations, representative bodies and government departments to deliver environmental and radiological protection, research coordination and science-based decision making.

Management and structure of the EPA

The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:

- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by advisory committees who meet regularly to discuss issues of concern and provide advice to the Board.

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WATER QUALITY MONITORING REPORT ON NITROGEN AND PHOSPHORUS CONCENTRATIONS IN IRISH WATERS (2020)

ENVIRONMENTAL PROTECTION AGENCY

An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland
Telephone: +353 53 9160600 Fax: +353 53 9160699
Email: info@epa.ie Website: www.epa.ie
Lo Call 1890 33 55 99

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Background to this Report

Regulation 38 of the European Union (Good Agricultural Practices for the Protection of Waters) (Amendment) Regulations (S.I. 65 of 2018) requires the EPA to prepare an annual report of the results of water quality monitoring to support the assessment of the impact of the nitrate's derogation as required by the Commission Implementing Decision (EU) 2018/209.

In preparing this report, the EPA has used data from the National Water Framework Directive Monitoring Programme. The report summarises phosphorus and nitrate data, taking account of the water quality reporting guidance used for Council Directive 91/676/EEC (the Nitrates Directive).

Nitrogen and phosphorus data are presented for groundwater, rivers, lakes, estuarine and coastal waters. Nitrogen results are expressed as nitrate and phosphorus results are measured as molybdate reactive phosphate or total phosphorus. The results are expressed as annual means in the case of rivers, lakes and groundwater or as winter medians for estuarine and coastal waters. The figures and tables in this report summarise the mean or median annual concentrations in 2020 and mean or median annual concentration changes in the last decade.

While both nitrate and phosphorus are important drivers of nutrient enrichment and pollution (eutrophication) their impact should be considered in conjunction with the overall ecological condition of our waters. The EPA's Water Quality in Ireland report, covering the period 2013-2018, provides a full assessment of the chemical and ecological water quality and WFD status of Irish waters. The EPA's Water Quality Indicators report for 2020 provides a snapshot of nitrate, phosphorus and other water quality indicators.

Public access to the nutrient data for the sites in the WFD monitoring programme is available on www.catchments.ie.

Key Water Quality Findings

- Nitrate concentrations in rivers, groundwaters and estuaries have been increasing since 2013.
  - In 2020, 32% of rivers had mean nitrate concentrations greater than 11.5[1] mg/l NO_3. River concentrations above 11.5 mg/l NO_3 may be impacting on the ecological health of the receiving marine waters.
  - Since 2013, the number of rivers with concentrations greater than 11.5 mg/l NO_3 has increased by over 10%. There have also been increases of more than 1.5 mg/l NO_3 in over a third (35%) of rivers since 2013.
  - A quarter of groundwater sites had mean nitrate concentrations greater than 25 mg/l NO_3 in 2020. There has been a net increase of more than 1.5 mg/l NO_3 at almost half (42%) of all groundwater sites since 2013.
  - Nearly a fifth (18%) of estuarine and coastal water bodies had winter median nitrate concentrations greater than 11.5 mg/l NO_3.
- The greatest increases in riverine and groundwater nitrate concentrations have been in the south and south east of the country. Ten of the 16 monitored estuaries and coastal waters in this south east having concentrations above the nitrogen standard for marine waters.
- River and lake phosphorus concentrations are highest, and have increased most, in areas with poorly draining soils.
  - Over a quarter (29%) of river sites have mean phosphorus concentrations greater than the good status EQS (0.035 mg/l P) in 2020.
  - Similarly, 29% of lakes have mean phosphorus concentrations greater than the good status EQS (0.025 mg/l P).

Summary assessment

The 2013-2018 assessment of water quality in Ireland (EPA, 2019) found that only just over half of our rivers and lakes were in satisfactory ecological health and overall water quality was in decline. The picture for our estuaries was even more stark with only 38% in satisfactory condition. The assessment indicated the main problem damaging our waters was the presence of too much phosphorus and nitrogen.

This report finds that nitrogen concentrations remain too high in rivers, groundwater and estuaries in the south, south east and east of Ireland; and the concentrations have been increasing since 2013. Over a third (35%) of all river sites have seen an increase of more than 1.5 mg/l NO_3 in the annual mean concentration since 2013. A quarter of groundwater sites are also showing an increase of more than 1.5 mg/l NO_3. The greatest increases in nitrate have been in the south east and south, with 10 of the 16 monitored estuaries and coastal waters in this south east having concentrations above the nitrogen standard for marine waters, and a quarter of these waterbodies have had an upward trend of more than 1.5 mg/l NO_3 since 2013.

In relation to phosphorus the report finds that over a quarter of river sites (29%) and lake sites (29%) have mean phosphorus concentrations greater than the good status EQS (0.035 mg/l P and 0.025 mg/l P respectively). The highest river and lake phosphorus concentrations

1 For the purposes of catchment nutrient management, it is assumed that if the nitrate concentrations in streams and rivers throughout the contributing catchment are maintained at less than 11.5 mg/l NO_3, then the statutory dissolved inorganic nitrogen standard of 2.6 mg/l as N will be achieved in the receiving marine waters.

are found in areas with poorly draining soils and it is in these areas that concentrations have increased the most since 2013. For an average Irish stream catchment, average losses of only 200 g/ha from land are enough to cause a water quality issue. Agriculture and wastewater discharges are the main sources of phosphorus in surface water.

The increase in nutrient concentrations in water since 2013 represents a worrying development in the context of the status objectives of the Water Framework Directive (WFD) as 29% of rivers and lakes already exceed the phosphorus environmental quality standards and 32% of rivers had concentrations higher than 11.5 mg/l NO_3, which may be contributing to a breach of the environmental quality standard in the receiving marine waters.

As part of the development of the draft River Basin Management Plan the EPA has quantified the nutrient load reductions needed to achieve water quality outcomes for major river catchments in Ireland that discharge to monitored coastal waters (EPA, 2021a). Thirteen river catchments have elevated nitrogen concentrations that may be contributing to a breach of the environmental quality standard in the receiving marine waters; all of which are located along the south, south east and east coasts. The relative nitrogen load reduction needed in each catchment has been determined by calculating the difference between the annual nitrogen load and the nitrogen load required to maintain the concentration below the EQS of 2.6 mg/l (as N) in the receiving estuaries and coastal waters[2].

The EPA assessment shows that comparatively the nitrogen load reduction required in the Suir, Slaney and Barrow catchments in the south east, and the Blackwater catchment in the south is substantially higher than the other nine catchments with elevated nitrogen concentrations. The analysis includes nitrogen load reduction assessments and the generation of load reduction maps at the sub-catchment level and indicates that approximately 85% of the nitrogen in these catchments is from agricultural sources. Assessments by the EPA have shown that there is a clear nitrogen response in water to changes in herd numbers and gross nitrogen balance (EPA, 2020).

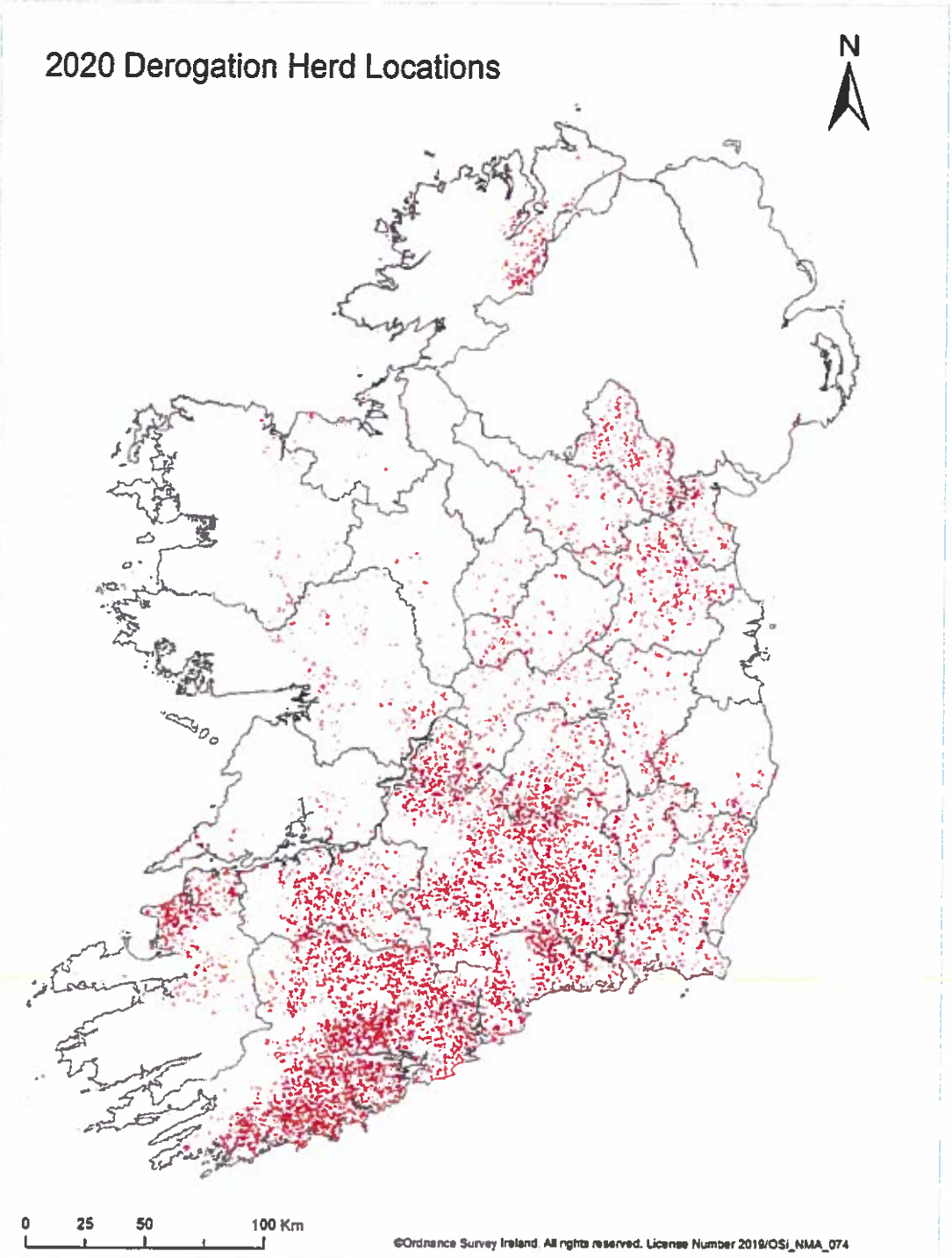
This evidence base can be used by the policy makers to help prioritise measures to support good water quality, and healthy aquatic ecosystems[3] and meet its statutory obligations.

