Office for Environmental Protection

Review of implementation of the Nutrient Action Programme Regulations (2019) in Northern Ireland

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Foreword

Foreword

Clean water, clean air and healthy soils are essential to the health, prosperity and wellbeing of people, as well as to nature itself. Reliance on a healthy environment is especially pronounced for farming, which forms such an important part of the economy, as well as of society, landscapes and rural communities. Food production in all its forms relies fundamentally on the natural environment for its long-term sustainability.

Nutrient pollution is a key threat to the environment. Nutrient emissions from both agriculture and from wastewater must be reduced greatly and rapidly if the environmental challenges facing Northern Ireland are to be resolved for current and future generations.

This report forms part of the OEP's wider work on nutrient pollution, which we have identified as the top priority for Northern Ireland's environment. We are considering all significant sources of nutrient pollution and, alongside this work on regulation of agricultural nutrients, we are examining nutrients from wastewater, including our first investigation into regulation of wastewater entering Belfast Lough.

In this report, we look at one element of the suite of measures to reduce nutrient pollution. We examine the effectiveness and implementation of the current Nutrient Action Programme (NAP) Regulations, adopted in 2019. These provide the main regulatory mechanism for managing nutrient pollution from agricultural sources.

Our conclusion is that the current controls under the NAP Regulations (2019), and aspects of their implementation, are insufficient to achieve a sustainable future for the environment. We highlight a number of gaps in the regulations and areas of legal uncertainty that limit their effectiveness.

Pollution must be tackled on all fronts. That said, ongoing debate regarding the relative contributions of different sectors and activities to nutrient pollution in no way diminishes the robust evidence that the agri-food industry is a significant contributor to nutrient pollution. It must also, therefore, be a significant contributor to reducing pollution.

The agri-food industry is a driving force in the economy and the environment. Its development, strongly encouraged by government, has addressed demand for increased production of affordable food. It has, at the same time, been a driver of biodiversity loss and its growth has come at considerable cost to the natural environment. Nature's restoration now depends on positive changes to farming practices and upon the positive engagement with farmers, landowners and the wider sector that this will require.

Much has been achieved since the introduction of the first nutrient regulations in 2007, and alongside the industry, the Department of Agriculture, Environment and Rural Affairs (DAERA) should be commended for its commitment to continuous improvement. The industry has already made considerable progress in reducing nutrient emissions, through innovation and investments in infrastructure and changes to farming systems. Over time, farmers have adapted their practices in line with shifting priorities, to align with changing policies, the demands of the agri-food industry and consumer expectations. It is evident that most farmers care deeply about protecting the environment, which directly affects their livelihoods, families and communities.

Despite recent progress, however, nutrient emissions from agriculture remain high. More must now be done to secure the natural foundations of the industry's future. The urgency of the need for action is undeniable. Achieving sustainable nutrient management

will become more difficult in the face of climate change, especially for the agricultural sector. Postponing actions that are ultimately unavoidable will only exacerbate the challenges facing the next generation of farmers.

Revising nutrient regulations presents a challenging and complex task for DAERA and the Northern Ireland Executive, given the high environmental and economic stakes. The nature and extent of any changes to the regulations, and the timeframe over which they should be applied, must be matters for government. They pose economic and technical challenges as much for the agri-food industry as for government. Those changes are necessary to protect and enhance the environment, maintain clean and safe drinking water supplies and air quality, and safeguard key industries such as tourism and fisheries, and indeed, farming itself.

Farmers and farming practice are key to achieving a sustainable future. But farming families should not be expected to shoulder the full burden of delivering change. Government and the wider agri-food industry and its diverse businesses must play their part in ensuring a just transition for the farming community.

It is crucial that government is clear about what is ultimately required to achieve all that is necessary for a sustainable future. Moving towards this future with transparency and clarity is essential both to give the agri-food sector the scope to adapt as it must, and to give confidence to Northern Ireland's people that there is a clear plan and action is being taken.

We are grateful to all those who have given generously of their time and information to inform our thinking in this report. We hope our analyses and recommendations prove useful and informative as DAERA, the Northern Ireland Executive and other interested stakeholders consider ways forward.

Natalie Prosser
Chief Executive, Office for Environmental Protection

Executive summary and recommendations

Office for Environmental Protection

REDUCING NUTRIENT POLLUTION FROM FARMING

Regulations have not done enough. What needs to change?

Review of Northern Ireland's Nutrient Action Programme Regulations (2019)

CHALLENGES

FARMERS NEED MORE **SUPPORT** WITH NUTRIENT MANAGEMENT

ENFORCEMENT OF RULES IS **WEAK**

POOR TIMING AND LOCATION OF MANURE APPLICATION → **RUNOFF AND AIR POLLUTION**

NUTRIENT REGULATIONS ARE NOT JOINED UP WITH **OTHER LAWS**

Excess nutrients – mainly nitrogen and phosphorus from farming and wastewater **CAUSE POLLUTION OF WATER, LAND AND AIR**

Water quality declines, algal blooms affect **DRINKING WATER FISHERIES, RECREATION AND BIODIVERSITY**

Nature declines **ECOSYSTEMS COLLAPSE, AFFECTING FUTURE FARMING**

TOO MUCH PHOSPHORUS AND NITROGEN IN ANIMAL FEED → **EXCESS IN MANURE**

USE OF SOIL **SAMPLING** TO INFORM MANURE USE **IS LIMITED**

LIMITS ON MANURE LOADING ON LAND **NEED CHECKING**

CLIMATE CHANGE MAKES NUTRIENT MANAGEMENT **HARDER**

RECOMMENDATIONS

12 actions for positive change, to build on progress already made

Improving implementation

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2. Provide more on-farm support
3. Increase inspections
4. Check and ensure farm compliance with manure nitrogen limits
5. Clarify enforcement approach and penalties

Ensuring the rules are sufficient

6. Review evidence for manure nitrogen loading limits
7. Set nutrient balance targets, addressing inputs from animal feeds
8. Require soil sampling so nutrient inputs can match crop needs
9. Better rules for manure application
10. Integrate regulations for air and water pollution
11. Adapt for climate change

Achieving the goal of clean water

12. Calculate and ensure the necessary reductions in nutrient pollution from both farming and wastewater

Executive summary and recommendations

Introduction

Pollution by nutrients from agriculture and wastewater is a longstanding, severe and chronic problem that affects the economy, society and environment of Northern Ireland. Toxic algal blooms in Lough Neagh are only the most visible evidence of the widespread pollution now affecting the majority of rivers, loughs and coastal areas.

Lough Neagh supplies more than 40% of the population with drinking water. At significant cost, toxins can be removed to make drinking water safe, while adverse taste and odour can variously be treated or tolerated. Lough Neagh's eel fishery was closed due to pollution in 2025. Its designated bathing water area at Rea's Wood was suspended. Risks to human and animal health have led to public health warnings. These and other harms will increase in severity and frequency unless the underlying causes are addressed.

Lough Neagh is also a globally significant site for biodiversity and is protected as a Ramsar site (a wetland of international importance), a Special Protection Area for its birds and an Area of Special Scientific Interest for its habitats and species. Its ecological condition is officially categorised as 'bad'. It exemplifies ecosystem collapse.

Beyond the prominent example of Lough Neagh, however, impacts on other waterbodies are also widespread. Our report in September 2024 on the implementation of the Water Framework Directive Regulations in Northern Ireland ('the WFD NI Regulations') highlights that water quality has deteriorated in recent years, in part because the regulations were only partially implemented. Our further report in October 2024 on the drivers and pressures affecting biodiversity identified nutrient pollution from agriculture and wastewater as a key factor in the loss of biodiversity.

The Nutrient Action Programme Regulations

The Nutrient Action Programme Regulations (Northern Ireland) 2019 ('the NAP Regulations') represent the principal regulatory mechanism to address pollution of waters by nutrients from agriculture. Although originally derived from the 1991 EU Nitrates Directive, these regulations are now assimilated law and have been extended to cover phosphorus (P) as well as nitrogen (N).

In this report, we evaluate the effectiveness of the NAP Regulations in limiting nutrient pollution from agriculture and how the NAP Regulations interrelate with legal duties owed under separate legal regimes. We set out the objectives and provisions of the regulations and assess their application in practice and how they may affect compliance with wider legal duties. In so doing, we consider whether they provide a sound basis for achieving the environmental outcomes set by the Department of Agriculture, Environment and Rural Affairs (DAERA) and the Northern Ireland Executive.

These outcomes include the objectives of Northern Ireland's statutory Environmental Improvement Plan (EIP) to achieve the sustainable management and efficient use of natural resources, water and soils. They also include restoring surface waterbodies to 'good ecological status' in accordance with the WFD NI Regulations. We also evaluate how the NAP Regulations address air pollution and greenhouse gas emissions, in the form of ammonia and nitrous oxide from agriculture.

Our overall assessment

The agri-food industry has come a long way in addressing nutrient emissions from agriculture through investments in infrastructure, and changes to farming systems, including to meet legal requirements since 2007 that preceded the NAP Regulations.

However, our assessment is that, notwithstanding positive contributions in several areas, the current NAP Regulations and aspects of their implementation are not sufficient to achieve intended environmental outcomes, including good ecological status for Northern Ireland's rivers, loughs and coastal waters.

To achieve these outcomes and to reduce water and air pollution, the NAP Regulations and their implementation need to be strengthened and areas of legal uncertainty should be clarified. This should happen alongside measures that effectively address pollution from other sectors, particularly wastewater.

DAERA's consideration of changes to the NAP Regulations will need to assess the costs to society of a degraded and deteriorating environment, and the environmental implications of new or amended measures, in tandem with their practicality, costs and potential impacts for the agri-food industry. This will include consequences for land use, land value and livestock numbers, and issues of regulatory consistency and trade across the UK and Ireland.

A pathway to compliance with effective, evidence-based regulations is needed. DAERA will therefore need to develop a plan and a timeline, determining what will be done, when and by whom. The plan should consider priority areas for urgent attention as well as longer term actions, ensuring a credible pathway to compliance within available resources. The alternative is that nutrient pollution will continue to present ongoing and long-term threats to Northern Ireland's environment, prosperity and sustainability.

Our specific findings

1. Evidence underlying the current nitrogen limit of 170 kg N/ha/year is lacking

The NAP Regulations set a limit of 170 kg of nitrogen per hectare per year (N/ha/year) on the amount of livestock manure that may be applied to land, including that deposited by the animals themselves.

This limit was originally established as a standard in accordance with the Nitrates Directive. It continues to apply throughout the EU under that directive, and in the UK under assimilated law. However, there has been no comprehensive assessment of the sustainability or sufficiency of this limit in Northern Ireland.

The suitability of the current 170 kg N/ha/year limit, which is a fundamental element of the regulatory regime, is therefore unknown.

The 170 kg N/ha/year limit is intended to reduce nitrate loss to surface water and groundwater by limiting organic manure loads to land. However, it also affects the quantity of ammonia, nitrous oxide and phosphorus released into the environment.

The limit has implications for the amount of land required for manure applications, and the number of animals that may graze in a particular area. It also affects a wide range of nutrient management practices, including the amounts of fertiliser and animal feed used on farms.

Setting the limit at 170 kg N/ha/year restricts farm stocking rates to approximately two 'livestock units' per hectare. In broad terms, a livestock unit is a single adult dairy cow, or a different number of other animals, which can be expressed as fractions or multiples of this standard unit.

An assessment of the overall suitability of this nitrogen limit would need to take into consideration nitrate, phosphorus, nitrous oxide and ammonia emissions under varying landscape and weather conditions, particularly in relation to the current state of aquatic and terrestrial habitats.

Establishing an appropriate limit, or limits, for nitrogen that are environmentally sustainable is therefore a key challenge and evidence gap.

2. Unsuitable land may be included in nitrogen limit calculations

To comply with the current 170 kg N/ha/year limit, farmers must calculate their nitrogen loading rates, taking into account their farm characteristics, and using standardised values for nitrogen in livestock-excreted waste. This is a 'whole farm' limit and is calculated on a farm's 'Agricultural Area' which is defined in the NAP Regulations.

Unless a farm is chosen for inspection, however, DAERA does not currently check to ensure that land included in these nitrogen limit calculations is suitable for grazing or organic manure application. Such land may also include land, often rented, that is remote from the main farm area, where it is not practical to graze or apply organic manure. Land may therefore be included in these calculations even where nitrogen is not applied in practice, leading to other land receiving a higher loading of nitrogen.

This may be exacerbated by inconsistencies between the 'Agricultural Area' as defined in the NAP Regulations and the new land eligibility rules under the Farm Sustainability Payment Scheme. This could result in land such as bog, heather and rush being included when calculating a farm nitrogen loading rate, despite not being suitable for grazing or manure applications. Understanding the difference between the area of land eligible for farm payments and that which constitutes the specific 'Agricultural Area' for the purposes of the NAP Regulations is also a potential point of confusion for farmers.

Similarly, land that is rented and remote from the main farm area may receive no slurry applications due to the practicalities and cost of transporting slurry.

This increases the likelihood and magnitude of localised nutrient surpluses, where more nutrients are added than plants can take up, leading to accumulation in the soil and increasing losses to water.

3. Non-compliance with nitrogen limits may be widespread and checks are infrequent

To comply with the law, farms that are exceeding 170 kg N/ha/year should either apply for a 'derogation' (see Section 4 below), or take other action (such as exporting manure) to bring their nitrogen loading within the limit.

DAERA considers nitrogen loading calculations for all farms when undertaking risk assessments to determine which farms it will inspect for 'cross-compliance' purposes, relating to fulfilment of conditions for agricultural support payments.

However, apart from those farms selected for cross-compliance inspections, there has been no substantive follow-up by DAERA since 2018 with farmers whose calculations suggest

their nitrogen loading is or may be above the 170 kg N/ha/year limit. This is despite the fact that DAERA has determined that nearly 2,000 farms without a derogation (1,990 farms in 2024) may be exceeding this limit, after manure export is taken into account.

In some of these cases, DAERA's figures may not reflect the practical reality on the ground, while in others farmers may be exporting additional manure during the year to comply with the NAP Regulations. However, the figures indicate that hundreds, if not thousands, of farms may be exceeding the 170 kg N/ha/year limit without holding a derogation allowing them to do so or being subject to the additional measures that should apply in such cases. These are likely to include some of the most intensive farms with the highest stocking densities and, therefore, potentially the highest emissions of nutrient pollution to air and water.

The current inspection regime reviews 1% of non-derogated farms per year. We consider that this rate of inspections is not sufficient to effectively identify and address instances of non-compliances with the nitrogen limit. As a result, we have low confidence that this key component of the NAP Regulations is being effectively implemented.

4. Derogations from nitrogen limits increase risks of water and air pollution

Under the NAP Regulations, farmers can apply for a derogation from the 170 kg N/ha/year limit, to enable the operation of intensive grassland farms up to a limit of 250 kg N/ha/year (about 2.9 livestock units per hectare). Pig and poultry farms are not eligible for derogations.

Derogated farms must apply additional measures, such as mandatory phosphorus balance targets and development of fertilisation plans, to help mitigate the risk of increased nutrient losses to water. Buildup of nutrients in soil remains of concern on derogated farms, however, as organic manure can still be applied above crop requirements despite these measures.

These derogations rely on favourable grass growth conditions and soils conducive to denitrification, thereby reducing nitrate leaching. However, these same conditions increase nitrous oxide emissions to air. Higher stocking rates associated with derogated farms also elevate the risk of ammonia emissions to air, if adequate mitigation measures are not taken. At present, emissions of nitrous oxide and ammonia, and their mitigation, are not considered as criteria for assessing derogation applications.

5. Applications for derogations may lack substantive scrutiny

When a farmer applies for a derogation from the 170 kg N/ha/year nitrogen limit, the regulations provide that an application is allowed if the applicant has not been notified within 28 days that it has been refused. This means that a farmer does not need to receive any active approval from DAERA to increase their operation from the normal limit of 170 kg N/ha/year up to 250 kg N/ha/year. This applies in all cases except where a farm was in breach of derogation conditions in the previous year and, as such, is not eligible to apply for a derogation.

The regulations specifically require DAERA to refuse applications within this limited 28-day time period where the conditions for a derogation are not fulfilled. However, where DAERA has not notified the applicant of a refusal within this fixed period, the regulations provide that the derogation is 'deemed to have been granted'. This creates a default outcome of approval and a risk of inadequate scrutiny of the applications.

6. Habitats Regulations Assessments are not carried out on derogation applications

DAERA does not currently undertake 'Habitat Regulations Assessments' (HRAs) for nitrogen limit derogations under the NAP Regulations. This raises questions about compliance with the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 ('the Habitats Regulations'). The Habitats Regulations require that public authorities carry out HRAs before granting permission for plans or projects that would be likely to have significant effects on the most important protected sites for wildlife.

As the Northern Ireland Executive has noted in its EIP, many of Northern Ireland's protected sites are in poor condition and high levels of nitrogen and ammonia pollution contribute to this. Our separate report in April 2025 on protected sites also found that their condition is generally getting worse rather than better.

DAERA's recent (May 2025) consultation on revision of the NAP Regulations included an associated HRA on the proposed changes, as well as a Strategic Environmental Assessment. DAERA noted in this consultation that: 'The Department is at risk of contravention of the Habitat Regulations in the application of NAP without giving due consideration to the impact on habitats through the land application of manures'.

7. Imported animal feeds are largely unregulated as a major source of nutrient pollution

There is clear evidence that the high crude protein and phosphorus content of animal feeds are significant drivers of the current surpluses of nitrogen and phosphorus in Northern Ireland, and their associated losses to air and water.

Northern Ireland has a significant phosphorus surplus which must be reduced if intended environmental outcomes are to be achieved. However, while the NAP Regulations contain measures concerning phosphorus, its content in animal feeds is largely unregulated. This will be an important policy matter for DAERA and the Northern Ireland Executive to consider.

Of the total amount of phosphorus used on farms, some 80% is in the form of concentrated animal feed and the remaining 20% is chemical fertiliser. Imported grains and supplements contain more phosphorus than animals need and the excess passes into animal waste and ends up in soil.

Crude protein in animal feed is a key source of both ammonia and nitrous oxide emissions to air. There is a proposed commitment to address this issue in DAERA's draft Ammonia Strategy and draft Climate Action Plan.

The Northern Ireland Executive also identifies the need to reduce the phosphorus and protein content of concentrated animal feeds in its EIP. However, the NAP Regulations largely do not address the nutrient surpluses associated with the importation of animal feeds. While they do control chemical fertiliser use, the regulations do not directly address the contribution that nutrient-rich animal feeds make to water and air pollution.

8. Restrictions on chemical fertilisers have been effective and could be further enhanced

Restrictions on chemical fertiliser use under the NAP Regulations and preceding measures have helped reduce nutrient surpluses and losses to water. There has been a 54% reduction in chemical nitrogen fertiliser purchases and an 80% reduction in chemical phosphorus fertiliser purchases over the period 1995 to 2023. These changes will have been driven by improvements in farming practices and increased costs as well as by regulation.

However, there is limited evidence to support the current chemical nitrogen fertiliser application rates. In our view, there is scope to further refine these rates so that they are better aligned with crop requirements and soil nitrogen content.

9. There are critical omissions in the regulations concerning soil testing and matching fertiliser applications with crop needs

Current quantities of soil phosphorus exceed those required for sustainable agronomic production in many fields. Evidence is clear that previous and existing measures have not effectively prevented the accumulation of phosphorus in agricultural soils. Phosphorus has built up because, while the NAP Regulations restrict nitrogen loading to land, they largely do not do so for phosphorus, except for chemical fertiliser.

The Soil Nutrient Health Scheme is a welcome, landmark initiative in this area. It provides detailed information for farmers on the nutrient status of soils and run-off risks in almost every agricultural field in Northern Ireland. It is helpful in making available detail that could be used to enhance farmers' understanding of soil management, particularly fertiliser applications.

However, this sort of valuable information is not reflected in the NAP Regulations. Despite mandatory soil analysis and fertilisation planning for derogated farms, the application of organic manure is still allowed on such farms even where there is no crop requirement. Further, on non-derogated farms there is no provision in the regulations for mandatory soil analysis or any requirement to tailor organic manure applications to crop needs. In our view, these are significant gaps in the regulations which affect their ability to achieve the intended environmental outcomes.

10. Closed periods for fertilisers are important in reducing pollution

Under the NAP Regulations, fertiliser spreading is restricted during 'closed periods' (for example, 15 October to 31 January for slurry). These are periods when grass growth and nutrient uptake are reduced, and cold, wet weather increases the risk of pollution from run-off.

These measures have made an important contribution to limiting nutrient losses to water. Outside the current closed periods, however, substantial risks of losses to water remain following the application of fertilisers to land. This is especially the case in early October and February, which fall outside the current closed period for slurry application, but when conditions can be similarly adverse.

Further, there is no closed period at all for the application to land of 'dirty water'. This is water collected from farmyards that is often contaminated with manure, urine, effluent, milk and cleaning materials. This is a gap in the current regulations.

11. The regulations are partly effective in reducing gaseous emissions but could do more

While the NAP Regulations are, in the main, not specifically designed to address air pollution, their measures do influence releases of ammonia and nitrous oxide, which are affected by the storage, management and application of fertilisers.

In this respect, the provisions in the NAP Regulations for the use of low emission slurry spreading equipment are a positive move towards more integrated management of emissions to air and water.

However, some other current measures in the regulations (including derogations and restrictions on organic manure applications) may inadvertently increase gaseous emissions unless accompanied by further mitigation. For example, current chemical fertiliser application rates do not appear to factor in the need to minimise nitrous oxide emissions to air.

12. On-farm advice can result in improved nutrient management

Adopting an integrated approach to regulating nutrient losses is essential to address trade-offs, avoid unintended consequences, and minimise the regulatory complexity that can be challenging for farmers to navigate. A key factor is providing farmers with sufficient support and incentives to effectively manage a complex set of regulations related to nutrient management.

DAERA's College of Agriculture, Food and Rural Enterprise already offers much valuable support to farmers in the form of guidance documents, online training, discussion groups and online calculators.

However, the current system lacks significant on-farm advisory services. Evidence demonstrates that such services can result in improved nutrient management. In relation to the NAP Regulations, this could help to overcome the barriers to farmers making effective use of available nutrient management advice and guidance, including those related to the adoption of existing decision support tools, such as nitrogen loading calculators.

13. Climate change exacerbates risks both to the sector and to the environment

Climate change is introducing greater uncertainty into agricultural systems, influencing a wide range of farming practices including nutrient management. In the short term, warming temperatures may increase grass yields without requiring additional nutrients. However, this could be offset by more frequent droughts. In addition, more frequent intense rainfall events may lead to episodes of greater run-off and higher losses of nutrients from the land into waterbodies.

The impacts of a changing climate on agriculture were clearly demonstrated during the 2018 fodder crisis. This saw a sequence of adverse growing conditions reduce crop reserves and yields, leading to a severe fodder shortage, increased feed imports and the need for government interventions. The likelihood of such events and their adverse effect on nutrient management are increasing with climate change.

14. DAERA's approach to enforcement of the regulations is limited and could be more transparent

Where DAERA identifies breaches of the NAP Regulations, it can reduce farm payments for 'cross-compliance' purposes relating to fulfilment of conditions for agricultural support payments. This is DAERA's main route for enforcement of the NAP Regulations and certain other standards that apply to farms. Such steps would follow the civil law standard of proof of the 'balance of probabilities' that a breach has been committed.

Where DAERA views a water pollution incident as serious enough to justify criminal prosecution, it normally acts under the Water Order (Northern Ireland) 1999. Such action would follow the criminal evidential test of an offence having been committed 'beyond reasonable doubt'.

The range of possible criminal and civil enforcement actions means farmers may be penalised under both regimes for the same event, at different standards of proof. This has been a point of concern to some in the agriculture sector.

Our view is that environmental regulators should have access to both criminal and civil sanctions. We therefore support the availability of both approaches for the NAP Regulations, enabling reductions of farm payments to encourage overall compliance, and criminal proceedings for the most serious cases.

However, the financial penalties imposed following enforcement action are usually only a small percentage of the direct aid payments that farmers receive from public funds. Coupled with low inspection rates, this means that the incentives for farmers to comply, and the deterrent effect associated with the likelihood and consequences of being found to be non-compliant, may be relatively limited.

We also consider that DAERA's intended approach to enforcing the NAP Regulations is not set out as clearly as it could be to best support consistency, transparency and incentivisation of compliance.

Recommendations

We make 12 recommendations for action to increase the likelihood of the regulations meeting their intended environmental outcomes. These recommendations should help DAERA apply the NAP Regulations more effectively and inform the consideration by the department and the Northern Ireland Executive of how best to revise and improve them.

Our recommendations fall broadly under three headings: ensuring the NAP Regulations are **implemented effectively and complied with**; ensuring the **sufficiency of their technical provisions**; and understanding the reductions in nutrient loss required to achieve the desired **overall environmental outcomes**.

Implementation and compliance

Regardless of any revision of the NAP regulations, they will not control nutrient losses as successfully as they should unless they are implemented effectively and there is general compliance.

We identify significant opportunities to improve implementation and compliance and make five recommendations in this area. We highlight, in particular, the importance of DAERA addressing issues concerning the HRA process (Recommendation 1), advice and support to farmers (Recommendation 2), and assessment and enforcement of compliance with the 170 kg N/ha/year limit (Recommendation 4).

Recommendation 1. DAERA should ensure that the derogation process under the NAP Regulations meets its legal obligations and supports intended outcomes for protected sites under the Habitats Regulations, including:

a) providing clarity on how it ensures there is sufficient scrutiny of applications within the 28-day window for refusal, and considering whether an active approval process should be implemented;

b) considering and clarifying how its legal duties under the Habitats Regulations interrelate with the NAP Regulations.

Recommendation 2. DAERA should consider further investment in the development of targeted approaches to the delivery of on-farm advice and support to help farmers comply with the NAP Regulations.

Recommendation 3. DAERA should materially increase the current inspection rates and the number of random inspections. It should ensure inspection rates are sufficient to provide a credible picture of compliance, and assess whether such compliance means the NAP Regulations will deliver the intended outcomes.

Recommendation 4. In relation to the organic nitrogen limits set out in the NAP Regulations, DAERA should:

a) ensure that only land which is suitable for grazing or the application of manure is included in farm nitrogen loading calculations;

b) where it has information that indicates farmers are or may be working above the 170 kg N/ha/year limit without a derogation, take appropriate steps to ensure those farmers understand and are complying with the regulations.

Recommendation 5. DAERA should review how it monitors and enforces compliance with laws relating to water pollution from agriculture under the NAP Regulations, the Water Order (Northern Ireland) 1999 and the cross-compliance framework governing area-based agricultural payments. This should include:

a) setting out its intended approach to ensure there is clarity for the agricultural sector regarding which compliance and enforcement tools may be used when breaches and incidents occur;

b) ensuring that the combination of the frequency of inspections and the financial or other penalties that may be imposed following detection of breaches is sufficient to incentivise compliance.

Sufficiency of technical provisions

The current requirements of the NAP Regulations, even if fully complied with, may not be sufficient to achieve intended environmental outcomes. Therefore, we make six recommendations for consideration in DAERA's revision of the technical provisions of the regulations. We highlight in particular the need to review the current 170 kg N/ha/year limit (Recommendation 6), controls on phosphorus as well as nitrogen balances (Recommendation 7), and the use of soil analysis as part of the regime (Recommendation 8).

Recommendation 6. DAERA should review the evidence relating to the current 170 kg N/ha/year nitrogen limit and, if necessary, bring forward proposals to revise this limit to ensure the protection and restoration of aquatic and terrestrial ecosystems.

Recommendation 7. DAERA should consider proposing mandatory phosphorus and nitrogen balance targets at both the individual farm and national levels, to require better nutrient management and drive improvements throughout the agri-food sector. This could include the introduction of limits on both the phosphorus and crude protein content of concentrated animal feeds to help control farm-level nutrient surpluses.

Recommendation 8. DAERA should consider proposing additional mandatory requirements for soil analysis, and that all applications to land of both organic manure and chemical fertilisers are based on crop needs.

Recommendation 9. DAERA should consider options to strengthen the existing NAP Regulations related to 'closed periods' and the timing and location of organic manure applications to land. This should include reassessing farmyard dirty water management controls where current measures appear impractical, and winter applications are increasing the risk of nutrient losses to water.

Recommendation 10. DAERA should consider extending the NAP Regulations to reflect a broader, more integrated approach that addresses nutrient losses to air alongside water pollution.

Recommendation 11. DAERA should determine how best the NAP Regulations can be 'future-proofed' in the face of ongoing and accelerating climate change. This will require an adaptive management approach, including interim reviews, that take account of new evidence and data concerning the impacts of climate change on nutrient management and the environment.

Overall environmental outcomes

Finally, we note that the NAP Regulations form part of a wider suite of measures to address nutrient pollution in Northern Ireland. However, we do not yet see any available assessment of how the different measures are intended to combine together to deliver Northern Ireland's overall objectives for nutrient pollution and water quality. This is essential so that government and each responsible sector can understand how far the current measures will go to achieving these outcomes and where additional reductions will be required in the future.

Recommendation 12. DAERA should establish the scale of reductions in nutrient pollution necessary to improve water quality in Northern Ireland and to comply with the law. This will entail reductions from agriculture and from wastewater, among other sectors. DAERA should then ensure that measures in the NAP Regulations and their implementation are sufficient to deliver the necessary reductions from agriculture.

Photo 1. Satellite image of Lough Neagh taken on 4 September 2023 showing algal blooms caused by nutrient pollution, primarily from agriculture and wastewater.

Photo Credit: Copernicus Service Information [2023], <https://dataspace.copernicus.eu/gallery/2023-9-4-algae-bloom-lough-neagh> accessed 16 February 2026.

