The Protection of Waters Against Pollution from Agriculture

Consultation on implementation of the Nitrates Directive in England

August 2007
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Other Supporting Documents

The following supporting documents are all available on the Defra website: http://www.defra.gov.uk/corporate/consult/waterpollution-nitrates/index.htm

Alternatively paper copies can be requested from Defra by telephone (0207 238 5494) or email (nitratesconsultation@defra.gsi.gov.uk)

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Protecting natural resources (in particular improving the quality of water), and improving the condition of natural habitats and enhancing biodiversity, are key objectives for the Department. The large amount of nitrogen entering our waters from agriculture is one problem we need to tackle if we are to achieve these objectives.

The Nitrates Directive is the main policy mechanism available to the Department for tackling water pollution caused by nitrogen from agricultural sources. It requires farmers within Nitrate Vulnerable Zones to follow an Action Programme of measures aimed at controlling when, where, how, and in what amount, nitrogen can be applied to land.

We have reviewed efforts undertaken to date under this Directive to tackle pollution and consider that the evidence points to a need to take further action.

Our review of the current Nitrate Vulnerable Zones (NVZs) has shown that coverage needs to be increased from 55% to about 70% of England. This increase is required mainly because nitrate pollution has increased in some areas of the country, and because improvements in modelling techniques have enabled assessment of an increased number of water bodies. Given that the extent of NVZs is will increase, and in light of wider efforts to improve water quality, we seek views on the option of applying the Action Programme measures throughout the whole of England.

Our review of the effectiveness of the current Action Programme has highlighted that nitrate levels remain high and that, whilst having an impact on nitrate losses in some small areas of the country, is unlikely to effectively reduce agriculture’s contribution to this problem at the national scale. This is largely because many of the current measures only apply to very small areas of the country (e.g. the closed period for organic manures is limited to areas where slurry or poultry manure is applied to sandy or shallow soil) and consequently only affects a small proportion of farmers in NVZs.

Therefore, if we are to achieve widespread, sustained downward trends in nitrate concentrations, we need to revise the Action Programme, through the introduction of reinforced and/or additional measures, to ensure it applies to a greater proportion of the NVZ. Other changes proposed to the Action Programme are to improve the clarity and enforceability of the measures.

The key proposals for the revised Action Programme include:

- **Whole farm manure N loading limit**: Establishes a limit of 170 kg/ha of total N from livestock manures (deposited during grazing and by spreading) per calendar year, averaged across the farmed area.
- **Closed period (organic manures)**: Prohibits the spreading of organic manures with high available nitrogen content during specified periods. It is proposed to extend the length of the closed periods, and apply it to all soil types.
- **Manure storage**: Requires farms to provide sufficient storage facilities to store all slurry produced by livestock during a period of 26 weeks for pigs and 22 weeks for cattle, and to store all poultry manure for a period of 26 weeks.
- **Closed period (manufactured nitrogen fertilisers)**: Prohibits the spreading of manufactured nitrogen fertiliser during specified periods unless there is a crop nitrogen requirement.
Crop nitrogen requirement limit: Requires farms not to apply more nitrogen than the crop requires and to assume a level of efficiency of nitrogen supply from any manure applications.

Spreading locations: Requires farmers to undertake a written assessment to identify areas of land at risk of runoff and causing water pollution. Applications of nitrogen fertiliser and organic manures to areas of land identified as posing a high risk of runoff are prohibited.

Spreading techniques: Prohibits the use of high trajectory, high pressure application techniques for spreading organic manure. Additionally, applications of organic manure to bare soil or stubble will require incorporation into the soil in certain situations.

Record-keeping: Establishes a requirement to keep a record of all N applications to land to facilitate compliance checking.

Cover crops: Requires farmers to establish cover crops before spring sown crops (e.g. potatoes, sugar beet).

These proposals represent what we consider to be the best way of:

- Achieving reductions in nitrogen loss from agriculture and improving water quality
- Improving the efficiency with which nitrogen, in particular from organic manure, is used on farms
- Minimising pollution swapping\(^1\)
- Balancing achievement of environmental objectives with a sustainable agricultural industry
- Fulfilling our obligations under the Nitrates Directive

The Regulations giving effect to the revised NVZs and Action Programme are anticipated to come into force in Spring 2008. We recognise that a number of farmers will not be able to comply with some of the proposed measures straight away (e.g. it will take time to construct new slurry stores to comply with the storage capacity requirement). Therefore, farmers will be given reasonable time to implement some of the new measures (e.g. up to two years after the Regulations come into force in the case of the storage capacity requirement).

To ensure that farmers are aware of, understand, and are able to fulfil their obligations under the proposed Action Programme, we are developing a range of mechanisms to provide advice and guidance.

A number of Regulations, including the proposed Action Programme, are likely to mean that farmers will have to make substantial changes to the manner in which they manage manure. The role of innovative solutions and technologies, particularly anaerobic digestion (AD), could, in some circumstances, become important in enabling farmers to comply with these Regulations. These technologies could also turn wider environmental challenges, such as climate change and the need to develop renewable sources of energy, into an opportunity for the UK agricultural sector to make a positive environmental contribution and generate additional income.

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\(^1\) In some cases, action aimed at reducing the release or impact of one pollutant may simultaneously cause an increase in the release or impact of another. This phenomenon is sometimes referred to as “pollutant swapping”, and can undermine the effects of environmental policy.
Purpose of Consultation Paper=

i. This Consultation Paper is part of a wider process of engagement by the Department of Environment, Food and Rural Affairs (Defra) in the development of measures for tackling diffuse pollution from agriculture. Whilst this paper focuses upon regulatory measures to tackle one specific aspect of water pollution (i.e. from nitrogen compounds, including nitrate), the Department has published two other consultations that consider measures to tackle other aspects of diffuse water pollution from agriculture (i.e. one on revisions to the existing Codes of Good Agricultural Practice\(^2\), and one on proposals for tackling Diffuse Water Pollution from Agriculture\(^3\)).

ii. The purpose of this Consultation Paper is to seek your views, by Tuesday 13 November 2007, on:

- proposals for revised Action Programme measures to control pollution caused by nitrogen from agricultural sources.
- whether to apply these measures within discrete Nitrate Vulnerable Zones (as revised) or throughout the whole of England.

iii. The proposals set out in this paper will predominantly affect farmers of agricultural land located within Nitrate Vulnerable Zones (NVZs) in England, as they will be required by law to comply with the proposed Action Programme measures. The Environment Agency (EA) will retain its powers to inspect farms and enforce the Action Programme.

iv. The Department has recently completed reviews of both the extent of current NVZs and the effectiveness of the current Action Programme. The outcomes of these reviews are discussed in this paper and form the basis of the above proposals/options.

v. This paper presents (i) the need for action, (ii) a national map of the revised areas to be designated within an NVZ, (iii) a detailed description of the proposed Action Programme measures, (iv) a summary of the scientific rationale underpinning the proposed measures, (v) their associated environmental and economic impacts, (vi) the proposed arrangements for enforcement and timetable for implementation, and (vii) proposals for advice and support.

vi. The paper is the culmination of a series of informal discussions and consultations with a wide range of stakeholders. For example, the Department held a series of workshops with farmers to listen to their views on the proposals at different stages of their development, and has had several meetings with farmer representative bodies.

UK Devolved Administrations

vii. Northern Ireland, Scotland and Wales are undertaking similar actions to those proposed in England to implement the Nitrates Directive. There are, however, some differences between the administrations in both their approach and stage of implementation. This is due to the differing environmental conditions and agri-environment policies that apply within their respective countries.


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- Northern Ireland brought in revised Action Programme Regulations in January 2007. This revised Action Programme has been applied across the whole of the Province\(^4\).
- Scotland has already consulted on a revised Action Programme and is currently assessing the responses received\(^5\).
- Wales is at a similar stage to England and is still to consult on a revised Action Programme and NVZs.

Summary of questions

viii. When considering the proposals outlined in this paper, the Department would welcome your views on the following questions:

Chapter 2 – Nitrate Vulnerable Zones

Question 1: We are considering whether to continue with the targeted NVZ approach or apply the Action Programme throughout the whole of England. Which is your preferred approach? Why? The Department would welcome comments on the respective advantages and disadvantages of the two options.

Question 2: We are considering under what circumstances de-designation of NVZs would be possible in the future. We would welcome your views on this issue and what Action Programme measures should be applied in potential de-designation areas in the interim.

Chapter 4 – Proposals for a revised Action Programme

Question 3: We would welcome comments on the proposed Action Programme measures. Questions 4 – 7 highlight specific areas where your views are sought.

Question 4: Are there other crops with an agronomic nitrogen requirement during the closed period? If so, are you aware of any evidence available to support this requirement?

Question 5: Are there other livestock categories for which standard manure N production figures would be useful?

Question 6: Do you feel there is a convincing justification for a derogation from the whole farm limit for organic manure? If so, explain why.

Question 7: The Nitrates Directive does not explicitly require cover crops to be included in the Action Programme. However, we consider that the evidence indicates that they are a cost-effective measure for tackling diffuse water pollution. We would welcome your views on the inclusion of cover crops within the Action Programme.

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Chapter 5 – Environmental and Economic Impacts

Question 8: We would welcome comments on the partial RIA and in particular upon the accuracy of the assumptions that underlie the calculated costs and benefits. Note: supporting paper G4 contains further, more specific questions regarding the calculation of costs.

Chapter 6 – Support and enforcement arrangements

Question 9: We would welcome comments on the advice and support you consider necessary for implementation of the revised Action Programme. What is the best format for providing this? Would you prefer specific advice relating to the Action Programme, or advice integrated into wider best practice and environmental issues?

Question 10: The Department would welcome your ideas on how we can facilitate a greater uptake in anaerobic digestion. What are the main barriers? How can these be overcome?
Chapter 1 – The Need for Action

1.1 This chapter provides background information on water pollution in England caused by nitrogen compounds, and introduces the policy mechanisms available to tackle this pollution.

Water pollution

1.2 Water is a vital resource. We need it to drink and keep us clean; it supports a wide variety of animal and plant life; it is a major recreational resource with important links to rural tourism; and it is used by many industries.

1.3 Society is becoming more aware of the vulnerability of this finite resource and the need to manage carefully activities that threaten its quality and sustainability. In particular, climate change, which is likely to create changes in the pattern, duration and frequency of precipitation and droughts, will lead to reduced water availability but increased demand. Protecting the environmental quality of our water resource will therefore become even more important in the future.