Map 1 shows the location of derogation farm holdings[4] in 2020 and the highest densities are found along the southern seaboard, the south east and to a lesser extent along the east coast.

2 Nitrate concentrations are expressed as mg/l NO_3, and the standard to protect the receiving estuarine and coastal water is expressed as mg/l N. To convert Nitrate to Nitrogen, divide by 4.43 e.g. 11.5 mg/l NO_3 = 2.6 mg/l N.

3 Some catchments may also need additional water quality measures such as reductions in phosphorus, chemicals and sediment, or improvements in hydromorphology or some of the biological elements, but for the purposes of this assessment, the focus is on nitrogen.

4 Derogation farms are those which have been granted a derogation from the standard limit of 170 kg nitrogen per hectare of livestock manure from grazing livestock which can be applied to the land each year on grassland farms. Farms granted derogations may apply manure up to a limit of 250 kg nitrogen per hectare (including by the animals themselves).



Map 1: National distribution of derogation herds in 2020
(Source: Department of Agriculture, Food and the Marine)

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Results of Water Quality Monitoring

The following section sets out the results of monitoring for groundwater, rivers, lakes and transitional and coastal waters. Groundwater monitoring data were averaged and are presented for monitoring undertaken during 2020, while the 2020 surface water data presented represents the average or median concentration between 2018-2020. Water quality trend analysis were undertaken using data since 2013 for groundwater, rivers and lakes and 2010 for transitional and coastal waters. These years have been selected as they represent a point in time when nationally nutrient concentrations started to increase.

The nitrate and phosphorus water quality data presented hereafter, uses a common, comparable set of water quality ranges across all waterbody types to allow for consistent analysis across water types and between member states. The ranges have been standardised across all water types and where applicable align with environmental quality standards and/or environmental limits of concern for different water quality categories.

Groundwater

Nitrate in Groundwater

Figure 1 summarises the mean nitrate concentrations for the 194 national groundwater monitoring programme sites monitored in 2020.

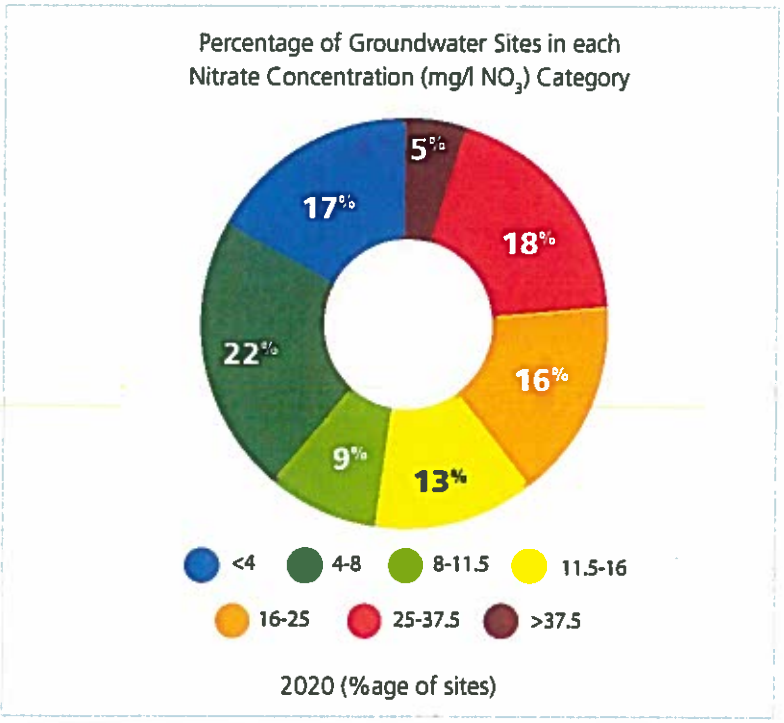

Figure 1: Mean nitrate concentrations in groundwater during 2020

In 2020, 25% of groundwater monitoring sites had a mean nitrate concentrations greater than 25 mg/l NO_3 compared with 22% in 2019 and 10.4% of sites in 2013. Map 2 highlights that most of the sites with concentrations greater than 25 mg/l NO_3 are in the south and south-east of Ireland. Ten monitoring sites exceeded the Irish Threshold Value of 37.5 mg/l NO_3. Three of these sites had a mean nitrate concentration greater than the drinking water standard of 50 mg/l NO_3.

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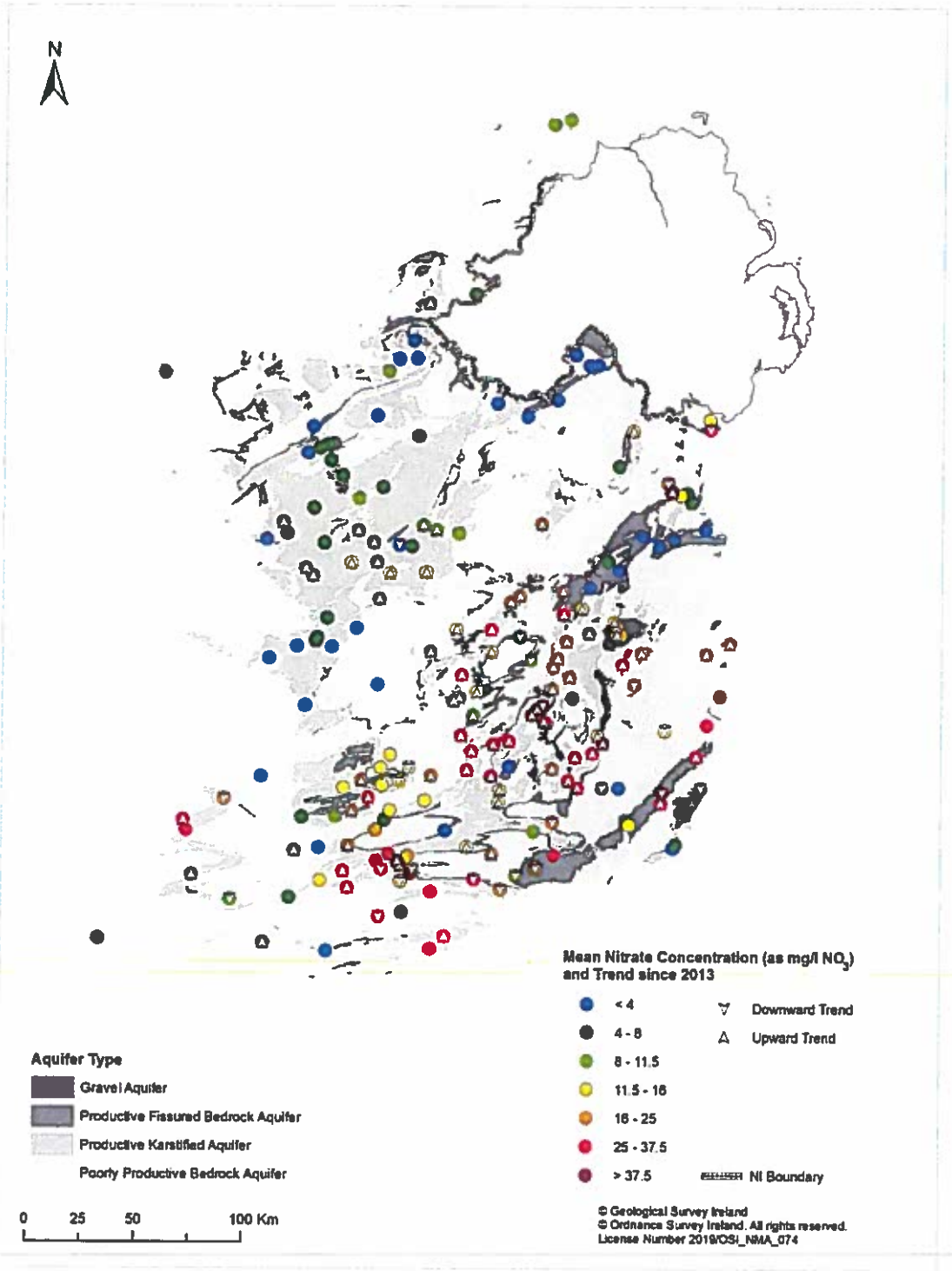

Map 2: Mean nitrate concentrations in groundwater during 2020 and concentration trends since 2013

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Table 1 shows that nitrogen concentrations in groundwater are increasing. Even when inter annual variability has been considered, there has been a net increase of more than 1.5 mg/l NO_3 (i.e. an average annual change of 0.05 mg/l N) in the last seven years at almost half (42%) of all sites. Map 2 indicates there has been an increasing nitrate trend at almost all sites in the south-east since 2013.

Table 1: Comparative change in groundwater nitrogen concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.05 mg/l N	81	42
No trend or static	88	45
Average annual decrease >0.05 mg/l N	25	13
Total	**194**	**100.0**

Figure 2 indicates that the average groundwater nitrate concentration in the south east[5] is approximately 50% higher than the average concentration in the remainder of the country. Figure 2 also highlights that the average groundwater nitrate concentration in the south east has largely mirrored the national trend since 2013.