1. Introduction

1. Introduction

1.1 About this report

This report looks at the implementation of the Nutrient Action Programme Regulations (Northern Ireland) 2019 ('the NAP Regulations').[1] These are the main regulations in Northern Ireland to control and reduce pollution from agricultural nutrients. They are mainly focused on protecting the water environment but also have implications for the build-up of nutrients in soil, and emissions to air.

Losses of excess nutrients from agriculture, alongside other sources such as wastewater, cause significant environmental and wider socio-economic damage. This has been prominently demonstrated in recent years by the impacts of the significant algal blooms seen in Lough Neagh. However, it is a much wider and more longstanding problem.

This report assesses the effectiveness of the NAP Regulations in reducing nutrient losses from agriculture to water and the wider environment. It summarises their objectives and requirements and examines their practical implementation. On the basis of this analysis, the report considers whether the regulations and their application in practice form a robust foundation for achieving the environmental outcomes that have been set by the Department of Agriculture, Environment and Rural Affairs (DAERA) and the Northern Ireland Executive.

The main outcomes addressed in this evaluation include the goals of the Northern Ireland Executive's statutory Environmental Improvement Plan (EIP) under the Environment Act 2021, such as the sustainable and efficient use of natural resources like water and soils.[2] The report also considers the objectives in Northern Ireland's River Basin Management Plan,[3] particularly the restoration of surface waterbodies to 'good ecological status', under the Water Framework Directive Regulations ('the WFD NI Regulations').[4]

In addition to reflecting our statutory role of reporting to the Northern Ireland Assembly on the implementation of environmental law, this report is intended to serve as a resource for policymakers, stakeholders, and the public interested in environmental progress in Northern Ireland. It provides a thorough evaluation of the NAP Regulations, drawing upon recent research, evidence, and feedback from stakeholders to identify both strengths and areas for improvement within the current regulatory framework.

The report highlights the progress achieved to date, while also acknowledging ongoing challenges. These challenges include adapting agricultural practices, responding to climate change, and ensuring continued investment in infrastructure and innovation.

Ultimately, the report aims to provide evidence, analysis and recommendations which will support the more effective implementation of the NAP Regulations and the consideration of their possible revision by policy- and law-makers. This in turn should support the achievement of Northern Ireland's environmental objectives, promoting sustainable agriculture while protecting natural resources for current and future generations.

1 The Nutrient Action Programme Regulations 2019. Northern Ireland Statutory Rules 2019 No. 81.

2 Department of Agriculture, Environment and Rural Affairs, 'Environmental Improvement Plan for Northern Ireland' (2024) <www.daera-ni.gov.uk/publications/environmental-improvement-plan-northern-ireland> accessed 15 October 2025.

3 Department of Agriculture, Environment and Rural Affairs, 'Third River Basin Management Plan for Northern Ireland' (13 June 2025) <www.daera-ni.gov.uk/publications/third-river-basin-management-plan-northern-ireland> accessed 7 October 2025.

4 The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Northern Ireland Statutory Rules 2017 No. 81.

Terminology used in this report

For the most part, the NAP Regulations apply obligations on the 'controllers' of agricultural 'holdings', or, in some cases, on other 'appropriate persons'. These terms are defined in the NAP Regulations.[5] In this report, however, we use more general terms such as 'farmer', 'farm' and 'agriculture', except where the context requires a more specific reference.

To describe types of fertiliser we have used the same approach as DAERA (Figure 1.1). The glossary in the Annex sets out our definitions of other terms that we use in this report.

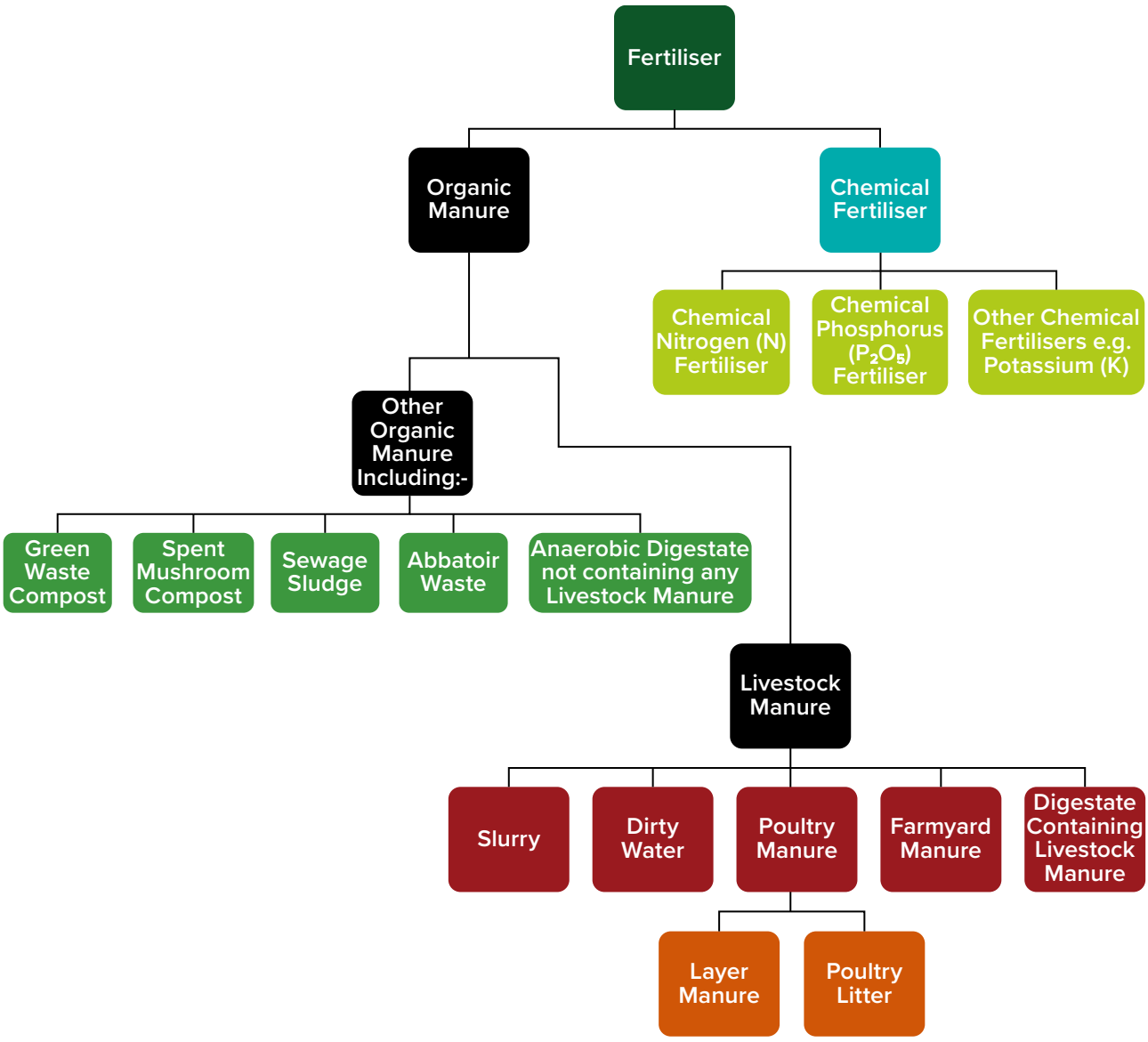

Figure 1.1. Fertiliser types as defined by DAERA and used in this report (Source: DAERA)[6]

5 See Regulation 3(2) of the NAP Regulations for the full list and precise definitions of defined terms in the regulations.

6 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' <www.daera-ni.gov.uk/publications/nutrient-action-programme-regulations-northern-ireland-2019-22-and-associated-documents> accessed 24 April 2025.

The OEP's wider nutrients programme

This report forms part of the OEP's broader programme of work on nutrients in Northern Ireland. The evidence underpinning the development of this programme stems from our report on the Drivers and Pressures Affecting Biodiversity in Northern Ireland (October 2024), which highlighted nutrient pollution from both agriculture and wastewater as a key contributor to the decline in biodiversity.[7]

Although this report primarily addresses agricultural sources of nutrients, the evidence is clear that nutrient inputs from wastewater must also be tackled to achieve the environmental objectives set by DAERA and the Northern Ireland Executive. We are therefore looking at the implementation of and compliance with the Urban Wastewater Treatment Regulations[8] and other related legislation in our parallel, ongoing work on other aspects of nutrients in Northern Ireland, including our current investigation into wastewater discharges to Belfast Lough.[9]

1.2 Why we are reviewing implementation of the Nutrient Action Programme Regulations

Getting the NAP Regulations right is essential. They are the primary regulatory measures to limit emissions of nutrients from agriculture to the environment in Northern Ireland. Their implementation is fundamental to achieving DAERA's and the Northern Ireland Executive's intended environmental outcomes and legally binding objectives. They also provide the policy and legal foundations upon which other critical initiatives, such as Northern Ireland's Soil Nutrient Health Scheme and the Sustainable Utilisation of Livestock Slurry, are built.[10]

The NAP Regulations are subject to review and possible revision every four years. At the time of writing, DAERA has established a 'task and finish group' to develop proposals for the next round of revision, on which it first consulted in May 2025.[11] This report is therefore intended to inform DAERA's further development of proposals for the upcoming revision of the NAP Regulations in 2026, as well as any further adjustments in future cycles.

Each previous revision to date has seen DAERA undertake a thorough stakeholder engagement process. This has been crucial in securing buy-in and fostering a sense of ownership among stakeholders for the solutions developed. DAERA deserves recognition for its commitment to engagement, which has played a pivotal role in the positive progress achieved to date.

Alongside this, DAERA has made substantial investments in research and development, targeting reductions in nutrient emissions to air and water, and developing solutions that aim to safeguard the environment whilst supporting sustainable agricultural production.

7 The Office for Environmental Protection, 'Drivers and Pressures Affecting Terrestrial and Freshwater Biodiversity in Northern Ireland' (2024) E03082970 <www.theoep.org.uk/report/drivers-and-pressures-northern-ireland> accessed 30 May 2025.

8 The Urban Waste Water Treatment Regulations (Northern Ireland) 2007. Northern Ireland Statutory Rules 2007 No. 187.

9 Office for Environmental Protection, 'The OEP Investigates DfI, DAERA and Utility Regulator over Belfast Lough Sewage Discharges' (25 November 2025) <www.theoep.org.uk/news/oep-investigates-dfi-daera-and-utility-regulator-over-belfast-lough-sewage-discharges> accessed 11 December 2025.

10 Department of Agriculture, Environment and Rural Affairs, 'Sustainable Use of Livestock Slurry (SULS) SBRI Phase 2' (5 December 2024) <www.daera-ni.gov.uk/publications/sustainable-use-livestock-slurry-suls-sbri-phase-2> accessed 24 November 2025; Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (2025) <www.afbini.gov.uk/article/soil-nutrient-health-scheme> accessed 5 September 2025; College of Agriculture, Food & Rural Enterprise, 'Soil Nutrient Health Scheme' (*CAFRE*, 2025) <www.cafre.ac.uk/business-support/agriculture/environment/soil-nutrient-health-scheme/> accessed 5 September 2025.

11 Department of Agriculture, Environment and Rural Affairs, 'Update on Public Consultation for the Revised Nutrients Action Programme' (30 June 2025) <www.daera-ni.gov.uk/news/update-public-consultation-revised-nutrients-action-programme> accessed 11 December 2025.

This has established a robust and transparent evidence base on which proposals for the NAP Regulations have been considered.

It is also important to acknowledge the considerable commitment shown by farmers, who have made significant changes to their practices over recent decades that help protect the environment. These adjustments have not always been straightforward, often involving challenging shifts in livestock, land, manure and fertiliser management. Changes have required ongoing investment from farmers, the agri-food sector and government in infrastructure, technology and support.

Despite the progress and efforts by government and the agri-food industry to date, however, the evidence is clear that nutrient levels from agriculture and other sources are excessively high. This results in continued and serious environmental damage with significant negative impacts on Northern Ireland's biodiversity, people, communities and economy.

It is broadly accepted, therefore, that more needs to be done to reduce nutrient emissions from agriculture and from other sectors, notably wastewater. This is widely recognised by a range of stakeholders, including in the agriculture sector.[12] It was also acknowledged in the Independent Strategic Review of the Northern Ireland Agri-food Sector carried out by Sir Peter Kendall in 2022, in which he commented:

> 'In terms of its environmental credentials, Northern Ireland agri-food does not have a positive story to tell right now. This is particularly true when it comes to the impact of (a) agriculture's surplus nutrients on water quality, and (b) of ammonia on sensitive sites and biodiversity generally. A scaling back of the livestock sector is a real possibility if this is not turned round.'[13]

The expected upcoming revision of the NAP Regulations is unlikely to be the final one, especially if the changes do not deliver the intended environmental outcomes set by DAERA and the Northern Ireland Executive and required in law, or address points of legal uncertainty. It is important for stakeholders to understand what actions will be necessary to achieve these environmental outcomes. Our report therefore aims to set out an evidence-based analysis of what needs to be done to sufficiently reduce agricultural nutrient pollution, so as to protect and improve ecosystems, such as Lough Neagh.

Further, addressing nutrient impacts on the environment will only become more challenging in the face of climate change, growing demand for food, urban and rural development, and the deteriorating condition of aquatic and terrestrial habitats. Therefore, it is important that any significant gaps in the NAP Regulations are identified so that DAERA and the Executive can consider how best to address these.

1.3 Our approach

This report draws upon the best available evidence on addressing the challenges of mitigating nutrient losses from agriculture to the environment. Where relevant, we have utilised and referenced information from previous work conducted by the OEP on implementation of the WFD NI Regulations, as well as separate studies on Protected Sites

12 Ulster Farmers Union, 'An Open Letter to Minister Muir from the NI Agri Food Sector' (29 May 2025) <www.ufuni.org/an-open-letter-to-minister-muir-from-the-ni-agri-food-sector/> accessed 6 January 2026.

13 P Kendall, 'Independent Strategic Review of the Northern Ireland Agri-Food Sector' (2022) <www.daera-ni.gov.uk/sites/default/files/publications/daera/Independent%20Strategic%20Review%20of%20NI%20Agri-Food%20-%20Summary%20Report.PDF> accessed 1 July 2024.

and the Drivers and Pressures Affecting Biodiversity in Northern Ireland.[14] Our review encompasses both the existing body of evidence and consultation with government, scientific and industry experts across the UK and Ireland.

We are cognisant of DAERA's proposals for revision of the NAP Regulations that were published for consultation in May 2025.[15] The OEP provided advice to the DAERA Minister on those proposals.[16] They are now being revisited by DAERA's Nutrients Action Programme Stakeholder Task and Finish Group, with new proposals expected to be consulted on in 2026.

In this report, therefore, we do not further evaluate the measures that were proposed in May 2025, since they are to be updated. Rather, we evaluate the provisions of the NAP Regulations as they are now. Where we identify possible areas of improvement that were discussed in DAERA's previous consultation, we note that for completeness. We have also used the information that was presented in the consultation document and in supporting evidence to inform our own analysis in this report.

While we have made every effort to gather comprehensive evidence, there are inevitably gaps which we highlight in this report. We have also striven to maintain objectivity by carefully evaluating conflicting viewpoints and remaining neutral in our synthesis of evidence. The report integrates quantitative data, qualitative insights, regulatory guidance, technical reports and scientific papers.

We have undertaken stakeholder engagement where possible both through meetings and individual discussions. Some aspects of wider engagement were not possible due to the challenges for some stakeholders to engage with us on this topic, at the same time as DAERA's work on revision of the NAP Regulations. We therefore remain open to receiving additional evidence and further engagement with stakeholders in this important area. This may be of relevance, for example, if the OEP is to provide additional advice in response to DAERA's expected second consultation on revision of the NAP Regulations in 2026.

In evaluating the evidence, we have also recognised that uncertainty is inherent in research and development efforts. We have addressed this by assessing the overall weight of evidence, rather than relying on individual sources.

For the evaluation of compliance, enforcement and advisory aspects of the NAP Regulations, we consulted closely with DAERA and reviewed material provided by the department to ensure a thorough understanding of these processes.

Additionally, we commissioned an independent report on the application of the Habitats Regulations Assessment (HRA) process for derogation applications under the NAP Regulations and current issues of legal uncertainty in this area. HRAs are required for certain plans and projects under the Conservation (Natural Habitats, etc.) Regulations

14 The Office for Environmental Protection, 'A Review of Implementation of the Water Framework Directive Regulations and River Basin Management Planning in Northern Ireland' (2024) <www.theoep.org.uk/report/implementation-water-framework-directive-northern-ireland> accessed 27 February 2025; Office for Environmental Protection, 'Review of Implementation of Laws for Terrestrial and Freshwater Protected Sites in Northern Ireland' <www.theoep.org.uk/report/action-urgently-needed-protect-and-restore-northern-irelands-natural-treasures-says-oep> accessed 15 December 2025; The Office for Environmental Protection, 'Drivers and Pressures Affecting Terrestrial and Freshwater Biodiversity in Northern Ireland' (n 7).

15 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (29 April 2025) <www.daera-ni.gov.uk/consultations/public-consultation-proposed-nutrients-action-programme-2026-2029> accessed 8 August 2025.

16 The Office for Environmental Protection, 'OEP Gives Advice to DAERA Minister on Nutrients Action Programme Regulations Consultation' <www.theoep.org.uk/report/oep-gives-advice-daera-minister-nutrients-action-programme-regulations-consultation> accessed 15 October 2025.

(Northern Ireland) 1995 ('the Habitats Regulations').[17] We have published this independent report on our website.[18] The report presents the legal interpretation of the consultant. The OEP reserves its view on the position presented in the report. We discuss this issue further in Chapter 4.

Agricultural nutrient loss is a complex topic. Our intention has been to make this report as accessible as reasonably possible, particularly for decision makers within DAERA and wider government. The report is not a scientific study but rather bridges the science-regulatory-legal interface. It seeks to provide sufficient and substantive information to support government commitments to improve and protect the environment.

Our approach also prioritises transparency and inclusivity throughout the review process. We have sought contributions from established experts, environmental and agricultural representatives and government officials, capturing both technical insights and practical experiences. This approach is essential for addressing the complex and evolving challenges of nutrient management and environmental protection.

1.4 Structure of this report

After this introduction, the remaining chapters of the report are as follows.

Chapters 2 and 3 provide factual background information as context for the analytical chapters that follow.

Chapter 2 introduces the topic of nutrient management in agriculture. After outlining the importance and characteristics of Northern Ireland's agri-food sector, it explains nutrient balances on farms and describes the main nutrient sources and approaches for mitigating losses of nutrients to water and air.

Chapter 3 summarises the provisions and requirements of the NAP Regulations and certain related measures that apply in Northern Ireland.

Chapters 4 to 6 then set out our analysis of three key aspects of the NAP Regulations and their implementation which will be critical in determining their effectiveness. In each of these analytical chapters, we review the evidence and set out our assessment and recommendations.

Chapter 4 considers DAERA's approach to assessing and enforcing compliance with the requirements of the regulations.

Chapter 5 examines the advice, guidance and support provided to farmers to enable them to comply with the regulations.

Finally, Chapter 6 looks at the sufficiency of the technical provisions of the regulations in controlling and reducing nutrient losses to achieve the intended environmental outcomes.

17 The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995. Northern Ireland Statutory Rules 1995 No. 380.
18 DTA Ecology, 'The Application of the Habitats Directive to Derogation Decisions under the Nitrates Directive' (due for publication) (2026) <www.theoep.org.uk/office-environmental-protection>.

2. Agricultural nutrients: sources and environmental impacts

2. Agricultural nutrients: sources and environmental impacts

2.1 Introduction

Nutrients, such as phosphorus and nitrogen, that support plant and livestock growth in agriculture can be harmful when they are lost to the wider environment. After outlining the importance and characteristics of Northern Ireland's agri-food sector, this chapter explains nutrient management in agriculture and the importance of nutrient balances on farms. It then describes the main nutrient sources and approaches for mitigating losses of agricultural nutrients to water and air.

2.2 Northern Ireland's agri-food sector

The agri-food sector is the largest manufacturing sector in Northern Ireland's economy. The sector produces more food than is required by the population of Northern Ireland.[19] Over three quarters of its finished products are exported for consumption elsewhere.[20] Proportionately, the industry is almost three times as important to the local economy as agriculture in the overall UK economy.[21]

In addition, the agri-food sector is important to rural areas, communities and balanced regional development. Some 86% of agri-food processors are based outside the Belfast City Council area and almost 26,000 farms operate in rural settings.[22] Approximately 21% of farm businesses are regarded as large enough to provide full-time employment for one or more persons (based on a standardised labour requirement).[23]

The current structure of the agricultural industry has largely resulted from long-term societal pressures for affordable food, government drivers to increase the quantity of home-produced food, and the agri-food business sector's drive for growth.[24] In response, farmers have adapted their practices in alignment with government policies, agri-business demands and consumer expectations.

At the same time, farmers and the agriculture sector more broadly understand the importance of safeguarding and enhancing water quality. They also recognise that changes are necessary to improve water quality in Northern Ireland, while calling for any significant changes in farming practices to be implemented in a manner that is supported, balanced, fair, and rooted in the everyday realities of farm life.[25]

The industry and government have already invested significantly in water quality improvement measures, such as slurry storage and spreading equipment, in recent years. For example, through the Farm Business Improvement Scheme, which is a package of measures aimed at improving the competitiveness and sustainability of farming,

19 Kendall (n 13).

20 Kendall (n 13).

21 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (2024) <www.daera-ni.gov.uk/publications/nutrients-action-programme-implementation-report-2020-2023> accessed 24 February 2025.

22 Kendall (n 13).

23 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

24 Department of Agriculture, Environment and Rural Affairs, 'Going for Growth - a Strategic Action Plan in Support of the NI Agri-Food Industry' (30 April 2015) <www.daera-ni.gov.uk/publications/going-growth-strategic-action-plan-support-ni-agri-food-industry> accessed 5 January 2026.

25 Ulster Farmers Union, 'An Open Letter to Minister Muir from the NI Agri Food Sector' (n 12).

1,567 farm businesses have received a total of £11.3 million for purchasing low emission slurry spreading equipment.[26]

It must also be recognised that around 70% of Northern Ireland's agricultural land has previously been designated by the EU as 'Less Favoured Area'. In the UK as a whole, 50% of the agricultural area is designated as less favoured, compared to 39% in the EU countries.[27] This illustrates that there are significant natural constraints on agriculture practices and challenges for the livelihoods of farmers in Northern Ireland.

Some 6% of farms in Northern Ireland are classed as 'large', with almost 79% classed as 'very small'. The predominant activity on Northern Ireland's farms is cattle and sheep farming. Over three quarters of farms have some cattle, 38% have some sheep, 4% have some poultry and 1.5% have some pigs.[28]

Economically, dairy farming was the leading agricultural sector in 2023, with a gross margin of £570 million (47% of the total agricultural gross margin). Beef production followed with a gross margin of £220 million (18% of the total).[29]

Almost 6% of Northern Ireland's agricultural land is under agri-environment schemes. This has decreased significantly in recent years due to the ending of older schemes.[30] Nevertheless, they remain significant. For example, under the current Environmental Farming Scheme, nearly 2,500 km of watercourses were fenced off from the impact of livestock damage. Evidence from a sample of sites in Northern Ireland suggests this has improved water quality by decreasing losses of sediment and phosphorus.[31]

Photo 2. Grazing cattle near the Mourne Mountains, County Down. The cattle are fenced off from a watercourse which helps to protect the bank and reduce nutrient runoff.

Photo Credit: © Rivers Trust, 2025.

26 Department of Agriculture, Environment and Rural Affairs, 'Farm Business Improvement Scheme - Capital Scheme (FBIS-C)' (8 September 2015) <www.daera-ni.gov.uk/articles/farm-business-improvement-scheme-capital-scheme-fbis-c> accessed 15 December 2025; Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (2025) <www.daera-ni.gov.uk/consultations/public-consultation-proposed-nutrients-action-programme-2026-2029> accessed 2 February 2026.

27 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

28 The Northern Ireland Executive, 'Results from the June Agricultural Census 2024' (12 December 2024) <www.daera-ni.gov.uk/news/results-june-agricultural-census-2024> accessed 28 November 2025.

29 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

30 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

31 Alison Scott and others, 'Quantifying Nutrient and Sediment Erosion at Riverbank Cattle Access Points Using Fine-Scale Geo-Spatial Data' (2023) 155 Ecological Indicators 111067.

2.3 Nutrients in agriculture

Nitrogen and phosphorus have been fundamental in driving agricultural growth, enabling increased production to meet rising food demand over recent decades. They are used in chemical fertilisers to promote crop growth and are fed directly to animals in the form of grains and supplements to support animal health and growth.

Phosphorus, a critical non-renewable raw material for the UK economy, is mined in a limited number of countries, including Morocco, China, and the USA.[32] Nitrogen is also an essential resource, but it can be synthesised, so its long-term availability is more secure.[33]

The effective management and manipulation of natural nutrient cycles are central to the success of modern food production systems. Advances in scientific understanding, technology and agricultural practices have enabled better control over these cycles, with the goals of increasing the amount of food produced per unit of phosphorus or nitrogen input and boosting overall agricultural output.

However, interventions in natural nutrient cycles can also have significant environmental costs, as losses of nitrogen and phosphorus can adversely affect terrestrial and aquatic ecosystems as well as presenting risks to human health and wellbeing through air and water pollution.[34] Considerable efforts have therefore been made to mitigate these negative impacts via further interventions and changes to the nutrient cycles in agricultural systems.

Within Northern Ireland's predominantly pastural agricultural system involving the use of land for grazing animals, the loss of nutrients to the environment is influenced by the interplay between agricultural management practices, landscape and soil characteristics, and weather conditions. Grazing animals consume nutrient-rich feed and/or grass, and their excreted waste returns nutrients to the soil.

Livestock manure, such as slurry and farmyard manure, is collected from animal housing, stored, and applied to fields, thereby enriching the soil with nutrients including nitrogen and phosphorus. Chemical fertilisers are also used to meet the demands of crop production, particularly in more intensive farming systems.

Nutrient losses to air and water can occur at various stages within this cycle: directly from livestock manure or silage stores and farmyard areas; following the application of organic manure and chemical fertilisers to soil, especially when this coincides with rainfall; or from the soil if nutrient levels from fertiliser or livestock-excreted waste exceed crop requirements.

The nutrient cycles are influenced by other natural cycles, including those related to hydrology and ecology, and by climate change. Alterations in these cycles can affect agricultural production and nutrient losses to the environment.

This is illustrated in Figure 2.1. The figure shows in a simplified form the main sources of nutrients and how they enter freshwater systems and move through the environment.

32 Cordell D and others, 'UK Phosphorus Transformation Strategy: Towards a Circular UK Food System' (Zenodo 2022) <https://zenodo.org/record/7404622> accessed 6 January 2026.

33 BBC News, 'How Fertiliser Helped Feed the World' (2 January 2017) <www.bbc.co.uk/news/business-38305504> accessed 17 November 2025.

34 Katie E Wyer and others, 'Ammonia Emissions from Agriculture and Their Contribution to Fine Particulate Matter: A Review of Implications for Human Health' (2022) 323 Journal of Environmental Management 116285; Roberto Picetti and others, 'Nitrate and Nitrite Contamination in Drinking Water and Cancer Risk: A Systematic Review with Meta-Analysis' (2022) 210 Environmental Research 112988; The Office for Environmental Protection, 'Drivers and Pressures Affecting Terrestrial and Freshwater Biodiversity in Northern Ireland' (n 7).

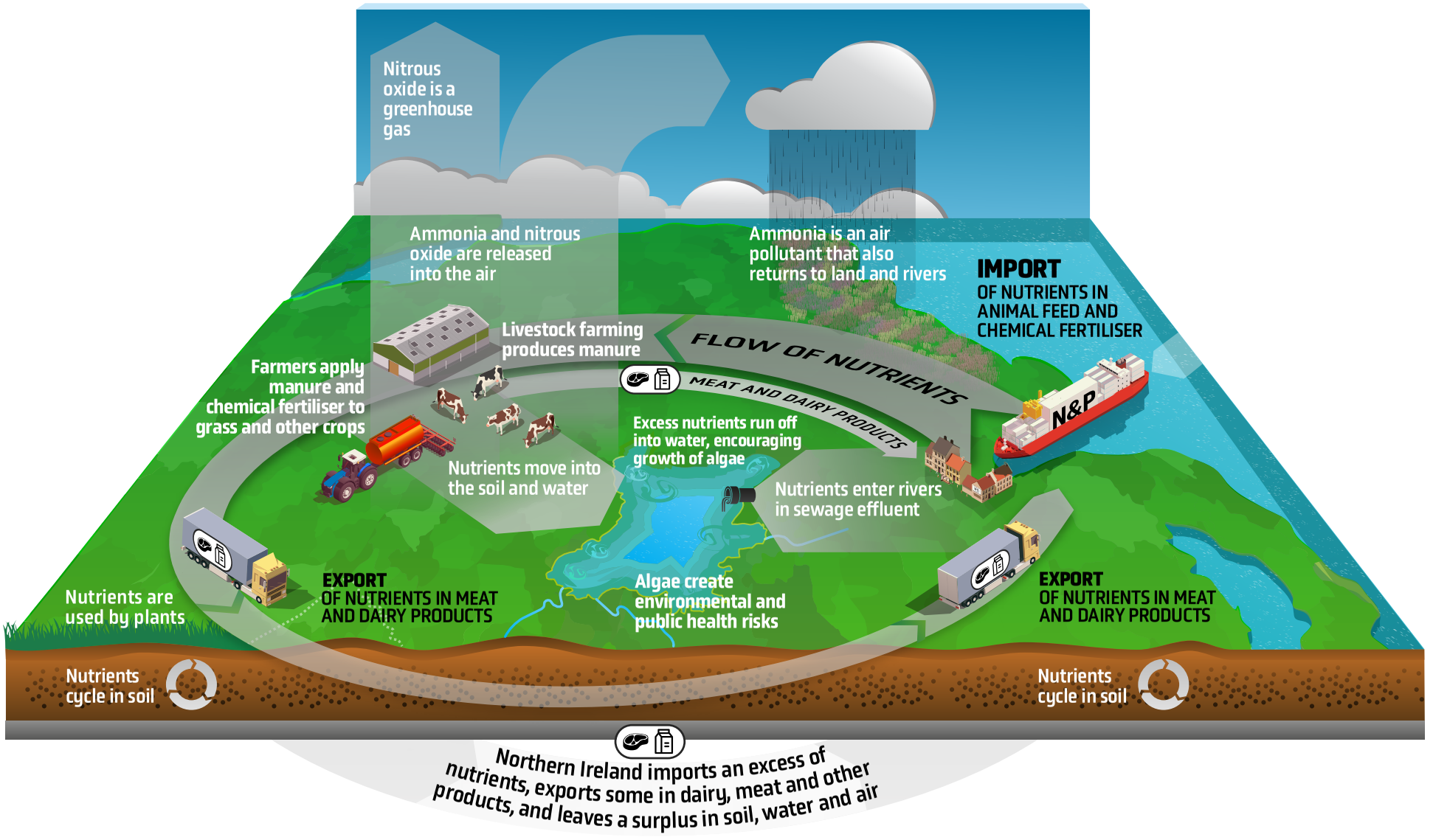

Figure 2.1. Simplified pathways of nutrients (nitrogen and phosphorus) in Northern Ireland

2.4 Farm nutrient balances

A farm's 'nutrient balance' is the difference between the inputs of nutrients entering a farm (through fertilisers and animal feed) and the exports of those leaving as outputs (such as livestock, milk, crops or manure). When inputs exceed exports, there is a 'nutrient surplus', and associated increased risks of nutrient buildup in soil and losses to water and air.