1.4 England faces a series of problems affecting the quality of its rivers, lakes, estuaries, coastal and marine waters, and groundwaters. Of particular concern are the large amounts of nitrogen, largely in the form of nitrate, entering and polluting our waters. High concentrations of nitrate in water can cause problems for two principal reasons:

- Water companies are required by law to supply drinking water to consumers with a nitrate concentration of less than 50mg/l. The treatment of drinking water to meet this, and other, standards is an energy intensive process and consequently contributes to emissions of greenhouse gases. Additionally, the cost to the water industry to reduce high nitrate levels caused by diffuse pollution in drinking water supplies has been estimated at £288 million (capital expenditure) and £6 million per annum (operating expenditure) for the 2005-2010 period. These costs are not static and are set to rise as groundwater concentrations continue to increase.

- Nutrients, such as nitrogen and phosphorus, are essential for plant growth. However, too many nutrients can result in the unusual growth of aquatic plants, such as algae and seaweed, leading to an undesirable disturbance and deterioration of water quality. This nutrient enrichment of waters is known as eutrophication, and can occur in natural freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters. Eutrophication can adversely affect the biodiversity of aquatic habitats and reduce the value of water as a resource (e.g. recreational use of the water body will decline with knock-on implications for tourism). Whilst it is difficult to assess the financial cost of damage to the environment it has been estimated that the total annual cost of water pollution upon river and wetland ecosystems and natural habitats in England and Wales is approximately £716m - £1,297m.

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6 See the partial RIA for more information (supporting paper B is available via the Defra website).
1.5 Although there have been some localised reductions in recent years, nitrate concentrations in England’s ground and surface waters remain high in many parts of the country, with waters often exceeding 50mg/l nitrate\(^7\). There are also a number of water bodies continuing to display signs of eutrophication, so clearly there is still some way to go before our waters achieve their full environmental and ecological potential, and contribute to an improved living environment.

1.6 The largest source of inputs of nitrate to rivers in England is agriculture, which contributes approximately 60% of the nitrate found in surface waters. This is hardly surprising as agriculture covers approximately 75% of England’s land area and involves the handling of large quantities of nitrogen (e.g. manure and fertiliser applications to crops).

1.7 Nitrate pollution can also originate from a number of non-agricultural sources including sewage treatment works, industry and various diffuse sources (e.g. transport and urban drainage systems). However, significant investment by water companies in recent years has led to reductions in pollution from sewage treatment works (see paragraph 1.15). Work is also underway to identify the most appropriate mechanisms to tackle non-agricultural diffuse water pollution\(^8\).

**Policy drivers to tackle nitrate pollution**

1.8 Protecting natural resources (in particular improving the quality of water), and improving the condition of protected sites and enhancing biodiversity, are key objectives for the Department\(^9\).

1.9 As highlighted earlier, this consultation is part of a wider process of engagement by the Department in the development of measures for tackling diffuse pollution from agriculture – consultations on a revised Code of Good Agricultural Practice and Diffuse Water Pollution from Agriculture (DWPA) are also under way.

1.10 The DWPA consultation document considers water quality more broadly than just nitrate pollution, and discusses a wider range of policies for controlling diffuse pollution from agriculture. For example, it considers the role of Environmental Stewardship, which pays farmers to take action to improve the environment, and Defra-funded advice schemes, which encourage farmers to adopt farming practices that are more environmentally-friendly.

1.11 Tackling DWPA will help meet the objectives of the EU Birds and Habitats Directives with regard to the conservation of natural habitats and species and the Natura 2000 site network. The Habitats Directive requires Member States to maintain or restore habitats and species of wild flora and fauna of Community interest at a favourable conservation status. At present, 18,750ha of Natura 2000 sites (12.1% by area) are adversely affected by DWPA.

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\(^7\) Supporting paper **E1**, available via the Defra website, discusses trends in water quality monitoring data and sources of nitrate pollution.

\(^8\) The Defra consultation on options for possible mechanisms for tackling non-agricultural diffuse pollution (now closed) is available via [http://www.defra.gov.uk/corporate/consult/nadwp-hydromorphology/index.htm](http://www.defra.gov.uk/corporate/consult/nadwp-hydromorphology/index.htm)

\(^9\) Key policy drivers relating to protected sites and biodiversity include the EU Birds and Habitats Directive, which require the protection and maintenance of Natura 2000 sites, Defra’s Public Service Agreement (PSA) to get 95% of land within Sites of Special Scientific Interest (SSSI) into a favourable or recovering condition by 2010, and the UK Biodiversity Action Plan (UKBAP). Tackling water pollution will help the achievement of these policy objectives.
1.12 Tackling DWPA will also be an important step towards meeting the objectives of the EU Water Framework Directive (WFD) which requires Member States to achieve ‘good ecological and chemical status’ in all water bodies (surface and groundwater) by 2015. Under the WFD, which was adopted in 2000, the UK has already made an initial assessment of the pressures putting water bodies at risk of not reaching good status by 2015 (e.g. the impact of agriculture, industry and transport).

1.13 By 2009, we must have identified the objectives for each water body and a summary of the measures (i.e. actions) that will be taken to achieve them. This ‘Programme of Measures’ should include action to tackle all sources of pollution. To this end, the Government needs to identify the right range of policy mechanisms for delivering these measures/actions.

1.14 Potential mechanisms for delivering measures that tackle agricultural pollutants, such as phosphorus, are discussed in the DWPA consultation document. A further consultation on measures to tackle non-agricultural sources of diffuse water pollution is expected in early 2008.

1.15 The main mechanisms currently available for tackling nitrate pollution are provided through implementation of two key pieces of EU legislation: the Nitrates Directive and the Urban Waste Water Treatment Directive (UWWTD). Action taken under both Directives must be included within the WFD’s Programmes of Measures.

**Urban Waste Water Treatment Directive**

1.16 The UWWTD, adopted in 1991, seeks to protect surface waters from pollution caused by nutrients contained in discharges from waste water treatment plants. It sets standards for the treatment of sewage which has led to a significant investment at a number of waste water treatment plants in England. This investment has reduced the contribution of these plants to water pollution and has exposed the importance of controlling other sources of pollution, such as agriculture.

**Nitrates Directive**

1.17 Implementation of the Nitrates Directive is the main focus of this consultation paper.

1.18 Adopted in 1991, the Nitrates Directive aims to tackle pollution of waters caused by nitrogen from agricultural sources. We would expect achievement of this objective to become manifest within monitored nitrate concentrations, with the majority of sampling points across the country either having levels which are low and stable or, if high, demonstrating a sustained downward trend.

1.19 The Nitrates Directive requires Member States to establish a code of good agricultural practice to be applied by farmers on a voluntary basis throughout their national territory. In England, we have included a section on “Minimising nitrate loss” within the draft Code of Good Agricultural Practice for this purpose. This is intended to provide a baseline level of protection against nitrate pollution from agriculture across the whole country.

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1.20 The Directive also requires an Action Programme of measures to be implemented by farmers either within areas of the country draining to nitrate-polluted waters (Nitrate Vulnerable Zones) or across the whole of the country.

1.21 The measures in the code of good agricultural practice and Action Programme are aimed at controlling when, where, how, and in what amount, nitrogen (either in organic manures or manufactured fertilisers) can be applied to land.

1.22 The Nitrates Directive is quite prescriptive and lists the criteria to be used in identifying nitrate-polluted waters, and the measures to be included in both the code of good agricultural practice and the Action Programme.

1.23 66 NVZs, covering 8% of England, were originally designated in 1996 for the protection of drinking water sources. An Action Programme of measures has been implemented within these NVZs since December 1998.

1.24 In December 2000, the European Court of Justice ruled that the UK had failed to properly implement the Directive because we had only designated NVZs for the protection of drinking water sources, rather than for all surface and ground waters. As a result of this ruling, a further 47% of England was designated as an NVZ in October 2002. The same Action Programme of measures that applied in the original NVZs entered into force within these additional NVZs in December 2002.

1.25 The Nitrates Directive requires that Member States submit a report to the European Commission every four years on the state of implementation of the Directive within their country. The Commission’s overall analysis, as set out in a recently published report\footnote{EC report is available via http://ec.europa.eu/environment/water/water-nitrates/index_en.html}, is that “significant progress is now being made in the implementation of the Nitrates Directive, but that considerable further work in improving designations of NVZs and the quality of Action Programmes is required in order to fully achieve the objectives of the Directive with regard to water quality.” The report also highlighted that nitrate concentrations in waters in the UK are amongst the highest in Europe.

1.26 Reviews of the extent of the NVZs and the effectiveness of the Action Programme are required by the Nitrates Directive every four years. The outcomes of both reviews should be used to make appropriate amendments (i.e. designate additional NVZs, and/or introduce reinforced or additional Action Programme measures).

1.27 The Department has just completed its reviews of NVZs and the Action Programme. The broad outcomes of these two reviews are as follows:

- Nitrate pollution has increased in some areas of England therefore additional designations of NVZs are proposed (see Chapter 2 for more details)
- The current Action Programme has not had a significant impact on nitrate pollution therefore reinforced and additional measures are proposed (see Chapters 3 and 4 for more details).

1.28 The proposals discussed within this consultation document are a result of these reviews, and are intended to ensure that we are continuing to take appropriate and effective action to tackle pollution caused by nitrogen and improve the quality of our waters.
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**Nutrient Management**

1.29 The above paragraphs highlight that the way in which organic manures and fertilisers are used on farms (i.e. when, where, how, and in what amounts they are applied) can have a significant impact on losses of nitrate to the water environment. But nitrate is not the only pollutant that is affected thus. Others include:

- **Nitrous Oxide**: a greenhouse gas.
- **Ammonia**: a gas which can have impacts on human health and can cause the eutrophication and acidification of natural terrestrial habitats.
- **Ammonium**: a pollutant of aquatic habitats which, at high concentrations, can be toxic to fish.
- **Phosphorus**: a nutrient which can cause the eutrophication of aquatic habitats.
- **Pathogens**: micro-organisms which can impact on human health if present in waters used for swimming and bathing (i.e. beaches).

1.30 The Action Programme under the Nitrates Directive, because it is designed to influence the management of manure and manufactured fertilisers, will have an impact on losses of these pollutants – even though that is not its express intention. We are aware that any environmental benefits achieved by reducing losses of nitrate through implementation of the Action Programme could be undermined if it leads to greater losses of these other pollutants (often referred to as ‘pollution swapping’).