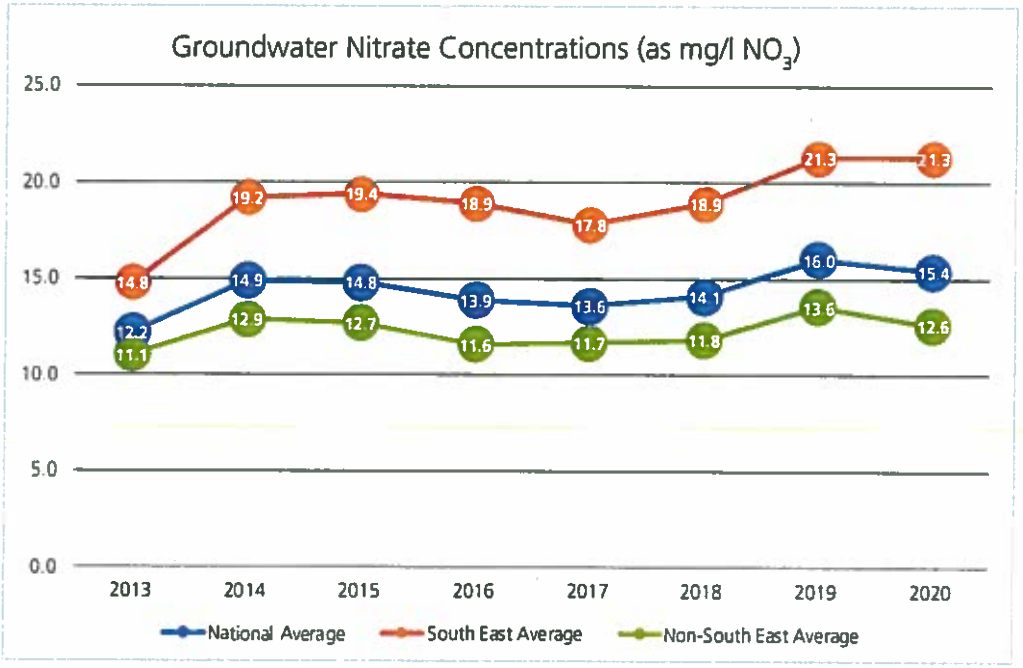


Figure 2: Groundwater nitrate concentrations since 2013

Phosphorus in Groundwater

Figure 3 summarises the mean phosphorus concentrations (measured as molybdate reactive phosphorus (MRP)) for the 193 sites in the national groundwater monitoring programme sites during 2020. Figure 3 shows that 8% of monitoring sites had mean phosphorus concentrations greater than the Irish threshold value of 0.035[6] mg/l P.

5 The south east includes hydrometric areas 11-17, which relates to the area covered by the South East River Basin District, as reported in the first WFD River Basin Management Plan.

6 This threshold value is the WFD Good Status EQS for rivers

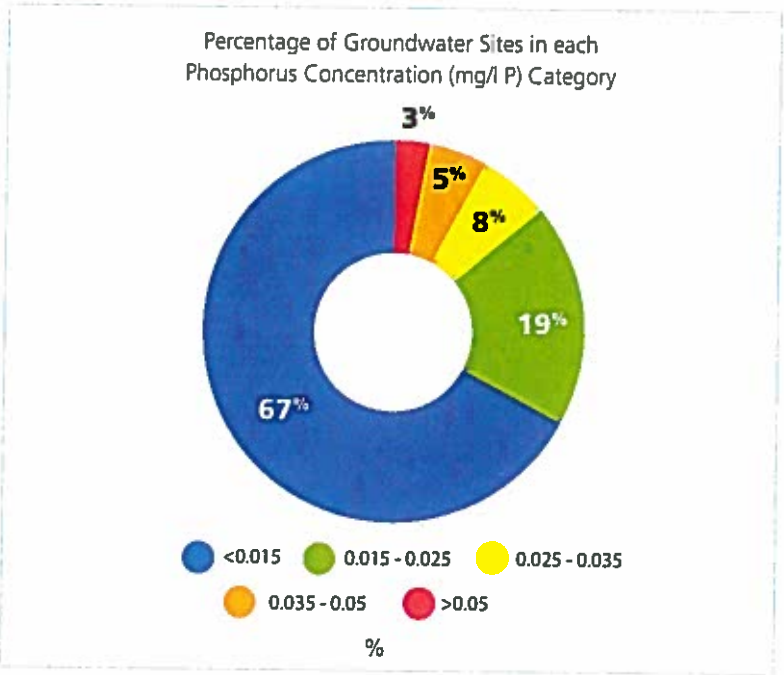


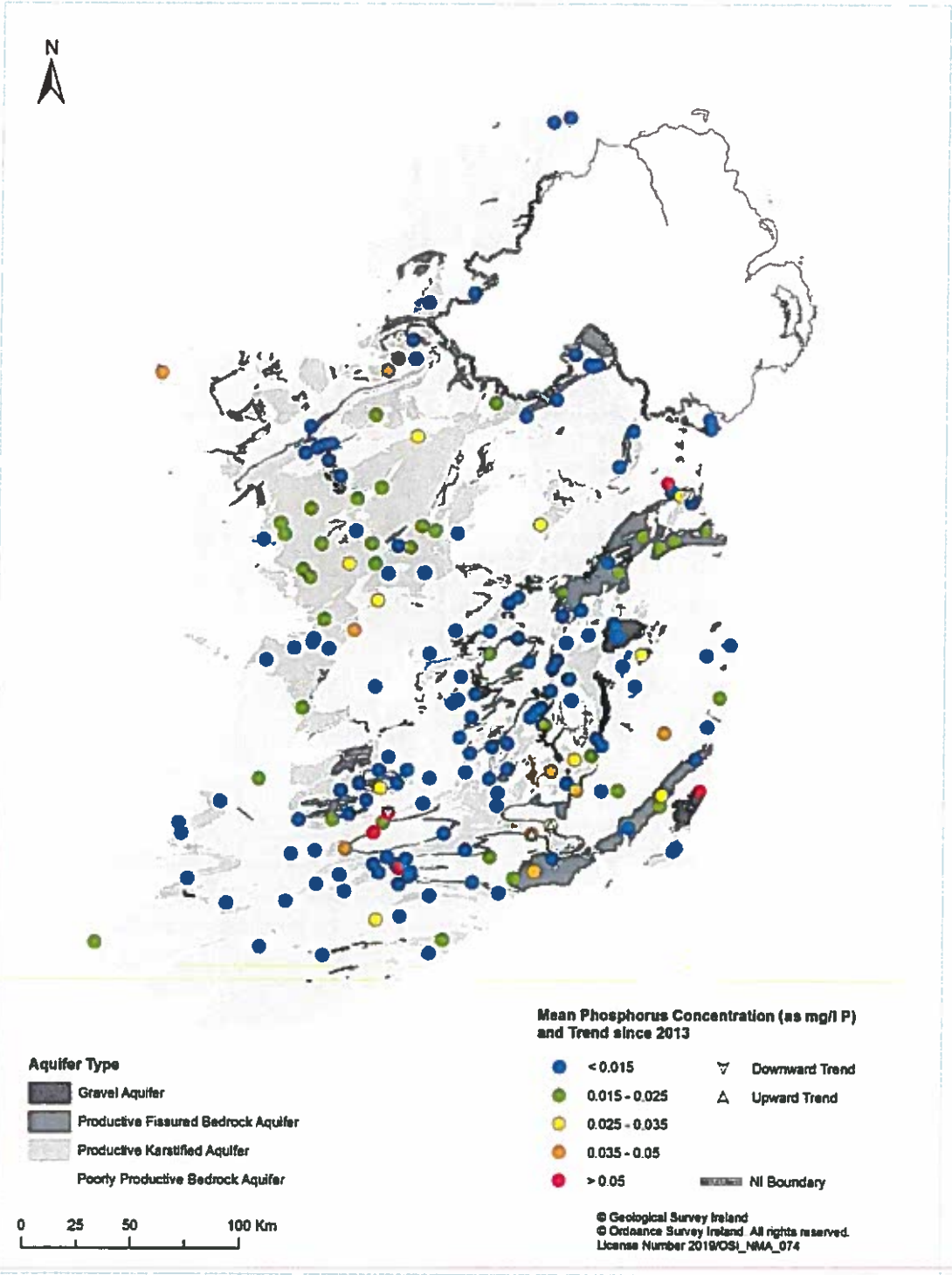
Figure 3: Mean phosphorus concentrations in groundwater during 2020

Table 2 indicates that since 2013, groundwater phosphorus concentrations have remained stable and Map 3 confirms that there is no regional pattern to the increases or decreases that could be correlated with regional agricultural intensification or presence of derogation farms.

Table 2: Comparative change in groundwater phosphorus concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.002 mg/l P	2	1
No trend or static	189	98
Average annual decrease >0.002 mg/l P	2	1
Total	**193**	**100.0**

This validates the conceptual understanding that groundwater only provides a phosphorus pathway to surface waters in areas with extreme groundwater vulnerability i.e. where there is little or no soil available to bind up the phosphorus before it reaches groundwater. The presence of rock outcrop and shallow soils can be prohibitive for grass growth, resulting in less intensive farming, and therefore areas of extreme groundwater vulnerability do not typically correspond to high phosphorus loads being applied to the land, although any losses that do occur may readily enter groundwater.



Map 3: Mean phosphorus concentrations in groundwater during 2020 and concentration trends since 2013

Rivers

Nitrate in Rivers

Figure 4 summarises the mean nitrate concentrations at 1,326[7] river monitoring sites from the national river monitoring programme in 2020.

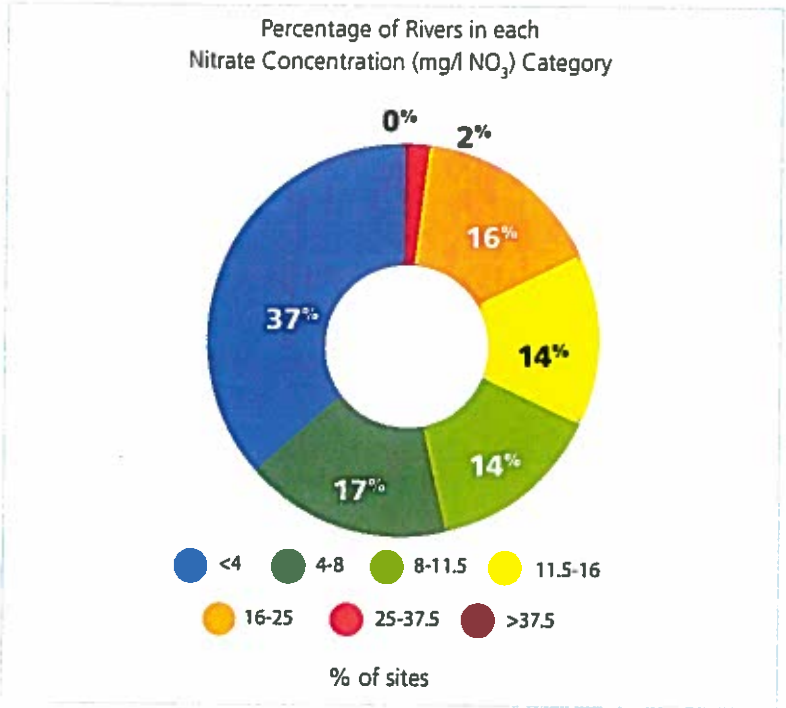


Figure 4: Mean nitrate concentrations at river monitoring sites in 2020

Thirty-two percent of river sites have concentrations greater than 11.5 mg/l NO_3, and Map 4 shows that most of the rivers in the south east have concentrations above this value. The average nitrate concentration in rivers in the south east is of concern as these concentrations contribute to an increase in the growth of algae and aquatics plants in rivers and the downstream estuaries and coastal waters, which impacts on aquatic ecosystem health.