Managing nutrient balances is therefore vital for reducing the loss of agricultural nutrients to the environment. It is also important to increase farm efficiency, since the loss of nutrients from chemical fertiliser or feed to the environment represents a waste of resources that farmers must pay for.

Achieving an overall zero balance, where nutrient imports and exports match one another, should therefore in theory support farm productivity as well as environmental protection. However, this depends on the farming system that is adopted. Achieving a zero nutrient balance is more likely in a grass-based livestock system than in an intensive dairy, pig or poultry system, where animals are housed much of the year and fed significant quantities of concentrated feed.

Nutritional supplements and concentrated feed (such as grains and soya) may be given alongside fodder (silage or hay) and forage (grazed grass) to provide or optimise nutrition for the production of meat, eggs, milk, wool, and healthy offspring.

In intensive livestock operations, especially dairy, pig, and poultry farms, animals are fed a large proportion of concentrated feed to maintain high productivity. However, these feeds often contain more nitrogen (in the form of crude protein) and phosphorus than the animals require or can absorb. This results in a nutrient surplus on the farm. The excess nutrients are excreted by the animals. The more concentrated feed they consume, the higher the nutrient content of their excreted waste.

Nutrient surpluses can also occur when a farm produces or imports more organic manure than is needed, applying it to the soil at levels that exceed crop requirements. This is common on intensive pig and poultry farms where animals are housed most of the year and there is insufficient land available to spread all the livestock manure. Nutrient surpluses can also occur if more chemical fertiliser is applied than the crops need. This leads to excessive soil nutrients, above what is required by crops, including grass.

Data provided to us by DAERA indicate that, as of 2024, agriculture in Northern Ireland operated at a national annual nutrient surplus of around 10 kg of phosphorus per hectare per year (kg P/ha/year) and 136 kg of nitrogen per hectare per year (kg N/ha/year). In the last 20 years, there has been a reduction in the phosphorus content of concentrated feed.[35] However, the quantity of feed use has increased significantly.[36] Since 2007, the phosphorus surplus has ranged from a low of 8.2 kg P/ha/year in 2009 to a high of 11.6 kg P/ha/year in 2018.[37]

However, farm nutrient balances vary significantly between farms. A recent survey of 211 farms of different types in Northern Ireland indicated that phosphorus nutrient balances

35 Department of Agriculture, Environment and Rural Affairs, 'Review of the Phosphorus Content of Concentrate Feedstuffs along with Nitrogen, Phosphorus and Manure Excretion from Dairy Cattle.' (12 May 2025) <www.daera-ni.gov.uk/publications/review-phosphorus-content-concentrate-feedstuffs-along-nitrogen-phosphorus-and-manure-excretion-dairy-cattle> accessed 14 November 2025.

36 Department of Agriculture, Environment and Rural Affairs, 'Nutrient Balance Spreadsheet Provisional 2024 Data Supplied to the OEP by DAERA'.

37 Department of Agriculture, Environment and Rural Affairs, 'Nutrient Balance Spreadsheet Provisional 2024 Data Supplied to the OEP by DAERA' (n 36).

ranged from -55 kg P/ha/year to +170 kg P/ha/year. Negative balances occur where farmers are exporting manure from their farms to other locations.[38]

Pig and poultry farms had the highest mean phosphorus surpluses of 68 kg P/ha/year and 92 kg P/ha/year, respectively. Beef, sheep, dairy and mixed farms had average surpluses of 15-16 kg P/ha/year.[39]

Overall, there has been a decline in the use of chemical fertilisers over the past decade in Northern Ireland.[40] However, this has been offset by an increase in the use of concentrated animal feed.[41] Currently, the majority of the phosphorus surplus in agriculture results from imported concentrated animal feed, while both fertiliser and feed are major contributors to the nitrogen surplus.[42]

2.5 Nutrient loss from farmyards

Farmyards and farm buildings are central to farm operations, serving as locations for milking cows, housing and moving livestock, and storing fertiliser and silage. Consequently, the activities in and around farmyards and farm buildings can be a source of nutrient loss from agriculture to the environment.[43]

Poorly constructed or poorly maintained infrastructure for storing fertilisers or silage can result in leaks of effluent, or significant pollution incidents if large quantities are released into waterbodies. Losses can also occur if infrastructure is inadequate for the size of the farm.[44]

Operations associated with farmyards can also result in nutrient loss to water if livestock-excreted waste, silage, and fertiliser deposited on concrete surfaces are washed into waterbodies during rainfall events. Slurry storage facilities are significant sources of gaseous emissions.[45]

To limit these losses, regular cleaning of farmyards is essential, along with the use of storage systems designed to contain ‘dirty water’ during rainfall events. ‘Dirty water’ is water on farmyards that is contaminated with organic manure, urine, effluent, milk and cleaning materials. If this is washed off the farmyard and enters waterbodies it causes pollution.[46]

Managing dirty water presents a significant challenge for farmers, as deciding when farmyard runoff should be classed as dirty water is crucial but difficult. Where farmers have sufficient slurry storage capacity, dirty water can also be stored in these slurry tanks. Otherwise, additional storage is required. In addition, rainwater from roofs and other clean

38 Jason Rankin, Frances Titterington and Professor Gerry Boyle, ‘Interim Economic Impact Assessment of Proposed Measures Within Daera’s Nutrients Action Programme 2026 – 2029’ (AgriSearch).

39 Rankin, Titterington and Boyle (n 38).

40 RPS Consulting Engineers, ‘Nutrients Action Programme 2026-2029 Strategic Environmental Assessment’ (2025) Environmental Report IBE2249 <www.northernireland.gov.uk/sites/default/files/2025-04/DAERA%20NAP%20-%20Strategic%20Environmental%20Assessment.PDF> accessed 5 January 2026.

41 Department of Agriculture, Environment and Rural Affairs, ‘Statistical Review of Northern Ireland Agriculture 2023’ <www.daera-ni.gov.uk/publications/statistical-review-ni-agriculture-2007-onward> accessed 5 January 2026; RPS Consulting Engineers (n 40).

42 Department of Agriculture, Environment and Rural Affairs, ‘Nutrient Balance Spreadsheet Provisional 2024 Data Supplied to the OEP by DAERA’ (n 36).

43 Sara E Vero and Donnacha Doody, ‘Applying the Nutrient Transfer Continuum Framework to Phosphorus and Nitrogen Losses from Livestock Farmyards to Watercourses’ (2021) 50 Journal of Environmental Quality 1290; Sara E Vero, Erin Sherry and Donnacha Doody, ‘Evidence and Perception of Phosphorus Loss Risk Factors in Farmyards’ (2020) 114 Environmental Science & Policy 542.

44 Vero and Doody (n 43); Vero, Sherry and Doody (n 43).

45 Vero and Doody (n 43); Vero, Sherry and Doody (n 43).

46 Vero and Doody (n 43); Vero, Sherry and Doody (n 43).

areas of the farmyard should be diverted away from areas that will produce dirty water, thereby reducing the volume of dirty water to be stored.[47]

Spills of nutrient-rich agricultural effluent from silage and slurry stores into waterbodies can have both short-term and long-term effects. Short-term effects include deaths of fish and freshwater pearl mussels, damage to plants, oxygen depletion, elevated levels of organic matter and nutrients, eutrophication, and damage to fisheries. In the longer term, sensitive species such as mayflies and otters can lose habitat and food sources, and nature corridors and biodiversity hotspots can be severely degraded.

2.6 Organic manure and chemical fertilisers

The organic manure produced in livestock farming varies with livestock type, housing and diet. Livestock manure ranges from dirty water and liquid slurry to solid forms such as poultry litter and farmyard manure. The nutrient content of livestock manure also varies. Poultry litter, pig slurry, and dairy cattle slurry generally contain high levels of nitrogen and phosphorus.[48]

The forms of these nutrients in different manures influence how readily they are taken up by crops and lost to the environment. Intensive systems in which livestock are fed large quantities of concentrated feed tend to produce manure with high nutrient content.[49] Winter housing of livestock will result in the accumulation of livestock manure that farmers must apply to land or export from the farm to ensure their storage facilities are emptied for the subsequent winter period. To use their resources most efficiently, farmers need to apply fertiliser at the optimal time for plant growth, while avoiding application on waterlogged soil or during rainfall in order to minimise losses to water.

Although livestock manure contains phosphorus and nitrogen, chemical fertilisers are also applied to fields to ensure crops receive the precise nutrients they need. Chemical fertilisers are often favoured because their nutrient content is consistent, allowing farmers to apply them at rates that more closely match crop requirements. The use of chemical fertilisers poses a risk to water quality, but managing the timing of their application is less problematic than organic manures. Farmers are not under the same pressure to use chemical fertilisers, as they are with slurry, in order to free up slurry storage tanks.

If organic manure and chemical fertilisers are applied close to rainfall events, or on frozen or waterlogged ground, they can be washed off the land before being incorporated into the soil and taken up by crops.[50] Slurry, being largely liquid, is particularly vulnerable to losses to water if applied at the wrong time.

In Northern Ireland, frequent rainfall and poorly drained soils complicate the application of livestock manure. Recent research has highlighted the risks of applying slurry in Northern Ireland during the autumn and winter months, emphasising the need for 'closed periods' when fertiliser applications are prohibited.[51]

47 Vero and Doody (n 43); Vero, Sherry and Doody (n 43).

48 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).

49 Department of Agriculture, Environment and Rural Affairs, 'Review of the Phosphorus Content of Concentrate Feedstuffs along with Nitrogen, Phosphorus and Manure Excretion from Dairy Cattle.' (n 35).

50 Mairead Shore and others, 'Incidental Nutrient Transfers: Assessing Critical Times in Agricultural Catchments Using High-Resolution Data' (2016) 553 Science of The Total Environment 404.

51 Russell Adams and others, 'Evaluating Scenarios to Reduce Phosphorus Transport in Surface Waters from Slurry Applications in Temperate Grasslands' (2022) 67 Hydrological Sciences Journal 1216.

Even outside of the 'closed periods', farmers face considerable challenges in using fertilisers in the right place and at the right time to avoid wet conditions and subsequent nutrient losses. The risk of rainfall remains high outside the closed period, including sometimes during the summer months.[52] Nearly 50% of Northern Ireland's soils are poorly drained and particularly prone to runoff during rainfall events.[53]

Furthermore, a large proportion of agricultural fields are artificially drained. This increases the connectivity between fields and nearby waterbodies, and thereby the risk of losses of nutrients to water.[54] Evidence has demonstrated that organic fertiliser can remain at the surface of the soil for extended periods and so can be lost in runoff many days after application.[55]

This combination of factors means that, even when farmers adhere to best practice, there is a high risk of nutrient loss following fertiliser application. These risks are further heightened when considering the need to reduce ammonia and nitrous oxide emissions by avoiding the application of fertiliser during warm, dry, and windy conditions. Ammonia emissions peak when all three of these conditions coincide.

2.7 Nutrients in soil

Over time, applications of livestock manure and chemical fertiliser to land are incorporated into the soil matrix and the nutrients become available for plant uptake. When soil nutrients are just right for maximum crop yield, this is referred to as the 'agronomic optimum'. Achieving this requires farmers to apply nitrogen and phosphorus at the right time (when required by crops), in the right place (targeting soils with nutrient levels that are otherwise below what crops require), and in the right amounts (matching the specific needs of the crop).

Prevention of over- or under-application requires knowledge of nutrients already in the soil and their availability to plants. Soil nitrogen is highly mobile and quickly lost to the environment or taken up by plants. As a result, chemical nitrogen fertiliser is usually applied on multiple occasions annually to satisfy crop needs. Phosphorus, on the other hand, binds strongly to soil particles and persists for longer periods, reducing the required frequency of application.

Not all phosphorus is taken up by plants, especially when the soil is already at its agronomic optimum. Phosphorus that is not taken up by the plants remains in the soil and accumulates over time.[56] The higher the surplus above the agronomic optimum, the faster and more sharply phosphorus is lost to water.[57] Greater phosphorus losses occur from wet soils and sloping fields that are prone to runoff.[58]

Over-application of organic manure and chemical fertiliser has resulted in more than 40% of agricultural land in Northern Ireland having phosphorus concentrations above

52 Adams and others (n 51).

53 Adams and others (n 51).

54 M Snell, 'Impact of Nutrient Enrichment and Hydromorphological Modification on Riverine Biodiversity in Northern Ireland.' (2024) OEP commissioned research <www.theoep.org.uk/report/drivers-and-pressures-northern-ireland> accessed 16 February 2025.

55 JL González Jiménez and others, 'Split Phosphorus Fertiliser Applications as a Strategy to Reduce Incidental Phosphorus Losses in Surface Runoff' (2019) 242 Journal of Environmental Management 114; KA Smith, DR Jackson and TJ Pepper, 'Nutrient Losses by Surface Run-off Following the Application of Organic Manures to Arable Land. 1. Nitrogen' (2001) 112 Environmental Pollution 41.

56 CJ Watson and DI Matthews, 'A 10-year Study of Phosphorus Balances and the Impact of Grazed Grassland on Total P Redistribution within the Soil Profile' (2008) 59 European Journal of Soil Science 1171.

57 Watson and Matthews (n 56).

58 Alison Scott and others, 'Soil Phosphorus, Hydrological Risk and Water Quality Carrying Capacities in Agricultural Catchments' (2024) 240 CATENA 107964.

the agronomic optimum, posing a long-term risk to water quality.[59] Overapplication occurs for many reasons, including to avoid the cost of exporting manure from the farm and the logistical challenges of redistribution of manure within and between farms.

Reducing the percentage of agricultural land with soil phosphorus levels above the agronomic optimum from 40% to around 15% is predicted to be a safe target to improve water quality, noting that some catchments may require more stringent measures.[60] Such a reduction is expected to take decades and will require careful nutrient management to reduce soil phosphorus levels without compromising crop growth.[61]

Although nitrogen is more mobile than phosphorus, surplus nitrogen can still accumulate in soil organic matter.[62] As this organic matter turns over, the stored nitrogen in the soil is gradually released and, where it is not taken up by crops, it is lost to air and water. However, nitrogen in fertiliser or soil can also be rapidly lost to the air as ammonia or nitrous oxide, or to the water as nitrate or ammonium.[63]

2.8 Nutrient losses to water

Nutrient inputs to aquatic ecosystems in Northern Ireland originate mainly from two sectors: agri-food and wastewater management. Both sectors comprise a complex and interconnected array of sources that contribute nutrients to waterbodies across various spatial and temporal scales.

Disentangling the relative contributions of these sources is challenging and subject to uncertainty. Nonetheless, it is evident that the current ecological status of waterbodies in Northern Ireland is poor, with nutrient inputs from the agri-food sector and wastewater identified as the principal causes.[64] Excessive nutrient enrichment of the aquatic environment has resulted in eutrophication and the proliferation of algal blooms, exemplified by recent events in Lough Neagh.[65]

The need to improve the ecological status of waterbodies is therefore clear. A recent statistical report indicates that, in 2024, only 131 (29%) of the 450 rivers monitored in Northern Ireland were classified as having ‘good’ or ‘high’ ecological status, with just two rivers achieving the latter condition. During the same period, five (24%) of the 21 lakes attained ‘good’ ecological status, while none were classified as ‘high’ status.[66]

59 Department of Agriculture, Environment and Rural Affairs, ‘Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029’ (n 15); Department of Agriculture, Environment and Rural Affairs, ‘Water Quality, Catchment Science Research and Linkages to Proposed Measures’ (12 May 2025) <www.daera-ni.gov.uk/publications/water-quality-catchment-science-research-and-linkages-proposed-measures> accessed 25 November 2025.

60 Scott and others (n 58).

61 Rachel Cassidy, Donnacha G Doody and Catherine J Watson, ‘Impact of Legacy Soil Phosphorus on Losses in Drainage and Overland Flow from Grazed Grassland Soils’ (2017) 575 Science of The Total Environment 474; Barbara J Cade-Menun and others, ‘Long-term Changes in Grassland Soil Phosphorus with Fertilizer Application and Withdrawal’ (2017) 46 Journal of Environmental Quality 537.

62 CJ Watson and others, ‘Impact of Grazed Grassland Management on Total N Accumulation in Soil Receiving Different Levels of N Inputs’ (2007) 23 Soil Use and Management 121.

63 Gina Vasile Scăețeanu and Roxana Maria Madjar, ‘The Control of Nitrogen in Farmlands for Sustainability in Agriculture’ (2025) 17 Sustainability 5619.

64 Department of Agriculture, Environment and Rural Affairs, ‘Significant Water Management Issues (Consultation Document & Annex - Summary of Water Quality and Pressures in Each Local Management Area)’ (2025) <www.daera-ni.gov.uk/consultations/significant-water-management-issues> accessed 7 January 2026.

65 Department of Agriculture, Environment and Rural Affairs, ‘The Lough Neagh Report and Action Plan’ (2025) <www.daera-ni.gov.uk/articles/action-being-taken-address-issues-lough-neagh> accessed 5 November 2025.

66 Northern Ireland Environment Agency, ‘Northern Ireland Water Classification Statistics Report 2024’ 13 <www.daera-ni.gov.uk/publications/water-classification-statistics-northern-ireland-2024-report>.

Around 70% of fresh waterbodies did not achieve good or better ecological status in 2024.[67] Excessive nutrient concentrations, particularly phosphorus, are the main reason waterbodies are failing to achieve good ecological status.[68] The proportion of rivers assessed as being at less than good status due to high phosphorus concentrations increased from 28% in 2015 to 40.4% in 2018. In 2024, almost 40% (39.3%) of freshwater bodies exceeded phosphorus levels required for good ecological status.[69] Further, average phosphorus concentrations in 93 surveillance rivers rose from 0.047 mg/l in 2012 to 0.065 mg/l in 2024.[70]

For lakes, the percentage achieving 'good' or 'high' status for total phosphorus declined sharply from 43% in 2014 to 19% in 2019.[71] However, in 2024 this figure had improved again to 43% of lakes with high or good total phosphorus status.[72]

Northern Ireland's 25 inshore coastal waterbodies, including estuaries and sea loughs, also show signs of nutrient stress. Only 10 (40%) were in 'good' or better ecological condition as last reported in 2024.[73] The most prevalent cause of failure was excessive nutrients detected in 10 of the 15 waterbodies not meeting good ecological status.[74] The Northern Ireland Statistics Report 2025 has also shown that nutrient (dissolved inorganic nitrogen) enrichment in transitional and coastal waters increased from 13% in 2017 to 62% in 2024.[75]

There is a clear relationship between the farm phosphorus surplus and phosphorus concentrations in rivers in Northern Ireland.[76] Achieving the WFD NI Regulations' phosphorus targets for waterbody status (as derived from Annex V of the EU Water Framework Directive)[77] would require reducing the phosphorus surplus in Northen Ireland to more sustainable levels.[78] While similar analyses for nitrogen using Northern Ireland-specific data have yet to be conducted, studies from other regions suggest that higher farm nitrogen surpluses are associated with increased environmental nitrogen losses.[79]

2.9 Nutrient losses to air

The two main types of losses to air resulting from agricultural nutrients are ammonia and nitrous oxide.

67 Department of Agriculture, Environment and Rural Affairs, 'Significant Water Management Issues (Consultation Document & Annex - Summary of Water Quality and Pressures in Each Local Management Area)' (n 64).

68 Department of Agriculture, Environment and Rural Affairs, 'Significant Water Management Issues (Consultation Document & Annex - Summary of Water Quality and Pressures in Each Local Management Area)' (n 64).

69 Northern Ireland Audit Office, 'Water Quality in Northern Ireland's Rivers and Lakes' (2024) <www.niauditoffice.gov.uk/publications/water-quality-northern-irelands-rivers-and-lakes> accessed 14 November 2025.

70 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Environmental Statistics Report 2025' (29 May 2025) <www.daera-ni.gov.uk/publications/northern-ireland-environmental-statistics-report-2025> accessed 18 November 2025.

71 Northern Ireland Audit Office (n 69).

72 Northern Ireland Audit Office (n 69).

73 Northern Ireland Environment Agency (n 66).

74 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Environmental Statistics Report 2025' (n 70).

75 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Environmental Statistics Report 2025' (n 70).

76 P Jordan, Y McElarney and R Cassidy, 'The Farmgate Phosphorus Balance as a Measure to Achieve River and Lake Water Quality Targets' (2024) 372 Journal of Environmental Management 123427.

77 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy [2000] (OJ L 327/1).

78 Jordan, McElarney and Cassidy (n 76).

79 Masooma Batool and others, 'Scenario Analysis of Nitrogen Surplus Typologies in Europe Shows That a 20% Fertilizer Reduction May Fall Short of 2030 EU Green Deal Goals' (2025) 6 Nature Food 787; Mona Dieser and others, 'Nitrate Leaching Potential from Arable Land in Germany: Identifying Most Relevant Factors' (2023) 345 Journal of Environmental Management 118664; T Dalgaard and others, 'Farm Nitrogen Balances in Six European Landscapes as an Indicator for Nitrogen Losses and Basis for Improved Management' (2012) 9 Biogeosciences 5303.

Ammonia

Ammonia is released when nitrogen compounds from fertiliser break down, especially under warm, dry and alkaline conditions. Factors such as surface application of livestock manure or urea-based chemical fertilisers, poor livestock manure storage and inadequate ventilation in animal housing can contribute to increased ammonia emissions.

In Northern Ireland, agriculture is responsible for the majority of ammonia emissions: 86% comes from livestock-excreted waste, 8% from chemical nitrogen fertilisers and 6% from sewage sludge and digestate.[80] By sector, dairy farming contributes 37% of emissions, beef production 29%, and the poultry and pig sectors just over 20% combined.[81] Increases in livestock numbers and indoor housing, and associated changes in manure management practices, have driven recent rises in ammonia emissions, which peaked in 2021 before a slight reduction in 2022.[82]

Gaseous emissions of nutrients negatively affect sensitive plant species and ecological communities through direct exposure and nitrogen deposition. DAERA has reported that all of Northern Ireland's most important protected sites for nature – 'Special Areas of Conservation', 'Special Protection Areas' and 'Areas of Special Scientific Interest' – have ammonia concentrations that exceed 1 $\mu g/m^3$. This represents the long-term annual average critical level for lichens, mosses and the ecosystems they support.[83]

Ammonia also has implications for human health. It contributes to the formation of fine particulate matter which is linked to respiratory and cardiovascular diseases.[84]

To reduce ammonia emissions, farmers can improve the management of organic manure and chemical fertiliser, adopt technologies such as low emission slurry spreading equipment, utilise slurry store covers, switch from urea-based to less volatile chemical fertilisers, and apply fertilisers during cool conditions when the soil is not dry.[85]

Nitrous oxide

When nitrogen is incorporated into soils, microbial processes convert some of it into nitrous oxide, especially under wet or compacted soil conditions. Nitrous oxide is a potent greenhouse gas with a global warming potential much greater than carbon dioxide.[86] Livestock manure management practices also make a significant contribution to gaseous emissions during storage and application to land.

Nitrous oxide emissions in Northern Ireland are reported to have dropped by 29% since 1990. Agriculture is the dominant source based upon 2023 data.[87] This change is mainly due to reduced chemical fertiliser use and improved nitrogen use efficiency.[88] Recent evidence from the Republic of Ireland indicates that the application of chemical fertilisers

80 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Environmental Statistics Report 2025' (n 70).

81 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (2023) <www.daera-ni.gov.uk/consultations/draft-ammonia-strategy-northern-ireland-consultation> accessed 7 October 2025.

82 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81); National Atmospheric Emissions Inventory, 'Air Pollutant Inventories for England, Scotland, Wales and Northern Ireland: 2005-2023' <https://naei.energysecurity.gov.uk/reports/air-pollutant-inventories-england-scotland-wales-and-northern-ireland-2005-2023> accessed 5 November 2025.

83 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81).

84 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81).

85 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81).

86 Cornelius Oertel and others, 'Greenhouse Gas Emissions from Soils—A Review' (2016) 76 Geochemistry 327.

87 Northern Ireland Statistics and Research Agency, 'NI Greenhouse Gas Inventory 1990-2023' <https://datavis.nisra.gov.uk/daera/northern-ireland-greenhouse-gas-inventory-1990-2023-statistical-bulletin.html> accessed 3 December 2025.

88 Northern Ireland Statistics and Research Agency (n 87).

accounts for 38% of nitrous oxide emissions, while the deposition of livestock-excreted waste and the storage and spreading of livestock manure account for 23% and 14% respectively.[89]

Reducing nitrous oxide emissions requires matching nitrogen inputs to crop needs, using split fertiliser applications, introducing nitrification inhibitors, improving soil drainage, preventing compaction, and maintaining optimal soil acidity to limit the anaerobic conditions that promote nitrous oxide release.[90]

89 The Agriculture and Food Development Authority (Teagasc), 'Nitrous Oxide' <https://teagasc.ie/environment/climate-change-air-quality/nitrous-oxide/> accessed 14 July 2025.

90 Dejun Li and others, 'A Review of Nitrous Oxide Mitigation by Farm Nitrogen Management in Temperate Grassland-Based Agriculture' (2013) 128 Journal of Environmental Management 893.

3. The Nutrient Action Programme Regulations

3. The Nutrient Action Programme Regulations

3.1 Introduction

The NAP Regulations originate from the EU Nitrates Directive (91/676/EEC), which was adopted in 1991 with the purpose to reduce water pollution caused by nitrates from agricultural sources throughout the EU.[91]

This chapter provides an overview of the origins, objectives, key provisions and review of the NAP Regulations. It summarises how they operate within the wider environmental and regulatory framework, including their links to the agricultural cross-compliance system, their role in supporting the achievement of outcomes under the WFD NI Regulations, and their interaction with the Habitats Regulations.

This is not intended to be an exhaustive list of each element of the NAP Regulations. Rather, it is a summary of the key requirements. Anyone who wishes to see the exact legal provisions should refer to the legislation directly.[92]

3.2 Main elements of the EU Nitrates Directive

Nitrate Vulnerable Zones

The Nitrates Directive requires member states to identify and designate 'Nitrate Vulnerable Zones' within their territories.[93] Such zones are defined in the Directive as all known areas of land which drain into waters that are affected by pollution caused or induced by nitrates from agricultural sources, or which could be so affected if action is not taken.[94] This includes, in particular, waters that are eutrophic or may become eutrophic in the near future, as well as groundwater containing, or likely to contain, nitrate concentrations exceeding 50 mg/l, and surface freshwaters containing nitrate concentrations exceeding 25 mg/l, notably those used or intended for the abstraction of drinking water.[95]

Where such zones exist, the Directive requires member states to establish and implement action programmes to reduce water pollution from nitrogen compounds. Alternatively, they may adopt a 'total territory approach' and apply an action programme across their whole area.

Following consultations and environmental assessments in 2004, the total territory of Northern Ireland was designated as the area to which an action programme would be applied, reflecting the risk of agricultural nutrient pollution to all surface, ground and estuarine waters.[96]

91 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] (OJ L 375/1).

92 The Nutrient Action Programme Regulations (Northern Ireland) 2019. Northern Ireland Statutory Rules 2019 No. 81.

93 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] art 3.

94 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] art 3.

95 Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States [1975] (OJ L 194/26); Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] Annex 1.

96 Reg. 3 The Protection of Water Against Agricultural Nitrate Pollution Regulations (Northern Ireland) 2004. Northern Ireland Statutory Rules 2004 No. 419.

Total nitrogen from livestock manure: limits and derogations

The Nitrates Directive's primary mechanism for reducing nitrate concentrations and nitrate leaching is the nitrogen loading limit it imposes. In areas covered by action programmes, no more than 170 kg N/ha/year may come from livestock manure.[97] This limit applies both to manure deposited directly by grazing livestock and to that collected while animals are housed and subsequently applied to land.