1.31 Impacts on pollution swapping was a key consideration during the recent review of the NVZs and Action Programme.

**Conclusions**

1.32 The large amount of nitrogen entering our waters from agriculture is one of a series of problems we need to tackle if we are to achieve the Department’s objectives relating to the protection of natural resources and improving the condition of natural habitats and enhancing biodiversity.

1.33 The Nitrates Directive is the main policy mechanism available to the Department for tackling pollution caused by nitrogen from agriculture - a major source of water pollution. We have reviewed efforts undertaken under this Directive to date and consider that the evidence points to a need to take further action.

1.34 The remainder of this consultation paper discusses this evidence and proposals for further action.
2.1 This chapter highlights the need to increase the extent of NVZ designations from 55% to about 70% of England, and seeks your views on whether we should continue with discrete NVZs or apply Action Programmes throughout the whole of England.

Discrete Nitrate Vulnerable Zones or whole of England?

2.2 The Nitrates Directive requires, as a minimum, that the Action Programme of measures is implemented by farmers within discrete Nitrate Vulnerable Zones that drain into polluted waters. However, Member States may apply Action Programmes more extensively, and the Directive makes special provision for their application across the whole of the country.

2.3 Out of the EU-15 (i.e. those Member States within the European Union prior to its recent expansion), nine Member States have taken this approach (e.g. Denmark, Netherlands, Germany) or have applied the Action Programme across the entirety of specific administrative regions (e.g. Flanders in Belgium and Northern Ireland in the UK).

2.4 To date, we have opted to take the targeted approach and have designated discrete NVZs which currently cover approximately 55% of land in England.

2.5 The recent review of NVZs indicates that we need to increase coverage to about 70% of England (a map of the estimated coverage is provided in figure 1). The reasons for the increase in the extent of the NVZ designations are outlined in paragraphs 2.10 – 2.11, and a summary of the methodology used to identify the NVZs is provided in supporting paper G1.

2.6 Given that the coverage of England will increase, and in light of wider efforts to improve water quality, we feel that there is merit in considering whether we:

- continue with discrete NVZs (Option 1), or
- apply the Action Programme across the whole of England (Option 2).

2.7 A partial Regulatory Impact Assessment\(^{12}\) has been completed to quantify and compare the costs and benefits of each option. The main advantages and disadvantages of each option are summarised below:

**Option 1 –Discrete Nitrate Vulnerable Zones (70% of England)**

**Advantages**

- Represents a targeted approach which will result in action being taken only in those parts of the country where nitrate pollution is most severe.
- Lower costs to the agricultural industry than under Option 2 (Option 1: £35m - £81m vs. Option 2: £60m - £116m).

\(^{12}\) Available via the Defra website (supporting paper B).
Disadvantages

- May give some farmers outside NVZs a competitive advantage over the majority inside NVZs.
- NVZ designation may impact on land values.
- There is a degree of uncertainty regarding whether NVZs will be extended in the future, either due to an increase in pollution or further legal action by the European Commission.
- The need to obtain and check detailed maps has, in the past, meant that many farmers were unaware they were within an NVZ. Consequently they may have inadvertently breached the Regulations and been at risk of sanctions and penalties.

Option 2 – Apply the Action Programme across the whole of England

Advantages

- Provides greater certainty for farmers by removing the need to (a) obtain maps to check whether their land is in an NVZ, and (b) be ready to adapt their business following each periodic revision of NVZs.
- Creates a level playing field, with all farmers required to operate to the same environmental standards.
- Improvements in water quality and enhancements in biodiversity will be seen in areas that would otherwise fall outside the proposed NVZs. This may assist in achieving wider environmental objectives relating to the improvement of water quality and reduce the amount of additional controls required in the future under other policies.

Disadvantages

- Greater costs to the agricultural industry than under Option 1 as farms that would otherwise fall outside the proposed NVZs will have to implement the Action Programme measures and consequently incur costs.
- Affects all farmers in England irrespective of the extent and severity of nitrate pollution in their area.

The Department does not have a firm view on whether it would be preferable to implement option 1 or 2. We are therefore seeking stakeholder views on this.

Question 1: Which is your preferred option? Why? The Department would welcome comments on the respective advantages and disadvantages of the two options.
Figure 1. Map showing extent of proposed additional designations in England following the outcomes of the recent review.
Additional designations of NVZs

2.9 If it is decided to continue with the designation of discrete NVZs, the outcome of the recent review indicates that we need to increase the extent of the designated area from 55% to about 70% of England (see figure 1). The reasons for this increase in NVZ designations are as follows:

2.10 Nitrate pollution, as monitored by the Environment Agency (EA), has increased in some areas of the country since the last round of NVZ designations in 2002. This is reflected in the additional waters that were identified as nitrate-polluted in the recent review, in particular groundwaters and eutrophic waters. We must now designate as NVZs land draining to these waters and contributing to their pollution.

2.11 The methodology used by the EA for identifying nitrate-polluted waters and designating NVZs has been updated since the last round of NVZ designations in 2002 in light of new scientific understanding. In particular:

- Improvements in modelling techniques have enabled the EA to evaluate more extensively nitrate pollution in waters which are not monitored through their water quality monitoring network. Consequently, a greater area of England has been assessed for designation as an NVZ than in previous reviews, as it is no longer limited by the spatial extent of the monitoring network.

- Historically, it was thought that nitrogen did not play an important role in driving the eutrophication of freshwaters. However, developments in the understanding of that role have meant that, as a result of the recent review, we are proposing to designate NVZs around a number of freshwaters identified as eutrophic.

2.12 To refine and develop the methodology used in the most recent review of surface and groundwaters, the Department established a Steering Group, which included stakeholders and independent technical experts. Given the scientific and technical nature of the methodology, we are not seeking comments on it through this consultation.

De-designation of NVZs

2.13 During the recent review it came to light that some small areas of the NVZs designated in 2002 no longer drain to nitrate-polluted waters. This could potentially be for a number of reasons, such as:

- Nitrate pollution in these areas may have reduced since the last review in 2002.

- The monitoring network in these areas may have changed since the last review. This could mean that we no longer have water quality data for some waterbodies previously identified as nitrate-polluted, and therefore were unable to assess whether they continue to be nitrate-polluted under the recent review.

- The catchment boundaries used in the 2002 review of NVZs were less accurate than those used in the recent review. Therefore, the area of land identified as draining to a particular nitrate-polluted may differ between the reviews.

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13 Supporting paper G1, available via the Defra website, provides a summary of the method used to identify NVZs during the recent review.

14 This peer review process was not applied to the eutrophication methodology as it was established in 1993 and was subject to a full consultation process at that time.
2.14 We are currently considering whether it would be possible, in the future, to de-designate these small areas of NVZs.

2.15 However, there are a wide range of issues that need to be considered before we could make a decision on de-designation. For example, if we de-designate on the basis that nitrate pollution in the area has reduced since the last review, there is a risk its de-designation could subsequently lead to an increase in nitrate pollution and its re-designation. This ping-pong approach to designations would be unhelpful for farmers operating in these areas.

2.16 Additionally, we consider that we do not have monitoring data for a sufficient number of years to be confident that the observed, localised improvements in water quality are sustained. Nor can we be sure of their cause (i.e. could simply be due to a short-term fluctuation in weather).

**Question 2:** The Department is considering under what circumstances de-designation of NVZs would be possible in the future. We would welcome your views on this issue and what Action Programme measures should be applied in potential de-designation areas in the interim.

**Detailed maps of NVZs**

2.17 In the event that we choose to implement option 1 (discrete NVZs), we will publish more detailed maps of the proposed NVZs. These will be similar to those currently available on the interactive NVZ mapping website and will identify precisely which fields are located inside or outside an NVZ. An announcement will be made when these maps are launched (likely to be in winter 2007).

**Appeals procedure**

2.18 A great deal of technical expertise and quality control has been applied to accurately identify NVZs, and we are confident that our methodology currently represents the best available way of identifying NVZs at the national scale.

2.19 However, we are proposing to put in place a procedure by which farmers can appeal against the inclusion of their land within an NVZ if they have evidence to demonstrate that it does not drain to a waterbody identified as nitrate-polluted.

2.20 Further details will be published when the detailed maps of the NVZs and nitrate-polluted waters become available.

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15 Interactive maps of the current NVZs are available via [http://nvz.adasis.co.uk/maps/index.html](http://nvz.adasis.co.uk/maps/index.html)
This chapter explains the need to revise the current Action Programme, and outlines the approach taken by the Department in carrying out this revision.

**Current Action Programme**

**Background**

3.2 The current Action Programme has been in place since 1998. Its overall aim is to achieve improved water quality in England through the promotion of good farming practice and the more efficient use of nitrogen on farms. The main requirements are that farmers should:

- Limit applications of organic manure at the farm level to 170kg of total nitrogen per hectare per year on arable land and 250kg per hectare on grassland.
- On sandy or shallow soils, avoid making applications of some types of organic manure during the following dates – 1 September to 1 November (grass) or 1 August to 1 November (arable) i.e. the ‘closed periods’.
- Ensure they have adequate slurry storage capacity to allow for the above annual closed periods, plus some spare contingency capacity.
- Limit nitrogen fertiliser applications to crop requirement, after allowing fully for residues in the soil and from other sources (e.g. organic manure).
- Avoid making applications of organic manures and nitrogen fertilisers in locations and under conditions (e.g. waterlogged soil) which are likely to lead to nitrate losses.
- Keep adequate farm records on cropping, livestock numbers and the use of organic manures and nitrogen fertilisers.

3.3 A full description of all the measures is provided within the publication Guidelines for farmers in NVZs – England\(^{16}\).

**Assessing the effectiveness of the Action Programme**

3.4 A key part of the life-cycle of any policy is a review of how effective it has been at achieving its objectives. Revisions to the policy may be needed if, for example, improvements are required to ensure its objectives are met.

3.5 The Nitrates Directive recognises this and requires Member States to monitor the effectiveness of their Action Programmes to enable a review of the measures at least every four years and, if necessary, to introduce reinforced or additional measures as appropriate.