7 Only those monitoring sites that have been consistently monitored since 2007 and that have at least four samples each year have been included in the assessment.

Figure 5 shows that, in the past year, there has been a slight reduction in the percentage of rivers with concentrations greater than 11.5 mg/l NO_3. However, since 2013, the number of rivers with concentrations greater than 11.5 mg/l NO_3 has increased by over 10%. Figure 5 also shows that the average river nitrate concentration in the south east is approximately double that of the rest of the country.

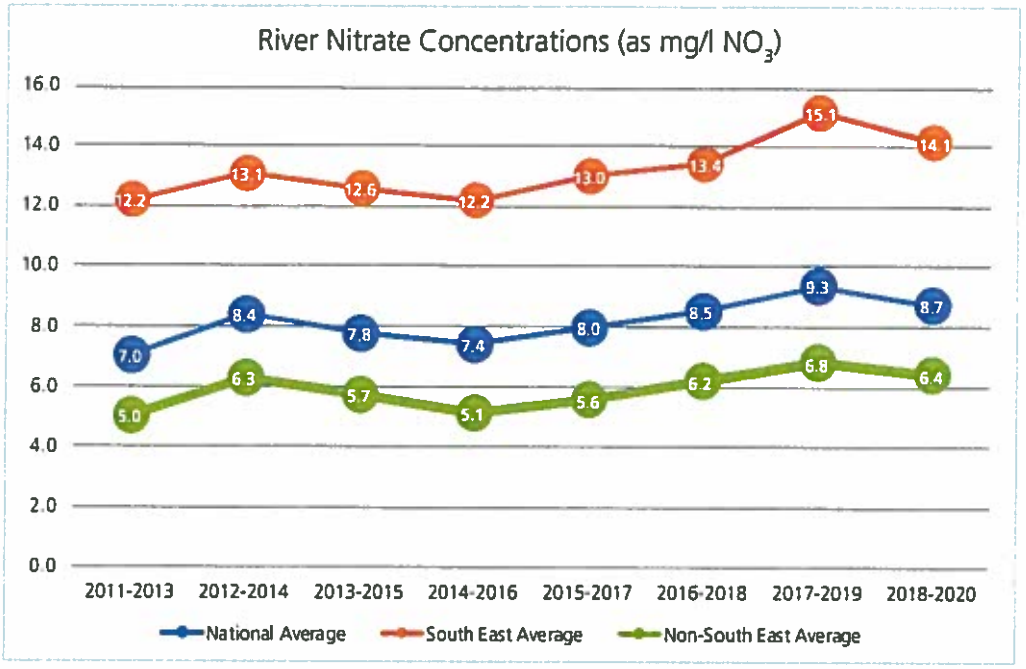
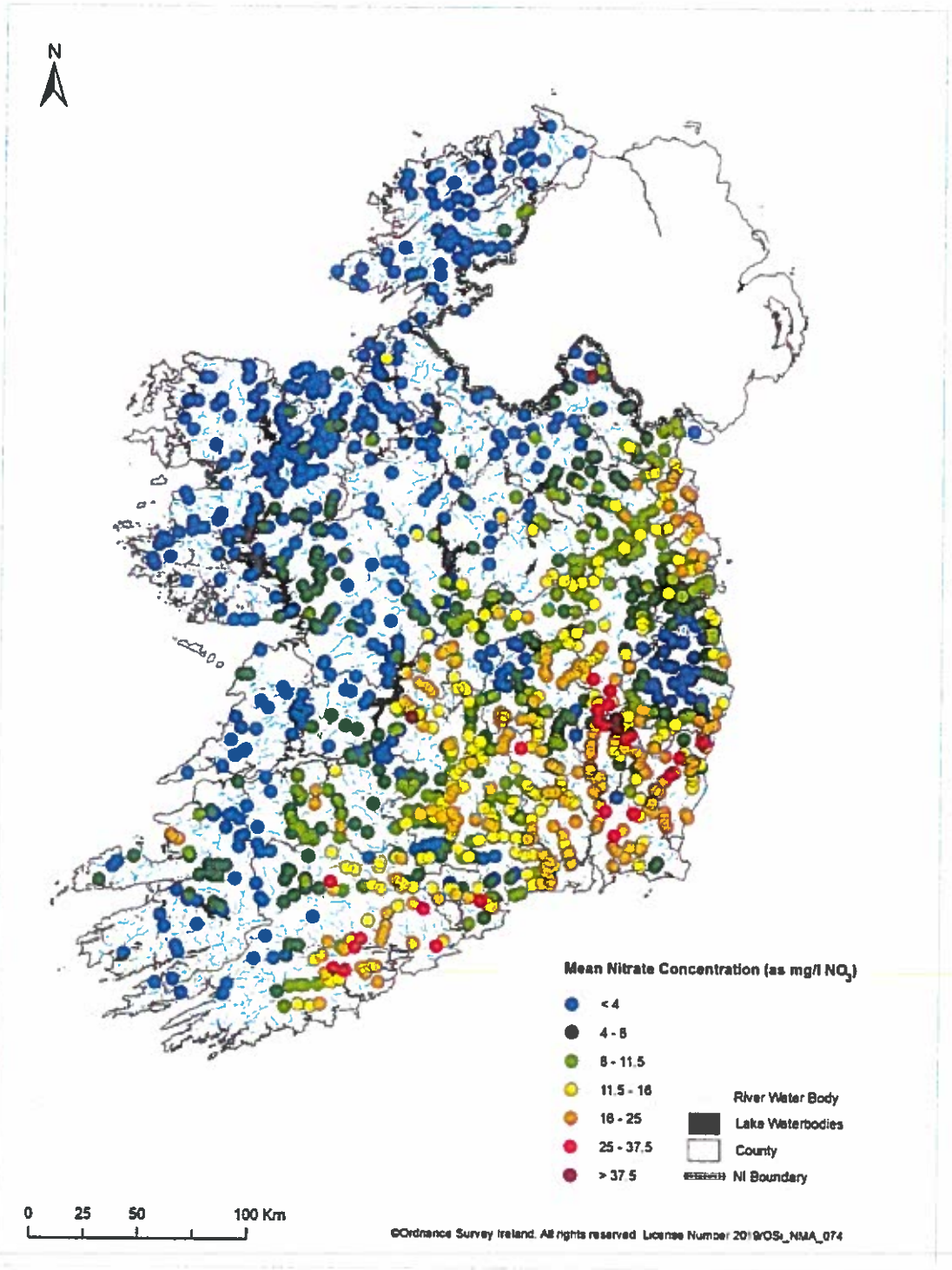


Figure 5: Riverine nitrate concentrations since 2013

Table 3 highlights that since 2013 there have been net increases of more than 1.5 mg/l NO_3 at 35% of river sites. Map 5 indicates that the greatest increases have been in the south, south-east and east of the country. Maps 4 and 5 indicate that the south and south-east are the areas with river nitrate concentrations that are too high and these are the areas that have shown the greatest increase in nitrate concentration since 2013.

Table 3: Comparative change in river nitrogen concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.05 mg/l N	465	35
No trend or static	821	62
Average annual decrease >0.05 mg/l N	40	3
Total	**1,326**	**100.0**



Map 4: Mean nitrate concentrations in rivers during 2020

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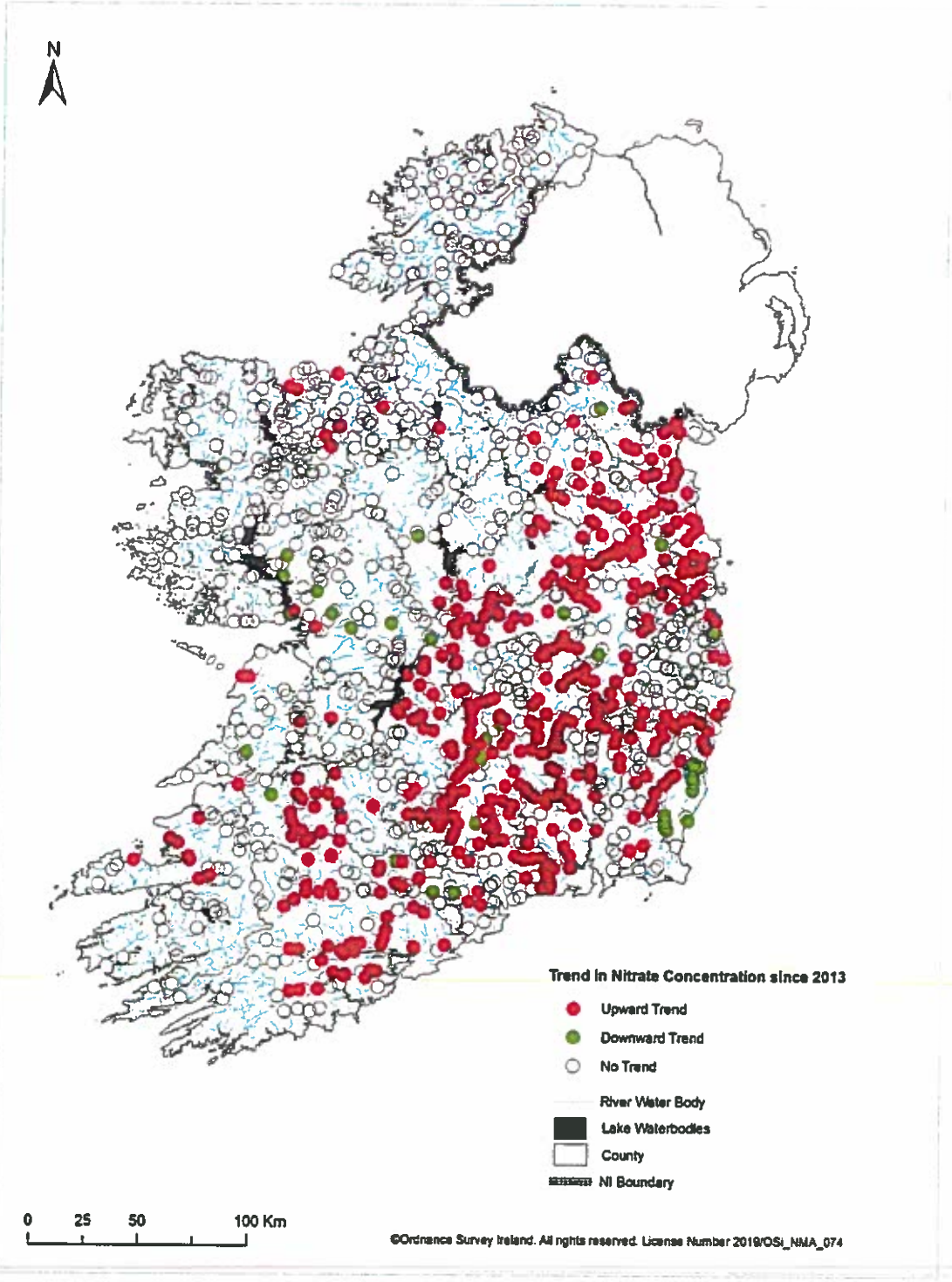


Map 5: Nitrate concentration trends in rivers since 2013

Phosphorus in Rivers

Figure 6 summarises the mean phosphorous concentrations at 1,336[8] river monitoring sites from the national river monitoring programme in 2020.