The Directive allows for 'derogations' (exceptions) to this rule, enabling member states to permit higher limits under specific conditions.[98] For EU member states, these derogations require justification to the European Commission and are subject to stricter management measures to ensure water quality objectives are still met.[99]

In Northern Ireland, derogations allow eligible farms to apply higher nitrogen loadings of up to 250 kg N/ha/year. The European Commission granted the last derogation to Northern Ireland in 2019 due to its primarily grassland-based farming, favourable climate for grass growth, and soils that encourage denitrification, which reduce nitrate leaching.[100]

Following the UK's exit from the EU in 2020, the requirement for derogations to be granted by the Commission no longer applies. The derogations are now provided for under the NAP Regulations.[101]

3.3 Implementation of the EU Nitrates Directive in Northern Ireland

Northern Ireland initially relied on general water pollution laws and voluntary agricultural codes to implement the Nitrates Directive.[102] The first formal transposition was the Protection of Water Against Agricultural Nitrate Pollution Regulations 1996.[103] Following several revisions, this was superseded by the Nitrates Action Programme Regulations (Northern Ireland) 2006 and the associated Phosphorus (Use in Agriculture) Regulations (Northern Ireland) 2006.[104]

There is an ongoing requirement for periodic review in the NAP Regulations which is derived from the underlying Nitrates Directive.[105] The Directive obliges member states to 'review the eutrophic state of their fresh surface waters, estuarial and coastal waters every four years' and to revise nitrate vulnerable zone designations and action programme measures accordingly.[106]

97 Reg. 9 The Nutrient Action Programme Regulations 2019; Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] Annex III(2).

98 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] Annex III, 2. Procedure for application for derogation in Article 9 of the Directive.

99 European Union, 'Fighting Water Pollution from Agricultural Nitrates, Summary of: Directive 91/676/EEC Concerning the Protection of Waters against Pollution Caused by Nitrates from Agricultural Sources' <https://eur-lex.europa.eu/EN/legal-content/summary/fighting-water-pollution-from-agricultural-nitrates.html> accessed 14 October 2025.

100 Commission Implementing Decision (EU) 2019/1325 of 27 May 2019 granting a derogation requested by the United Kingdom with regard to Northern Ireland pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (notified under document C(2019) 3816) [2019] (OJ L 206/21).

101 Reg. 39 The Nutrient Action Programme Regulations 2019.

102 The Water Regulations (Northern Ireland) 1991. Northern Ireland Statutory Rules 1991 No. 50; Department of Agriculture, Environment and Rural Affairs, 'The Code of Good Agricultural Practice (COGAP)' (6 May 2015) <www.daera-ni.gov.uk/publications/code-good-agricultural-practice-cogap> accessed 11 December 2025.

103 The Protection of Water Against Agricultural Nitrate Pollution Regulations (Northern Ireland) 1996, SR 1996/217.

104 The Nitrates Action Programme Regulations (Northern Ireland) 2006; Phosphorus (Use in Agriculture) Regulations (Northern Ireland) 2006. Northern Ireland Statutory Rules 2006 No. 488.

105 Reg. 35 The Nutrient Action Programme Regulations 2019.

106 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy [2000] art 6(1)(c).

When the current regulations came into force in 2019, they consolidated previously separate nitrogen and phosphorus regulations into a single instrument. While serving mostly to provide legal continuity, they also brought in some further changes. These include additional phosphorus controls, wider slurry buffer zones, a phased introduction of low emission slurry spreading equipment in specific circumstances and stricter storage requirements.[107]

Following the UK's exit from the EU in 2020, the NAP Regulations have now become 'assimilated law'. The regulations do not fall under the terms of the Northern Ireland Protocol, which is part of the UK–EU Withdrawal Agreement.[108] This means there is no ongoing requirement for alignment with EU law in this area.

3.4 Summary of the NAP Regulations

General duties

The NAP Regulations provide a legally binding framework of measures designed to protect water quality in Northern Ireland by reducing pollution from agricultural sources.

The regulations set out general duties for the 'controllers' of agricultural holdings to prevent water pollution arising from the use of fertilisers.[109] These duties prohibit both the direct and indirect entry of fertilisers into surface waters or groundwater, as well as any activity that creates a risk of such entry.

The regulations also require controllers to comply with the NAP Regulations. In doing so, controllers must have regard to guidance issued by DAERA and to the Code of Good Agricultural Practice.[110]

The NAP Regulations define a 'controller' in relation to a holding as 'the person charged with management of the holding for the calendar year in question and will be taken to be the person claiming direct agricultural aid payments for the agricultural area or, where direct agricultural aid payments are not being claimed, the person who enjoys the decision making power, benefits and financial risks in relation to the agricultural activity carried out on the land'.[111]

Prevention of water pollution from the application of fertilisers

The NAP Regulations set out detailed rules for the application, timing, and management of fertilisers to prevent nutrient losses to water.[112] Specifically, the regulations prohibit the application of any fertiliser to land that is waterlogged, flooded, frozen, snow-covered or steeply sloping. They also establish 'closed periods' during which spreading is banned to protect water quality during high-risk autumn and winter months.[113]

The regulations specify minimum 'buffer zones' that must be left unfertilised between fertiliser application areas and watercourses. These are generally at least 2 metres wide

107 Part 3, The Nutrient Action Programme Regulations 2019; Schedule 2 The Nutrient Action Programme Regulations 2019; Schedule 3 The Nutrient Action Programme Regulations 2019.

108 Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community [2020] (OJ L 29/7).

109 Part 2, The Nutrient Action Programme Regulations 2019.

110 Department of Agriculture, Environment and Rural Affairs, 'The Code of Good Agricultural Practice (COGAP)' (n 102).

111 Reg. 3 The Nutrient Action Programme Regulations 2019.

112 Part 3, The Nutrient Action Programme Regulations 2019.

113 Reg. 8 The Nutrient Action Programme Regulations 2019.

for chemical fertilisers, 10 metres for organic manures from any waterway other than lakes, and 20 metres for lakes or sources of public water supplies, with limited flexibility where precision-spreading equipment is used. Buffer zones can also vary depending on field size, shape and slope.[114]

Total nitrogen limits

The NAP Regulations set limits on the total volume of livestock slurry or manure that can be applied in any one event, and minimum intervals between such applications.[115] In addition to setting nitrogen loading from livestock manures at 170 kg N/ha/year, the regulations establish total nitrogen limits for chemical fertiliser.[116]

The 170 kg N/ha/year nitrogen limit applies to all livestock manure, whether deposited on fields directly by grazing animals or collected in livestock housing and spread on land. This effectively controls livestock density by restricting total nitrogen from livestock manure per hectare.

The 170 kg N/ha/year limit equates to roughly two 'livestock units' per hectare. However, the higher the concentration of nitrogen in animals' excreted waste, the fewer animals that can be kept per hectare.

Derogations

In 2007, Northern Ireland secured a derogation from the European Commission that allowed eligible grassland cattle farms to apply up to 250 kg N/ha/year from grazing livestock manure, subject to specific conditions and an annual application.[117]

The derogation has been renewed through each iteration of the NAP Regulations since that time. The Nutrient Action Programme (Amendment) Regulations (Northern Ireland) 2019 provide the current legislative basis for allowing qualifying farms to exceed the standard 170 kg N/ha/year limit and operate at up to 250 kg N/ha/year (approximately 2.9 livestock units per hectare).[118] This is provided that certain additional requirements are met and no additional environmental nutrient loss occurs.[119]

Controllers of derogated farms must prepare and maintain fertiliser management plans and records of fertiliser applications, based on soil analysis, crop requirements and storage capacity. They must also retain and submit records for inspection by DAERA.[120] A farm nutrient balance with a phosphorus surplus of below 10 kg P/ha/year must be maintained.[121]

Under the derogation, farmers must apply at least 50% of livestock slurry to land before 15 June each year. Slurry must also be applied by low emission spreading methods after 15 June.[122]

114 Reg. 8 The Nutrient Action Programme Regulations 2019.

115 Reg. 8 The Nutrient Action Programme Regulations 2019.

116 Reg. 9 The Nutrient Action Programme Regulations 2019.

117 Commission Decision 2007/863/EC of 14 December 2007 granting a derogation requested by the United Kingdom with regard to Northern Ireland pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (notified under document number C(2007) 6281) [2007] (OJ L 337/21).

118 The Nutrient Action Programme (Amendment) Regulations (Northern Ireland) 2019. Northern Ireland Statutory Rules 2019 No. 183.

119 Reg. 39 The Nutrient Action Programme Regulations 2019.

120 Reg. 14 The Nutrient Action Programme Regulations 2019; Reg. 16 The Nutrient Action Programme Regulations 2019.

121 Schedule 8 The Nutrient Action Programme Regulations 2019.

122 Commission Implementing Decision (EU) 2019/1325 of 27 May 2019 granting a derogation requested by the United Kingdom with regard to Northern Ireland pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (notified under document C(2019) 3816) [2019].

Storage requirements

The NAP Regulations set out storage requirements for silage and livestock manure (including slurry, poultry manure, anaerobic digestate fibre and dirty water) on farms.[123] They require that storage facilities are of adequate size, well-maintained and managed to prevent seepage or run-off into surface or groundwater.

Holdings with pigs or poultry must have space to store manure generated over 26 weeks, while others require space for 22 weeks' storage. All new or enlarged slurry stores must meet specified structural standards and be notified to DAERA before use. Manure, litter, digestate, dirty water and silage effluent must be stored on impermeable bases or under cover, away from watercourses, and managed during winter to prevent rainwater ingress and maintain containment.[124]

Land management and record keeping

The NAP Regulations require that, where grass leys are grown in rotation with arable crops, the first arable crop must be sown as soon as practicable after ploughing.[125] This is intended to reduce the duration of bare soil exposure and thereby minimise the potential for nitrate leaching to watercourses.

The regulations also require controllers of agricultural holdings to keep annual records for at least five years and provide them to DAERA on request.[126] Records must include the identity of the holding's controller, as well as details of fields and cropping, soil nitrogen and phosphorus, livestock, manure and fertiliser applications and movements, crop nutrient requirements, and any grazing or storage authorisations.

Compliance assessment and enforcement

The NAP Regulations set out a framework for compliance assessment and enforcement.[127] They provide DAERA, or authorised officers acting on the department's behalf (such as officers from the Northern Ireland Environment Agency - NIEA), with powers to inspect farms, require remedial action, and initiate prosecutions in response to non-compliance.

Specifically, the regulations allow DAERA to issue enforcement notices requiring action to prevent or correct breaches.[128] Failure to comply with these notices or with specified operational or record-keeping duties constitutes an offence.[129]

For the most part, these provisions of the regulations make it a criminal offence for the 'controller' or other 'appropriate person' at a farm to fail comply with the requirements without 'reasonable excuse'. The regulations also provide for penalties including fines on summary conviction and, for more serious offences, an indictment.[130]

In practice, however, DAERA does not normally use these provisions to enforce the NAP Regulations (see Chapter 4). Rather, it primarily acts through the reduction of agricultural payments (see Section 3.5). Where it considers that a farm pollution incident justifies

123 Part 4, The Nutrient Action Programme Regulations 2019.
124 Part 4, The Nutrient Action Programme Regulations 2019.
125 Part 5, The Nutrient Action Programme Regulations 2019.
126 Part 6, The Nutrient Action Programme Regulations 2019.
127 Part 7, The Nutrient Action Programme Regulations 2019.
128 Reg. 30 The Nutrient Action Programme Regulations 2019.
129 Reg. 32 The Nutrient Action Programme Regulations 2019.
130 Reg. 33 The Nutrient Action Programme Regulations 2019.

criminal prosecution, DAERA takes enforcement action under the Water Order (Northern Ireland) 1999.[131] This makes it an offence if someone 'discharges or deposits any poisonous, noxious or polluting matter so that it enters a waterway'.[132]

The NAP Regulations and the Water Order both apply the criminal standard of proof of an offence having been committed 'beyond reasonable doubt'. The offences can be found to have been committed without needing to establish an intent to commit the criminal act. In its first consultation on amendment of the NAP Regulations in May 2025, DAERA proposed to introduce provision for fixed and variable civil monetary penalties, when primary powers are available.[133]

Reporting and review

The NAP Regulations require DAERA to prepare a report on their implementation every four years.[134] DAERA published the last such report, covering the period 2020 to 2023, in 2024.[135]

DAERA must also review the NAP Regulations every four years in consultation with the public and, if appropriate, publish a 'revised action programme'.[136] DAERA has told us that this includes consideration of the position in neighbouring jurisdictions to help inform the approach for Northern Ireland. In practice, when it revises the action programme, DAERA undertakes this by amending the regulations for the subsequent programme period.

As they were last amended in 2019, the NAP Regulations should have been reviewed under this provision by 2023. However, this date was missed. The OEP highlighted this failure,[137] in response to which DAERA outlined a timetable for the delayed review, which was then carried out.[138]

Following the review, DAERA published its proposed changes to the regulations for public consultation in May 2025, to cover the period 2026 to 2029.[139] The OEP submitted advice to DAERA in response to that consultation.[140]

In June 2025, the DAERA Minister issued an update on the proposed changes.[141] He announced that, when the initial consultation closed in July 2025, DAERA would set up a timebound stakeholder 'task and finish group' including farming, agri-food and environmental sector representatives. This group, he said, would be asked to take into account the consultation responses, plus any other potential solutions, in order to

131 The Water (Northern Ireland) Order 1999. SI 1999 No. 662 (N.I. 6).

132 The Water (Northern Ireland) Order 1999. SI 1999 No. 662 (N.I. 6) art 7.

133 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

134 Reg. 34 The Nutrient Action Programme Regulations 2019 (1).

135 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

136 Reg. 35 The Nutrient Action Programme Regulations 2019.

137 Office for Environmental Protection, 'Failure to Meet NI EIP Deadline "Deeply Regrettable"' <www.theoep.org.uk/report/failure-meet-ni-eip-deadline-deeply-regrettable> accessed 12 January 2026; The Office for Environmental Protection, 'Review of Nutrient Action Programme in NI a "Matter of Urgency" as Deadline Missed' <www.theoep.org.uk/report/review-nutrient-action-programme-ni-matter-urgency-deadline-missed> accessed 3 June 2025.

138 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

139 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation Launched on the Nutrients Action Programme to Improve Water Quality' (1 May 2025) <www.daera-ni.gov.uk/news/public-consultation-launched-nutrients-action-programme-improve-water-quality> accessed 3 June 2025.

140 The Office for Environmental Protection, 'OEP Gives Advice to DAERA Minister on Nutrients Action Programme Regulations Consultation' (n 16).

141 Department of Agriculture, Environment and Rural Affairs, 'Update on Public Consultation for the Revised Nutrients Action Programme' (n 11).

propose measures and actions for the revised NAP Regulations that are evidence-based and workable at farm level within realistic timeframes, as well as meeting legislative requirements. The minister also announced DAERA's intention to undertake a further, eight-week public consultation on the resulting updated proposals, and an associated draft economic impact assessment.

At the time of completing this report, the proposed changes to the NAP Regulations are still outstanding.

3.5 Related law and policy

Cross-compliance and agricultural support payments

As well as having their own criminal enforcement mechanisms, the NAP Regulations form part of the Statutory Management Requirements within the cross-compliance framework governing area-based agricultural payments.[142] Under this system, breaches of the NAP Regulations may lead to reductions or withdrawal of agricultural support payments, depending on the severity, extent and recurrence of non-compliance.

DAERA guidance states that such deductions are applied following inspection and verification by inspection teams.[143] We discuss this further in Section 4.4.

The Water Framework Directive (Northern Ireland) Regulations

The aquatic environment in Northern Ireland is managed in accordance with the WFD NI Regulations and associated plans. The implementation of the WFD NI Regulations is in its third cycle.[144]

The OEP has reviewed and published a report on the implementation of the WFD NI Regulations.[145] The report made sixteen recommendations and found that almost seven in ten of Northern Ireland's rivers, lakes and other surface waters are not in good ecological condition, or on a clear trajectory towards it.

The NAP Regulations are part of the legal framework listed in the WFD NI Regulations, giving DAERA powers and duties to manage water quality to achieve the intended outcomes.[146] By setting rules for fertiliser and manure use, storage, nutrient management and other activities on farms, the NAP Regulations are intended to reduce pressures on rivers, lakes, groundwater, and coastal waters in support of achieving the objectives that are set for individual waterbodies. The information collected under the NAP Regulations by DAERA through farm records and inspections also feeds into monitoring the status of waterbodies and progress towards objectives under the WFD NI Regulations.

142 Department of Agriculture, Environment and Rural Affairs, '2025 Cross-Compliance Verifiable Standards - Full & Summary Versions' (27 November 2024) <www.daera-ni.gov.uk/publications/2025-cross-compliance-verifiable-standards-full-summary-versions> accessed 11 December 2025; Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme' <www.daera-ni.gov.uk/articles/nutrients-action-programme> accessed 12 August 2025.

143 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Cross-Compliance Verifiable Standards Summary' <www.daera-ni.gov.uk/publications/2025-cross-compliance-verifiable-standards-full-summary-versions> accessed 15 October 2025.

144 Department of Agriculture, Environment and Rural Affairs, 'Third River Basin Management Plan for Northern Ireland' (n 3).

145 The Office for Environmental Protection, 'A Review of Implementation of the Water Framework Directive Regulations and River Basin Management Planning in Northern Ireland' (n 14).

146 The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Northern Ireland Statutory Rules 2017 No. 81 Schedule 2.

The Habitats Regulations

The EU Habitats Directive was adopted in 1991 to reflect obligations in international law arising from the 1979 Convention on the Conservation of European Wildlife and Natural Habitats and the 1993 Convention on Biological Diversity.[147] Its objective is to 'contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States'.[148]

The Habitats Directive was transposed into law in Northern Ireland through the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 ('the Habitats Regulations').[149] These regulations have been amended several times.

A key measure provided for in the Habitats Regulations is the carrying out of an 'appropriate assessment' pursuant to Article 6(3) of the Habitats Directive.[150] This is more commonly referred to in Northern Ireland as a 'Habitats Regulations Assessment' (HRA). HRAs must be undertaken by public authorities before granting permission for plans or projects that could be damaging to certain habitats. In addition to the specific legal duties in Article 6 of the Habitats Directive, the Habitats Regulations also impose general legal duties on public authorities, including to avoid the deterioration of habitats.[151]

There is currently no legal case precedent or legal authority in Northern Ireland which indicates how the Habitats Regulations specifically interrelate with the NAP Regulations. However, DAERA's most recent review of the NAP Regulations recommended that DAERA conduct an HRA of the overall Nutrient Action Programme.[152] DAERA engaged an external contractor to carry out an HRA of the proposals coming out of the review of the NAP Regulations.[153]

HRAs are not currently conducted in Northern Ireland for derogations under the NAP Regulations. This has raised questions about compliance with the Habitats Regulations at the derogation level as well as at the overall plan level.

DAERA acknowledged in its 2025 consultation on revision of the NAP Regulations: 'The Department is at risk of contravention of the Habitat Regulations in the application of NAP without giving due consideration to the impact on habitats through the land application of manures.'[154] We discuss this further in the next chapter.

147 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora [1992] (OJ L 206/7).

148 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora [1992] art 2(1).

149 The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995. Northern Ireland Statutory Rules 1995 No. 380.

150 Reg. 43 The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995. Northern Ireland Statutory Rules 1995 No. 380.

151 Reg. 3 The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995. Northern Ireland Statutory Rules 1995 No. 380.

152 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

153 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

154 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

4. Effectiveness of inspections and enforcement

4. Effectiveness of inspections and enforcement

4.1 Introduction

This chapter is concerned with the inspection and enforcement of compliance with the NAP Regulations. We consider inspections (Section 4.2), nitrogen loading calculations (Section 4.3), agricultural water pollution events (Section 4.4), derogations (Section 4.5), and Habitats Regulations Assessments (Section 4.6).

4.2 Inspections

Inspections are central to effective environmental regulation. A well-functioning inspection regime enables regulators to assess implementation and compliance, ensure rules are followed, and identify and address instances of non-compliance through appropriate enforcement actions.

Inspections help safeguard environmental protection by upholding regulatory standards and deterring violations. They also provide an opportunity to educate and serve as a valuable tool for monitoring and gathering performance information to support informed decision-making and accountability.

The inspection and enforcement of the NAP Regulations are undertaken by NIEA. NIEA officers are also authorised to carry out farm inspections for cross-compliance purposes and for other environmental legislation, including the Water (Northern Ireland) Order 1999.

4.2.1 Inspection rate

Each year, NIEA inspects 1% of farms that are subject to the regulations. Farms operating under an approved derogation are inspected at a rate of 5% per year.[155]

DAERA has told us that the rationale for using a 1% inspection rate is derived from previously applicable EU law, which required at least 1% of farms claiming area-based agricultural payments to be inspected for cross-compliance purposes annually.[156] The origin of the 5% inspection rate for derogated farms can be traced to a 2015 decision by the European Commission to allow the continued use of derogations in Northern Ireland.[157]

DAERA has noted that the inspection percentages may be increased 'depending on the extent of non-compliance'.[158]

4.2.2 Risk-based approach

Information provided to the OEP by DAERA outlines that, of the 1% of farms inspected annually, a minimum of three quarters are selected based on a risk assessment. The

155 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6) 85.

156 Commission Regulation (EC) 809/2014 laying down rules for the application of Regulation (EU) No 1306/2013 of the European Parliament and of the Council with regard to the integrated administration and control system, rural development measures and cross compliance.

157 Commission Implementing Decision (EU) 2015/346 of 9 February 2015 on granting a derogation requested by the United Kingdom with regard to Northern Ireland pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (notified under document C(2015) 542) [2015] (OJ L 60/42).

158 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).

remaining scheduled inspections are at randomly selected farms. DAERA told us that this approach was developed to reflect EU cross-compliance regulations dating back to 2014.[159]

NIEA is responsible for co-ordinating the selection of farm holdings for compliance inspection. NIEA told us that farms are allocated risk scores based on a range of factors that are relevant to requirements in the cross-compliance inspection process. One such factor is nitrogen loading. We discuss this further in Section 4.3.

4.2.3 Inspections in response to referrals

In addition to scheduled inspections, NIEA conducts inspections in response to referrals from other agencies, members of the public or other relevant sources. The number of farms inspected on the basis of such referrals varies from year to year. DAERA's most recent implementation report on the NAP Regulations shows an average of 78 farms (~0.3 %) having been inspected per year as a result of referrals between 2020 and 2023.[160] It also states that all such reports are investigated by NIEA and that the great majority of these reports are substantiated.[161]

Although the report does not quantify this majority or explain the criteria applied when determining whether a referral is 'substantiated', it can be inferred that, because referral-based inspections arise from suspected breaches rather than random sampling, they tend to have higher levels of confirmed non-compliance. As such, when results from the farms inspected based on referrals are combined with scheduled inspections, the overall rates of non-compliance increase (see Section 4.2.7).

4.2.4 Notification of inspections

Farms that are inspected based on referrals are not typically notified in advance. There is also no requirement for NIEA to provide advance notice of planned inspections.[162] However, the majority of controllers whose farms are subject to cross-compliance inspections are notified in advance.

A Memorandum of Understanding between NIEA and the Ulster Farmers' Union provides for between seven and fourteen days' notice ahead of scheduled inspections.[163] This is intended to allow time to assemble the necessary records for inspection.

However, pre-notification does carry a risk that issues of potential or past non-compliance are rectified before inspection, thus leaving NIEA without a complete understanding of the general picture of compliance across Northern Ireland as a whole.

NIEA does recognise the risks with this approach. However, we have been informed that NIEA considers it a balance between reasonably accurate assessment and enabling farmers to prepare in accordance with the Memorandum of Understanding.

159 Commission Regulation (EC) 809/2014 laying down rules for the application of Regulation (EU) No 1306/2013 of the European Parliament and of the Council with regard to the integrated administration and control system, rural development measures and cross compliance art 69.

160 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

161 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

162 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6) 82.

163 Department of Agriculture, Environment and Rural Affairs, 'Memorandum of Understanding: Farming for a Healthier Environment' <www.daera-ni.gov.uk/sites/default/files/publications/daera/Signed-NIEA-UFU-MOU.PDF> accessed 7 January 2026.

4.2.5 Inspection of farm records, land and facilities

The NAP Regulations require controllers of farms to prepare and maintain records for inspection.[164] This documentation is intended to provide NIEA with the necessary data to determine compliance.

Examples of farm records required include livestock manure loading, amounts of nitrogen from chemical fertilisers and other organic manures (such as spent mushroom compost) applied to land, and the number of weeks' manure storage capacity. The records inspected can be for any year going back five years.[165] The records must be compiled for each calendar year. DAERA provides resources and guidance documents that outline the information required and the recommended record sources (see Chapter 5).[166]

Controllers have the option to accompany NIEA in the inspection of the land and the farm facilities. During the inspection, NIEA examines areas that are considered most susceptible to pollution.[167] The inspection includes an assessment of whether the land included in the total nitrogen loading calculation is suitable for the application of organic manure or for grazing. This contrasts with the lack of consideration of this issue for farms that are not selected for inspection, which we discuss in Section 4.3 below.

Farm infrastructure, such as slurry storage systems, is inspected to assess containment to prevent pollution. In addition, the capacity of slurry storage tanks is assessed and checked against the calculated quantity of slurry to be stored.[168]

4.2.6 Inspection reports

For each inspection, NIEA produces a farm inspection report. This may include photographs taken as part of the record of the inspection.

In some instances, NIEA may take samples, such as water samples to test if suspected pollution has occurred. NIEA will seek to outline any areas of concern or non-compliances on the day of inspection, and to agree remedial actions.

If non-compliances are identified, NIEA will subsequently write to the farmer to confirm those non-compliances and inform them of any improvements required. It will additionally notify DAERA's Agricultural Payments Branch payments branch which may apply a penalty depending on the severity of the breach (see Section 4.4).

If any remedial works are not implemented during the timeframe specified by NIEA, then that failure may represent an additional non-compliance.[169]

4.2.7 Non-compliances identified in DAERA implementation reports

The inspection findings as shown in DAERA's implementation reports identify that the most frequent areas of non-compliance with the NAP Regulations are associated with water pollution. Specifically, these are breaches categorised as 'nitrogen fertiliser

164 Reg. 27 The Nutrient Action Programme Regulations 2019.
165 Reg. 27 The Nutrient Action Programme Regulations 2019.
166 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).
167 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).
168 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).
169 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6) 24.

entering a waterway or water contained in underground strata', 'livestock manure storage requirements', and 'land application restrictions'.[170]

The percentage of inspections demonstrating non-compliance in these areas fluctuates across reporting years from 2008 to 2023. However, there is no discernible upward or downward trend. Rather, non-compliance levels in these areas have tended to remain fairly stable when viewed over the whole period, averaging over 20% for both nitrogen fertiliser entering a waterway or underground strata and livestock manure storage requirements, and close to 10% for land application restrictions.[171] These issues represent potentially environmentally significant breaches.

DAERA highlights an increase in non-compliance relating to record keeping in 2022 and 2023, which it said was 'mostly related to new requirements for fertilisation plans required from 2020'. It also observed an 'increase in those not submitting manure export records discovered at inspection when checking their nitrogen loading'.[172]

In contrast, each implementation report produced since the introduction of the NAP Regulations has reported that '100 percent compliance was recorded for both closed spreading periods for chemical fertiliser and land management in this and previous reporting periods.' At the same time, DAERA notes that these figures are 'more likely attributable to enforceability limitations rather than confirmed compliance.'[173]

This suggests potential constraints in monitoring and verification rather than evidence of full compliance in practice. For instance, closed period compliance relating to slurry spreading is particularly difficult to determine without continuous oversight. Therefore, recorded compliance rates may reflect the scope and intensity of inspections rather than actual behaviour across the regulated population.

4.2.8 Our assessment and recommendation

Enforcement of the NAP Regulations combines formerly EU-derived cross-compliance requirements with risk-based targeting and reactive inspections. While this approach focuses most resources on farms that present higher environmental risks, the overall sampling rate is small. We consider that inspecting only around 1% of farms per year is unlikely to produce a dataset that reflects the diversity of farming systems or management practices across Northern Ireland.

The higher inspection rate for derogated farms provides more coverage. However, we question its sufficiency to support representative conclusions.

The use of risk-based selection should help identify non-compliance but also narrows the sample to farms already assessed as more likely to breach the rules. When combined with inspections triggered by referrals, therefore, the overall dataset is likely to over-represent farms with known or suspected problems.

170 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).
171 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).
172 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 76.
173 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 76-77 (section 5.2).

The combination of risk-based selection, random sampling and referral-based inspections has operational merit in the context of constrained NIEA resources. However, its likely effectiveness is restricted by the limited overall sampling rate.

Unless an inspection is undertaken following a referral, the 5% inspection rate for a farm with a derogation means such a farm could be expected to be inspected around once every twenty years on average. A farm without a derogation might be inspected less than around once every 100 years on average based on a 1% overall inspection rate. The number of non-derogated farms inspected on a purely random basis is particularly low at less than a quarter of the 1% (or 1 in 400) selected per year.

DAERA has advised that operational practice is slightly more nuanced than the broad picture set out in the previous paragraph. For example, it has told us that farms which appear to be operating above 170 kg N/ha/year without a derogation will come higher up in the risk-based scoring system.

Nevertheless, we are concerned that, at these levels of inspections, DAERA's ability to assess whether the regulations are being implemented effectively and achieving their intended purposes may be seriously compromised.

Further, pre-notification of scheduled inspections reduces the likelihood that inspections will capture typical conditions. While advance notice helps ensure that records are available, it also provides an opportunity for temporary or post-event corrective measures to be taken. This limits NIEA's ability to observe day-to-day land management, storage capacity and handling practices as they may normally occur. While some notice is necessary for administrative and safety reasons, an increased proportion of unannounced inspections would strengthen the reliability of the findings.