3.6 In line with its obligations under the Directive, the Department has made an assessment of the effectiveness of the current Action Programme measures in promoting uptake of good agricultural practice and reducing losses of nitrogen to waters. This assessment is outlined in supporting paper D2 and in summary was based upon:

A. Measuring nitrate concentrations in waters

B. Measuring changes in farm practice

C. Measuring nitrate losses from agriculture

A. Measuring nitrate concentrations in waters

3.7 An improvement in water quality is the true test of the effectiveness of the Action Programme.

3.8 The Environment Agency monitors nitrate concentrations at thousands of surface water and groundwater monitoring points to identify trends in water quality. Whilst this data has identified reductions in nitrate concentrations in some areas, we cannot be confident that these downward trends will be sustained, and are not simply a short term fluctuation (e.g. due to the weather). Additionally, we can conclude that concentrations in many areas have either increased or remain high\(^{17}\).

B. Measuring changes in farm practice

3.9 Nitrate losses from agriculture will only be reduced if there is a change in farm practice. Therefore, the effectiveness of the Action Programme is reliant on the degree to which it brings about a change in farm practice.

3.10 The Department uses information on farm practice collected through regular surveys (e.g. Farm Practice Survey) and/or specific NVZ surveys to identify any changes.

3.11 A re-survey of farmers in NVZs in 2003\(^{18}\) identified that the greatest changes in practice were that more farmers keep records, and that they take more factors into account (i.e. the type of crop, application rate, fertiliser analysis, and supply of nitrogen from manures) more often when planning the use of manufactured fertiliser. Pig, poultry and dairy farms are most likely to describe the effects of being in an NVZ as being significant. However, the general view of the farmers surveyed is that being in an NVZ has had very little effect on their practices. Anecdotal evidence suggests that this could be for a number of reasons, including that the measures lacked clarity and that the most significant measures only applied to a small proportion of farmers in NVZs (e.g. those on shallow and sandy soils).

3.12 Surveys have also identified wider trends in agriculture that, whilst not driven by the NVZ Action Programme, could have an impact on water pollution. For example, total nitrogen fertiliser usage and livestock numbers have declined in recent years and could be expected to reduce agriculture’s contribution to water pollution. However, other changes, such as the continuing trend towards intensification, are likely to counteract this to some extent. Given the apparent lack of response in water quality to these current trends and the uncertainty with which they will persist in the future (i.e. trends driven by economics are unpredictable) and their locality, we cannot rely on these to deliver the improvements we are seeking in water quality and biodiversity.

\(^{17}\) Supporting paper D1, available via Defra website, summarises water quality data and trends

\(^{18}\) Supporting paper G2, available via Defra website, presents evidence of changes in farm practice due to the NVZ Action Programme
C. Measuring nitrate losses from agriculture

3.13 Solely relying upon measurements of nitrate concentrations in waters (as discussed under A) can create difficulties in assessing the impacts and the effectiveness of measures due to:

- the difficulty in detecting small changes against inherent background variability;
- the long time-scale for response (potentially many decades in some groundwaters or groundwater-fed surface waters);
- the difficulty in distinguishing the effect of measures from the effect of other factors (e.g. weather, changes driven by economics, epidemics such as Foot and Mouth disease); and
- the difficulty of attributing discernible impacts to individual policy measures.

3.14 To help overcome these difficulties, the Department commissioned a project which combines development of a modelling system for predicting the impact of measures, with field-level monitoring of nitrate losses from a range of commercial farms throughout England.

3.15 This project highlighted that a number of the Action Programme measures, whilst effective at reducing losses of nitrogen, only applied to very small areas of the country (e.g. the closed period for organic manures only applied to areas where slurry or poultry manure was applied to sandy or shallow soil). Therefore, the effectiveness of the Action Programme at tackling water pollution at the national scale was limited by the spatial application of its measures.

3.16 Using the models developed under this project, we estimate that the 2002 NVZ Action Programme, fully implemented, would reduce mean nitrate concentrations by about 2-7% in NVZs overall. This would help explain why monitored nitrate concentrations remain high and sustained downward trends are not widespread.

Conclusions

3.17 The evidence discussed above demonstrates that nitrate levels are still high and that the current Action Programme, whilst having an impact on nitrate losses in some small areas of the country, is unlikely to effectively reduce agriculture’s contribution to this problem at the national scale. Also, we cannot rely, with any degree of confidence, upon more general trends in agriculture to address the problem.

3.18 Therefore, if we are to achieve widespread, sustained downward trends in nitrate concentrations, we need to revise the Action Programme through the introduction of reinforced and/or additional measures. Improvements in the clarity and enforceability of some of the measures also needs to be improved.

19 Supporting paper G3, available via the Defra website, provides details of the project and its findings
Developing the revised Action Programme

3.19 The approach taken by the Department in developing the revised Action Programme was evidence-based and can be broken down into a number of steps:

A. Developing a good background understanding of nitrate loss from agriculture and the range of measures that farmers can take to mitigate these losses.
B. Identifying and shortlisting the nitrate mitigation measures to include in the Action Programme
C. Defining the chosen mitigation measures
D. Identifying the impacts of the chosen mitigation measures on nitrate pollution
E. Consulting on proposed Action Programme measures and refining as necessary – this step is ongoing

A. Understanding nitrate loss and mitigation measures

3.20 Nitrate losses vary from field to field and across the country due to the influences of soil type, environmental conditions, land use, and agricultural management practices. A large programme of research in recent years has developed the scientific understanding of the processes involved in nitrate loss which, in turn, has led to the identification of a wide range of actions that can be taken on farm to reduce these losses. The majority of these actions are included within the Code of Good Agricultural Practice.

3.21 During the development of the revised Action Programme we have reviewed this programme of research and compiled an inventory of the main nitrate mitigation measures that could potentially be included in the revised Action Programme\(^\text{20}\).

B. Shortlisting the nitrate mitigation measures

3.22 The next step was to choose which of the measures contained in the inventory should be developed and included within the revised Action Programme. One of the main factors influencing this choice were the legal obligations imposed by the Nitrates Directive (i.e. the Directive specifically lists the measures that must be included by way of rules in an action programme). We also wanted to ensure that the chosen measures, when combined into a package, would apply to a greater proportion of the NVZ (thereby addressing one of the main shortcomings of the current Action Programme).

\(^{20}\) Supporting paper D3, available via the Defra website, provides a summary of this review and the inventory of nitrate mitigation measures
C. Defining the chosen mitigation measures

3.23 It is essential to define the detail behind each measure for reasons of clarity. For example, whereas a description of a mitigation measure in a voluntary Code of Practice might suffice as ‘do not apply organic manure during high risk periods’, this definition would be inadequate for compliance and enforcement purposes and inclusion in Regulation. A precise definition is required, and so it would need to include details of specific dates, soil type restrictions, manure type restrictions, etc.

3.24 When defining the proposed Action Programme measures, the following factors were taken into account:

- **Losses of nitrogen**: The measures have been designed to reduce losses of nitrogen and to achieve the environmental objectives of the Nitrates Directive.

- **Pollution swapping**: The measures have been designed to minimise negative impacts, and maximise positive impacts, on losses of other pollutants to both air and water (e.g. phosphorus, ammonia).

- **Environmental factors**: Many factors, for instance soil type, climate and crop type, can all impact on the effectiveness of a mitigation measure.

- **Practicability**: The practical impacts of a measure on existing farm practices were considered when defining the measure.

- **Simplicity and Clarity**: Some of the proposed changes are to improve clarity, to ensure that farmers understand their obligations and how the Environment Agency will enforce compliance. This has broadly required moving much of the detail previously provided within guidance into the Action Programme itself.

- **Consistency**: Some of the proposed measures are similar to those required under other Regulations. Therefore, it is necessary to ensure that the Action Programme proposals are consistent with those other measures.

- **Flexibility**: There is a large variation in farming systems and practices in England. It was important, therefore, to build in a level of flexibility into the measures to enable farmers to continue to make decisions that are best suited to their individual circumstances.

- **Cost-effectiveness**: We have sought, within the constraints of the Nitrates Directive, to develop the revised measures in the most cost-effective way by targeting the measures in a way that is proportionate to the risk being addressed.

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21 Supporting paper D4, available via the Defra website, explains how the factors listed above were taken into account when defining the mitigation measures.
D. Predicting the impacts of the mitigation measures

3.25 Models have been used to predict the impacts of some of the main changes to the Action Programme to help us choose which definition of a measure would improve its effectiveness and minimise any pollution swapping (e.g. increased losses of ammonia or phosphorus)\(^2\).

E. Consultation and refinement of the mitigation measures – ongoing

3.26 Consultation with stakeholders is important as it is likely to lead to the development of a more effective Action Programme of measures. We have already engaged with stakeholders during the development of the proposed measures, which has led to some refinements. For example, during a series of workshops with farmers over winter 2005/2006, a number of practical issues surrounding the Action Programme measures were highlighted and we have tried to address these during the review.

3.27 This paper is our formal written consultation. The next chapter outlines the proposed Action Programme measures and highlights where there is specific scope for refinement – your comments are specifically invited in relation to these areas.

3.28 We intend to publish an analysis of responses to this consultation on the Defra website in December 2007. This will clearly indicate where and how we have refined our proposals in light of comments made.

\(^2\) Supporting paper D5, available via the Defra website, presents the outcomes of the modelling to predict the impacts of the main Action Programme measures.
Chapter 4 – Proposals for a revised Action Programme

4.1 This chapter outlines the proposed measures to be included in the revised Action Programme. Your views are sought on the proposed measures in general and, in particular, upon the questions highlighted. The environmental and economic impacts of the measures are summarised in Chapter 5.

Proposed Action Programme measures

4.2 The proposed measures are based upon good agricultural practice and reflect the culmination of the development process outlined in Chapter 3. Supporting papers provide the scientific rationale for these measures, explain how they were defined, and predict their impacts upon losses of a range of pollutants.

4.3 This package of measures represents what the Department considers to be the best way of:

- Achieving reductions in losses of nitrogen from agriculture (with associated benefits of improving water quality and enhancing biodiversity)
- Improving the efficiency with which nitrogen is used on farms
- Minimising pollution swapping
- Balancing achievement of environmental objectives with a sustainable agricultural industry
- Fulfilling our obligations under the Nitrates Directive

Question 3: The Department would welcome comments on the following proposed amendments to the Action Programme.

4.4 When making comments on the proposals you should be aware of the following:

- Some of the measures described below remain unchanged from the current Action Programme – these are provided in green text.
- The Nitrates Directive specifically lists the measures that must be included within an Action Programme and therefore there is little scope to remove completely many of the proposed measures.
- Given that the proposed measures represent what we consider to be our ‘best package’ we do not discuss alternative options. However, there may be some flexibility to refine individual measures in relation to their form or definition.
- Supporting paper C provides a draft of the Regulations that will implement the proposed Action Programme.
- Technical terms are defined in the glossary.