In 2020, mean river concentrations were greater than the good status EQS (0.035 mg/l P) at over a quarter (29%) of sites. Map 6 shows that the highest phosphorus concentrations i.e. greater than 0.05 mg/l P, are found in areas that have a high proportion of poorly draining soils e.g. Limerick, Monaghan, the area north west of Dublin and Wexford. The Suir catchment in the south east has elevated nitrogen and phosphorus concentrations in rivers, which may reflect that this catchment has a higher density of derogation farms but has heterogenous soils that have been strongly influenced by the underlying geology i.e. phosphorus losses are observed in the poorly drained upland soils, with nitrogen losses from the more freely draining lowland soils.

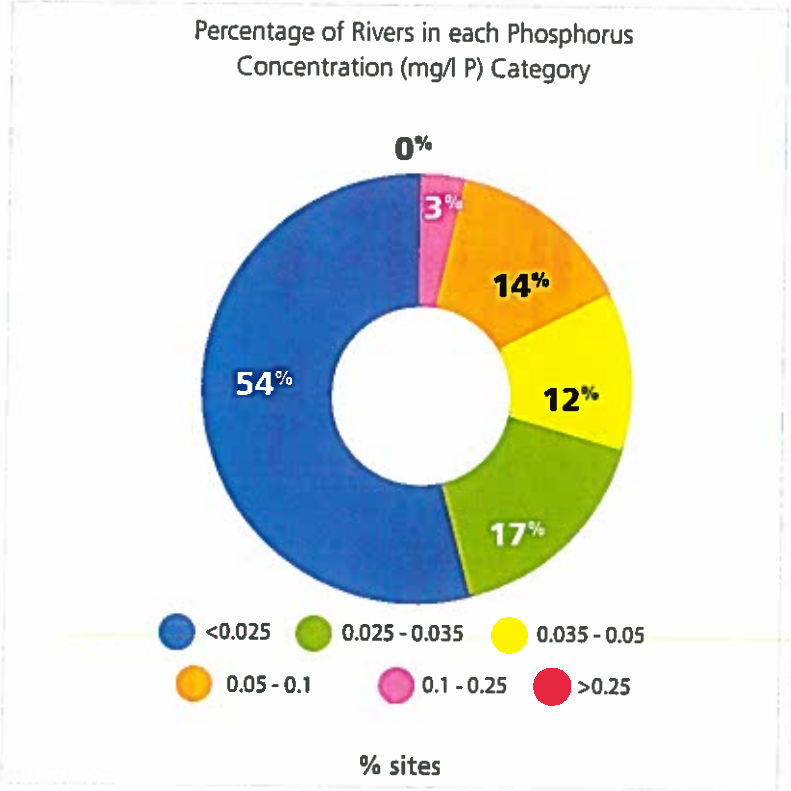


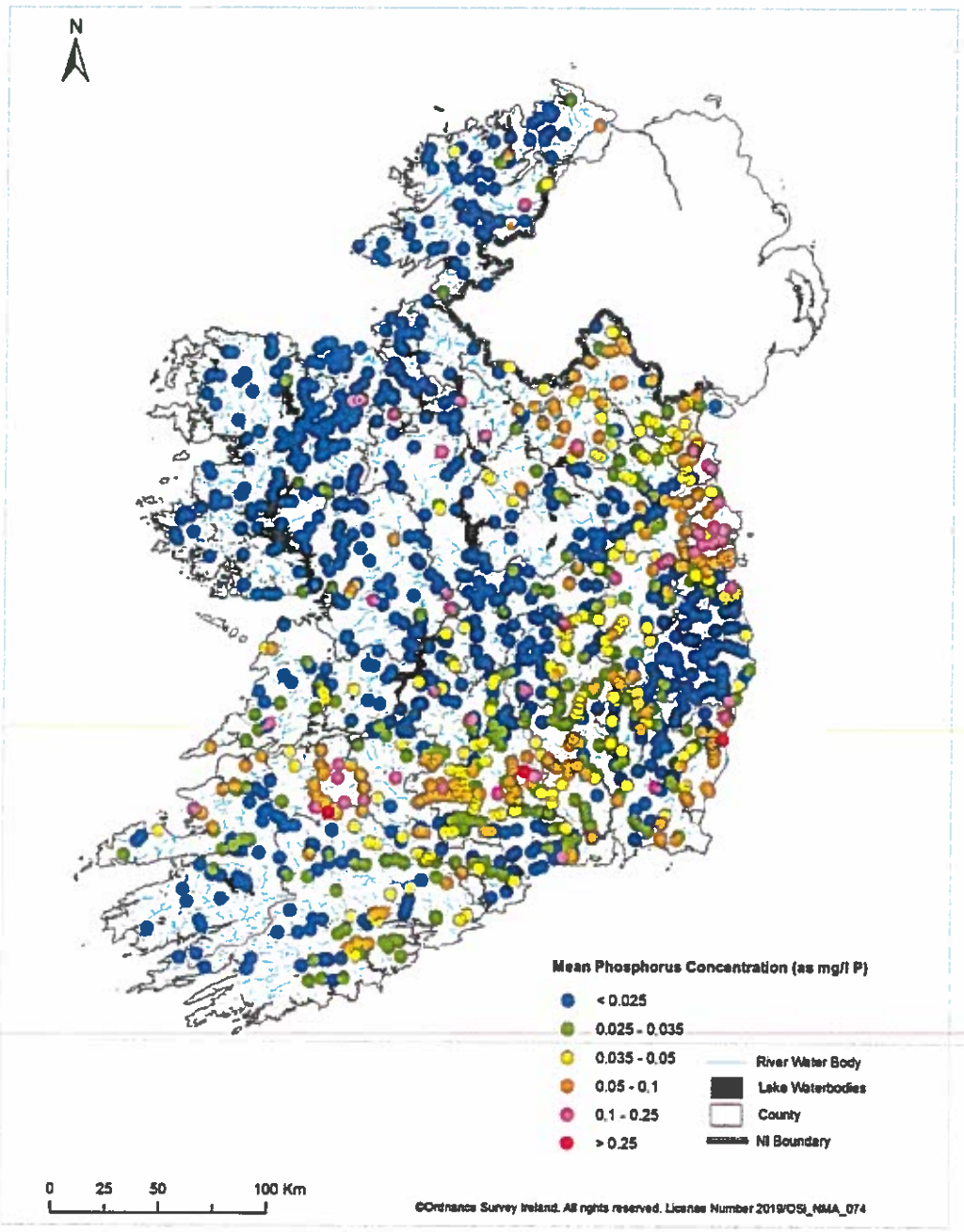
Figure 6: Mean phosphorus concentrations at river monitoring sites in 2020

Table 4 highlights that phosphorus concentrations at individual river sites since have increased by almost 0.015 mg/l P (i.e. an average annual change of 0.002 mg/l P) in the last seven years at 22% of sites. Map 7 indicates that the highest proportion of concentration increases since 2013 have been observed in Limerick, Monaghan, the area north west of Dublin and parts of the south-east i.e. those areas with the highest concentrations.

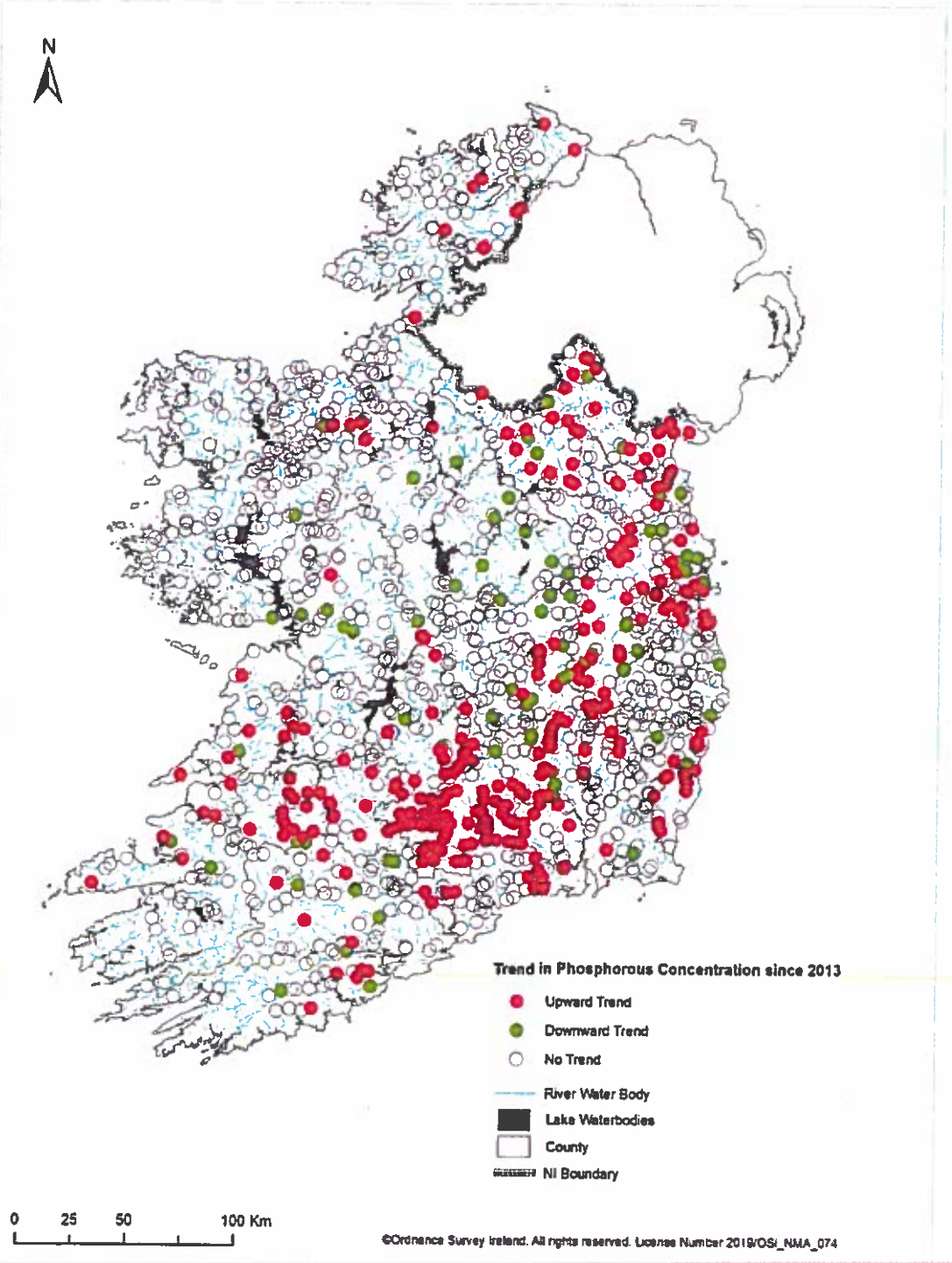
8 Only those monitoring sites that have been consistently monitored since 2007 and that have at least four samples each year have been included in the assessment.