In our view, DAERA and NIEA need a larger and more statistically robust dataset and approach to inspections in order to better understand whether the NAP Regulations are being implemented effectively. We suggest that this should include an increased number of random inspections, clearer justification for inspection levels and more transparent reporting on referral-based activity.

We do not suggest specific inspection levels, or the split between scheduled and random inspections, which are for DAERA and NIEA to determine. Without any such improvements, however, it will remain difficult to assess whether compliance is improving or the regulatory regime is delivering the intended environmental outcomes.

We note that this issue was also discussed in DAERA's 2025 consultation on revision of the NAP Regulations, where DAERA proposed to increase the number of on-the-spot inspections in targeted areas from January 2027. It also stated that these focused inspections would be in addition to those carried out to assess compliance with the new Farm Sustainability Standards.[174]

Recommendation

DAERA should materially increase the current inspection rates and the number of random inspections. It should ensure inspection rates are sufficient to provide a credible picture of compliance, and assess whether such compliance means the NAP Regulations will deliver the intended outcomes.

174 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

4.3 Nitrogen loading calculations

4.3.1 Calculation method

The calculation of the total nitrogen from livestock manure loading is central to how NIEA assesses the environmental risk presented by individual farm holdings and their compliance with the NAP Regulations. Nitrogen loading calculations influence inspection prioritisation and are used to determine whether farms remain within the limits set by the regulations.

NIEA calculates nitrogen loading for all farm holdings using information provided through DAERA's annual Single Application Form. This includes details such as the 'Maximum Eligible Area' associated with each farm business (see Section 4.3.2). From 1 January 2026, revised land eligibility rules have been introduced under the Farm Sustainability Payment Scheme.[175]

NIEA also uses other relevant datasets such as animal numbers and annual livestock manure export data. Using these sources, NIEA produces a theoretical nitrogen loading figure for each holding.

Under NIEA's approach, non-derogated farms with a calculated nitrogen loading above 170 kg N/ha/year are assigned a high risk score and are therefore more likely to be selected for inspection under the system (see Section 4.2.2). However, as explained above, the probability of selection remains low.

4.3.2 Maximum Eligible Area

Under the NAP Regulations, farm controllers are required to keep a record of the total agricultural area of the holding, including the size and location of each field.[176] To verify the agricultural area used in its nitrogen loading calculations, NIEA told us it obtains information from DAERA about the claimants of direct agricultural payments. This includes data on the Maximum Eligible Area (MEA) available to the farm business: the area that can be used to claim direct agricultural support.

DAERA has confirmed to us that the MEA used for the calculation of nitrogen loading includes all eligible land associated with the holding, including land that may be unsuitable for grazing or the application of organic manure. As a result, areas that cannot in practice be grazed or receive organic manure, for example due to slope, soil conditions, environmental constraints or other physical factors, are nevertheless incorporated into nitrogen loading calculations.

This presents a concerning issue. Including land unsuitable for grazing or organic manure application within the total area used for nitrogen loading calculations means that the actual nitrogen loading on the suitable land may be increased. This may result in the accumulation of nutrients in the soil and the risk of nutrient losses to water and associated wider harm.

At present, the extent of land unsuitable for grazing or organic manure application included within MEA data is unknown. It is, therefore, not possible to assess the overall impact of this issue in practice or identify how many holdings may be affected.

175 The Northern Ireland Executive, 'Guide to Land Eligibility 2026' <www.daera-ni.gov.uk/publications/guide-land-eligibility-2025> accessed 6 January 2026.

176 Reg. 27 (1)(b) The Nutrient Action Programme Regulations 2019.

From 1 January 2026, eligible areas for the Farm Sustainability Payment scheme, which replaces the Single Farm Payment Scheme, will include: soft features such as rush, scrub, bracken, blanket bog, lowland raised bog; discrete areas of woodland of less than 5 hectares; areas with up to and including 70% stones, scree, rock or scattered rock; and woodland that is or has been part of a forestry or agri-environment scheme administered by DAERA on or after 1 January 2009.[177]

There are inconsistencies between the 'Agricultural Area' as defined in the NAP Regulations and the new land eligibility rules under the Farm Sustainability Payment Scheme. This has the potential to exacerbate the current situation, as land such as bog, heather and rush may be included when calculating a farm nitrogen loading rate, despite not being suitable for grazing or manure applications. DAERA has told us that it is aware of this issue and will provide clarity to farmers in due course.

Further, during our engagement in producing this report, DAERA and NIEA acknowledged that nitrogen loading calculations may not always reflect the operational reality of farm businesses. For example, they noted to us that cases may arise where a herd or flock is registered to an individual with very limited land area, while the practical farming activity is carried out jointly with a family member who controls most of the land.

In such cases, the calculated nitrogen loading for the herd or flock holder may be artificially high, while the person controlling the land could appear compliant during inspection. These complexities make it difficult for NIEA to maintain a fully accurate understanding of actual nitrogen application patterns and compliance with the regulations.

We note that the issues described above were not directly discussed in DAERA's 2025 consultation on the revision of the NAP Regulations. However, the consultation did contain broad proposals that were designed to improve the validity and accuracy of nitrogen loading calculations at farm level.

4.3.3 Our assessment and recommendation

The use of MEA data in its current form creates a limitation in how nitrogen loading is calculated. It means that land unsuitable for the application of organic manure or grazing may be included in whole-farm area calculations, assuming a distribution of organic manure that may not occur in practice and might not be realistic.

Therefore, nitrogen loading calculations are unlikely always to provide an accurate assessment of actual nitrogen application at farm level. At present, there is no systematic process in place to identify the risk of such discrepancies, or to correct them, outside of those farms selected for inspection. Given the potential significance of the issue, we consider that this represents a material weakness in how the NAP Regulations are being implemented and monitored.

The absence of information on the extent of land unsuitable for organic manure application or grazing also means that DAERA and NIEA cannot assess the scale of the issue. If significant areas of land in Northern Ireland cannot receive organic manure, then nitrogen pressure on the remaining area may be considerably higher than calculations suggest. This situation may be made worse by the introduction of the new land eligibility rules under the Farm Sustainability Payment Scheme introduced in January 2026.

177 The Northern Ireland Executive (n 175).

Table 4.1 below highlights that DAERA has a good understanding of which farms may be in exceedance of nitrogen loading limits through NIEA's nitrogen loading calculations. The table reflects data provided to us by DAERA in producing this report. The data show DAERA and NIEA's figures for the number of farms which have been calculated as exceeding the 170 kg N/ha/year limit after manure export is accounted for. However, we also understand from DAERA that there has largely been a lack of follow up with individual farms that have been calculated to be operating above the limit without a derogation, except those selected for inspection.

Farmers exceeding the 170 kg N/ha/year limit without a derogation should export manure, reduce stock numbers or procure additional land so as to become compliant with the limit, or, if eligible, they should apply for a derogation to operate up to 250 kg N/ha/year. However, information provided to us by DAERA shows that, in 2024, the department calculated 2,391 farms to be over the 170 kg N/ha/year limit, after manure export was taken into account. Yet only 401 of farmers over the limit were approved for a derogation in that year. The remaining 1,990 were not operating under a derogation.

The precise figures need to be treated with some caution rather than viewed as exact. In some cases they may not reflect the practical reality on the ground, whilst in other cases farmers may be exporting additional manure during the year to comply with the NAP Regulations. In addition, small numbers of farms may be granted derogations but not ultimately exceed the N limit. In broad terms, however, the figures indicate that hundreds, if not thousands, of farms may be exceeding the 170 kg N/ha/year limit without holding a derogation allowing them to do so, or being subject to the additional measures that should apply in such cases.

This is a significant issue as the remaining 1,990 farms in question are likely to include some of the most intensive farms in Northern Ireland, with the highest stocking rates and potentially the greatest nutrient losses to air and water.

Table 4.1. Number of farms calculated by DAERA as operating above the 170 kg N/ha/year limit between 2019 and 2024 (Source: data provided to the OEP by DAERA)

Year	Number of farm businesses above 170 kg N/ha/yr post imports/exports	Number of farm businesses above 170 kg N/ha/yr not derogated
2019	2,065	1,656
2020	2,150	1,746
2021	2,200	1,795
2022	2,245	1,849
2023	2,208	1,800
2024	2,391	1,990

DAERA informed us that a campaign to increase awareness of the 170 kg N/ha/year limit was undertaken in 2018, following indications that a significant number of farmers were likely operating above this threshold without a derogation. DAERA told us that, as part of the campaign, it sent an advisory letter to some 1,800 farm businesses explaining the 170 kg N/ha/year limit, its implications for compliance, and the options available to those exceeding it. One of the options highlighted was the nitrogen derogation.

DAERA also told us that, following this engagement, the number of derogation applications almost doubled, rising from just over 200 to more than 400 per year. Despite the impact of this intervention, the campaign has not been repeated. Yet since 2019, the number of farms calculated as operating above 170 kg N/ha/year has increased steadily, while the number of derogated farms has decreased. NIEA's acknowledgement that real-world farm structures do not always align with herd registration data further complicates the reliability of nitrogen loading calculations.

DAERA has told us that it is currently updating its information technology system to improve the accuracy of the nitrogen loading calculations. While that is welcome, the extent to which it will yield appreciable improvements to the environment may be limited unless it is accompanied by improved efforts to ensure compliance with the 170 kg N/ha/year limit.

Recommendation

In relation to the organic nitrogen limits set out in the NAP Regulations, DAERA should:

a) ensure that only land which is suitable for grazing or the application of manure is included in farm nitrogen loading calculations;

b) where it has information that indicates farmers are or may be working above the 170 kg N/ha/year limit without a derogation, take appropriate steps to ensure those farmers understand and are complying with the regulations.

4.4 Agricultural water pollution events

To be most effective, the inspections and enforcement elements of any system of regulation need to be outcome focused and aligned with the ultimate purpose of the regime. In the case of the NAP Regulations, this is the protection of waters against nutrient pollution caused by agricultural sources, including supporting the achievement of environmental objectives set under the WFD NI Regulations. However, enforcement challenges persist, with a significant number of pollution breaches recorded over the past decade, many involving fish kills.[178]

The NAP Regulations contain various provisions concerning criminal offences and penalties. Generally, non-compliance with the requirements constitutes a criminal offence unless a 'reasonable excuse' applies.

In practice, DAERA does not normally use these provisions to enforce the NAP Regulations' regime in the criminal courts. Instead, where it considers that a farm pollution incident is serious enough to justify criminal prosecution, DAERA takes enforcement action under the Water Order.[179] This makes it an offence if someone 'discharges or deposits any poisonous, noxious or polluting matter so that it enters a waterway'.

However, the primary route for enforcement of the NAP Regulations operates not through criminal enforcement but rather through reductions in payment entitlements in the form of 'cross-compliance' penalties. These originate from agricultural subsidy rules that require farmers to meet certain environmental, animal health, and land management standards. DAERA's Agricultural Payments Branch uses NIEA inspection results to determine where financial sanctions will be levied.

DAERA has published a 'penalty matrix', reproduced in Table 4.2 below, which sets out the current levels of reductions in payments for different types of breaches associated with a range of farm sustainability standards, including the requirements of the NAP Regulations. These came into effect on 1 January 2026. The penalties applied are a function of the severity of the breach identified and the size of the payment received.

178 The Detail and 05 August 2024, 'Farms Broke Environmental Rules Thousands of Times over Last Decade' (*The Detail*) <www.thedetail.tv/articles/farms-broke-environmental-rules-thousands-of-times-over-last-decade> accessed 12 January 2026.

179 The Water (Northern Ireland) Order 1999. SI 1999 No. 662 (N.I. 6).

Table 4.2. Penalty matrix for breaches of farm sustainability standards (Source: DAERA)[180]

Severity	First Breach	First Repeat Breach	Second Repeat Breach	Third Repeat Breach
Very Low	Warning Letter, Mandatory Training	1% or £50 (whichever is greater)	2% or £100 (whichever is greater)	4% or £200 (whichever is greater)
Low	Guidance Letter, Mandatory Training + 1% or £50 (whichever is greater)	2% or £100 (whichever is greater)	4% or £200 (whichever is greater)	8% or £400 (whichever is greater)
Medium	Guidance Letter, Mandatory Training + 5% or £200 (whichever is greater)	10% or £400 (whichever is greater)	20% or £800 (whichever is greater)	40% or £1600 (whichever is greater)
High	Guidance Letter, Mandatory Training + 25% or £1000 (whichever is greater)	50% or £2000 (whichever is greater)	75% or £3000 (whichever is greater)	100% + Exclusion from all area-based schemes and packages for the next year
Very High	Guidance Letter, Mandatory Training + 50% or £2100 (whichever is greater)	75% or £3100 (whichever is greater)	100% + Exclusion from all area-based schemes and packages for the next year	100% + Exclusion from all area-based schemes and packages for the next 2 years

The NAP Regulations and the Water Order both apply the criminal standard of proof of establishing 'beyond reasonable doubt' that a polluting offence has been committed. The offences can also be found to have been committed without the need to establish an intent to commit the criminal act.

In contrast, reductions in farm payments relating to fulfilment of conditions for agricultural support payments rely on the civil law standard of proof of the 'balance of probabilities'. We note, additionally, that DAERA previously proposed in its first consultation on amendment of the NAP Regulations to introduce provision for fixed and variable civil monetary penalties, when primary powers are available.[181]

Of 1,480 agriculture-related water pollution incidents recorded between January 2017 and September 2021, in line with DAERA's enforcement policy,[182] polluters were subject to, or considered for, enforcement action in 343 cases (23%). No action was taken in the majority of cases, as the incidents were assessed as low severity, the polluter was not in

180 Department of Agriculture, Environment and Rural Affairs, 'Farm Sustainability Standards (FSS)' (12 November 2025) <www.daera-ni.gov.uk/articles/farm-sustainability-standards-fss> accessed 16 January 2026.

181 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

182 Department of Agriculture, Environment and Rural Affairs, 'DAERA Enforcement Policy' <www.daera-ni.gov.uk/publications/daera-enforcement-policy> accessed 15 December 2025; Northern Ireland Audit Office (n 69).

receipt of an agricultural support payment which could be penalised, or the polluter was not identifiable.[183]

Over the five-year period, the total levied in cross-compliance penalties was £446,000 over 273 cases, an average of £1,634 per case. In addition to this, £25,000 of prosecution fines was levied across 51 incidents, an average of £490 per case.[184]

These cross-compliance and criminal sanctions are usually considerably lower than the direct aid payments that most farms receive from public funds. For example, Table 4.2 above notes that a medium severity breach would be subject to a 5% penalty on initial occurrence, or 10%, 20% or 40% on first, second or third recurrence respectively. Further, criminal fines imposed over the period 2017 to 2021 generally were on average less than a third of the value of reductions in farm payments over the same period for each incident enforced.

As a result, while sanctions create some incentive to comply with the regulations, their deterrent effect may be relatively limited. Coupled with the low inspection rates (see Section 4.2), low sanctions create the possibility that the likely cost of non-compliance may be less than that of compliance.

The range of criminal and civil enforcement actions also creates a possibility that farmers may be penalised under both regimes for the same event, with different standards of proof. This has been a point of concern to some stakeholders in respect of issues of transparency and proportionality.[185]

The OEP's position is that, in general, environmental regulators should have access to both criminal and civil sanctions. We therefore agree with the availability of both approaches in parallel for the NAP Regulations, enabling the use of reductions of farm payments to encourage overall compliance and address the majority of breaches, while also allowing criminal proceedings for serious cases such as deliberate or reckless breaches.

Where criminal cases are pursued, we consider that, normally, it will also be appropriate to reduce farm payments. Otherwise, parties who are subject to criminal enforcement for serious offences might still receive full farm payments, while those committing less significant breaches would see their payments reduced.

Further, we consider that DAERA's intended approach to enforcement of the NAP Regulations ought to be clear to the regulated community, in the interests of consistency and transparency as well as incentivising compliance. DAERA currently sets out its general approach and principles for enforcement across all of its functions and regulatory regimes in a single policy document.[186] This presents high-level principles and a framework for DAERA's enforcement, but does not contain any regime-specific information. Nor does it discuss the situation where both civil and criminal sanctions are available, or explain where one, the other or both may be applied.

The NAP Regulations Guidance Booklet for farmers (which we discuss further in Section 5.2.1) also provides a short overview of enforcement.[187] It explains that where the NAP

183 Northern Ireland Audit Office (n 69).

184 Northern Ireland Audit Office (n 69).

185 NewsLetter, 'Farmers Set for Heavier Penalties for Environmental Breaches - but UUP's Tom Elliott Urges Proportionate Approach' <//www.newsletter.co.uk/news/politics/farmers-set-for-heavier-penalties-for-environmental-breaches-but-uups-tom-elliott-urges-proportionate-approach-4656824> accessed 17 December 2025.

186 Department of Agriculture, Environment and Rural Affairs, 'DAERA Enforcement Policy' (n 182).

187 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).

Regulations are not complied with, enforcement action will follow the DAERA Enforcement Policy. It does not provide additional detail beyond the enforcement policy itself.

For the NAP Regulations, therefore, this means that DAERA's intended approach to enforcement is not set out as clearly as it might be.

Recommendation

DAERA should review how it monitors and enforces compliance with laws relating to water pollution from agriculture under the NAP Regulations, the Water Order (Northern Ireland) 1999 and the cross-compliance framework governing area-based agricultural payments. This should include:

a) setting out its intended approach to ensure there is clarity for the agricultural sector regarding which compliance and enforcement tools may be used when breaches and incidents occur;

b) ensuring that the combination of the frequency of inspections and the financial or other penalties that may be imposed following detection of breaches is sufficient to incentivise compliance.

4.5 Derogations

Under the NAP Regulations, eligible grassland cattle farms can apply for a derogation to enable them to operate above the 170 kg N/ha/year limit, up to a limit of 250 kg N/ha/year (approximately 2.9 livestock units per hectare), subject to certain nutrient management and environmental criteria.[188]

Farmers who want to benefit from a derogation must submit an online application for that year and a fertilisation account (if operating under a derogation in the previous year) to NIEA each year on or before 1 March. They must enter a written undertaking that they will submit to the controls set out in the regulations. The application for a derogation is submitted through 'DAERA Online Services'.[189]

The process for derogation applications in the NAP Regulations means that an application for derogation is deemed to be have been granted unless it is explicitly refused.[190] If an application has been refused, the applicant is notified within 28 days of the closing date for that year's derogation applications, with an explanation of the reason for refusal. Where no communication of refusal has been received within 28 days of the closing date for application, the applicant can assume that their application was 'deemed to have been granted' and can proceed to operate above the 170 kg N/ha/year limit up to a limit of 250 kg N/ha/year.

The 'deemed granted' aspect of the derogation process can be problematic. 'Deemed grant' of permission (rather than an active approval process) can lead to situations whereby competent authorities allow activity to occur by default, without adequate scrutiny of applications.

188 Reg. 39 The Nutrient Action Programme Regulations 2019; Schedule 8 The Nutrient Action Programme Regulations 2019.

189 Department of Agriculture, Environment and Rural Affairs, 'DAERA Online Services' <www.daera-ni.gov.uk/services/daera-online-services> accessed 30 January 2026.

190 Reg. 39 The Nutrient Action Programme Regulations 2019.

NIEA has told us it does not consider the 28 days a barrier to assessing applications. Nevertheless, this fixed period, coupled with the default outcome of approval, leaves the potential for inadequate scrutiny of the applications. There are currently around 400 such applications per year. The adequacy of the current fixed period for the scrutiny of derogation applications will also be affected in the future if more farms require derogations (see Section 4.3) and HRAs are required (Section 4.6 below).

4.6 Habitats Regulations Assessments

DAERA's NAP Derogation Guidance Booklet, in the 'Legal Requirements and Cross-Compliance' section, references the measures in the NAP Regulations which apply to derogations, whether or not the farmer is claiming any Area-Based Scheme payments. It also refers to the Nitrates Directive as underpinning one of the Cross-Compliance Statutory Management Requirements.[191]

Neither NIEA nor DAERA currently require an HRA to be carried out when deciding whether to refuse an application for a derogation under the NAP Regulations. However, DAERA's 2025 consultation on the revision of the NAP Regulations included a proposal to cross-reference the Habitats Regulations in the NAP Regulations, and the proposed screening of derogation applications in line with objectives under the Habitats Regulations.

We commissioned DTA Ecology to produce an independent report on how the HRA process applies to derogation applications under the NAP Regulations. We have published this independent report on our website alongside this report. The OEP reserves its position on the consultant's views expressed in the report. The report outlines DTA Ecology's assessment of the objectives in Article 2 of the Habitats Directive, and the possible ways that Article 6 of the Habitats Directive can be implemented in the context of derogation applications in Northern Ireland.

Case law and other legal authorities suggest that HRAs are required to be carried out for derogation applications. As there is currently no legal case precedent or authority on how the Habitats Regulations and the underlying Habitats Directive specifically interact with derogations at farm level in Northern Ireland, however, there remains room for some legal uncertainty and different interpretations on the application of the law in this area.

DAERA may therefore wish to consider and clarify its position on how the NAP Regulations interrelate with all of the legal duties owed under the Habitats Regulations at both the national plan level and the individual derogation applications level, if it has not already done so.

Recommendation

DAERA should ensure that the derogation process under the NAP Regulations meets its legal obligations and supports intended outcomes for protected sites under the Habitats Regulations, including:

a) providing clarity on how it ensures there is sufficient scrutiny of applications within the 28-day window for refusal, and considering whether an active approval process should be implemented;

b) considering and clarifying how its legal duties under the Habitats Regulations interrelate with the NAP Regulations.

191 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme (NAP) Derogation 2019-2022' (26 January 2021) <www.daera-ni.gov.uk/publications/nutrients-action-programme-nap-derogation-2019-2022> accessed 6 January 2026.

Photo 3. Cattle in the Mourne Mountains. The Mournes contain several Special Areas of Conservation that are sensitive to nutrient pollution

Photo Credit: kitz-travellers/ iStock Getty Images Plus via Getty Images

5. Effectiveness of nutrient management advice, guidance and support

5. Effectiveness of nutrient management advice, guidance and support

5.1 Introduction

The effective implementation of the NAP Regulations relies heavily on the efforts and commitment of farmers to comply with the regime.[192] In this chapter, we assess the effectiveness of the advice, guidance and support offered to farmers by DAERA and other bodies.

The requirements of the NAP Regulations and information on wider nutrient management should be communicated to farmers in a practical and useful format.[193] It is well evidenced that farmers' engagement and awareness is one of the most important factors in determining whether the best management practices are adopted and how well they are implemented.[194]

5.2 Main sources of guidance and advice

Advice and guidance on the NAP Regulations, and on nutrient management more broadly, are provided to farmers on DAERA's website, and by the College of Agriculture, Food and Rural Enterprise (CAFRE).[195]

CAFRE is a public, tertiary-level college offering training in agriculture, food technology, horticulture, equine and agri-business at three campuses in Northern Ireland, with industry facing programmes delivered locally by teams of agricultural advisors. It operates as a division within DAERA to support the development of those entering or already working in these sectors through a range of education, knowledge transfer and innovation programmes.[196]

5.2.1 DAERA advice and guidance

DAERA has published a Nutrients Action Programme 2019-2022 Guidance Booklet and calculations workbooks. Both are available on the DAERA website and as hard copies.

The Guidance Booklet is designed for farm controllers.[197] It provides background information on the NAP Regulations, explains duties, and lists practical actions needed to comply with the regulations.[198] The sections of the Guidance Booklet cover: closed spreading periods; land application restrictions; livestock manure nitrogen loading; nitrogen

192 The Office for Environmental Protection, 'OEP Gives Advice to DAERA Minister on Nutrients Action Programme Regulations Consultation' (n 16).

193 Ulster Farmers Union, 'Commodity Watch - New Nutrients Action Programme' (21 December 2019) <www.ufuni.org/commodity-watch-new-nutrients-action-programme/> accessed 24 November 2025.

194 M Okumah and others, 'Behavioural Impacts of Northern Ireland's Funded Soil Sampling and Training Evaluation Report.' [2019] Evaluation report prepared for the Department of Agriculture, Environment and Rural Affairs, Northern Ireland <www.researchgate.net/publication/344442916_Behavioural_impacts_of_Northern_Ireland's_Funded_Soil_Sampling_and_Training_Evaluation_report>.

195 College of Agriculture Food & Rural Enterprise, 'Environment Technical Support Nutrients Action Programme (NAP) 2019-2022' (*CAFRE*) <www.cafre.ac.uk/business-support/agriculture/environment/environment-technical-support/nutrients-action-programme-nap-2019-2022/> accessed 16 December 2025; Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme' (n 142).

196 College of Agriculture, Food and Rural Enterprise, 'College of Agriculture, Food and Rural Enterprise Website' (*CAFRE*) <www.cafre.ac.uk/> accessed 9 January 2026.

197 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).

198 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).

fertiliser limits; restrictions on phosphate application; manure, silage and silage effluent storage requirements; land management; record keeping; inspection; and enforcement.

The Guidance Booklet includes a summary table and questions and answers for the measures in the regulations. In our view, this format is clear and easy to read for controllers and so generally removes the need for farmers to consult the NAP Regulations directly.

Each section in the Guidance Booklet concludes with a summary, outlining what will be reviewed to assess compliance in that area if the farm is chosen for inspection. In addition, there are examples and templates of documents and working calculations that may be required in the event of an inspection. The Guidance Booklet also gives contact details of agencies that farmers may wish to approach for further support.

DAERA provides workbooks for farmers to manually complete nutrient calculations. These calculations alternatively can be completed using online nutrient calculators developed by CAFRE, which we discuss in Section 5.2.2 below. Controllers must understand nutrient calculations in order to comply with the nutrient loading limits in the NAP Regulations.[199]

DAERA also publishes a Derogations Guidance Booklet, which outlines guidance on the derogation requirements of the NAP Regulations, and a fertiliser plan workbook for controllers applying for derogation.[200]

We understand from the Ulster Farmers' Union that DAERA and CAFRE engaged with farmers during the development of some advice and guidance material for the NAP Regulations, such as the nutrient calculators.

From 2015 to 2021, DAERA also published a Farm Advisory System Newsletter three times a year. This was circulated to all farm businesses in Northern Ireland.[201] The Newsletter was a mechanism to communicate key information on Common Agricultural Policy reform schemes to farmers. However, some editions also included information on the NAP Regulations and nutrient management.

DAERA paused production of the newsletter in 2021 due to the transition from the EU Common Agricultural Policy to the national Sustainable Agriculture Programme.[202] In a written ministerial statement in January 2025, Minister Muir outlined that the first Sustainable Agriculture Programme newsletter would be issued in a hard copy to all farms in a few months' time.[203] This has not yet been issued at the time of completing this report.

5.2.2 CAFRE advice and guidance

CAFRE has a Knowledge Advisory Service that is available free of charge to all farm businesses in Northern Ireland. The stated role of the Knowledge Advisory Service is to 'holistically develop farm businesses'.[204]

199 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Workbook 2019-2022' <www.daera-ni.gov.uk/articles/nutrients-action-programme-2019-2022> accessed 5 November 2025.

200 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme (NAP) Derogation 2019-2022' (n 191).

201 Department of Agriculture, Environment and Rural Affairs, 'Farm Advisory System (FAS) Newsletter' (1 June 2017) <www.daera-ni.gov.uk/publications/farm-advisory-system-fas-newsletter> accessed 28 November 2025.

202 Department of Agriculture, Environment and Rural Affairs, 'Farm Advisory System (FAS) Newsletter' (n 201).

203 Department of Agriculture, Environment and Rural Affairs, 'Minister Muir Provides Update on DAERA's Programme of Farm Support' (29 January 2025) <www.daera-ni.gov.uk/news/minister-muir-provides-update-daeras-programme-farm-support> accessed 1 December 2025.

204 College of Agriculture, Food & Rural Enterprise, 'Agriculture Business Support' (*CAFRE*) <www.cafre.ac.uk/business-support/agriculture/> accessed 4 November 2025.

The service offers advice on various topics relevant to farm businesses, which include the NAP Regulations.[205] Advice in relation to environmental management, which includes the NAP Regulations and nutrient management, is delivered as an integral part of all the Knowledge Transfer Programmes through the Beef and Sheep Branch in CAFRE (BSB) and its Dairy, Pigs, Poultry and Crops Branch (DPPCB).

The service has been enhanced by the formation of the CAFRE Sustainable Land Management Branch.[206] The purpose of the Sustainable Land Management Branch is to 'translate the scientific research to demonstrate best practice across key areas of air and water quality, biodiversity and land management on the CAFRE farms and provide support to BSB and DPPCB branches.'[207]

Additionally, CAFRE aims to strengthen knowledge transfer by providing training and fostering collaboration with agri-professionals, enabling them to effectively communicate essential information to farmers through its 'Supporting Agri-Professionals' programme. This initiative is intended to support the objectives of communicating a consistent message on key DAERA policy areas.[208]

CAFRE's specific advisory and guidance mechanisms concerning the NAP Regulations and general nutrient management, which it offers through the Knowledge Advisory Service, are outlined below.

Online nutrient calculators

CAFRE offers online nutrient calculators and instructional support videos to help farmers comply with the NAP Regulations and undertake nutrient management planning.[209] There are five different calculators, as set out in Table 5.1 below.

It is not compulsory for farmers to use the calculators or to submit the data calculated to DAERA to demonstrate compliance. However, a farm's calculations, completed manually or online, may be required if it is inspected.

Each calculator operates independently. There is no data sharing across the calculators. This may mean users have to add the same data more than once if they wish to use a different calculator, which could be cumbersome. Access to the calculators through DAERA online services is restricted to users with a DAERA business identifier.[210]

Table 5.1 shows the number of unique users for each calculator as of January 2024. With over 26,000 farm businesses in Northern Ireland,[211] these figures indicate that the use of the calculators is not widespread across farms in Northern Ireland.