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23 Supporting paper D4, available via the Defra website, provides the rationale for the measures and explains how they were defined.
24 Supporting paper D5, available via the Defra website, presents the predicted impacts of the measures upon losses of nitrate, phosphorus and ammonia.
4.5 The proposed Action Programme measures are grouped under the following headings:
   i. Controlling when nitrogen is applied
   ii. Provisions for the storage of livestock manure
   iii. Limiting the amount of nitrogen applied to land
   iv. Controlling where nitrogen is applied
   v. Controlling how nitrogen is applied
   vi. Cover crops
   vii. Record-keeping

(i) Controlling when nitrogen is applied

Closed periods for organic manure

4.6 Organic manures with high available N (>30% of total N), such as slurry and poultry manure, must not be applied to land between the following dates:

<table>
<thead>
<tr>
<th>Average Annual Rainfall (mm per year)</th>
<th>Grassland</th>
<th>Arable land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sandy and Shallow</td>
<td>Sandy and Shallow</td>
</tr>
<tr>
<td></td>
<td>soils</td>
<td>soils</td>
</tr>
<tr>
<td>Up to 1050</td>
<td>1 Sep – 15 Dec</td>
<td>1 Aug – 31 Dec</td>
</tr>
<tr>
<td>Over 1050</td>
<td>1 Sep – 31 Dec</td>
<td>1 Aug – 15 Jan</td>
</tr>
<tr>
<td></td>
<td>1 Oct – 31 Jan</td>
<td>15 Sep – 31 Jan</td>
</tr>
</tbody>
</table>

4.7 Applications during the closed period will be permitted before 15\textsuperscript{th} September, on arable land with sandy and shallow soils, where the manure is applied and a crop is drilled by this date.

Closed periods for manufactured fertiliser

4.8 Manufactured nitrogen fertilisers must not be applied to land during the following periods:
   - Grassland = 15 September to 31 January
   - Arable land = 1 September to 31 January

4.9 Applications of manufactured nitrogen fertiliser during the closed period will be permitted to listed crops. Maximum application rates to these crops will also be specified\textsuperscript{25}.

4.10 Applications during closed periods will also be permitted on a case-by-case basis and if written advice is obtained from a FACTS qualified adviser.

Question 4: Are there other crops with an agronomic nitrogen requirement during the closed period? If so, are you aware of any evidence available to support this requirement?

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\textsuperscript{25} See Annex A1 for the list of permitted crops and maximum application rates. Supporting paper F1, available via the Defra website, provides the evidence underpinning this list.
Periods when the risk of runoff is high

4.11 Do not apply nitrogen fertiliser, including organic manures and manufactured fertilisers, when:

- the soil is either waterlogged, flooded, frozen hard or snow covered
- heavy rain is forecast within 48 hours

(ii) Provisions for the storage of livestock manure

Capacity of storage vessels

4.12 Farms that produce livestock manures with high available N (>30%) must provide the following storage capacity requirements:

- 26 weeks storage capacity for pig slurry and poultry manure
- 22 weeks storage capacity for all other slurry

4.13 Farmers will be required to use a standard procedure to calculate the volume to which this 22/26 weeks equates\(^\text{26}\). The calculation procedure will be broken down into the following steps:

- Calculating the volume of excreta produced by animals on the farm over the 22/26 week period. Farmers will be required to use standard excreta volumes\(^\text{27}\) provided in Regulation to undertake this part of the calculation.
- Calculating the volume of water collected and stored (if any) during the 22/26 week period.
- The sum of these two amounts represents the potential capacity of manure storage required.
- The following deductions from this potential capacity will be permitted in calculating the actual volume of storage required:
  - Volume of manure exported off the farm
  - Volume of solids separated from the slurry
  - Amount of poultry litter (i.e. a mixture of poultry excreta plus bedding) which is stored in an appropriately located, temporary field heap (see paragraph 4.15).

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\(^{26}\) Supporting paper E1, available via the Defra website, provides proposed guidance which sets out the storage capacity calculation

\(^{27}\) See Annex A2 for the standard excreta volumes. Supporting paper F2, available via the Defra website, provides the evidence underpinning these figures
Provisions for storage of solid livestock manures

4.14 Poultry litter and solid manures with low available nitrogen content (<30%) must be stored in an appropriate manner as follows:

- In the livestock house
- At a suitable, temporary field site (see below), or
- On concrete constructed to the appropriate standard (see paragraph 4.17).

4.15 The requirements for a suitable field site, for the temporary field storage of poultry litter and other solid livestock manures, include the following:

- Temporary field heaps must not be located within 50m of a spring, well or borehole or within 10m of a surface water or land drain.
- Temporary field heaps must not be located in any single position for more than 12 successive months.
- There must be a 2 year gap before returning to the same field site.

4.16 Pig buildings with scraped dunging passages, where it is intended to produce stackable solid manure there must be sufficient concrete yard area to retain the solid fraction for at least 1 month to allow drainage of liquids into a suitable slurry store.

Construction standards

4.17 Guidance will highlight that stores need to meet the construction standards set down in The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 (amended 1997).

(iii) Limiting the amount of nitrogen applied to land

The whole farm limit for livestock manures

4.18 Livestock manure loadings shall not exceed 170 kg/ha of total nitrogen each calendar year averaged over the farm.

4.19 This limit applies to:

- all livestock manures, including those deposited by grazing animals,
- all the agricultural land on the farm within the NVZ boundaries.
- all farms using livestock manures, whether producing them or importing them.

4.20 Compliance with the 170 kgN/ha limit must be calculated using a standard procedure as set out in guidance28.

28 Supporting paper E2, available via the Defra website, provides the proposed guidance which sets out the whole farm limit calculation
4.21 In undertaking the calculation, it should be noted that:

- Areas of woodland, roads and hardstanding must be excluded from the area of agricultural land.
- Imports and exports of livestock manure must be taken into account.
- Standard manure N production figures must be used\(^{29}\), except where alternative figures are derived via the following:
  - A Decision Support Tool (under development – see paragraph 6.23)
  - Manure analysis using a method approved by the EA. An approved sampling method is currently only available for solid manures from permanently housed pig and poultry units.

Note: The new manure N production figures make allowances for N losses in livestock housing and storage.

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**Question 5:** Are there other livestock categories for which standard manure N production figures would be useful?

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**Derogation from the 170kgN/ha whole farm limit for livestock manures**

4.22 The Nitrates Directive permits Member States to set a different limit from 170kgN/ha/yr for applications of livestock manures. Such derogations are temporary in nature (around four years) and are only permitted if it can be demonstrated that applying a higher limit will not undermine the achievement of the environmental objectives of the Directive.

4.23 We are currently compiling evidence to investigate whether there may be a case for establishing a higher limit (e.g. 250kg total nitrogen per hectare each calendar year averaged over the farm in relation to grazing systems on grassland farms).

4.24 A higher limit such as this will reduce the immediate economic pressure on grassland farms by enabling them to maintain current stock levels and make adjustments to the lower application rate of 170kgN/ha over a longer time period.

4.25 Once we have established the proposed Regulations, and if our evidence suggests that we have a sound case, we will approach the European Commission to obtain approval for allowing this higher limit.

4.26 If approval is given, we will issue amendment Regulations to establish the higher limit together with the terms and conditions for its application (e.g. a registration process may be required).

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**Question 6:** Do you feel there is a convincing justification for a derogation? If so, explain why?

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\(^{29}\) See Annex A2 for the standard manure N production figures. Supporting paper F2, available via the Defra website, provides the evidence underpinning these figures.
The protection of waters against pollution from agriculture

The field limit for organic manures

4.27 Organic manure must not be applied to any field where the application would result in the total nitrogen in kilograms contained in the organic manure applied in any calendar year exceeding a rate of 250 kg per hectare.

4.28 This limit does not include manures deposited by grazing animals and runs in conjunction with the whole farm limit.

Crop requirement limitation

4.29 Farmers must balance, at the field level, the foreseeable nitrogen requirements of the crops with the nitrogen supply to the crops from all sources including the soil, mineralization of reserves of organic nitrogen in the soil, additions of organic manures, and additions of manufactured fertiliser and other fertilisers.

4.30 To this end, farmers must be able to demonstrate (via the use of field records) that they have undertaken the following mandatory steps when planning their nitrogen fertiliser applications:

- Assessed the soil nitrogen supply
- Assessed the nitrogen requirement of the crop (taking into account Soil Nitrogen Supply)
- Assessed the nitrogen supplied to the crop from applications of organic manures
- Calculated the need for manufactured fertiliser nitrogen by deducting the contribution from organic manures from the nitrogen requirement of the crop

4.31 Compliance with this measure will also be assessed by checking that the average nitrogen application rate (from both manure and fertiliser) made to a particular crop type across the whole farm is not greater than crop requirement. Farmers will be required to use a standard procedure to undertake this assessment.

4.32 The calculation procedure can be summarised as:

\[ \text{Crop requirement (Nmax)} > \text{supply from organic manure (Total manure N x manure N efficiency)} + \text{supply from manufactured fertiliser} \]

Where:

- **Nmax** is the maximum nitrogen application rate that can be applied to a particular crop. The farmer will have to use standard reference figures when calculating Nmax for the main arable crops and grass.
- **Total manure N** is the total amount of nitrogen applied to that crop type via applications of organic manures. This is calculated by adding up all the organic manure applications made to that crop type across the farm divided by the total area of that crop. As with the whole farm limit for livestock manures, farmers will have to use

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30 See supporting paper E3, available via the Defra website, which provides the proposed guidance setting out the standard calculation procedure for the Nmax limit.

31 See Annex A3 for the Nmax limits. Supporting paper F1, available via the Defra website, provides the evidence underpinning these figures.
standard reference figures to work out the total amount of N within the livestock manure, unless alternative figures can be derived using an agreed Decision Support Tool (under development) or acceptable manure analysis.

- **Manure N efficiency** is the percentage of the total nitrogen in the manure that is available for uptake by the crop. Farmers will have to use standard reference figures which will be low at the start of the Action programme but will increase over time to drive an increase in the effective use of nitrogen in manures\(^{32}\).

- **Supply from manufactured fertiliser** is the average application rate for that crop type across the farm. This is calculated by adding up all the fertiliser applications made across the farm to a particular crop divided by the total area of land given over to that crop.