Table 4: Comparative change in river phosphorus concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.002 mg/l P	297	22
No trend or static	956	72
Average annual decrease >0.002 mg/l P	83	6
Total	**1,336**	**100.0**



Map 6: Mean phosphorus concentrations in rivers during 2020



Map 7: Phosphorus concentration trends in rivers since 2013

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Lakes

Nitrate in Lakes

Figure 7 summarises the mean nitrate concentrations from the national lake monitoring programme during 2020. Data were available for a total of 222 lakes. In summary, mean nitrate concentrations in lakes remain low but increases have been observed in a few lakes in the south and south-east. Nitrate is not thought to be a significant driver of nutrient enrichment in Irish lakes.

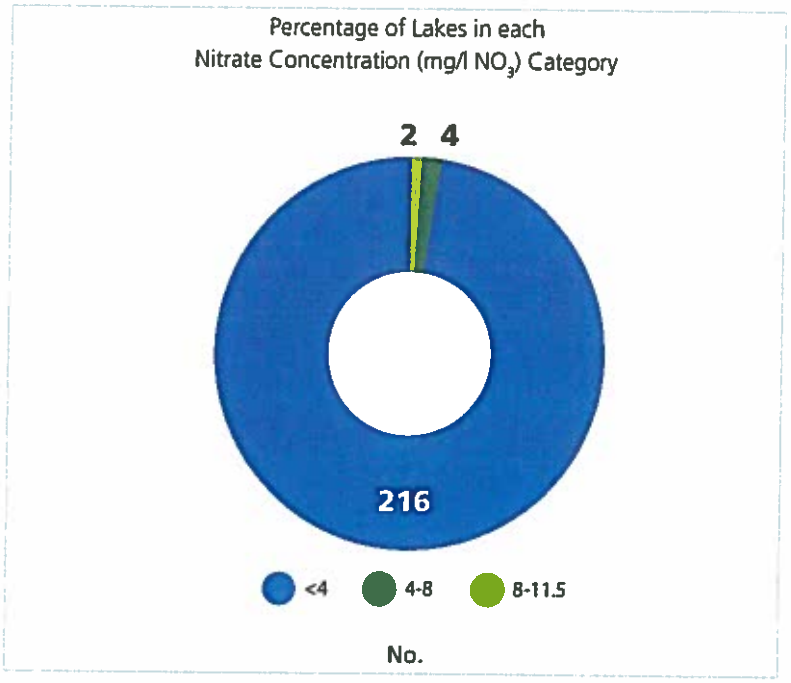
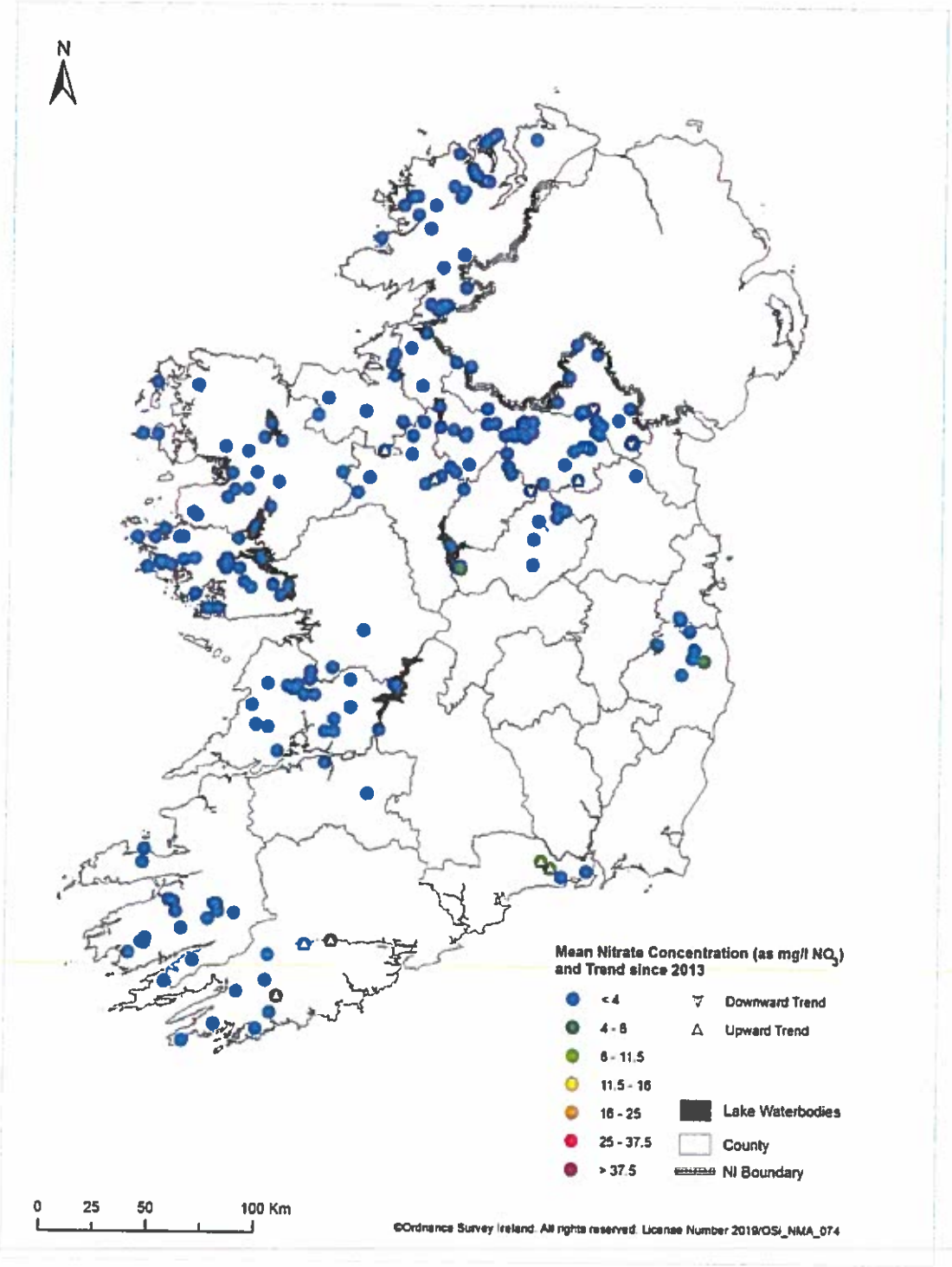


Figure 7: Mean nitrate concentrations in WFD monitored lakes during 2020

Table 5 and Map 8 indicate that lake nitrate concentrations have been relatively stable for most lakes since 2013.

Table 5: Comparative change in lake nitrogen concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.05 mg/l N	8	3.5
No trend or static	211	95
Average annual decrease >0.05 mg/l N	3	1.5
Total	**222**	**100.0**



Map 8: Mean nitrate concentrations in Lakes during 2020 and concentration trends since 2013

Phosphorus in Lakes

Figure 8 summarises the mean total phosphorus concentrations for 223 lakes in the national lake monitoring programme during 2020. In 2020, 29% of lakes had total phosphorus concentrations higher than the good status EQS of 0.025 mg/l P. Map 9 shows that almost all lakes with elevated total phosphorus concentrations are in Monaghan, Cavan or Leitrim. These counties are known to have a high proportion of poorly draining soils.