205 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 59.

206 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

207 College of Agriculture Food & Rural Enterprise, 'Environment Support' (*CAFRE*) <www.cafre.ac.uk/business-support/agriculture/environment/> accessed 30 January 2026.

208 Department of Agriculture, Environment and Rural Affairs, 'DAERA Minister Andrew Muir Launches New Agri-Professionals Programme' (12 February 2025) <www.daera-ni.gov.uk/news/daera-minister-andrew-muir-launches-new-agri-professionals-programme> accessed 16 December 2025.

209 College of Agriculture, Food & Rural Enterprise, 'CAFRE Online Nutrient Calculators' (*CAFRE*, 2025) <www.cafre.ac.uk/business-support/agriculture/environment/environment-technical-support/cafre-online-nutrient-calculators/> accessed 3 September 2025.

210 Anne Bhogal, Fiona Nicholson and John Williams, 'Review of Nutrient Management Planning Tools Available for Use with Forage Crops in Northern Ireland' (2023) <https://adas.co.uk/wp-content/uploads/2024/01/NMPT-review_Northern-Ireland-forage-crops_final-report_revised-13_11_2023.pdf> accessed 9 January 2026.

211 Department of Agriculture, Environment and Rural Affairs, 'June Agricultural Census 2024' (12 December 2024) <www.daera-ni.gov.uk/news/results-june-agricultural-census-2024> accessed 13 August 2025.

Some businesses may have agents completing the calculations on their behalf. However, we understand from CAFRE that agent access is a recent change. CAFRE has told us that the figures of reported unique users in Table 5.1 reflect individual farm businesses.

Table 5.1. CAFRE's online calculators for the NAP Regulations, and reported numbers of unique users (Source: CAFRE)[212]

Calculator	Unique users, as of January 2024
Nitrogen loading: Assists farmers to calculate the nitrogen loading for the farm to check if the farm is below the limit of either 170 kg N/ha/year or 250 kg N/ha/year if operating under a derogation.	5,973
N-max for grassland: Assists farmers to check that nitrogen applications to the whole grassland area on the farm do not exceed the NAP Regulations' limits.	1,984
Crop nutrient: Assists farmers to help comply with nutrient requirements and develop a nutrient management plan for the farm.	1,724
Phosphorus balance: Assists farmers operating under a derogation to calculate the phosphorus balance to check the farm is operating within the limits. For all farms it can assist to manage phosphorus inputs and outputs to use phosphorus efficiently.	1,518
Manure storage: Assists farmers to calculate the weekly slurry, dirty water, manure production and the current storage capacity to check the farm has the required storage capacity for the NAP Regulations.	2,856

A previous study has suggested that the limited uptake of the online nutrient calculators may reflect a lack of awareness of them among farmers, as well as reported concerns about outdated design or basic interfaces.[213] The study highlights that the CAFRE nutrient calculators are the 'industry standard' calculators for farmers to use and should continue to remain so with improvements in their functionality, accuracy and useability.[214] To further maximise their use and effectiveness, therefore farmers need to understand the importance, usefulness and functionality of the nutrient calculators.[215]

Alongside addressing any issues with their accessibility and practicality, more and better promotion and communication of the calculators may improve uptake. This should include highlighting the advantages of the tools to the farmer, such as potentially increased profitability, improving nutrient management practices, and saving time.[216] CAFRE has said that this is taking place through its knowledge transfer avenues. Using the calculators may help farmers to better understand and comply with the NAP Regulations, and reduce the administrative effort required for them to do so.

212 College of Agriculture, Food & Rural Enterprise, 'CAFRE Online Nutrient Calculators' (n 209); Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

213 Okumah and others (n 194); Bhogal, Nicholson and Williams (n 210).

214 ADAS and AgriSearch, 'Review of Nutrient Management Planning Tools Available for Use with Forage Crops in Northern Ireland' (2003) <https://adas.co.uk/news/review-of-nutrient-management-planning-tools-published/> accessed 2 February 2026.

215 ADAS, 'Review of Nutrient Management Planning Tools Published' (5 January 2024) <https://adas.co.uk/news/review-of-nutrient-management-planning-tools-published/> accessed 16 December 2025.

216 ADAS (n 215).

Effective means of communication and promotion, such as greater face-to-face engagement,[217] may also help in the uptake of the nutrient calculators, alongside the online tutorial videos on the CAFRE website.[218]

A review of nutrient calculators, which included those provided by CAFRE, was conducted in 2023. This outlined some recommendations for improvements in the functionality of the CAFRE nutrient calculators. We understand from CAFRE that it is in the process of completing a business case proposal to improve the nutrient calculators, taking account of the recommendations of the review. Evidence suggests that when farmers complete their own nutrient management plans, this can lead to positive changes in their nutrient management practices.[219]

Nutrient management guidance notes

CAFRE develops and publishes technical guidance notes for farmers, to support their understanding of specific topic areas. CAFRE has produced several notes on matters relating to nutrient management, such as the application of protected urea (a synthetic nitrogen compound that slows the conversion of urea into ammonia).[220] These technical notes are available on the CAFRE website.[221] CAFRE informed us at the time of completing this report that hard copies were printed and ready for distribution to farmers by local advisory teams.

Business Sustainability Groups

CAFRE operates Business Sustainability Groups (previously called Business Development Groups) as a further mechanism to provide advice. These are sectoral-based groups of farmers' meetings facilitated by CAFRE advisors. CAFRE established 25 Environmental Business Development Groups supporting 570 farmers in 2019/20.[222]

The aim of these groups is to 'support farmers improve the economic and environmental sustainability of their farm business'.[223] Where possible, these meetings are held on a host farm, which receives a hosting payment. Members of each group must attend at least three meetings annually to qualify for learner support payments.

CAFRE told us that some training and support on nutrient management has been delivered through these groups. Approximately 3,000 farmers have participated in such groups since their initiation in 2016.[224]

Participation in these groups is voluntary, however, and remains low among Northern Ireland's 26,000 farms. It has been reported that several barriers may limit farmers' participation, such as lack of awareness or perceived usefulness.[225]

217 Okumah and others (n 194).

218 College of Agriculture, Food & Rural Enterprise, 'CAFRE Online Nutrient Calculators' (n 209).

219 Okumah and others (n 194).

220 College of Agriculture, Food & Rural Enterprise, 'Making Better Use of Urea' <www.cafre.ac.uk/technical-resources/> accessed 3 September 2025.

221 College of Agriculture Food & Rural Enterprise, 'CAFRE Technical Resources' <www.cafre.ac.uk/technical-resources/> accessed 4 December 2025.

222 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

223 College of Agriculture, Food & Rural Enterprise, 'Business Sustainability Groups (BSGs)' <www.cafre.ac.uk/business-support/knowledge-transfer-programmes/business-sustainability-groups/> accessed 27 November 2025.

224 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 60.

225 Claire Jack and others, 'Investigating the Drivers of Farmers' Engagement in a Participatory Extension Programme: The Case of Northern Ireland Business Development Groups' (2020) 12 Sustainability 4510.

To our knowledge, there has been no review of how participation in these groups has supported farmers with compliance with the NAP Regulations or nutrient management more broadly. However, we understand from CAFRE that it is working to establish different thematic groups as a potential way to increase attendance numbers, such as a water quality theme group, and to target such efforts in priority catchments.

On-farm demonstrations

CAFRE has a dairy, beef and sheep farm enterprise centre at the Greenmount college campus. In Glenwherry in the Antrim Hills, CAFRE has a hill farm enterprise.[226] DAERA considers on-farm demonstrations at such centres vital to the delivery of education, training and knowledge transfer to farmers.[227] CAFRE told us that when farm visits are organised, where possible, nutrient management messages are incorporated into the visits.

CAFRE also organises open days and farm events in Northern Ireland to promote nutrient management practices. For example, it held slurry management open days on two farms in 2024, which just over 400 farmers attended.[228] CAFRE also held three 'Fertilise to maximise in a sustainable way' events in 2025.[229]

In addition, CAFRE facilitates group visit bookings to 'Technology Demonstration Farms' across Northern Ireland to learn about innovative farming technologies. One such farm focuses specifically on efficient crop nutrition.[230] These will now be replaced with a network of Innovation Farms under the new Sustainable Agriculture Programme.[231]

Soil Nutrient Health Scheme

CAFRE provides nutrient management training and guidance as part of the Soil Nutrient Health Scheme. The scheme aims to test all of Northern Ireland's 650,000 farmland fields to help farmers manage nutrient use by applying fertilisers at the correct level for crop uptake of nutrients – the agronomic optimum.[232] The Soil Nutrient Health Scheme is one of the largest baseline soil sampling programmes ever undertaken.[233]

Due to the scale and complexity of the scheme, soil analysis under the Soil Nutrient Health Scheme is being conducted on a zonal basis across Northern Ireland. Because of the large amount of soil sampling required, Northern Ireland has been divided into four separate zones, each scheduled for sampling at different times. For instance, fields in zone 1 were sampled between 2022 and 2023, with those in zone 4 fields being sampled between 2025 and 2026. All the testing is due to be completed by 2026.[234]

226 College of Agriculture Food & Rural Enterprise, 'Agriculture Educational Facilities | Greenmount Campus - CAFRE' <www.cafre.ac.uk/about-us/our-facilities/agriculture-facilities/> accessed 4 December 2025.

227 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 59.

228 College of Agriculture, Food & Rural Enterprise, 'Industry Training and Knowledge Transfer on NAP' (2025) <www.daera-ni.gov.uk/sites/default/files/publications/daera/Industry%20Training%20and%20Knowledge%20Transfer.PDF> accessed 3 September 2025.

229 College of Agriculture Food & Rural Enterprise, 'Fertilise to Maximise in a Sustainable Way - CAFRE' <www.cafre.ac.uk/events/fertilise-to-maximise-in-a-sustainable-way/> accessed 1 December 2025.

230 College of Agriculture, Food & Rural Enterprise, 'Technology Demonstration Farms - Efficient Nutrition of Crops' (*CAFRE*, 2025) <www.cafre.ac.uk/business-support/knowledge-transfer-programmes/technology-demonstration-farms/efficient-nutrition-of-crops/> accessed 3 September 2025.

231 College of Agriculture Food & Rural Enterprise, 'Innovation Farms' (*CAFRE*) <www.cafre.ac.uk/business-support/knowledge-transfer-programmes/innovation-farms/> accessed 4 February 2026.

232 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10); College of Agriculture, Food & Rural Enterprise, 'Soil Nutrient Health Scheme' (n 10).

233 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10).

234 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10).

In December 2025, the Agri-Food and Biosciences Institute (AFBI) reported that, since the Soil Nutrient Health Scheme's launch in 2022, approximately 440,000 fields had been sampled and 22,750 farm businesses registered. Sampling is typically carried out between November and February with results sent to farmers within 4 to 6 weeks through the post. After receiving results, farmers can access detailed soil sample analyses and runoff risk maps online via their Government Gateway accounts.[235]

CAFRE provides all farmers whose fields have been tested with training on interpreting soil analysis results, with the aim to support farmers to optimise nutrient application and the generation of a farm nutrient plan.[236] In addition, farm businesses receive runoff risk maps to identify areas at high risk of nutrient loss during rainfall.[237] CAFRE also told us the Soil Nutrient Health Scheme training is available to all farmers, not just those who have received Soil Nutrient Health Scheme soil results.

In producing the runoff risk maps, AFBI has noted that the connectivity of land to water in Northern Ireland is very high, with around 5 km of watercourses (open drains, streams and rivers) in every square kilometre. It has therefore encouraged farmers to look at the high-risk areas identified in these maps and see if there are any steps that can be taken to reduce or break the connection between land and water.[238]

Training for farmers on the Soil Nutrient Health Scheme is predominantly conducted online by CAFRE. It has also provided some face-to-face sessions. The training covers understanding nutrient management and completing nutrient management plans.

Participation in the CAFRE training, along with registration to the Soil Nutrient Health Scheme, is a condition of the new Farm Sustainability Payment scheme. Farm businesses who do not register or receive training on the Soil Nutrient Health Scheme will have their farm sustainability payments reduced.

Of the 22,700 farm businesses currently registered for the Soil Nutrient Health Scheme, CAFRE informed us over 8,000 have completed the training, and around 3,700 farmers, along with 480 agents, have accessed the online mapping tool. This indicates that participation and engagement with these resources have been limited relative to the total number of registered farms.

A potential reason for the low uptake to date is the limited availability of one-to-one advice. Evidence suggests that farmers find face-to-face, accessible verbal communication helps them better understand soil test results and apply nutrient management recommendations. This approach can also offer more practical, context-specific advice instead of just generic recommendations.[239]

There is also some evidence to demonstrate that, where one-to-one advice has been provided to farmers, reductions in soil phosphorus and improvements in soil pH have been observed. It is noted, however, that this was from a small sample size.[240]

235 Agri-Food and Biosciences Institute, 'SNHS – Soil Sampling Update and Results' <www.afbini.gov.uk/news/snhs-soil-sampling-update-and-results> accessed 5 January 2026; Department of Agriculture, Environment and Rural Affairs, 'DAERA Online Services Government Gateway Account' <https://reference.daera-ni.gov.uk/AuthWeb/auth/login/DAERAOnlineServices/2/> accessed 6 January 2026.

236 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10).

237 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

238 Agri-Food and Biosciences Institute, 'SNHS – Soil Sampling Update and Results' (n 235).

239 Okumah and others (n 194).

240 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59) loc Slide 13.

5.2.3 Other sources of advice, guidance and support

Sustainable Catchment Programme

The intention of the Sustainable Catchment Programme is to reduce the adverse effects of agriculture on water quality across several key catchments in Northern Ireland.[241] Farmers in participating catchment areas are encouraged to take up measures and interventions designed to improve and protect water quality.[242] The catchments in the programme include Dundrum, Ballinderry, Salterstown (western Lough Neagh shore), and Upper Bann Rivers.[243]

The measures are identified by non-regulatory farm advisors employed by the Rivers Trust.[244] These measures are incorporated into bespoke Water and Environment Management Plans for each farm, which are agreed with the individual farmers.[245]

On-farm work is paid for through the Sustainable Catchment Programme, which is funded by DAERA's Green Growth Investment Programme.[246] The Environmental Farming Scheme group funding covers the resource cost of the Rivers Trust farm advisors and group facilitation.[247] At the time of completing this report, 418 Water Environment Management Plans were in place.[248]

According to the Rivers Trust, the Sustainable Catchment Programme has had a positive impact on water quality across Northern Ireland. The Rivers Trust notes that participating farms have improved water and soil management, reducing nutrient and sediment runoff. A recent study also found that farm interventions carried out with advice and guidance from Rivers Trust advisors had led to improvements in water quality.[249]

The Ulster Farmers' Union has indicated that it is particularly supportive of the localised catchment approach. It considers this to be the most effective method for promoting compliance and improving water quality.[250]

The Farm Water Project

The Ulster Farmers' Union, the Rivers Trust and Countryside Services are also working in partnership to develop and deliver the Farm Water Project. The aim of this project is to improve water quality by collaborating to train farm advisors on water quality, create practical training and resources for farmers, and strengthen farmers' connection with water environments. The project is funded through the DAERA Environment Fund.[251]

241 The Rivers Trust, 'Sustainable Catchment Programme'.

242 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26) 78.

243 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 67.

244 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26) 78.

245 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

246 The Rivers Trust (n 241).

247 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21) 67.

248 The Rivers Trust, 'Sustainable Catchment Programme 2024-25 Capital Funding for On-Farm Water Quality Protection Measures Project Code: SCP24-25 Report on the Implementation of Capital Investment Measures for SCP 2024-2025' (2025).

249 M Fresne, P Jordan and R Cassidy, 'A Paired-Catchment Evaluation of Voluntary Agri-Environmental Scheme Measures Targeting Diffuse Phosphorus and Sediment Pollution' (2025) 395 Journal of Environmental Management 127783.

250 Ulster Farmers' Union, 'UFU Response - Public Consultation on the Nutrients Action Programme 2026-2029' <www.ufuni.org/consultations/> accessed 27 November 2025.

251 'Working Together to Improve Water Quality' (*Ulster Farmers Union*, 21 August 2025) <www.ufuni.org/working-together-to-improve-water-quality/> accessed 14 November 2025.

5.2.4 Our assessment and recommendation

A range of advice and guidance material has been developed and delivered in support of the NAP Regulations and nutrient management more widely. However, some aspects of its uptake have been limited. Further, while general advice and guidance are available to all farmers, there is limited farm-specific and on-farm advice and support.

There is a high degree of reliance on advice and guidance being delivered online. DAERA therefore needs to take into account the variable internet services available in rural Northern Ireland, as well as the needs of those farmers affected by the NAP Regulations.[252]

Unless the farm is under a derogation, it is not a requirement for farmers, either under the Soil Nutrient Health Scheme or the NAP Regulations, to submit a nutrient management plan to DAERA, or to apply it so as to minimise nutrient loss. There also does not appear to be any follow-up mechanism, for example a farm visit with a CAFRE advisor, to review nutrient management plans.

Feedback from those who use advice and guidance on the NAP Regulations and nutrient management shows an interest in receiving on-farm, face-to-face advice, with support for a catchment-based approach to its delivery.[253] Our separate report on the implementation of laws for protected terrestrial and freshwater sites in Northern Ireland similarly notes that many farmers prefer ongoing face-to-face communication.[254] That report recommended a specified point of contact for each protected site, supported by a multi-agency and disciplinary team.

Combining one-to-one advice and group learning can result in greater awareness and behaviour change. One-to-one advice provides the chance for farmers to receive the context-specific, practical and relatable information that they need.[255]

Group learning provides the opportunity to learn from other farmers and share experiences. It is also important to consider the conditions under which advice is most successfully provided, by scheduling sessions at times convenient for farmers and managing the number of attendees.[256]

Delivery of on-farm, tailored advice requires resources. Partnership with organisations that already deliver such services may therefore be considered to deliver on-farm advice effectively and efficiently. We understand this is something that CAFRE is working to address with the creation of its 'Supporting Agri-Professionals' programme.

We also note that DAERA previously proposed, in its consultation on the revision of the NAP Regulations in May 2025, to develop and implement a more focused approach for measures applied in high-risk areas. One of the measures proposed in this approach includes non-regulatory farm advisory visits and signposting farmers to financial support for pollution prevention measures.[257]

252 Northern Ireland Assembly, 'An Overview of the Digital Divide in Northern Ireland' (*Research Matters*, 16 November 2021) <www.assemblyresearchmatters.org/2021/11/16/an-overview-of-the-digital-divide-in-northern-ireland/> accessed 5 September 2025.

253 Ulster Farmers' Union (n 250).

254 Office for Environmental Protection, 'Review of Implementation of Laws for Terrestrial and Freshwater Protected Sites in Northern Ireland' (n 14).

255 Okumah and others (n 194).

256 Okumah and others (n 194).

257 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Nutrients Action Programme 2026-2029' (2025) <www.daera-ni.gov.uk/sites/default/files/2025-05/NAP%20Consultation%20Document_1.pdf> accessed 2 June 2025.

A separate evaluation commissioned by the OEP has looked at the spatial targeting and coherence of nature-friendly farming advisory activities in England.[258] In general terms, the outputs of the analysis are also relevant to improving advice and guidance for nutrient management in Northern Ireland. The report highlights how local advisory services can significantly improve the adoption of nature-friendly farming practices. It identifies four key components whereby local advice can help to ensure that environmental initiatives are not only regulatory-compliant, but also tailored to the specific needs of farmers and the environment.[259]

Central to the success of such approaches are the targeting of advisory services to high-priority areas, such as specific catchments or landscapes, and the involvement of locally trusted advisors who can adapt their guidance to the unique realities of each farm system. This targeted approach increases the relevance and credibility of the advice, fostering greater trust and engagement among farmers.

The analysis highlights that the most effective advice strategies blend both one-to-one advice and group-based learning to drive positive behavioural and environmental outcomes. This finding is strongly supported by research in Northern Ireland that has demonstrated the improvement in nutrient management practices as a result of on-farm advice.[260]

When advice is perceived as locally grounded and realistic, farmers are more likely to adopt recommended practices where they can have the greatest impact. This can lead to enhanced environmental benefits and ensure that resources are directed where they are needed most and can be most effective.

Recommendation

DAERA should consider further investment in the development of targeted approaches to the delivery of on-farm advice and support to help farmers comply with the NAP Regulations.

258 A Morse, and others, 'A Realist Evaluation of Local Scale Advice for Nature Friendly Farming' (Countryside and Community Research Institute: Cheltenham) <www.theoep.org.uk/commissioned-research/realist-evaluation-local-scale-advice-nature-friendly-farming> accessed 9 December 2025.

259 Morse, and others (n 258).

260 Okumah and others (n 194).

6. Effectiveness of the technical provisions of the Nutrient Action Programme Regulations

6. Effectiveness of the technical provisions of the Nutrient Action Programme Regulations

6.1 Introduction

This chapter presents our assessment of the technical provisions included in the NAP Regulations. By technical provisions we mean the requirements and restrictions that apply to farms as set out in the regulations. Our aim is to determine the effectiveness of these technical provisions in reducing nitrogen and phosphorus losses to water from various agricultural sources. We also consider how they affect nitrogen emissions to the air in the forms of ammonia and nitrous oxide.

The chapter breaks down the technical provisions of the NAP Regulations into discrete areas. Each section begins with a summary of our assessment in that area and presents our recommendations.

To inform our evaluation we conducted a review of key literature for each technical provision in the NAP Regulations. Where there was uncertainty, we sought further evidence and consulted external experts, individually and in stakeholder workshops.

Section 6.2 evaluates the limits on livestock manure deposition and application to land set at 170 kg N/ha/year, or 250 kg N/ha/year for farms with derogations. These limits effectively set thresholds for animal stocking rates and thus form the foundation of the NAP Regulations. The sufficiency of other measures in the NAP regulations relies significantly on the effectiveness of these limits, and on how well they are implemented in practice (which we discuss in Chapter 4). We address these other measures in subsequent sections as follows.

Section 6.3 evaluates the measures aimed at addressing nutrient loss from agricultural soil. Section 6.4 focuses on measures to mitigate losses from applications of organic manure and chemical fertiliser. Section 6.5 addresses measures to control farm nutrient surpluses. Section 6.6 examines how the existing measures affect emissions of ammonia and nitrous oxide to air.

In Section 6.7, we evaluate the effects of climate change on nutrient emissions from agriculture and consider the extent to which the NAP Regulations account for these impacts.

Section 6.8 provides our overall assessment concerning the effectiveness of the technical provisions of the NAP Regulations as a whole, alongside measures needed to address losses of nutrients from other sectors, notably wastewater.

6.2 The manure nitrogen limits

6.2.1 Our assessment and recommendation

Limits on the land application of total nitrogen up to 170 kg N/ha/year from livestock manure (or 250 kg N/ha/year under derogations) effectively restrict livestock numbers on farms.[261] However, scientific support for the limits is weak, and they appear to have originated more from political compromise at the EU level rather than from robust evidence as to the standards needed to achieve intended environmental outcomes.[262]

Agriculture remains the main source of ammonia emissions, which have risen with higher livestock numbers and more indoor housing.[263] Derogations to operate at 250 kg N/ha/year are allowed based on favourable conditions for grass growth and soils conducive to denitrification, a microbial respiration process that converts nitrate to gaseous form so that it is no longer dissolved in soil water. However, these same conditions increase nitrous oxide emissions.[264] There is little available evidence in Northern Ireland with which to define an optimal manure nitrogen loading limit for managing emissions of nitrous oxide or ammonia.

While nutrient losses increase with stocking density, the scale of these losses varies significantly depending on local conditions and farming practices. Total nitrogen limits of 170 and 250 kg N/ha/year from livestock manure may therefore be too high to achieve the intended outcomes in some areas, unless significant mitigation measures are implemented, in particular to reduce emissions of phosphorus, ammonia and nitrous oxide.

Recommendation

DAERA should review the evidence relating to the current 170 kg N/ha/year nitrogen limit and, if necessary, bring forward proposals to revise this limit to ensure the protection and restoration of aquatic and terrestrial ecosystems.

6.2.2 Analysis of evidence

The scientific basis for the 170 kg N/ha/year limit that was established under the Nitrates Directive is limited.[265] There is little substantive evidence to indicate that this threshold is sufficient to significantly reduce nitrate losses to groundwater and surface water across Europe.

While it is well documented that nitrate losses increase with greater nitrogen loading to land, the specific threshold at which adverse impacts on water quality occur varies considerably depending on landscape characteristics, soil types, crop varieties and manure management practices.[266] In some regions, higher nitrogen loads to land may not

261 Reg. 9 The Nutrient Action Programme Regulations 2019.

262 House of Commons Environment, Food and Rural Affairs Committee, 'Implementation of the Nitrates Directive in England. Seventh Report of Session 2007–08.' (2008) HC 412 <https://publications.parliament.uk/pa/cm200708/cmselect/cmenvfru/412/412.pdf> accessed 17 April 2025; Gerard Ros, 'Background of the Usage Standard of 170 Kg N/Ha in the Nitrates Directive' (2025) <https://parlementenwetenschap.nl/wp-content/uploads/2025/09/250904_Position_paper_Nitraatrichtlijn_Ros_De_Vries.pdf> accessed 13 October 2025.

263 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81).

264 Cong Wang and others, 'Factors That Influence Nitrous Oxide Emissions from Agricultural Soils as Well as Their Representation in Simulation Models: A Review' (2021) 11 Agronomy 770.

265 Members & advisors of the Scientific Committee on Nutrient Management Policy, 'Protecting Waters from Pollution Caused by Nitrates from Agricultural Sources – Evaluation' (2024) <https://edepot.wur.nl/708127> accessed 2 February 2026; Ros (n 262).

266 DJ Murphy and others, 'Nitrate Leaching on Irish Grassland Dairy Farms: A Review' (2024) 153 European Journal of Agronomy 127042; Ros (n 262).

compromise water quality targets, whereas in others, lower limits are necessary to avoid harm.[267]

In Northern Ireland, where agriculture is predominantly grassland-based with favourable conditions for grass growth and soils conducive to denitrification, nitrate leaching to groundwater has not posed a significant problem. However, nitrates have affected some freshwaters and coastal areas. Catchments where there are derogated farms operating above the 170 kg N/ha/year limit can exhibit greater nitrogen losses to rivers than those where all farms operate below the limit.[268]

Although the 170 kg N/ha/year limit has not been formally reviewed in Northern Ireland, steps have been taken, such as those outlined in DAERA's 2025 consultation on revision of the NAP Regulations, to revise the nitrogen excretion rates attributed to dairy cows based on milk yield.[269] This change would effectively reduce the permissible number of livestock that could be kept within the 170 kg N/ha/year threshold.

Since the establishment of the 170 kg N/ha/year limit, agricultural practices in Northern Ireland have also changed considerably. Changes include: reduced chemical fertiliser use, primarily due to increases in the cost of fertiliser; increased use of concentrated animal feeds; and increased housing of livestock, especially in the poultry and dairy sectors.[270]

In Northern Ireland, agriculture operates with surpluses of nitrogen and phosphorus at the national scale (see Chapter 2). Nutrient balance data provided by DAERA shows that the nitrogen surplus has remained relatively stable in recent years, at above 100 kg N/ha/year. The phosphorus surplus has risen, driven by an increase in the use of imported concentrated animal feed, as agricultural systems have intensified.

Concerns about phosphorus and ammonia are increasing in Northern Ireland, particularly as the ecological status of many nutrient-sensitive aquatic and terrestrial ecosystems has declined. At the same time, a comprehensive review of the Nitrates Directive is underway in the EU, to evaluate its effectiveness in safeguarding waterbodies from agricultural nutrient pollution.[271] In parallel, the introduction of the Climate Change Act 2008 and the Climate Change Act (Northern Ireland) 2022 have brought more attention to the role of nitrous oxide as a greenhouse gas.

Alongside these agricultural and environmental changes, scientific understanding has advanced, allowing for a greater understanding of the sources, mobilisation, transport, and impacts of agricultural nutrients.

In the following paragraphs, we further evaluate the relationship between the current nitrogen limits (170 and 250 kg N/ha/year) and phosphorus, ammonia and nitrous oxide emissions to the environment.

267 Wim De Vries and others, 'Spatially Explicit Boundaries for Agricultural Nitrogen Inputs in the European Union to Meet Air and Water Quality Targets' (2021) 786 Science of The Total Environment 147283.

268 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

269 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15) 20.

270 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

271 European Commission, 'Commission Consults Citizens and Stakeholders on Evaluation of the Nitrates Directive - Environment' <https://environment.ec.europa.eu/news/commission-consults-citizens-and-stakeholders-evaluation-nitrates-directive-2023-12-01_en> accessed 14 November 2025.

Phosphorus

Evidence indicates that the current nitrogen limits may be too high to reduce phosphorus losses to aquatic ecosystems across all catchments in Northern Ireland.[272] This is because the nitrogen-to-phosphorus ratio in organic manure is such that, when applied at the 170 kg N/ha/year limit, there is a risk, if not managed correctly, that phosphorus is applied in excess of crop requirements. This risk is higher on derogated farms operating at up to 250 kg N/ha/year.