(iv) Controlling where nitrogen is applied

4.33 Manufactured fertiliser and organic manures must not be spread in locations which will cause either nitrogen-enriched surface run-off to enter, or nitrogen compounds to directly contaminate, surface waters.

4.34 To this end:

- All farmers within NVZs must undertake a written risk assessment procedure (based upon the Defra “Manure Management Plan - Step by Step Guide for Farmers”) to demonstrate they have identified locations on their farm suitable for spreading organic manure.

- Applications of nitrogen fertiliser to land with a steep slope (defined as land with an incline greater than 12 degrees\(^{33}\) or more) will be prohibited where, taking into account factors such as proximity to surface waters, soil condition, ground cover and rainfall, there is a significant risk of causing water pollution via runoff.

- Applications of organic manure within 50m of a spring, well or borehole shall be prohibited.

- Applications of organic manure within 10m of a surface water shall be prohibited.

- Applications of manufactured fertiliser within 2m of a surface water shall be prohibited.

4.35 Farmers must also undertake a field inspection to consider the risk of runoff prior to spreading (taking account of the factors listed above).

(v) Controlling how nitrogen is applied

4.36 Manufactured fertiliser and organic manures must not be spread in a manner which will cause either nitrogen-enriched surface run-off to enter, or nitrogen compounds to directly contaminate, surface waters.

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\(^{32}\) See Annex A4 for the manure N efficiency figures. Supporting paper F3, available via the Defra website, provides the evidence underpinning these figures.

\(^{33}\) Equivalent to 20% or 1 in 5
To this end:

- The use of high trajectory, high pressure techniques for making applications of organic manures will be prohibited.
- Nitrogen fertiliser must be applied in as uniform and accurate manner as possible.
- Organic manures with low available N applied to bare soils or stubbles prior to crop planting or drilling must be incorporated into the soil as soon as possible and within 24 hours at the latest on all sloping land that is located within 50m of a surface water and which could receive run-off from that land.
- Organic manures with high available N applied to bare soils or stubbles by broadcast methods prior to crop planting or drilling, must be incorporated into the soil as soon as possible and within 24 hours at the latest.

(vi) Cover crops

Cover crops are required where ground would otherwise be left bare over winter, except in the case of crops harvested after 1 September (e.g. sugar beet).

Notes:

The Nitrates Directive does not explicitly require cover crops to be included in the Action Programme (unlike all other measures presented in this chapter). However, we consider that the evidence\(^{34}\) indicates that they are a cost-effective measure for tackling diffuse water pollution. Additionally, advice on cover crops has been included within the Code of Good Agricultural Practice for the Protection of Water since 1991. It is also included in the ‘Minimising nitrate loss’ section of the proposed CoGAP.

- We are aware of links between this measure and some requirements of cross-compliance, and will be considering these if we need to develop the measure into a specific rule.

Question 7: We would welcome your views on the inclusion of cover crops within the Action Programme.

(vii) Record-keeping

All records must be kept for a minimum of five years and include the following:

- the calculation for compliance with the whole farm N limit (170 kgN/ha/yr), which will need to be updated when circumstances change
- the storage capacity calculation, which will need to be updated when circumstances change
- the fields in which poultry litter and other solid manure is stored

\(^{34}\) Supporting paper D3, available via the Defra website, contains evidence regarding the efficacy of cover crops.
• a copy of the written field risk assessment
• the Nmax calculation for each crop type grown on the farm
• annual field records of the balance between crop requirement and supply of nitrogen from all sources. The field records must contain details of:
  o The type of any crop grown and the date the crop is sown
  o Results of the assessment of soil nitrogen supply
  o Results of the assessment of the nitrogen requirement of the crop
  o The quantity and type of any organic manure applied to the field, the date of application, and the estimated supply of nitrogen to the crop.
  o The quantity of any manufactured fertiliser applied to the field, the nitrogen content, and the date of application

4.40 Farmers who import livestock manures on to the farm must keep details of:
• The type (animal origin and whether slurry or solid manure), quantity and their total nitrogen content
• The name and address of the supplier

4.41 Farmers who export livestock manures from the farm must keep records of:
• The type (animal origin and whether slurry or solid manure), quantity and their total nitrogen content
• The name and address of the recipient
• Details of a contingency plan (e.g. land in reserve or available for spreading) in the event that an export agreement fails

Technical note

When adapting farming practices to the proposed Action Programme measures, farmers will have to continue to respect any management agreements they have entered into (e.g. under Environmental Stewardship) and other legal obligations, such as the need to apply to Natural England for an Environmental Impact Assessment (EIA) screening decision before spreading slurry on uncultivated land or semi-natural areas\(^{35}\).

\(^{35}\) Information on the EIA is available via the EIA helpline: 0800 028 2140 or http://www.defra.gov.uk/farm/environment/land-use/eia/index.htm
Chapter 5 – Environmental and economic impacts

5.1 This chapter summarises the predicted environmental and economic impacts of some of the main measures of the proposed Action Programme. A full discussion of the impacts is provided in the partial Regulatory Impact Assessment\(^\text{36}\) (RIA) and your comments are sought on the assumptions that underlie our assessment.

Environmental impacts

5.2 Estimates of the extent to which the main measures of the proposed Action Programme will impact losses of pollutants from agriculture are provided in Table 1 below.

Table 1. Predicted environmental impacts of the Action Programme measures (% change)

<table>
<thead>
<tr>
<th>AP measure</th>
<th>Nitrate</th>
<th>Phosphorus</th>
<th>Ammonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole farm limit</td>
<td>0 to -0.5</td>
<td>0 to -0.5</td>
<td>0 to -0.3</td>
</tr>
<tr>
<td>Crop requirement limit</td>
<td>-1.0 to -6.0</td>
<td>0</td>
<td>~</td>
</tr>
<tr>
<td>Closed period: manufactured</td>
<td>0 to -1.0</td>
<td>0</td>
<td>~</td>
</tr>
<tr>
<td>Closed period: organic manure</td>
<td>-0.5 to -1.0</td>
<td>0 to -4.0</td>
<td>0.5 to 2.0</td>
</tr>
<tr>
<td>Cover crops</td>
<td>-4.0 to -7.0</td>
<td>~</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>-5.5 to -15.5</td>
<td>0 to -4.5</td>
<td>0.2 to 2.0</td>
</tr>
</tbody>
</table>

(Source: partial RIA)

Note: As the impacts are expressed as a ‘percentage change’, the above figures do not alter according to whether the Action Programme is applied within NVZs or across the whole of England.

5.3 This assessment does not include many of the other Action Programme measures, and therefore the anticipated reduction in nitrate and phosphorus is expected to be greater than that set out in Table 1.

5.4 We cannot be completely certain that the reductions in nitrate loss actually realised by the proposed Action Programme will be sufficient to achieve the environmental objectives we are seeking. Therefore future reviews will be required to monitor trends in water quality (these reviews will also be necessary to adapt the measures in response to climate change).

5.5 However, in general, we can expect the estimated reduction in nitrate and phosphorus losses to have a number of benefits including:

- Reduced risk of eutrophication in surface waters. This should lead to improvements in biodiversity and the condition of natural habitats, with increased opportunities for leisure and tourism.
- Protection of drinking water supplies. This should limit the need for costly, energy-intensive treatment of drinking water and consequently reduce the water industry’s carbon footprint.

\(^{36}\) The partial RIA is set out in supporting paper B, available via the Defra website.
The anticipated improvement in the use of organic manures will reduce the need for inputs of manufactured fertiliser, and will help reduce disturbance of the nitrogen cycle. This is expected to reduce losses of all forms of nitrogen from land to water and air, including losses of ammonia and nitrous oxide to air, and losses of nitrate and ammonium to water.

Impacts upon a range of other water pollutants, such as pathogens, ammonium-N and organic matter, have not been quantified. However, as they follow similar loss pathways to phosphorus, it can be assumed that the scale and direction of impact upon losses of these pollutants will be similar to that estimated for phosphorus.

In developing the Action Programme we have tried to minimise any negative environmental impacts. So although ammonia emissions are predicted to increase as a result of the closed period, the measures presented in Chapter 4 reflect what we consider to be the best approach for minimising those increases; other options we considered for the closed period were predicted to result in even greater losses (see the partial RIA for details).

As previously noted, the impacts presented in Table 1 do not cover all the proposed measures, some of which are expected to reduce ammonia emissions (e.g. incorporation of manure within 24 hours of application). Therefore, the predicted increase is likely to be an overestimate and the proposed Action Programme is not expected to significantly affect the UK’s ability to achieve its ammonia emissions target under the Gothenburg Protocol and National Emission Ceilings Directive.

Economic impacts

The principal costs arising from the amendments to the Action Programme are summarised in Table 2 below and are largely due to the following measures:

- Whole farm limit for organic manures – this may require farmers to export excess manure, purchase/rent additional land, or reduce the number of livestock kept on the farm.
- Slurry storage capacity requirement – this may require farmers to construct extra storage facilities.

A number of measures also require an element of planning and record keeping, which require time and effort to undertake and maintain (usually referred to as ‘administrative’ costs).

It should be noted that implementation of the revised Action Programme could, in some circumstances, lead to cost-savings that will act to mitigate the costs identified. For example, it is expected that the efficiency of nitrogen utilisation on farms will improve, thereby enabling farmers to reduce their input costs (e.g. manufactured fertiliser). Additionally, costs associated with de-stocking will be reduced substantially if a successful application can be made to the European Commission for a derogation from the whole farm limit.