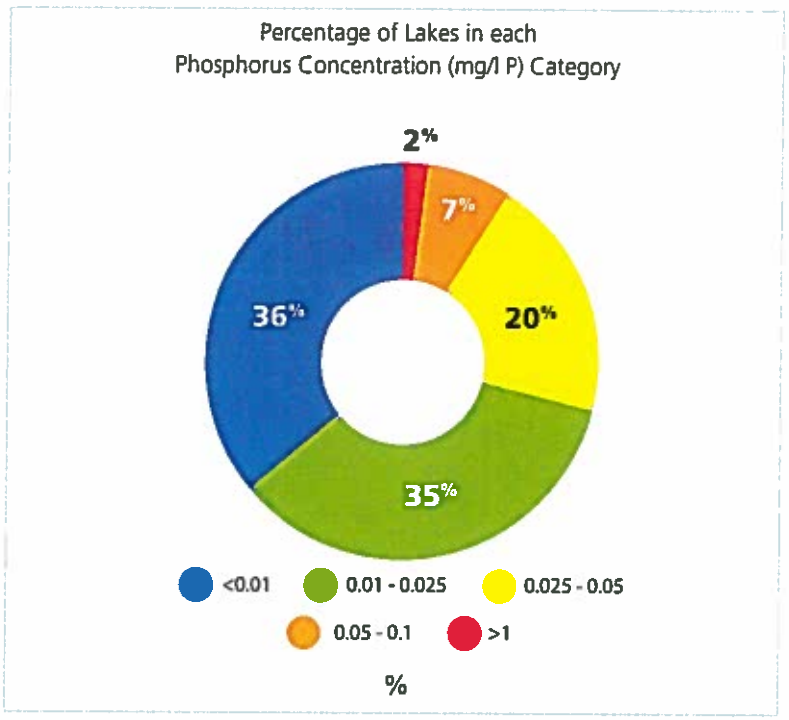
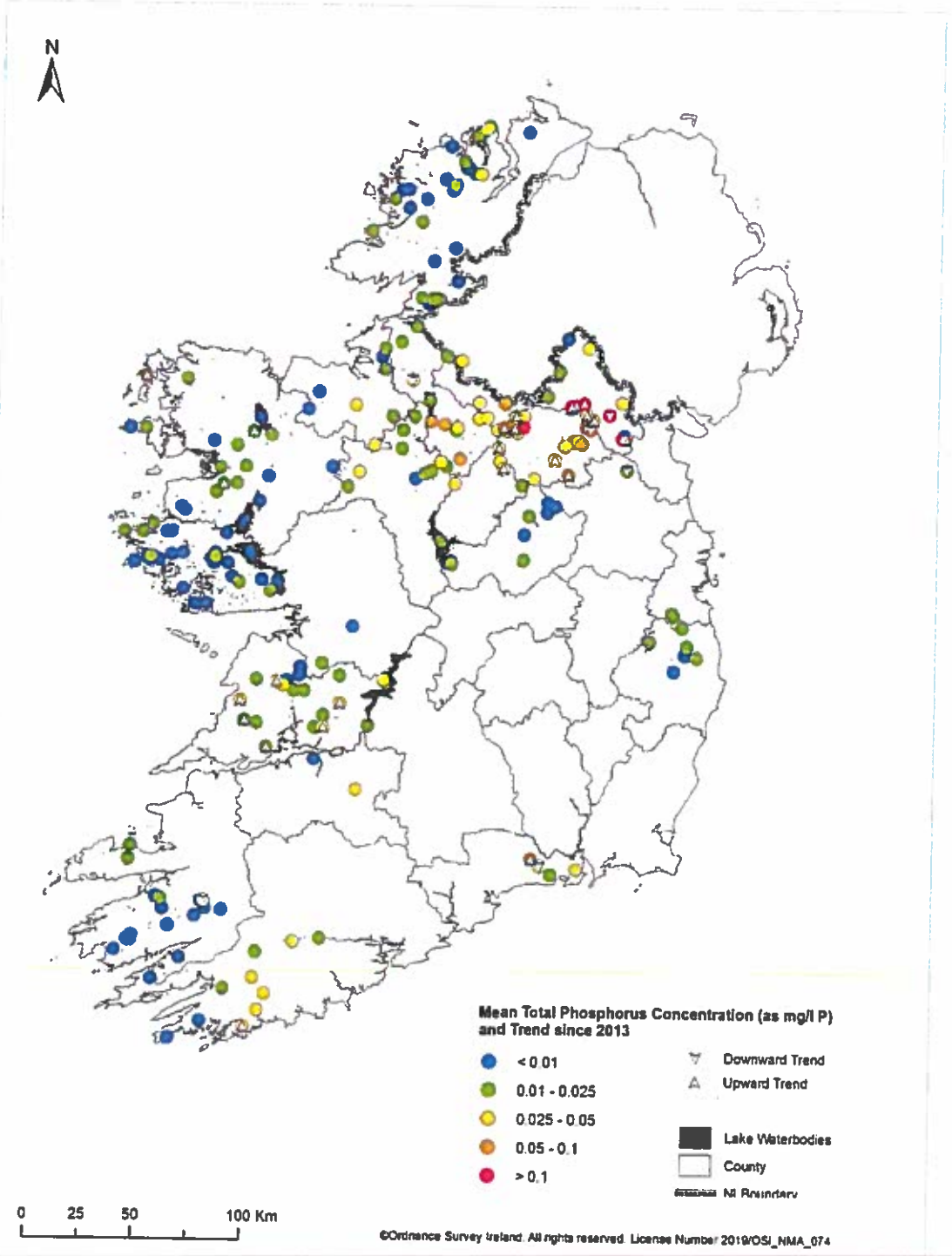


Figure 8: Mean total phosphorus concentrations in WFD monitored lakes during 2020

Table 6 indicates that mean total phosphorus concentrations have been stable for most lakes. Map 9 showing that most of the significant increases since 2013 have occurred in the lakes of Cavan and Monaghan, with increases also noted in County Clare. These are areas that historically have had high phosphorus concentrations in lakes and rivers because and the high proportion of poorly draining soils means that they are highly susceptible to phosphorus losses to surface water.

Table 6: Comparative change in lake total phosphorus concentrations since 2013

Trend	Number of Sites	% Sites
Average annual increase >0.002 mg/l P	27	12
No trend or static	190	85.5
Average annual decrease >0.002 mg/l P	6	2.5
Total	**223**	**100.0**



Map 9: Mean total phosphorus concentrations in lakes during 2020 and concentration trends since 2013

Estuarine and Coastal Waters

Nitrate in Estuarine and Coastal Waters

Figure 9 summarises the median winter nitrate concentrations from the national monitoring programme between 2018 and 2020. The median winter nitrate concentration in estuarine and coastal waters is measured as dissolved inorganic nitrogen (DIN) and it is assumed that all measured nitrogen is present as nitrate[9]. The most recent assessment was carried out on 90 transitional and coastal water bodies. Sixteen of the 90 water bodies had nitrogen concentrations that were higher than the environmental quality standard and are in an unsatisfactory condition in relation to nitrogen levels present.

Nationally, there have been gradually reducing winter median nitrate concentrations, but Map 10 shows that there are concentrations of concern in the estuaries in the south east and in County Cork. Higher nitrate concentrations in these areas coincide with, and are a consequence of, the losses of nitrate in the rivers and groundwater in the upstream catchments.

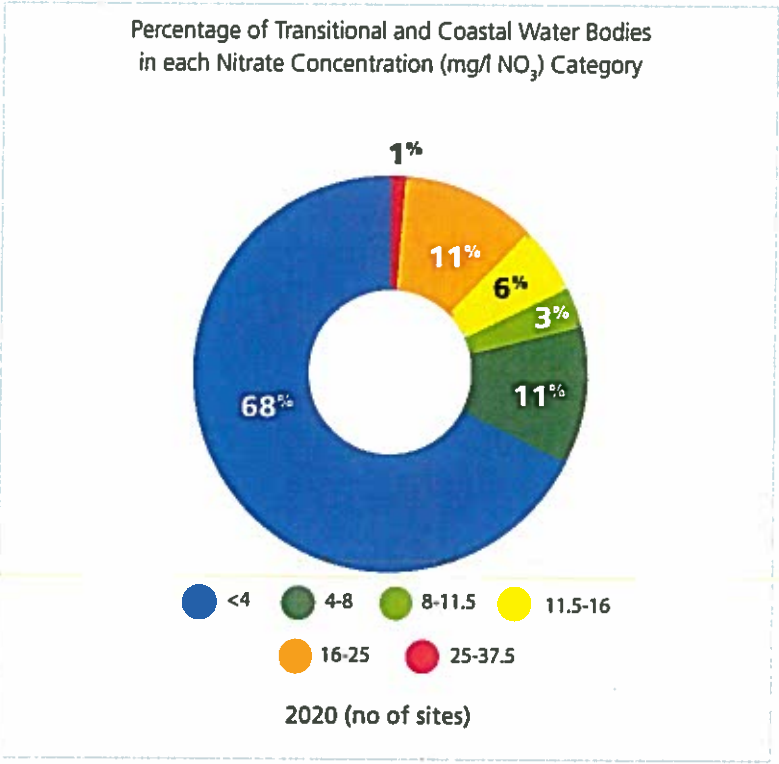


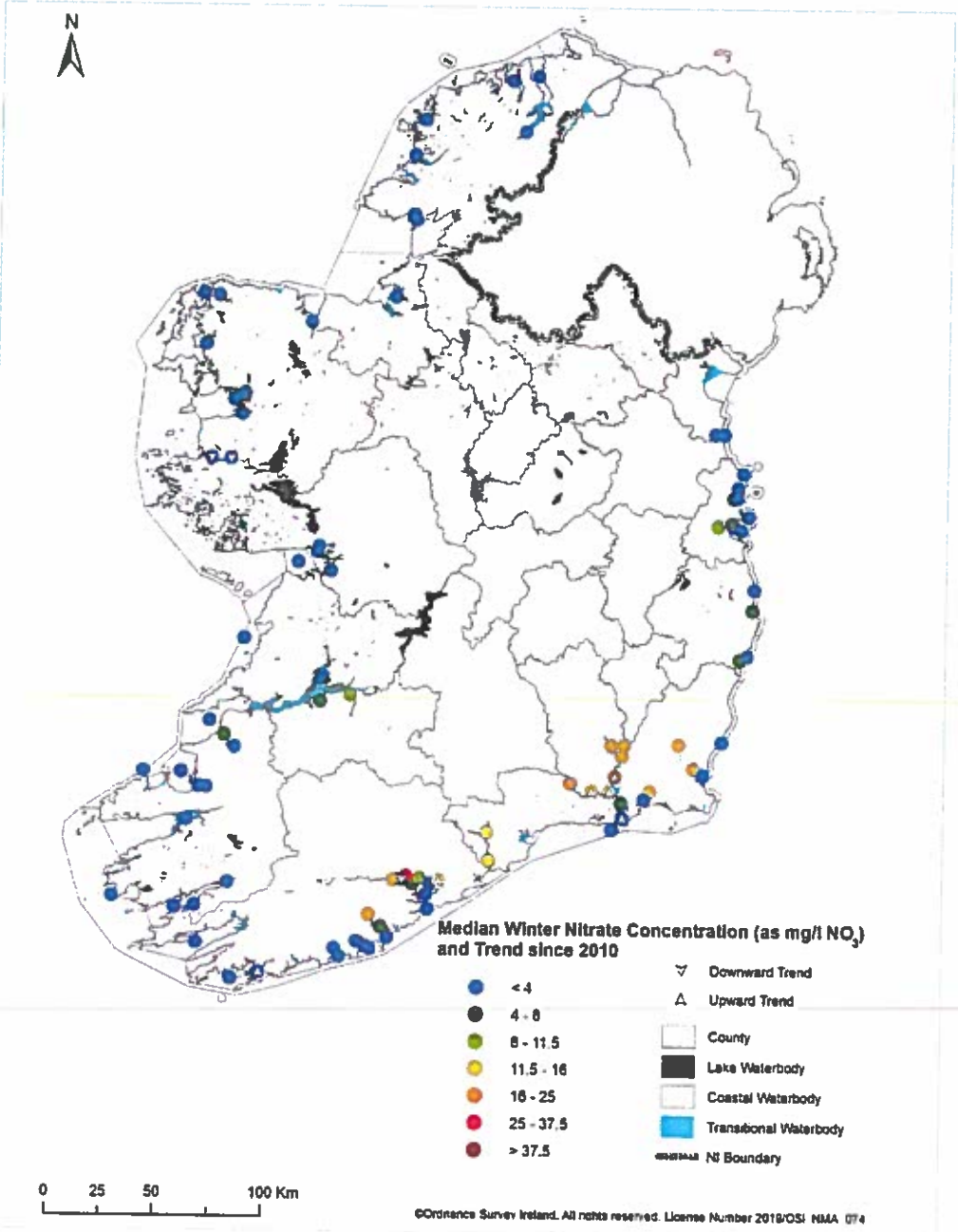
Figure 9: Median winter nitrate concentrations (mg/l NO_3) in estuarine and coastal waters during 2018-2020