The phosphorus surplus is exacerbated where livestock are fed a high proportion of concentrated animal feed.[273] As a result, phosphorus inputs exceed crop requirements, leading to long-term accumulation in soil. Over 40% of agricultural soils in Northern Ireland have more phosphorus than is required for crop growth.[274]

An analysis of 7,049 fields in Northern Ireland found that 62% showed increasing soil phosphorus concentrations over a five-year period.[275] In 2017, a surplus of over 7,000 tonnes of phosphorus accumulated in agricultural soils.[276] The evidence is also clear, both nationally and internationally, that phosphorus losses to water increase as the concentration of phosphorus in soils increases.[277]

There is a positive correlation between catchment livestock density and phosphorus concentrations in waterbodies in rural areas. Livestock densities of 1.5 to 2 livestock units per hectare (which equate to approximately 127 to 170 kg N/ha/year) are frequently seen alongside phosphorus concentrations in waterbodies that exceed phosphorus targets under the WFD NI Regulations.[278]

However, the relationship varies by catchment due to differences in the natural environment such as soil type, topography and hydrology.[279] For instance, catchments with wetter soils and strong land-water connectivity are more prone to phosphorus loss, both from recent organic manure and chemical fertiliser applications and from phosphorus accumulated in the soil.[280]

This was illustrated in a detailed study in Northern Ireland of two catchments where one had derogated farms operating up to the 250 kg N/ha/year limit, while the other had all

272 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59); Northern Ireland Audit Office (n 69); Scott and others (n 58).

273 AgriSearch, 'Reducing Phosphorus Levels in Dairy Cow Diets (Booklet 18)' (AgriSearch 2010) D-12-01 D-19-04 <https://agrisearch.org/%2Fdownload%2Ffiles%2FBooklet18-ReducingPhosphoruslevelsindairycowdiets.pdf> accessed 7 January 2026.

274 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15); Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

275 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

276 D Doody and others, 'Phosphorus Stock and Flows in the Northern Ireland Food System. RePhoKUs Report' (2020) <www.afbini.gov.uk/publications/rephokus-report-oct-2020> accessed 27 February 2025.

277 CJ Watson, RV Smith and DI Matthews, 'Increase in Phosphorus Losses from Grassland in Response to Olsen-P Accumulation' (2007) 36 Journal of Environmental Quality 1452; Jian Liu and others, 'Leaching of Dissolved Phosphorus and Carbon and Phosphorus Fractionation in Drainage: Effects of Soil Type, Chemical Characteristics and Amendments' (2025) 25 Journal of Soils and Sediments 1971.

278 Department of Agriculture, Environment and Rural Affairs and Agri-Food and Biosciences Institute, 'Agricultural Nutrients and Water Quality Report' (2021) 9 <www.daera-ni.gov.uk/publications/agricultural-nutrients-and-water-quality> accessed 26 February 2025; SA Rothwell and others, 'Phosphorus Stocks and Flows in an Intensive Livestock Dominated Food System' (2020) 163 Resources, Conservation and Recycling 105065; NT McDonald and others, 'Field Scale Phosphorus Balances and Legacy Soil Pressures in Mixed-Land Use Catchments' (2019) 274 Agriculture, Ecosystems & Environment 14.

279 Department of Agriculture, Environment and Rural Affairs and Agri-Food and Biosciences Institute (n 278); M Fresne, P Jordan and R Cassidy, 'The Relative Importance of Soil Moisture Deficit, Land Use Intensity and Fertiliser Spreading Regulations for Stream Water Quality in Agricultural Catchments' (2025) 377 Journal of Environmental Management 124704.

280 Scott and others (n 58).

farms operating under the 170 kg N/ha/year limit.[281] The catchment that had derogated farms had lower phosphorus loss from land to water than the catchment with no derogated farms. This was attributed to better phosphorus management on the derogated farms. However, this does not account for catchment characteristic and how differences in soil type, topography and hydrology may have influenced these findings.[282]

Nitrous oxide

Emissions of nitrous oxide from agricultural soils are influenced by factors such as stocking rate, soil properties (including compaction, drainage and organic matter content), climate, temperature, and farm management practices. High stocking rates can lead to nitrogen surpluses, increasing nitrous oxide emissions, particularly on farms with low nitrogen use efficiency.[283]

The Nitrates Directive has reduced nitrous oxide emissions by improving fertiliser use practices and livestock management. However, derogations are granted in Northern Ireland based on favourable conditions for grass growth and soils conducive to denitrification. While these conditions reduce nitrate losses to surface and groundwater, they also increase nitrous oxide emissions. In addition, as there is significant variability in emissions across farms and regions, even farms operating below the 170 kg N/ha/year limit may produce significant nitrous oxide emissions, where conditions promote denitrification.[284]

Ammonia

Emissions of ammonia are a major threat to Northern Ireland's terrestrial habitats, particularly its protected sites.[285] The agriculture sector is the dominant source of ammonia emissions, in particular via the management and application of livestock manure which is linked to livestock numbers.[286]

Modelling estimates suggest that modest reductions in ammonia emissions have occurred in the EU due to the Nitrates Directive.[287] However, this reduction is not reflected in ammonia emission trends in Northern Ireland. There has been a general increase in ammonia emissions in Northern Ireland since 2011, with some annual fluctuation attributed to changes in livestock numbers and chemical fertiliser applications.[288]

Higher stocking rates on derogated farms can contribute to increased local ammonia emissions if additional mitigation measures are not put in place.[289] Studies at the EU scale indicate that the overall impact of Nitrates Directive derogations on ammonia emissions

281 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

282 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

283 Nicholas Cowan and others, 'Nitrous Oxide Emission Factors of Mineral Fertilisers in the UK and Ireland: A Bayesian Analysis of 20 Years of Experimental Data' (2020) 135 Environment International 105366; Carlos Alberto Francisco-Cruz and others, 'Estimating Nitrous Oxide (N_2O) Emissions from Managed Soils at Higher Spatial Resolution in the Republic of Ireland' (2024) 158 Ecological Indicators 111471.

284 Wang and others (n 264); Isabel Zentgraf and others, 'How Scale Affects N_2O Emissions in Heterogeneous Fields of a Diversified Agricultural Landscape' (2025) 15 Scientific Reports 11013.

285 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

286 National Atmospheric Emissions Inventory (n 82).

287 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991]; GL Velthof and others, 'The Impact of the Nitrates Directive on Nitrogen Emissions from Agriculture in the EU-27 during 2000–2008' (2014) 468–469 Science of The Total Environment 1225.

288 National Atmospheric Emissions Inventory (n 82); Department of Agriculture, Environment and Rural Affairs, 'Historical Livestock Data' <www.daera-ni.gov.uk/publications/historical-livestock-data> accessed 11 December 2025.

289 The Agriculture and Food Development Authority (Teagasc), 'An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030' (2015) ISBN: 978-1-84170-665-8 <https://teagasc.ie/publications/an-analysis-of-the-cost-of-the-abatement-of-ammonia-emissions-in-irish-agriculture-to-2030-php/> accessed 2 February 2026.

remains limited due to the small proportion of land under derogation.[290] However, even if overall contributions are relatively low, the impact of an individual farm may be significant if it is adjacent to or near habitats that are sensitive to ammonia inputs.

Evidence is limited on the optimal manure nitrogen loading to manage ammonia emissions. However, changes in agricultural practices, such as increased concentrated feed imports and livestock housing, mean that nitrogen loads in some areas may be too high to protect terrestrial habitats from the negative impacts of ammonia emissions, unless accompanied by significant mitigation efforts.

6.3 Nutrient loss from agricultural soil

6.3.1 Our assessment and recommendation

The NAP Regulations address nutrient loss from soil to some extent by restricting total nitrogen loads from livestock manure, setting application rates, establishing buffer zones, and requiring soil analysis before applying high-phosphorus materials such as anaerobic digestate and poultry manure.

However, the absence of limits on all organic manure applications means that more phosphorus is being applied to soil than required by crops. As a result, there is an accumulation of phosphorus in soils.

Despite mandatory soil analysis and fertilisation planning for derogated farms, the application of organic manure is still allowed where there is no crop requirement, except for non-grass crops. Reducing soil phosphorus to levels compatible with good water quality could take decades, demanding careful nutrient management to minimise losses without reducing crop yields.

In addition, the justification for the current allowable chemical nitrogen fertiliser rates is unclear. The use of the current chemical nitrogen fertiliser application rates, together with the lack of assessment of nitrogen accumulated in grassland soils, leaves a significant risk that many farmers may be applying more nitrogen than is required by crops.

Recommendation

DAERA should consider proposing additional mandatory requirements for soil analysis, and that all applications to land of both organic manure and chemical fertilisers are based on crop needs.

6.3.2 Analysis of evidence

Total nitrogen loading from livestock manure, based on the 170 or 250 kg N/ha/year limits, has resulted in accumulation of phosphorus in many agricultural soils that now poses a long-term threat to water quality.[291] While nitrogen accumulation in soils is likely less acute, there are no data quantifying its extent in Northern Ireland.

290 GL Velthof and others, 'The Impact of the Nitrates Directive on Gaseous N Emissions. Effects of Measures in Nitrates Action Programme on Gaseous N Emissions' (Alterra 2011) <https://research.wur.nl/en/publications/the-impact-of-the-nitrates-directive-on-gaseous-n-emissions-effec/> accessed 2 December 2025.

291 Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

The provisions in the NAP Regulations do not sufficiently mitigate the risks to water quality associated with nutrient accumulation in soil. This is primarily due to the lack of a requirement for soil analysis followed by limits on applications of organic manure to match crop requirements.

This issue is of particular concern on derogated farms. The controllers of such farms are required to carry out soil analysis and make fertilisation plans. However, the application of organic manure is permitted even when analysis shows that there is no crop requirement for phosphorus, and the nutrient content in soils already poses a significant risk to water quality. The measures proposed in the 2025 consultation on the NAP Regulations did not include a provision to address this gap.

Soil tests will be carried out on most fields in Northern Ireland by the end of 2026 through the Soil Nutrient Health Scheme (see Chapter 5).[292] All farmers will have data from soil analysis to inform how nutrients are managed. We suggest that DAERA should consider how information from the scheme can be incorporated into the design and implementation of the NAP Regulations, subject to the scheme's Privacy Notice and DAERA's Retention and Disposal Schedule.[293]

With more than 40% of agricultural land in Northern Ireland exceeding the agronomic optimum for phosphorus, there is a need to reduce soil phosphorus concentrations to achieve 'good' status under the WFD NI Regulations.[294] This would involve reducing the phosphorus surplus on farms and limiting organic manure and chemical fertiliser applications.[295]

The proposals in the 2025 consultation on the revision of the NAP Regulations included proposals to reduce the phosphorus surplus and restrict phosphorus fertiliser use. These measures would go some way to addressing the issues if implemented. However, it is unlikely they would go far enough to deliver the reductions required in soil phosphorus to achieve the intended environmental outcomes, if manure application is not limited to crop requirements.

The evidence supporting the chemical nitrogen fertiliser application rates allowed in the NAP Regulations is also unclear. This was acknowledged in the 2025 consultation on the revision of the NAP Regulations, which included a significant proposed revision of the present chemical application rates.[296]

Currently, application rates are standardised across farms. This is in contrast to a more tailored and site-specific approach, as has been reflected in more precise guidance such as

292 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10); College of Agriculture, Food & Rural Enterprise, 'Soil Nutrient Health Scheme' (n 10).

293 Department of Agriculture, Environment and Rural Affairs, 'Soil Nutrient Health Scheme - Privacy Notice' (2 December 2021) <www.daera-ni.gov.uk/publications/soil-nutrient-health-scheme-privacy-notice> accessed 2 February 2026; Department of Agriculture, Environment and Rural Affairs, 'DAERA's Retention and Disposal Schedule' (26 January 2022) <www.daera-ni.gov.uk/publications/daeras-retention-and-disposal-schedule> accessed 2 February 2026.

294 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15); Department of Agriculture, Environment and Rural Affairs, 'Water Quality, Catchment Science Research and Linkages to Proposed Measures' (n 59).

295 Cassidy, Doody and Watson (n 61); JS Bailey, 'Assessing the Effectiveness of Manure Export plus Intensive Silage Cropping for Lowering the Olsen-P Status of P-Enriched Grassland' (2015) 31 Soil Use and Management 438; DP Wall and others, 'Forecasting the Decline of Excess Soil Phosphorus in Agricultural Catchments' (2013) 29 Soil Use and Management 147.

296 Agri-Food and Biosciences Institute, 'AFBI Scientific Evidence Contributing to N Fertiliser Limits NAP 2026-2029 Final June 25.PDF' (2025) <www.daera-ni.gov.uk/sites/default/files/2025-06/AFBI%20Scientific%20Evidence%20Contributing%20to%20N%20Fertiliser%20Limits%20NAP%202026-2029%20Final%20June%2025.PDF> accessed 2 February 2026.

the Nutrient Management Guide (RB209) produced by the UK Agriculture and Horticulture Development Board.[297]

In addition, there is no estimation of the quantity of nitrogen already in the soils. Given the current approach taken to chemical fertiliser application rates, there is a risk that more nitrogen is being applied to agricultural soils than needed in Northern Ireland, thus increasing the risk of losses to air and water.

6.4 Nutrient loss from application of organic manure and chemical fertiliser

6.4.1 Our assessment and recommendation

Closed spreading periods for fertiliser application have proven effective in lowering risks to water quality.[298] The current closed period for organic manure applications, excluding farmyard manure and dirty water, runs from 15 October to 31 January. However, evidence suggests that the entirety of October and February should be considered for inclusion in the closed period to support achievement of the intended environmental outcomes.[299]

The absence of a closed period for the application of dirty water is a gap in the regulations. Dirty water can contain high concentrations of nitrogen and phosphorus.[300] Application of dirty water during the winter, when rainfall is frequent, heightens the risk of nutrients being lost to waterbodies.

More precise information on the phosphorus and nitrogen content of livestock manure, including dirty water, would allow better targeting of applications and lower the potential for subsequent nutrient losses. Given Northern Ireland's frequent rainfall and wet soils, we suggest the use of runoff risk maps from the Soil Nutrient Health Scheme, supported by real-time rainfall and soil moisture data, to guide nutrient management and reduce pollution.[301]

Recommendation

DAERA should consider options to strengthen the existing NAP Regulations related to 'closed periods' and the timing and location of organic manure applications to land. This should include reassessing farmyard dirty water management controls where current measures appear impractical, and winter applications are increasing the risk of nutrient losses to water.

297 Agriculture and Horticulture Development Board, 'Nutrient Management Guide (RB209)' <https://ahdb.org.uk/nutrient-management-guide-rb209> accessed 5 November 2025.

298 Adams and others (n 51).

299 Adams and others (n 51); Fresne, Jordan and Cassidy (n 279).

300 EGA Forbes and others, 'Performance of a Constructed Wetland for Treating Farm-Yard Dirty Water' (2011) 64 Water Science and Technology 22; Anthony C Edwards and others, 'Farmyards, an Overlooked Source for Highly Contaminated Runoff' (2008) 87 Journal of Environmental Management 551; EJ Dunne and others, 'An Integrated Constructed Wetland to Treat Contaminants and Nutrients from Dairy Farmyard Dirty Water' (2005) 24 Ecological Engineering 219.

301 Thomas Service and others, 'A National-Scale High-Resolution Runoff Risk and Channel Network Mapping Workflow for Diffuse Pollution Management' (2024) 368 Journal of Environmental Management 122110; Per-Erik Mellander and Phil Jordan, 'Charting a Perfect Storm of Water Quality Pressures' (2021) 787 Science of The Total Environment 147576; Fresne, Jordan and Cassidy (n 279); Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10); College of Agriculture, Food & Rural Enterprise, 'Soil Nutrient Health Scheme' (n 10).

6.4.2 Analysis of evidence

Controlling nutrient loss from both organic manure and chemical fertilisers has been a central aim of the NAP Regulations. Evidence suggests that measures such as the establishment of closed periods, restrictions on the timing of fertiliser applications, and requirements for storage infrastructure have made a significant contribution to a reduction in nutrient losses to water.[302] However, evidence also supports including the entirety of October and February to increase the effectiveness of the closed period for slurry application.[303] This would require an investment in additional storage facilities on many farms at a significant cost to farmers.

Additional measures relating to fertiliser application rates, application methods, and livestock waste excretion rates have also helped to reduce the risk of nutrient losses. Fertiliser purchases in Northern Ireland have significantly declined in recent years. There has been a 54% reduction in chemical nitrogen fertiliser purchases and an 80% reduction in chemical phosphate fertiliser purchases from 1995 to 2023.[304]

The application rate of chemical nitrogen fertiliser has also decreased, from an average value of just over 90 kg N/ha/year in 2018-2020 to below 80 kg N/ha/year in 2021-2023. The application rate of chemical phosphorus fertiliser decreased from an average value of just below 5 kg P/ha/year in 2018-2020 to under 4 kg P/ha/year in 2021-2023. Overall, there has been a 51% reduction in the average application rate of phosphorus since 2004-2006.[305]

These reductions in the application of nitrogen and phosphorus chemical fertiliser have lowered the risk of applications coinciding with periods of rainfall and subsequent runoff. We note that further reductions were proposed in DAERA's 2025 consultation on revision of the NAP Regulations for both nitrogen and phosphorus chemical fertilisers.

However, for manures, due to the high frequency of rainfall and high percentage of wet soils in Northern Ireland, it is unlikely that the current suite of measures in the NAP Regulations will be sufficient to reduce the risks posed to aquatic ecosystems to a degree that will achieve the intended environmental outcomes.

At a minimum, we suggest that DAERA should pursue greater use of decision support systems to inform manure application. The proposals that were set out in the 2025 consultation on revision of the NAP Regulations, to alert farmers when yellow weather warnings are in place, would be a step in the right direction.

Ongoing efforts to export organic manures from farms, which were also supported by the proposals in the 2025 consultation on revision of the NAP Regulations, would help to reduce this risk further if manures are not returned to land elsewhere in Northern Ireland.[306] The proposals to reduce maximum allowable manure application rates during October and February, from 30 m^3 to 25 m^3 of slurry per hectare, would also be worthwhile, while not fully mitigating the risks associated with application during these periods.[307]

302 Adams and others (n 51); Fresne, Jordan and Cassidy (n 279); Cassidy, Doody and Watson (n 61).
303 Adams and others (n 51); Fresne, Jordan and Cassidy (n 279).
304 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).
305 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).
306 Department of Agriculture, Environment and Rural Affairs, 'Sustainable Use of Livestock Slurry (SULS) SBRI Phase 2' (n 10).
307 Adams and others (n 51).

The absence of a closed period for dirty water application is, in our view, a gap in the regulations.[308] There are few opportunities to apply dirty water to land during the winter without a risk of nutrient-rich runoff and increasing soil nutrients. However, the extent to which dirty water contributes to the overall nutrient load entering waterbodies is unclear.[309] More evidence is required on this issue to inform decision-making.

We recognise that there are significant practical challenges for farmers in the identification, collection and management of dirty water from farmyards. However, the NAP Regulations could be strengthened to support the achievement of intended environmental outcomes. If the absence of a closed period for dirty water is to continue, a greater focus on improving the identification and storage of dirty water will be essential to minimise the application of nutrient-rich dirty water to land during the winter months.

We note the proposal in the 2025 consultation on revision of the NAP Regulations to raise awareness around dirty water storage and management. We suggest that this should be viewed as a bare minimum that needs to be done if this issue is to be addressed effectively.

6.5 Nutrient loss due to farm nutrient surpluses

6.5.1 Our assessment and recommendation

Although the phosphorus content of animal feeds has decreased in recent years, national farm phosphorus surpluses remain above sustainable thresholds.[310] Only farms with derogations are required to maintain their farm balance phosphorus surpluses below 10 kg P/ha/year.[311]

On non-derogated farms, limiting total nitrogen from livestock manure to 170 kg N/ha/year and restrictions on chemical fertilisers will have helped reduce farm nitrogen surpluses. However, ongoing emissions of ammonia and nitrous oxide indicate that current surpluses remain unsustainable.

The requirement to conduct soil analysis before applying chemical fertilisers has improved farm phosphorus surplus management. However, gains are being offset by increasing use of concentrated feed, where there are currently no regulations on the nutrient content or quantity fed to livestock. The absence of restrictions on the use and composition of concentrated feed, combined with the lack of clear national or farm-level targets for nitrogen and phosphorus surpluses, drives the ongoing loss of nutrients, with a considerable detrimental effect on the environment.

308 Dunne and others (n 300); Farming and Water Scotland, 'Managing Dirty Water Around the Steading' (*Farming and Water Scotland*) <www.farmingandwaterscotland.org/resource/managing-dirty-water-around-the-steading-2/> accessed 7 November 2025; The Agriculture and Food Development Authority (Teagasc), 'Managing Farm Yards to Reduce Soiled Water Losses' (*Teagasc | Agriculture and Food Development Authority*) <https://teagasc.ie/news--events/daily/managing-farm-yards-to-reduce-soiled-water-losses/> accessed 7 November 2025.

309 Simon Harrison and others, 'The Problem of Agricultural "Diffuse" Pollution: Getting to the Point' (2019) 677 Science of The Total Environment 700.

310 Department of Agriculture, Environment and Rural Affairs, 'Review of the Phosphorus Content of Concentrate Feedstuffs along with Nitrogen, Phosphorus and Manure Excretion from Dairy Cattle.' (n 35).

311 Jordan, McElarney and Cassidy (n 76); Doody and others (n 276).

Recommendation

DAERA should consider proposing mandatory phosphorus and nitrogen balance targets at both the individual farm and national levels, to require better nutrient management and drive improvements throughout the agri-food sector. This could include the introduction of limits on both the phosphorus and crude protein content of concentrated animal feeds to help control farm-level nutrient surpluses.

6.5.2 Analysis of evidence

National and international evidence shows that farm nutrient surpluses of nitrogen and phosphorus result in increased losses to water and air.[312] While evidence is not available on a sustainable nitrogen surplus for Northern Ireland, it is for phosphorus and shows a clear correlation between the farmgate phosphorus surplus and phosphorus in rivers.[313] Previous studies have indicated that a phosphorus surplus of 5 kg P/ha/year is sustainable for maintaining production on Northern Ireland's farms.[314]

Although there has been a reduction in the application of nitrogen and phosphorus fertiliser, changes to the agri-food system in Northern Ireland have led to increased use of concentrated animal feed and prevented a significant reduction in the overall nutrient surplus.[315] Nitrogen and phosphorus surpluses fell prior to 2007 as fertiliser use decreased. Since then, however, both surpluses have fluctuated and, although they have not returned to the peak levels observed in the mid-1990s they are still at unsustainable levels.[316]

While the implementation of the NAP Regulations has likely delivered positive change compared to what would have happened without them, the fact that surpluses of both nitrogen and phosphorus remain at unsustainable levels indicates that the measures are insufficient to achieve the intended environmental outcomes. This was also noted in DAERA's 2025 consultation on revision of the NAP Regulations, which included proposals for phosphorus surplus targets on farms operating above a threshold of 150 kg N/ha/year.

The lack of controls on the use and composition of concentrated feed is a primary factor behind the unsustainable nutrient surplus. The recent reduction in the phosphorus content of concentrated feed is a welcome development.[317] However, it will be important to consolidate and maintain these gains to ensure that phosphorus levels do not rise again in the future due to changes in composition.

It is also clear that similar actions should be considered to reduce the crude protein content of concentrated feed, if nitrogen losses to the environment are to be addressed.[318]

312 Batool and others (n 79); Paul Withers and others, 'Indicators and Metrics to Monitor Environmental Performance in the New Harmonica Catchments' (NEW Harmonica) <https://newharmonica.eu/index.php/downloads/publications/44-d2-5-draft-indicators-and-metrics-to-monitor-environmental-performance-in-the-new-harmonica-catchments/file>.

313 Jordan, McElarney and Cassidy (n 76); Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Proposed Nutrients Action Programme for 2026 - 2029' (n 15).

314 Doody and others (n 276); JS Bailey, 'Phosphorus Management for Sustainable Dairy Production. (Conference Paper, ID: 58, Steps to Sustainable Livestock International Conference)' (2016) <www.cabidigitallibrary.org/doi/pdf/10.5555/20163196180>.

315 Department of Agriculture, Environment and Rural Affairs, 'Statistical Review of NI Agriculture 2007 Onward' (16 November 2015) <www.daera-ni.gov.uk/publications/statistical-review-ni-agriculture-2007-onward> accessed 4 December 2025.

316 Withers and others (n 312); CD Barry and RH Foy, 'Assessing the Success of Regional Measures for Lowering Agricultural Nutrient Pollution in Headwater Streams' (2016) 45 Journal of Environmental Quality 1329; Doody and others (n 276).

317 Department of Agriculture, Environment and Rural Affairs, 'Review of the Phosphorus Content of Concentrate Feedstuffs along with Nitrogen, Phosphorus and Manure Excretion from Dairy Cattle.' (n 35).

318 Department of Housing, Local Government and Heritage, 'Proposed Additional Measures for the Fifth Nitrates Action Programme Public Consultation 2024' (Department of Housing, Local Government and Heritage 2024) <www.gov.ie/en/department-of-housing-local-government-and-heritage/consultations/fifth-nitrates-action-programme-additional-measures-strategic-environmental-assessment-public-consultation/> accessed 2 February 2026.

The need to limit crude protein in feed is supported by the proposals in both the draft Ammonia Strategy and the draft Climate Action Plan.[319]

Limiting total nitrogen from livestock manure to 170 or 250 kg N/ha/year may have curbed increases in the nitrogen surplus. Despite this, the ongoing impacts of nitrogen on terrestrial and aquatic ecosystems suggest that additional reductions in the national nitrogen surplus are required if intended environmental outcomes are to be achieved. There is currently limited evidence to support the identification of a sustainable nitrogen surplus level.

6.6 Emissions of ammonia and nitrous oxide to the air

6.6.1 Our assessment and recommendation

The agricultural sector is the main source of both nitrous oxide and ammonia emissions to air in Northern Ireland. The nitrogen fertiliser load to land is an important determinant of the level of these gaseous emissions. Methods used for the storage of fertilisers and their application, especially in terms of rate, timing, and conditions, also directly affect ammonia and nitrous oxide emissions.[320]

Measures requiring the use of low emission slurry spreading equipment in the NAP Regulations will help to reduce ammonia emissions.[321] Similarly, the requirements in the regulations for covers on all new slurry storage facilities also reduce ammonia emissions.[322]

The regulations have therefore contributed to lowering nitrous oxide and ammonia emissions to air, despite mainly being targeted at reducing nutrient losses to water. However, there are also some challenging trade-offs. For instance, while closed periods and timing restrictions for the application of livestock manure (except dirty water) have reduced gaseous emissions, the longer storage periods required by the regulations may have had the opposite effect.[323] There is also a balance between minimising nutrient losses to water and reducing ammonia and nitrous oxide emissions from fertiliser use.

Given the synergies between the management of nitrous oxide, ammonia and nutrient loss to water, a more coordinated approach could help to manage such trade-offs and improve overall outcomes.

Recommendation

DAERA should consider extending the NAP Regulations to reflect a broader, more integrated approach that addresses nutrient losses to air alongside water pollution.

319 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81); Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland's Draft Climate Action Plan 2023-2027' (11 June 2025) <www.daera-ni.gov.uk/articles/northern-irelands-draft-climate-action-plan-2023-2027> accessed 4 December 2025.

320 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81); The Agriculture and Food Development Authority (Teagasc), 'Nitrous Oxide' (n 89).

321 Ricardo, 'Review of the Draft Northern Ireland Ammonia Strategy' (2023) OEP commissioned research <www.theoep.org.uk/report/oep-welcomes-draft-ammonia-strategy-ni-identifies-areas-improvement> accessed 1 July 2024.

322 Ricardo (n 321).

323 Part 4, The Nutrient Action Programme Regulations 2019; Ricardo Energy & Environment and Jeremy Wiltshire, 'Slurry Storage on Scottish Farms – A Feasibility Study' (ClimateXChange 2018) <www.climatexchange.org.uk/wp-content/uploads/2023/09/slurry-storage-on-scottish-farms.pdf> accessed 9 January 2026; Yong Hou, Gerard L Velthof and Oene Oenema, 'Mitigation of Ammonia, Nitrous Oxide and Methane Emissions from Manure Management Chains: A Meta-analysis and Integrated Assessment' (2015) 21 Global Change Biology 1293.

6.6.2 Analysis of evidence

Although certain measures within the NAP Regulations have reduced gaseous emissions, others have had the opposite effect. For instance, closed periods have necessitated extended storage and more complex management of organic manure, resulting in increased ammonia and nitrous oxide emissions.

With the exception of the provisions related to low emission slurry spreading equipment and covering above-ground slurry stores, the measures in the regulations were not specifically designed to address ammonia or nitrous oxide emissions. As a result, even measures that have the incidental effect of reducing gaseous emissions are unlikely to achieve the levels of reductions required to meet intended environmental outcomes, for example in respect of air quality or protected sites.

Notably, there is significant uncertainty regarding the adequacy of chemical nitrogen fertiliser application limits in minimising ammonia and nitrous oxide emissions, particularly given the lack of supporting evidence for setting the current limits. The need to address this issue was highlighted by the inclusion of proposals on the use of urease inhibitors in DAERA's 2025 consultation on revision of the NAP Regulations.

Achieving the desired reductions in ammonia emissions is dependent upon both widespread adoption and effective implementation of the measures in DAERA's draft Ammonia Strategy.[324] DAERA consulted upon the draft strategy in early 2023 but has yet to finalise it. Even with full implementation of all proposed actions in the draft strategy, however, ammonia emissions are expected to decrease by only 25%, benefiting a relatively limited number of protected sites.[325]

Since the current NAP Regulations do not comprehensively address ammonia emissions, incorporating the draft Ammonia Strategy's proposed measures into the regulations would provide a more coherent set of requirements. Such integration could support consistent implementation and enhance compliance, along with the adoption of the measures necessary to achieve the established ammonia emission reduction targets.