The costs associated with eutrophication and the treatment of drinking water (as identified in paragraph 1.4) should also reduce, although the scale of these reductions has not been quantified at this stage and are therefore not reflected in Table 2 below.
Table 2. Predicted costs to agriculture of the proposed Action Programme measures (£m)

<table>
<thead>
<tr>
<th>Cost type</th>
<th>Targeted NVZs (70%)</th>
<th>Whole territory (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Admin</td>
<td>0.4</td>
<td>2.7</td>
</tr>
<tr>
<td>Slurry storage</td>
<td>18.6</td>
<td>24.1</td>
</tr>
<tr>
<td>Spreading</td>
<td>8.9</td>
<td>11.4</td>
</tr>
<tr>
<td>Destocking</td>
<td>16.0</td>
<td>20.9</td>
</tr>
<tr>
<td>Cover crops</td>
<td>8.8</td>
<td>46.3</td>
</tr>
<tr>
<td>Sub-total</td>
<td>52.8</td>
<td>105.5</td>
</tr>
</tbody>
</table>

Mitigating costs 17.3 24.7 26.0 37.3

Total 35.5 80.7 59.6 115.9

(Source: partial RIA)

Better Regulation

5.14 The Department is committed to improving the way it regulates and enforces regulation, and to keeping administrative burdens to a minimum. We will seek to do this, in relation to implementation of the proposed Action Programme, as follows:

5.15 We will aim to minimise the administrative costs by:

- Developing clear guidance, templates and computer software that will make the administrative tasks as straightforward as possible (see Chapter 6 for further details).
- Working with the EA to develop an integrated approach to enforcement.
- Basing many of the requirements upon existing plans, documents, rules etc. and permitting farmers to keep records in a range of different formats. This should enable them to continue/adapt any existing system they have in place.
- Requiring that records are updated only when required (e.g. when circumstances on the farm change).

5.16 We will aim to minimise the costs associated with implementing the whole farm limit for livestock manures by investigating whether we are able to make a case for a derogation and thereby establish a higher limit (see Chapter 4).

5.17 We will explore the possibility of simplifying the process for obtaining planning permission for the construction of new manure storage facilities and other manure management technologies (e.g. anaerobic digestion plants).

---

5.18 We will provide a range of advice and support to farmers (see Chapter 6) which will:

- Advise farmers how they can minimise the amount of additional manure storage they need by taking simple cost-effective actions such as covering existing stores with a roof to keep out rainwater.

- Ensure that farmers are aware of, understand, and are able to fulfil their obligations under the proposed Regulations, thereby avoiding potential penalties and sanctions.

- Enable farmers to adopt innovative approaches to managing their nutrients.

5.19 We will consolidate a number of existing Regulations relating to implementation of the Nitrates Directive, and revoke a number of redundant Regulations. This will reduce the complexity of the regulatory landscape.

### Regulatory Impact Assessment

5.20 The predicted impacts presented in Tables 1 and 2 are taken from our partial Regulatory Impact Assessment (RIA) and are based on a significant number of assumptions (hence the presentation of benefits and costs as ranges). The RIA provides a full discussion of how the costs and benefits were estimated.

5.21 The RIA also highlights that we have investigated the impacts of making a range of different amendments to our Action Programme (other than those presented below), which helps demonstrate ‘how’ and ‘why’ we have decided upon the proposals as presented in Chapter 4.

5.22 The RIA will be updated following the consultation in light of comments received and once Ministers have decided which proposals will be implemented.

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**Question 8:** The Department would welcome comments on the partial RIA and in particular on the accuracy of the assumptions that underlie the calculations.

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Note: see supporting paper G4 for specific questions.
6.1 This chapter outlines the action the Department is considering taking to help farmers understand and implement the revised Action Programme, and to promote uptake of innovative manure management technologies, such as anaerobic digestion. It also outlines the timetable for implementing the revisions to the NVZs and Action Programme and how the measures will be enforced.

Implementation and Enforcement

6.2 The likely timetable for implementing the revisions to the NVZs and Action Programme measures is outlined below.

<table>
<thead>
<tr>
<th>Table 3. Timetable for implementation of revised NVZs and Action Programme measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 07 – Nov 07</td>
</tr>
</tbody>
</table>
| Nov 07 – Dec 07 | Review responses to consultation  
                 | Choose option – NVZs or whole territory  
                 | Revise AP measures as appropriate  
                 | Ministerial announcement |
| Dec 07 – Feb 08 | Finalise NVZ maps (if applicable)  
                 | Develop Action Programme guidance |
| Feb 08 | Issue NVZ maps (if applicable)  
         | Issue Action Programme guidance |
| March 08 | Regulations come into force |

6.3 We recognise that a number of farmers will not be able to comply with some of the proposed measures straight away (e.g. it will take time to construct new slurry stores to comply with the storage capacity requirement). Therefore, we are proposing that farmers are given reasonable time to adjust to some of the new measures (see the draft Regulations\(^{38}\) for details of transitional arrangements for individual measures).

6.4 The EA will continue to be the competent authority for assessing and taking appropriate action in relation to compliance with the revised Regulations, and will be responsible for monitoring the level of nitrate pollution in our waters. The Regulations will maintain the powers needed by the Environment Agency to continue these duties.

6.5 The EA is adopting an integrated approach to enforcement, endeavouring to cover all environment protection issues on a farm in one visit. This is cost-effective and minimises the time a farmer has to spend with an inspector. Inspections will be targeted at those farms where the risk to the environment of non-compliance with regulations is greatest. For individual farms, compliance with regulations may in time lead to reduced frequency of inspections.

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38 The draft Regulations are set out in supporting paper C, available via the Defra website.
6.6 The Action Programme under the Nitrates Directive is also a Statutory Management Requirement (SMR) for cross compliance under the Single Payment Scheme. This means that farmers will have to comply with the revised Action Programme measures to be entitled to their full subsidy payment; failure to comply could lead to deductions from their payment.

Advice and Support

6.7 The Department already uses a wide range of mechanisms and tools for delivering advice and guidance in relation to NVZs, good nutrient management and other related policies.

6.8 To ensure that farmers are aware of, understand, and are able to fulfil their obligations under the proposed Regulations, the Department is developing a range of advice and guidance – as outlined below. As far as possible, this will be provided by adapting and updating existing mechanisms and tools to be consistent with the proposed Action Programme rules. We will also develop new tools where necessary.

6.9 It should be noted that no new central Government money will be made available for assisting farmers with the costs of constructing new or additional manure storage capacity under the revised Action Programme.

Rural Development Programme for England 2007-2013

6.10 The analysis of the evidence base for the draft Rural Development Programme for England 2007-2013 (RDPE)\(^39\) found that “there is a major need to reduce the level of water and air pollution resulting from agriculture. This will be driven at least in part by the requirements of the Nitrates and Water Framework Directives. Meeting these challenges will require a range of instruments including advice, regulation and cross-compliance. Incentives will, however, also need to play a part, particularly during the period where farmers are adapting to the new, higher standards”.

6.11 The Department has recently announced that £98m of voluntary modulation money to be spent under Axis 1 of the RDPE will be dedicated to the livestock sector. This support will be delivered through the Regional Delivery Agencies (RDAs).

6.12 Managing nutrients, including innovative approaches for handling manures (e.g. slurry separation, anaerobic digestion) is one of the three areas where the RDAs will focus support. However, in line with the polluter pays principle, there should be no expectation that the funding will be provided to directly support meeting the new Action Programme measures.

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Defra website

6.13 The Defra website\(^{40}\) will act as a key portal for obtaining up-to-date information on NVZ policy developments, access to detailed NVZ maps, electronic copies of guidance documents, dates and details of NVZ workshops/events, and downloads of the Decision Support Tools.

Helpline

6.14 We are considering providing a helpline for farmers to help them determine whether they are in an NVZ and interpret the implications of the Action Programme measures in relation to the specific circumstances on their farm.

Guidance booklets

6.15 Following the expansion of NVZs in 2002, the Department produced two booklets specifically aimed at providing farmers with guidance on how to comply with the Action Programme measures: Guidelines for farmers in NVZs and Manure Planning in NVZs. We are intending to replace these booklets with similar guidance in support of the revised Action Programme. This will include the calculation procedures which are set out in supporting papers \(E1 – 3\).

6.16 Additionally, the series of booklets ‘Managing Livestock Manures’\(^{41}\) provides practical guidance on the management of manure applications to land. This guidance can be used to help farmers identify how they can improve the efficiency with which manure nutrients are used by arable crops and grassland.

Decision Support Tools

6.17 The Department has funded the production of a number of technical documents and pieces of computer software that can be used by farmers and their advisers to undertake the detailed calculations and decision-making processes necessary to comply with the Action Programme measures. Examples of some Decision Support Tools include:

6.18 **Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209)**\(^{42}\) – This reference book describes the principles of crop nutrition and gives recommendations for the use of lime, fertilisers and organic manures for field crops and grassland grown in England and Wales. It is currently being revised and will be replaced by a new Fertiliser Manual which will provide essential guidance and information to enable compliance with the ‘crop requirement limit’.

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\(^{41}\) Available via [http://www.defra.gov.uk/farm/environment/land-manage/fertilisers.htm](http://www.defra.gov.uk/farm/environment/land-manage/fertilisers.htm)

6.19 **PLANET**\(^{43}\) – This is a computerised version of the RB209 book (see 6.180. It provides a quick and easy way of obtaining RB209 recommendations for arable, horticultural or grassland crops in each field, each year, taking account of the crop nutrient requirement as well as the nutrients supplied from organic manures, soil and fertilisers. This will be updated when RB209 is replaced and will allow farmers to print out field records to demonstrate their compliance with the ‘crop requirement limit’. It will also be updated to include functions that will help farmers calculate their compliance with the ‘whole farm limit for organic manures’ and ‘storage capacity’ requirement.

6.20 **MANNER**\(^{44}\) – This software tool can be used to accurately predict the fertiliser nitrogen value of organic manures on a field specific basis. MANNER has been developed using results from the latest research on organic manure utilisation on agricultural land. The figures generated by this software could be used be used to help demonstrate compliance with the ‘crop requirement limit’.

6.21 **Nutrient Management Plan** – The Department is developing a step-by-step guide to help farmers plan the most efficient use of nutrients on their farm. This will help them gain the maximum economic benefit from nutrients whilst minimising environmental impacts. We intend the plan to become an industry standard so that a farmer can use it to demonstrate compliance with a wide range of regulations and schemes (including the Action Programme).

6.22 **Manure Management Plan**\(^{45}\) – This booklet provides a step-by-step guide to help farmers produce a plan for spreading livestock manures, slurries and organic wastes on their farm in a manner that will minimise the risk of causing water pollution. The written risk assessment, referred to under the proposed measures for ‘controlling where nitrogen is applied’, is based on this booklet.

6.23 **“Poocollator”** – This software tool is currently under development. It is intended that it will accurately predict the total amount of nitrogen in manures produced by different livestock. These figures can be used in the calculation procedure for the ‘whole farm limit’ instead of the standard reference figures contained within the Regulations.

**NVZ technical workshops**

6.24 It is our intention to run a series of workshops throughout the country to help farmers and advisers get to grips with some of the technical aspects of the revised Action Programme measures. These events will be held over winter 2007 and details will be published on the Defra website nearer the time.