Table 7 highlights that six estuarine and coastal waters have seen an increase of more than 1.5 mg/l NO_3 (i.e. an average annual change of 0.05 mg/l N) in the last seven years. Map 10 highlights that regionally the greatest increases in concentration have been in the south-east i.e. the areas with unacceptably high nitrate concentrations already.

9 The analysis in this report does not correct for salinity or the natural dilution and mixing properties of saline waters

Table 7: Comparative change in the median winter nitrogen concentrations of estuarine and coastal waters since 2010

Trend	Number of Sites	% Sites
Average annual increase >0.05 mg/l N	6	6.5
No trend or static	81	90
Average annual decrease >0.05 mg/l N	3	3.5
Total	**90**	**100.0**



Map 10: Winter median nitrate concentrations in estuarine and coastal waterbodies during 2020 and concentration trends since 2013

Phosphorus in Estuarine and Coastal Waters

Figure 10 summarises the median winter phosphorus (measured as molybdate reactive phosphorus (MRP)) concentrations from 90 estuaries and coastal waters in the national monitoring programme between 2018 and 2020[10].

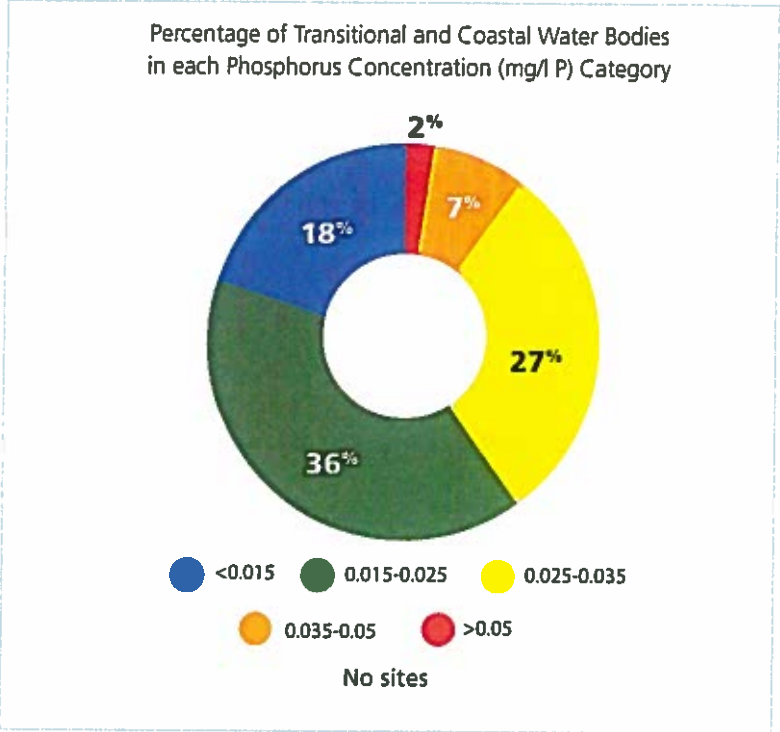


Figure 10: Median winter phosphorus concentrations in estuarine and coastal waters during 2018-2020

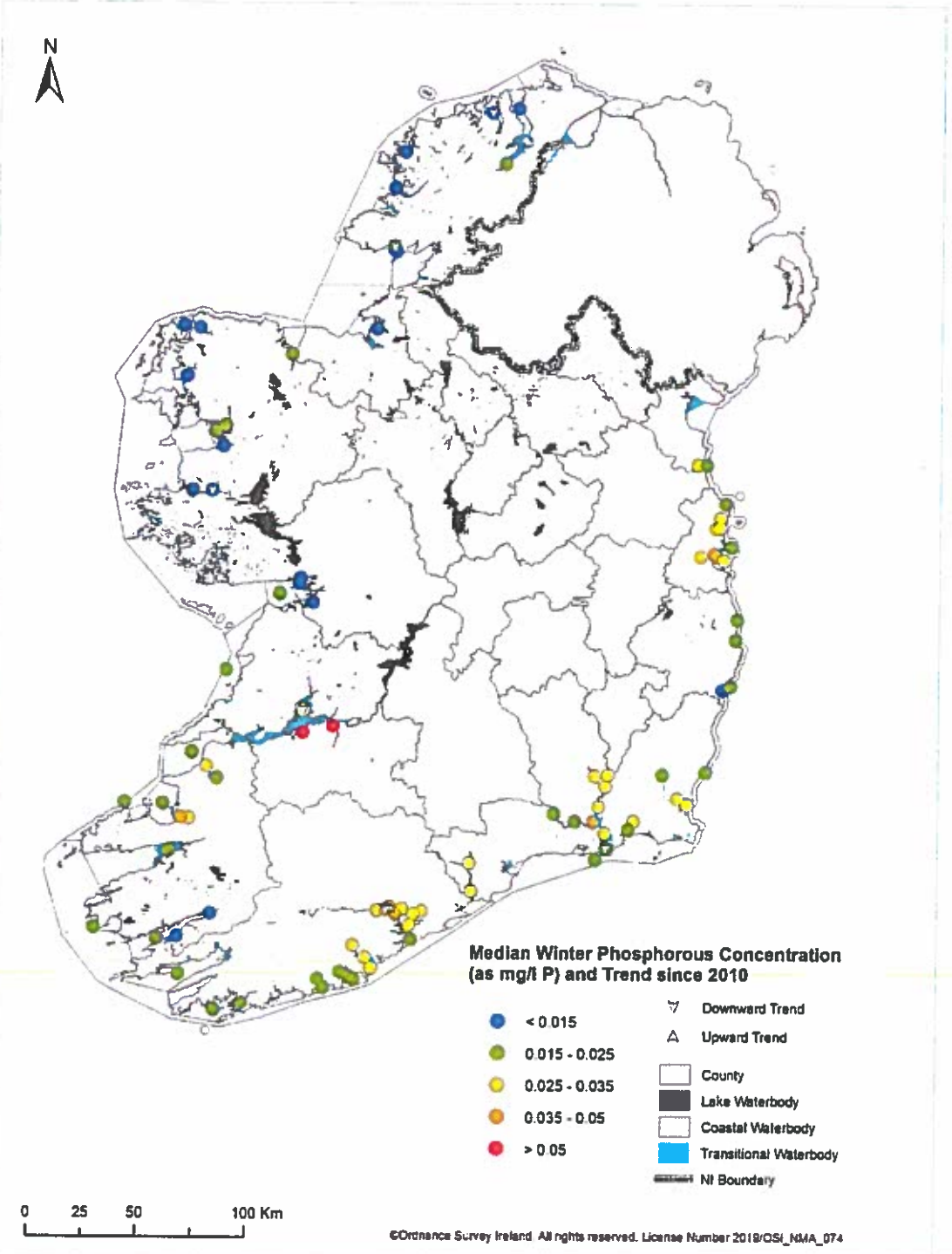
Winter median phosphorus concentrations are elevated in the south east and the southern estuaries and coastal waters, with Map 11 highlighting that there are high concentrations in the estuaries downstream of the major urban centres of Limerick, Waterford, Cork and Dublin.

Table 8 and Map 11 shows that median phosphorus concentrations have been relatively stable since 2010.

Table 8: Comparative change in the median winter phosphorus concentrations of estuarine and coastal waters since 2010

Trend	Number of Sites	% Sites
Average annual increase >0.002 mg/l P	1	1.5
No trend or static	83	92
Average annual decrease >0.002 mg/l P	6	6.5
Total	**90**	**100.0**

10 The analysis in this report does not correct for salinity or the natural dilution and mixing properties of saline waters.



Map 11: Winter median phosphorus concentrations in estuarine and coastal waterbodies during 2020 and concentration trends since 2013

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Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Headquarters

PO Box 3000,
Johnstown Castle Estate
County Wexford, Ireland

T: +353 53 916 0600
F: +353 53 916 0699
E: info@epa.ie
W: www.epa.ie
LoCall: 1890 33 55 99

Regional Inspectorate
McCumiskey House,
Richview, Clonskeagh Road,
Dublin 14, Ireland

T: +353 1 268 0100
F: +353 1 268 0199

Regional Inspectorate
Inniscarra, County Cork,
Ireland

T: +353 21 487 5540
F: +353 21 487 5545

Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny, Ireland

T +353 56 779 6700
F +353 56 779 6798

Regional Inspectorate
John Moore Road, Castlebar
County Mayo, Ireland

T +353 94 904 8400
F +353 94 902 1934

Regional Inspectorate
The Glen, Monaghan, Ireland

T +353 47 77600
F +353 47 84987

Regional Offices

The Civic Centre
Church St., Athlone
Co. Westmeath, Ireland
T +353 906 475722

Room 3, Raheen Conference Centre,
Pearse House, Pearse Road
Raheen Business Park, Limerick,
Ireland
T +353 61 224754

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