A similar approach could also be considered for the measures in the draft Climate Action Plan to address nitrous oxide emissions. Within the draft Climate Action Plan, which DAERA consulted upon in 2025, the principal measures to reduce nitrous oxide emissions include: the use of urea fertilisers treated with a urease inhibitor; integrating legumes into grass swards; lowering the crude protein concentration in animal feed; and aerating slurry.[326]

These measures, if implemented, will support the NAP Regulations because legumes can fix nitrogen from the atmosphere, thus reducing the need for fertiliser, and because lowering the crude protein concentration in animal feed will reduce the nitrogen concentration in livestock manure.[327]

324 Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81).

325 Agri-Food and Biosciences Institute, 'Reducing Ammonia Emissions across Northern Ireland - Second Article in a Series of Seven Being Released by AFBI to Address Ammonia Emissions in NI' <www.afbini.gov.uk/news/reducing-ammonia-emissions-across-northern-ireland-second-article-series-seven-being-released?utm_source=chatgpt.com> accessed 2 December 2025.

326 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland's Draft Climate Action Plan 2023-2027' (n 319).

327 M Kearney and others, 'Mitigation of Greenhouse Gas Emissions in Pasture-Based Dairy-Beef Production Systems' (2023) 211 Agricultural Systems 103748; Paul Murphy and others, 'Estimated Nitrous Oxide Emissions from Nitrogen Fertiliser Use on Multispecies Grasslands Compared to Monocultures' (2018) <www.researchgate.net/publication/326416061_Estimated_nitrous_oxide_emissions_from_nitrogen_fertiliser_use_on_multispecies_grasslands_compared_to_monocultures>; Department of Housing, Local Government and Heritage (n 318).

As with the draft Ammonia Strategy, the effectiveness of these measures relies on their rates of adoption. For instance, the proposal to make the use of urease inhibitors mandatory in the revised NAP Regulations would help to ensure that 75% of fertilisers used contain such an inhibitor. This should enable achievement of a 7.5% reduction in greenhouse gas emissions.[328]

We suggest that a similar approach should be considered to achieve a 50% uptake in the use of concentrated animal feed with low crude protein content that is outlined in the draft Climate Action Plan. This would support a further 1% decrease in greenhouse gas emissions as well as helping reduce nutrient losses to water.

Photo 4. Low emission slurry spreading equipment. The use of such equipment helps to limit air and water pollution by injecting slurry directly into topsoil

328 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland's Draft Climate Action Plan 2023-2027' (n 319).

6.7 Impacts of climate change on nutrient loss

6.7.1 Our assessment and recommendation

Climate change has many direct and indirect effects, including on ecosystem functions, nutrient cycling, biodiversity and water quality. This can lead to adverse and disrupting impacts on farm nutrient management and losses to the environment. In particular, reduced predictability of weather patterns and increasing frequency of extreme weather events pose significant challenges for managing manure application and soil nutrient losses to air and water.[329]

Reducing nutrient loss from agriculture will therefore continue to become increasingly challenging in the face of climate change. There is significant evidence available on the impact of climate change on nutrient management and losses.[330] However, it does not appear to have been taken into account in the design or implementation of the NAP Regulations to date. Nor are these issues addressed to any great extent in the draft Climate Adaptation Programme.[331]

Recommendation

DAERA should determine how best the NAP Regulations can be 'future-proofed' in the face of ongoing and accelerating climate change. This will require an adaptive management approach, including interim reviews, that take account of new evidence and data concerning the impacts of climate change on nutrient management and the environment.

6.7.2 Analysis of evidence

Climate change affects nutrient dynamics around the globe and exacerbates water quality challenges.[332] We focus in this section on the aspects of climate change most likely to affect nutrient management on farms in Northern Ireland. These are elevated atmospheric carbon dioxide, increased temperature, more precipitation and wetter winters and autumns, less predictable weather patterns, and drier, degraded soils in summer.[333]

There is significant evidence available on the impact of climate change on nutrient management and loss in Ireland and internationally.[334] Here, we only provide a summary of key issues identified.

329 Rachel Cassidy and others, 'Stakeholder Report Future Scenarios for N and P Management in NW EU Catchments' (NEW Harmonica) <https://newharmonica.eu/index.php/downloads/publications/45-d3-2-draft-stakeholder-report-future-scenarios-for-n-and-p/file> accessed 9 January 2026; Mellander and Jordan (n 301).

330 Cassidy and others (n 329).

331 Department of Agriculture, Environment and Rural Affairs, 'Public Consultation on the Draft Third Northern Ireland Climate Change Adaptation Programme (NICCAP3)' (29 May 2025) <www.daera-ni.gov.uk/consultations/public-consultation-draft-third-northern-ireland-climate-change-adaptation-programme-niccap3> accessed 17 December 2025.

332 Suzanne Painting and others, 'Impacts of Climate Change on Nutrient Enrichment' [2013] MCCIP Science Review 2013 17 pages.

333 Mike Kendon and others, 'State of the UK Climate in 2024' (2025) 45 International Journal of Climatology e70010.

334 Margaret Desmond, Phillip O'Brien and Frank McGo, *A Summary of the State of Knowledge on Climate Change Impacts for Ireland, Report 11 (2010-2016): 2014-CCRP-FS.19* (Online version, Environmental Protection Agency 2017); Cassidy and others (n 329); Per-Erik Mellander and others, 'Integrated Climate-Chemical Indicators of Diffuse Pollution from Land to Water' (2018) 8 Scientific Reports 944; Per-Erik Mellander and others, 'Achieving Agricultural and Environmental Targets in a Changing Climate Requires a Whole-System Based Approach' (2025) 3 Discover Geoscience 205; Per-Erik Mellander and others, 'Far-Future Hydrology Will Differentially Change the Phosphorus Transfer Continuum' (2024) 2 Discover Geoscience 60; Golnaz Ezzati and others, 'The Number of Phosphorus Loss Events Will Increase with Variability and Seasonality in Far Future Climate Scenarios' (2025) 15 Scientific Reports 37609; Rémi Dupas and others, 'High-Intensity Rainfall Following Drought Triggers Extreme Nutrient Concentrations in a Small Agricultural Catchment' (2024) 264 Water Research 122108; Emileigh Lucas and others, 'Climate Change Effects on Phosphorus Loss from Agricultural Land to Water: A Review' (2023) 9 Current Pollution Reports 623.

Nutrient loss to water

Climate change affects the hydrological and biological processes that control nutrient cycling in soil.[335] Prolonged droughts can render soils hydrophobic, reducing infiltration, while heavy rainfall often exceeds the soil's absorption capacity, triggering runoff, flooding, erosion and leaching.[336] These are key pathways for nutrient loss.

Under more intense rainfall and with flooding, nutrient losses through leaching, runoff and erosion increase. While warmer temperatures and elevated atmospheric carbon dioxide can temporarily enhance crop yields, prolonged droughts, extreme heat stress, or sudden cold events reduce plant growth and nutrient uptake, increasing the likelihood of nitrogen and phosphorus accumulation in soils if the current NAP Regulations' measures continue to be applied.[337] This is likely to be particularly pronounced on derogated farms, where there are higher nutrient loads per hectare.

Warmer summers, combined with increasing frequency of heat waves, also accelerate the microbial mineralisation of nutrient-rich organic manure and soil organic matter.[338] This can release nutrients faster than crops can absorb them, further increasing the risk of losses to air and water.

Fertiliser applications at the end of summer or in early autumn, near the start of closed spreading periods, intensify these risks, because declining plant uptake may coincide with increased autumn and winter rainfall. Consequently, there will be a greater risk of nutrient losses during this period. Additionally, one severe winter storm may result in phosphorus losses that exceed what would normally be expected across a full year.[339]

Nutrient emissions to air

Milder, drier winters can increase ammonia emissions from slurry applied just before the start or after the end of closed periods, while wetter conditions following late slurry applications promote nitrous oxide formation under anaerobic or low-oxygen conditions. Frequent wet–dry cycles, combined with elevated nutrient inputs and soil compaction, further amplify gaseous emissions unless low emission slurry spreading equipment is used and storage is carefully managed.[340]

Applying manure to satisfy crop nitrogen requirements can still lead to substantial nitrogen losses, particularly in the form of ammonia and nitrous oxide emissions. Slurry is rich in ammonium, which is prone to volatilisation when manure is applied to the soil surface, especially under warm or dry conditions which may become more common during the summer months.[341]

335 Lucas and others (n 334).

336 Dupas and others (n 334); Agriculture and Horticulture Development Board, 'Soil Pore Network and Infiltration' <https://ahdb.org.uk/knowledge-library/soil-pore-network-and-infiltration> accessed 2 December 2025.

337 Desmond, O'Brien and McGo (n 334); Yunpu Zheng and others, 'The Optimal CO_2 Concentrations for the Growth of Three Perennial Grass Species' (2018) 18 BMC Plant Biology 27; Elizabeth A Ainsworth and Stephen P Long, '30 Years of Free-air Carbon Dioxide Enrichment (FACE): What Have We Learned about Future Crop Productivity and Its Potential for Adaptation?' (2021) 27 Global Change Biology 27.

338 Rohini Mattoo, Suman B Mallikarjuna and Naveenachar Hemachar, 'Ecosystem and Climate Change Impacts on the Nitrogen Cycle and Biodiversity' (2025) 6 Nitrogen 78.

339 Mellander and Jordan (n 301); Dupas and others (n 334).

340 Mattoo, Mallikarjuna and Hemachar (n 338); Mansonia Pulido-Moncada, Søren O Petersen and Lars J Munkholm, 'Soil Compaction Raises Nitrous Oxide Emissions in Managed Agroecosystems. A Review' (2022) 42 Agronomy for Sustainable Development 38; Muhammad Umair Hassan and others, 'Management Strategies to Mitigate N_2O Emissions in Agriculture' (2022) 12 Life 439.

341 Huizhong Shen and others, 'Intense Warming Will Significantly Increase Cropland Ammonia Volatilization Threatening Food Security and Ecosystem Health' (2020) 3 One Earth 126.

There is also a component of organic nitrogen in manure that mineralises over time. This becomes more readily available to plants, but will be lost to the environment if crop uptake is limited during droughts.[342]

Ammonium is highly reactive and therefore susceptible to nitrification and denitrification, increasing nitrous oxide emissions.[343] These effects are further intensified when slurry and chemical fertilisers are applied during periods of extreme weather such as summer heat waves, heavy autumn rainfall events and winter storms, which amplify volatilisation, leaching, and soil conditions that favour denitrification.[344]

Impacts on sustainable nutrient management

Climate change has a significant impact on sustainable nutrient management, primarily due to its effects on farm systems, nutrient cycles and ecosystem responses. For example, rising water temperatures in Lough Neagh have shown how climate change can worsen the impact of nutrients on aquatic ecosystems.[345] This makes it even more challenging for farms to reduce nutrient emission to levels that are compatible with good water quality.

In addition to climate change increasing the sensitivity of aquatic ecosystems to nutrient inputs, and increasing nutrient losses to the water and air, there will also be changes in farming practices and nutrient management in response to climate change.[346]

For instance, farmers may need to house livestock for longer periods to prevent field compaction during wet weather and reduce heat stress in animals during hotter summers. This results in more slurry being produced and a greater reliance on imported concentrated feeds, which can increase the nutrient surplus on farms.[347] Larger volumes of slurry raise the risk of nutrient losses, either to waterways during wet periods or to the air as ammonia during dry spells.

Although higher temperatures may raise grass yields, droughts can have the opposite effect. The 2018 fodder crisis is a good example: a wet spring was followed by a summer drought, which severely reduced grass growth.[348] Farmers then had to import fodder and extra concentrated animal feed, further increasing nutrient levels on many farms. After the drought, there was a significant spike in nitrate losses to water, as grass was unable to take up available soil nitrogen during the dry period.[349]

These examples illustrate just some of the ways climate change can affect farm systems and sustainable nutrient management. Given the uncertainty and challenges posed by

342 Vasile Scăețeanu and Madjar (n 63).

343 The Agriculture and Food Development Authority (Teagasc), 'Nitrous Oxide' (n 89).

344 Griffis TJ and others, 'Nitrous Oxide Emissions Are Enhanced in a Warmer and Wetter World' (2017) 114 PNAS <www.pnas.org/doi/10.1073/pnas.1704552114> accessed 17 November 2025; Anthony King, 'Nitrous Oxide Emissions Accelerate as Agriculture Drives Climate Threat' (*Chemistry World*) <www.chemistryworld.com/features/nitrous-oxide-emissions-accelerate-as-agriculture-drives-climate-threat/4022460.article> accessed 3 December 2025.

345 James Thompson and others, 'Climate Factors Increasing in Importance for Internal P Dynamics in a Large Eutrophic Lake' (2025) 991 Science of The Total Environment 179911.

346 KJ Forber and others, 'The Phosphorus Transfer Continuum: A Framework for Exploring Effects of Climate Change' (2018) 3 Agricultural & Environmental Letters 180036; Diogo Costa and others, 'Impact of Climate Change on Catchment Nutrient Dynamics: Insights from around the World' (2023) 31 Environmental Reviews 4; Maria Bielza and others, 'Impacts of Reduced Livestock Density on European Agriculture and the Environment' (2025) 226 Agricultural Systems 104299.

347 M Melissa Rojas-Downing and others, 'Climate Change and Livestock: Impacts, Adaptation, and Mitigation' (2017) 16 Climate Risk Management 145.

348 Nithiya Streethran and others, *ClimAg: Multifactorial Causes of Fodder Crises in Ireland and Risks Due to Climate Change: 2018-CCRP-MS.50* (Online version, Environmental Protection Agency 2024) <www.epa.ie/publications/research/climate-change/Research_Report-464.pdf> accessed 9 January 2026.

349 Jan Coppens and others, 'Current N and P Loads to Water in the New Harmonica Study Catchments - Modelling of Baseline Loads' (NEW Harmonica).

climate change, it is crucial to adopt effective mitigation strategies that promote climate-resilient nutrient management. These include, but are not limited to: regular soil testing, using decision support tools to manage risks associated with manure application, and aligning fertiliser application timings with crop requirements as weather patterns change.

Additionally, tailoring nutrient loading on farms to specific soil types and local climate conditions is even more essential in the face of climate change. Such approaches will help boost the resilience of both farms and downstream ecosystems to the increased pressures of nutrient loss brought about by climate change.

6.8 Overall assessment

Nutrient Limits

The limits in the NAP Regulations on total nitrogen loading from livestock manure, while broadly effective in curbing nitrate pollution, fall short in comprehensively addressing other critical pollutants such as phosphorus, nitrous oxide, and ammonia.

Evidence highlights considerable spatial variability in losses of nitrates, phosphorus, nitrous oxide, and ammonia in different agricultural landscapes. This variability is influenced not only by the intensity of agricultural activity but also by the interaction between farm practices and the surrounding natural environment. The current limits on total nitrogen from livestock manure of 170 or 250 kg N/ha/year, applied uniformly, do not account for such spatial variability.

Effective nutrient management planning to address spatial variability in agricultural land requires consideration of factors such as soil type, crop nutrient requirements, soil nutrient status for both nitrogen and phosphorus, and the nutrient composition of organic manure. In our view, the absence of provisions for mandatory soil analysis, or to tailor organic manure applications to crop requirements, significantly limits the ability of the NAP Regulations to reduce phosphorus losses to waterbodies.

The Soil Nutrient Health Scheme presents an important opportunity for DAERA to address this issue.[350] The Sustainable Utilisation of Livestock Slurry scheme is also a positive development as it will help to reduce the application of manure to soils that already have too much phosphorus. However, it represents only a partial solution and, in our view, does not change the need for all manure application to be informed by soil analysis. Further, if all manure application were limited to crop nutrient requirements, this would also support the development of a circular bioeconomy, as envisaged when the Sustainable Utilisation of Livestock Slurry scheme was established.[351]

Without further measures to limit application of phosphorus to soils, the stocking rates associated with the 170 kg N/ha/year limit will allow further accumulation of phosphorus in agricultural soils, especially on farms where livestock are fed a high proportion of concentrated animal feed. This will jeopardise the attainment of the intended environmental outcomes, including, in many catchments, the WFD NI Regulations' phosphorus targets.

350 Agri-Food and Biosciences Institute, 'Soil Nutrient Health Scheme' (n 10); College of Agriculture, Food & Rural Enterprise, 'Soil Nutrient Health Scheme' (n 10).

351 Department of Agriculture, Environment and Rural Affairs, 'DAERA's Sustainable Utilisation of Livestock Slurry Competition Exceeds Expectations' (15 November 2023) <www.daera-ni.gov.uk/news/daeras-sustainable-utilisation-livestock-slurry-competition-exceeds-expectations> accessed 7 January 2026.

The absence of effective controls on phosphorus and nitrogen balances at both farm and national levels has resulted in unsustainable nutrient surpluses on many farms in Northen Ireland. This has been affected by the high levels of phosphorus and nitrogen (in the form of crude protein) in concentrated animal feeds. The need to reduce the crude protein content in animal feed is highlighted in both the draft Climate Action Plan and the draft Ammonia Strategy as a critical measure for reducing nitrous oxide and ammonia emissions.[352]

Coherence across policy area

Over the last two decades, climate change, intensification of agriculture in Northern Ireland and evolving management practices have significantly altered nutrient cycling and the associated environmental impacts. The challenge of protecting sensitive terrestrial and aquatic habitats now requires a more integrated and site-specific approach to nutrient management that takes into consideration losses to air and water and the specific characteristics of local soils, climate, and farming systems.

The dynamics of nutrients in the agricultural landscape are affected by climate change. The unpredictability and extreme weather events that typify climate change are making it increasingly difficult to manage nutrient losses from agriculture to the environment. If the NAP Regulations do not take into account the potential impact of climate change, even tighter measures may be required in the future to achieve the desired environmental outcomes. Planning to address this now will help to reduce the burden on future farming generations.

Looking ahead

DAERA's assessment of the NAP Regulations, as outlined in the department's Implementation Report for 2020-2023, is aligned with and reinforces our overall conclusion that the measures currently in place are not sufficient to deliver the scale of nutrient loss reductions required to meet the intended environmental outcomes for Northern Ireland.[353]

An independent review was carried out of the measures proposed in DAERA's 2025 consultation on revision of the NAP Regulations.[354] The review indicates that the proposed measures would be expected to improve water quality in catchments already characterised by relatively low nutrient levels. In contrast, it found that catchments with significant nutrient enrichment would be unlikely to see substantial improvements as a direct result of the proposed measures.

There has been no comprehensive assessment of the NAP Regulations and other measures to determine the overall reductions in nutrient losses required from agriculture, and from other sectors, to deliver the waterbody objectives that DAERA has set under the WFD NI Regulations. This will be vital in deciding what more needs to be done and over what timeframe to achieve the intended environmental outcomes. However, we do not yet see any available information that presents an assessment of how the overall objectives will be achieved.

352 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland's Draft Climate Action Plan 2023-2027' (n 319) 167; Department of Agriculture, Environment and Rural Affairs, 'Draft Ammonia Strategy for Northern Ireland Consultation' (n 81) 47.

353 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme Implementation Report for 2020 – 2023' (n 21).

354 Department of Agriculture, Environment and Rural Affairs, 'Review of the 2019 Nutrient Action Programme Regulations' (n 26).

Such an evaluation should include, for agriculture, the impact of complementary initiatives, including the Sustainable Utilisation of Livestock Slurry scheme. It should also encompass reductions required from all other significant sources of nutrient pollution, ranging from major urban wastewater treatment facilities to domestic septic tanks.

Recommendation

DAERA should establish the scale of reductions in nutrient pollution necessary to improve water quality in Northern Ireland and to comply with the law. This will entail reductions from agriculture and from wastewater, among other sectors. DAERA should then ensure that measures in the NAP Regulations and their implementation are sufficient to deliver the necessary reductions from agriculture.

Annex – Glossary

Annex – Glossary

Definitions

The list below sets out the general meaning of a number of terms that we use in this report. Many of these terms, and others, are defined more precisely in the NAP Regulations.[355]

Anaerobic digestion – a process that converts organic matter to biogas in the absence of oxygen.[356]

Agronomic optimum – the condition in which nutrients are present in the soil in the quantities required for maximum crop yield, without surplus or deficit.

Appropriate person – this means any one of the following people to whom the NAP Regulations apply: a) the **controller** of an agricultural holding; (b) any person, whether or not permitted by the controller to carry out any activity described in the regulations; (c) the owner of any storage facilities for storage of livestock manure, silage and silage effluent; and (d) any person using such storage facilities for storage of livestock manure, silage and silage effluent. In this report, however, we normally use the more general term **farmer** in place of controller or appropriate person, except where the context requires a more specific reference.

Buffer zones – an area of land next to a watercourse or waterbody where the application of **chemical fertiliser** or **organic manure** is restricted or prohibited to reduce the risk of nutrient pollution of surface and ground waters.[357]

Climate change – long-term shifts in temperatures and weather patterns. These shifts can be natural or attributed to human activities.[358]

Closed periods – times when the application of fertiliser is prohibited. The NAP Regulations establish closed periods for the spreading of certain fertilisers and manures as follows:

- Chemical nitrogen and phosphorus fertiliser must not be applied to grassland from midnight 15 September to midnight 31 January.
- All types of chemical fertiliser must not be applied to arable land from midnight 15 September to midnight 31 January, unless there is a demonstrable crop requirement.
- Organic manures, including slurry, poultry litter, digestate, sewage sludge and abattoir waste, must not be applied from midnight 15 October to midnight 31 January.
- Farmyard manure must not be applied from midnight 31 October to midnight 31 January.
- There is no closed spreading period for dirty water.

Concentrated feed – animal feed containing high concentrations of nutrients, typically imported onto a farm, often containing soya and grains.

355 See Regulation 3(2) of the NAP Regulations for the full list and precise definitions of defined terms in the regulations.

356 Agri-Food and Biosciences Institute, 'Anaerobic Digestion' <www.afbini.gov.uk/article/anaerobic-digestion> accessed 9 December 2025.

357 Reg. 8 The Nutrient Action Programme Regulations 2019.

358 United Nations, 'What Is Climate Change?' (*United Nations*) <www.un.org/en/climatechange/what-is-climate-change> accessed 9 December 2025.

Controller – in relation to an agricultural **holding**, this is the person charged with its management for the calendar year in question. As specified in the NAP Regulations, this will be the person claiming direct agricultural aid payments for the agricultural area or, where direct agricultural aid payments are not being claimed, the person who enjoys the decision-making power, benefits and financial risks in relation to the agricultural activity carried out on the land. In this report, we normally use the more general term **farmer** in place of controller, except where the context requires a more specific reference.

Derogation – replaces the limit in the NAP Regulations of 170 kg N/ha/year for the total nitrogen from **livestock manure** that can be applied to land each year, with a limit of 250 kg N/ha/year total N from grazing **livestock manure**. Derogations are deemed granted annually by NIEA and are valid for one year.[359]

Digestate (also called **anaerobic digestate**) – a nutrient-rich by product of **anaerobic digestion** which can be used as a **fertiliser**.[360]

Dissolved inorganic nitrogen – nitrogen present in water in various forms, including nitrite, nitrate, and ammonium, which can influence freshwaters and is primarily derived from agricultural nutrients and domestic sewage.

Dirty water – water contaminated by **organic manure**, urine, effluent, milk and cleaning materials.

Effluent – liquid waste from sources such as **slurry** stores.

Farmer – while the NAP Regulations refer to farms, farmyards and farming, they do not actually include the expression 'farmer'. Rather, for the most part they apply obligations on the **controller** of an agricultural **holding**, or in some cases to another **appropriate person**. In this report, however, we normally use the more general term **farmer** in place of controller or appropriate person, except where the context requires a more specific reference.

Fertiliser – a substance containing plant nutrients utilised on land to enhance growth of vegetation. This includes **chemical fertiliser** and **organic manure**.

Habitats Directive – an EU law introduced in 1992 to conserve natural habitats and wild species of European importance. It requires member states to protect and restore habitats and species to favourable conservation status, including through the designation of Special Areas of Conservation.

Habitats Regulations – national regulations made in 1995 to give effect to the **Habitats Directive** in domestic law. They provide legal protection for designated habitats and species and set out requirements for the assessment of plans and projects that may affect protected sites.

Habitats Regulations Assessment – a process required under the **Habitats Regulations** to assess whether a plan or project is likely to have a significant effect on a protected site. It determines whether the proposal would adversely affect the integrity of the site, either alone or in combination with other plans or projects.

Holding – farm, or the agricultural area managed by a **controller**.

359 Department of Agriculture, Environment and Rural Affairs, 'Nutrients Action Programme 2019-2022 Guidance Booklet' (n 6).
360 Barbara Lamolinara and others, 'Anaerobic Digestate Management, Environmental Impacts, and Techno-Economic Challenges' (2022) 140 Waste Management 14.

Infiltration – the characteristic of the soil allowing water to move into and through the soil profile.[361]

Livestock manure – **slurry**, **dirty water**, poultry manure, farmyard manure, or **digestate** containing livestock manure.

Livestock unit – a mathematical unit used to compare livestock, in which one standard adult dairy cow is one livestock unit. Other animals can be expressed as fractions or multiples of this standard unit. For example, a beef cow is 0.8 units, and a cow under one year of age is 0.4 units.

Leachate, leaching – **leaching** is the process by which soluble nutrients are dissolved and filtered through the soil by water. **Leachate** is the water containing the dissolved nutrients.

Maximum Eligible Area – the largest land area that a **controller** (or **farmer**) can use in a claim to DAERA for financial support or funding.

Mineralisation – the process through which organic materials, such as crop residues, compost and manure, are transformed into inorganic nutrients. This process requires energy and therefore also results in the release of carbon dioxide through microbial respiration.[362]

Mobilisation – the processes that release nutrients from soils, fertilisers, or organic matter into forms that can be transported by water. Once mobilised, nutrients such as nitrogen and phosphorus can be transported via processes such as runoff or leaching to waterbodies.

Nitrate Vulnerable Zone – area designated as being at risk from agricultural nitrate pollution. The whole of Northern Ireland is designated as a single nitrate vulnerable zone.

Nitrates Directive – an EU law introduced in 1991 aimed at protecting ground and surface waters from pollution caused by nitrates from agricultural sources. It forms a key component of the wider framework for water protection under the **Water Framework Directive**.

Nutrient Action Programme Regulations (the NAP Regulations) – regulations in Northern Ireland, originally introduced to implement the **Nitrates Directive**, to prevent and reduce water pollution by nutrients from agricultural sources.

Nutrient budget – a farm nutrient budget compares the nutrients that enter the farm (inputs, through fertilisers and animal feed) with those that are leave (as outputs such as livestock, milk, or crops), to determine the extent of any **nutrient surplus** or deficit.

Nutrient Management Guide (RB209) – guide for famers, produced by the UK's Agriculture and Horticulture Development Board. This is recognised as the industry standard for determining crop nutrient requirements, providing detailed guidance on when, where and how much fertiliser to apply.

Nutrient surplus – where a farm **nutrient budget** determines that the nutrients that enter the farm (inputs) are greater than those that leave in products (outputs), there is a nutrient

361 Agriculture and Horticulture Development Board (n 336).

362 Biosis - Biological Soil Information System, 'Mineralisation' <https://biosisplatform.eu/services/soil-biota-and-functions/process/mineralisation> accessed 12 January 2026.

surplus, and the associated greater risk of nutrient losses. A surplus can cause nutrient buildup in soil as well as water or air pollution, or greenhouse gas emissions.[363]

Organic manure – **livestock manure** or other fertilisers derived from organic matter (including anaerobic **digestate** not containing livestock manure, abattoir waste, compost, sewage sludge, and other organic wastes).

Phosphate – the phosphorus compound most used in **chemical fertiliser**.

Silage – forage crop conserved by fermentation or preservation.

Silage effluent – **effluent** produced from **silage** and coming from a silo, silage effluent collection system or drain.

Slurry – excreted waste produced by livestock whilst in a yard or building which may be mixed with other materials (including bedding, rainwater, seepage or washings). Slurry can include other **organic manure** of a consistency that allows it to be pumped or discharged by gravity. Slurry can also include **dirty water** that is stored with slurry or mixed with slurry.[364]

Sustainable Utilisation of Livestock Slurry – a DAERA project to develop ways to manage excess nutrients from agriculture.[365]

Volatilisation – the transfer of a chemical as a gas through the soil-air interface under environmental conditions.

Wastewater – water that has been used and is now contaminated by human, industrial, or agricultural activities.

Water Framework Directive (WFD) – an EU law that established a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater. It requires member states to manage water bodies on a river basin basis and to take measures to prevent deterioration, improve water quality, and achieve good ecological and chemical status.

The Water Framework Directive (Northern Ireland) Regulations (the WFD NI Regulations) – the domestic regulations originally introduced to give effect to the Water Framework Directive in Northern Ireland.

Waterlogged soil – soil where water appears on the surface of the land when pressure is applied.

363 Department for Environment, Food & Rural Affairs, 'Use a Whole Farm Nutrient Budget – Farming' <https://defrafarming.blog.gov.uk/sustainable-farming-incentive-pilot-guidance-use-a-whole-farm-nutrient-budget/> accessed 9 December 2025.

364 The Nutrient Action Programme Regulations 2019.

365 Department of Agriculture, Environment and Rural Affairs, 'Sustainable Use of Livestock Slurry (SULS) SBRI Phase 2' (n 10).

List of abbreviations

AFBI	Agri-Food and Biosciences Institute
CAFRE	College of Agriculture, Food and Rural Enterprise
DAERA	Department of Agriculture, Environment and Rural Affairs
HRA	Habitats Regulations Assessment
MEA	Maximum Eligible Area
N	Nitrogen
NAP	Nutrient Action Programme
N/ha/year	Nitrogen per hectare per year
NIEA	Northern Ireland Environment Agency
OEP	Office for Environmental Protection
P	Phosphorus
P/ha/year	Phosphorus per hectare per year
WFD	Water Framework Directive

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