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\(^{43}\) Available via [http://www.planet4farmers.co.uk/welcome/index.html](http://www.planet4farmers.co.uk/welcome/index.html)

\(^{44}\) Available via [http://www.adas.co.uk/manner/frameset.html](http://www.adas.co.uk/manner/frameset.html)

Other

6.25 To ensure the Department disseminates consistent advice and guidance to farmers we will also be working towards linking the Action Programme rules into other existing publications and advice mechanisms such as:

- The Whole Farm Approach
- Guidance on cross-compliance
- Farm advice contracts

Question 9: The Department would welcome comments on the advice and support you consider necessary for implementation of the revised Action Programme. What is the best format for providing this? Would you prefer specific advice relating to the Action Programme, or advice integrated into wider best practice and environmental issues?

Innovation in handling manures – Anaerobic Digestion

6.26 A number of Regulations, including the proposed Action Programme, are likely to mean that farmers will have to make substantial changes to the manner in which they manage manure. The role of innovative solutions and technologies, such as anaerobic digestion (AD), could, in some circumstances, become critical in enabling farmers to comply with these Regulations. These technologies could also turn wider environmental challenges, such as climate change and the need to develop renewable sources of energy, into an opportunity for the UK agricultural sector to make a positive environmental contribution and generate additional income.

6.27 The Government is particularly keen to promote the potential of anaerobic digestion. It is an effective source of renewable energy that can reduce greenhouse gas emissions from agriculture by capturing methane from manures and slurries. (Methane is a greenhouse gas with a global warming potential 21 times that of carbon dioxide over a 100-year time horizon.) Similarly, it can help to reduce emissions from landfill by diverting organic waste, especially food waste. The methane can be used as a renewable energy source, both for heat and power, and as a transport fuel. The treated liquid (or digestate) can be used as a fertiliser. This can replace mineral fertiliser, the production of which requires significant energy input. In this way it can provide additional benefits in terms of reducing greenhouse gas emissions.

6.28 The odour from animal slurries treated by anaerobic digestion is significantly lower than that of raw slurry applications. By destroying pathogens, anaerobic digestion reduces the risks of pollution of water from faecal indicator organisms (FIos). It also has the potential to reduce uncontrolled methane, ammonia and nitrous oxide emissions. However in order to fully realise these benefits, it is important that the system is operated well and that the digestate is correctly applied to land so that the nutrients can be used effectively.

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46 Anaerobic digestion involves harnessing the natural process whereby organic matter is broken down by bacteria in the absence of oxygen. The materials ferment in a closed vessel and produce a biogas which is a mixture of about 60% methane and 40% carbon dioxide, with other trace gases, such as hydrogen sulphide. Anaerobic digestion can be carried out in small scale systems, for example located on the farm and operated by farmers, or to serve businesses (or clusters of businesses) with large food waste arisings. Alternatively it can be carried out in large centralised systems, for example to treat manures and slurries from several farms or municipal food waste being diverted from landfill by local authorities.
6.29 We are working to establish the full potential of the market for digestate. Crucial steps are the development of a standard and protocol. These would provide regulatory clarity and confidence in its recovery on land. The Environment Agency and WRAP (Waste and Resources Action Programme) aim to develop a standard and protocol for digestate by Spring 2008. WRAP will support the development of the market for digestate alongside its work to establish markets for waste-derived compost.

6.30 More broadly, the UK Biomass Strategy and the Waste Strategy for England, which were published in May 2007, set out how we will work with stakeholders to drive a faster growth in the use of anaerobic digestion by local authorities, businesses and farmers, in a way that is both cost effective and beneficial to the environment. Our objective is to stimulate and develop the markets for anaerobic digestion and its products, and to address the administrative and technical challenges which may hamper its development.

6.31 We are examining whether there is a role for Government intervention to help overcome barriers to investment in the anaerobic digestion sector. The electricity derived from anaerobic digestion is eligible for market support through Renewable Obligation Certificates (ROCs). Alongside the May 2007 Energy White Paper, the Government launched a consultation on differentiated support levels for different renewables technologies (known as “banding”) for comment by 6 September 2007. Under these proposals anaerobic digestion is among the technologies that would receive additional support in the form of multiple ROCs, namely 2.0 ROCs/MWh. This would provide an additional incentive to deploy this technology. We are also examining the case and prospective mechanisms for long term support for the renewable heat sector and possible means to support the development of local infrastructure and supply chains.

6.32 There are also a number of administrative and technical challenges faced by potential operators of anaerobic digestion plants which need to be addressed. We are encouraging and facilitating communication between interested parties in industry, regulators, government delivery bodies and non-governmental bodies about meeting these challenges. We will work with stakeholders to develop and disseminate information on best practice and technology for the use of anaerobic digestion in a way that is both cost effective and beneficial to the environment, for example through Defra’s New Technologies Demonstrator Programme and through advice to farmers. We will also build on our existing research to improve the contribution of anaerobic digestion technology to reducing greenhouse gas emissions and delivering other environmental benefits.

More information on Anaerobic Digestion and what action the Government is taking to support its uptake is available in the Anaerobic Digestion Working Paper, published alongside the UK Biomass Strategy\(^47\).

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Question 10: The Department would welcome your ideas on how we can facilitate a greater uptake in anaerobic digestion. What are the main barriers? How can these be overcome?

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Abbreviations and Acronyms

AD – Anaerobic Digestion
AP – Action Programme
CoGAP – Codes of Good Agricultural Practice
CSF – Catchment Sensitive Farming
Defra – Department for Environment, Food and Rural Affairs
DWPA – Diffuse Water Pollution from Agriculture
EA – Environment Agency
ES – Environmental Stewardship
EU – European Union
IPPC – Integrated Pollution Prevention and Control
MANNER – MANure Nitrogen Evaluation Routine
N – Nitrogen
NMP – Nutrient Management Plan
NVZ – Nitrate Vulnerable Zone
PLANET – Planning Land Applications of Nutrients for Efficiency and the Environment.
RB209 – Fertiliser Recommendations for Agricultural and Horticultural Crops
RDPE – Rural Development Programme for England
RIA – Regulatory Impact Assessment
ROCs – Renewable Obligation Certificates
RPA – Rural Payments Agency
SMR – Statutory Management Requirement
UK – United Kingdom
UWWTD – Urban Waste Water Treatment Directive
WFA – Whole Farm Approach
WFD – Water Framework Directive
Definitions of terms

Designation of NVZs

<table>
<thead>
<tr>
<th>Nitrate vulnerable zone (NVZs)</th>
<th>an area of land designated in accordance with Article 3 of the Nitrates Directive as a vulnerable zone for the purposes of that Directive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing NVZs</td>
<td>NVZs designated either in 1996 or 2002</td>
</tr>
<tr>
<td>Additional NVZs</td>
<td>NVZs proposed for designation in 2008</td>
</tr>
</tbody>
</table>

Action Programme measures

(i) Fertiliser

<table>
<thead>
<tr>
<th>Nitrogen fertiliser</th>
<th>any substance containing a nitrogen compound or nitrogen compounds utilised on land to enhance growth of vegetation. It includes “manufactured fertiliser” and “organic manure”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufactured fertiliser</td>
<td>any nitrogen fertiliser, excluding those derived from organic materials, which is manufactured by an industrial process</td>
</tr>
<tr>
<td>Organic manure</td>
<td>includes livestock manure and any nitrogen fertiliser derived from organic matter. It includes sewage sludge and other organic materials.</td>
</tr>
<tr>
<td>Livestock manure</td>
<td>manure excreted by livestock, or a mixture of bedding material and manure excreted by livestock, even in processed form</td>
</tr>
<tr>
<td>Solid manure</td>
<td>manure that contains enough bedding material or is dry enough to be stacked</td>
</tr>
<tr>
<td>Farmyard manure</td>
<td>straw-based solid manures</td>
</tr>
<tr>
<td>Slurry</td>
<td>excreta produced by livestock while in a yard of building, including mixtures with bedding, rainwater and washings, that have a consistency that allows them to be pumped or discharged by gravity at any stage of the handling process. Very dilute wastes such as parlour washings and run-off from lightly fouled yards are excluded, providing they do not include liquid effluent from silage or stored slurry.</td>
</tr>
<tr>
<td>Poultry manure</td>
<td>all poultry-produced manures and litters</td>
</tr>
<tr>
<td>Poultry litter</td>
<td>a mixture of bedding material and poultry excreta which is sufficiently dry to be stored in a stack without slumping</td>
</tr>
<tr>
<td>Excreta</td>
<td>any livestock manure that is excreted by livestock that is deposited on the land whilst livestock are grazing in the field</td>
</tr>
<tr>
<td>High available N content</td>
<td>in relation to organic manure, means more than 30% of the total N content of the organic manure is released in the year in which it is applied to land. Examples include cattle and pig slurry, poultry manure, and liquid digested sludge.</td>
</tr>
<tr>
<td>Low available N content</td>
<td>in relation to organic manure, means less than 30% of the total N content of the organic manure is released in the year in which it is applied to land. Examples include Farm Yard Manure.</td>
</tr>
</tbody>
</table>
## (ii) Soil

<table>
<thead>
<tr>
<th>Sandy soil</th>
<th>soil where -</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) in the layer up to 40 cm deep, there are –</td>
<td></td>
</tr>
<tr>
<td>(i) more than 50 per cent by weight of sand sized particles (particles from 0.06 to 2mm in diameter),</td>
<td></td>
</tr>
<tr>
<td>(ii) less than 18 per cent by weight of clay sized particles (particles less than 0.02 mm diameter), and</td>
<td></td>
</tr>
<tr>
<td>(iii) less than 5 per cent by weight of organic carbon, and</td>
<td></td>
</tr>
<tr>
<td>(b) in the layer from 40 to 80 cm depth, the sum of the percentage, by weight, of silt sized particles (particles between 0.02 and 0.06 mm in diameter) and double the percentage, by weight, of clay sized particles is less than or equal to 30% of the total weight of sand, silt and clay sized particles</td>
<td></td>
</tr>
</tbody>
</table>

| Shallow soil | soil which is less than 40 cm deep |

| All other soils | means all soils which are not sandy or shallow |

## (iii) Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>any vegetation which is grown for agricultural profit or benefit, including grains, vegetables and fruit, grass and forage, horticulture and bulbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring sown crop</td>
<td>any crop which is sown after 1 January and before 31 July in any year</td>
</tr>
<tr>
<td>Grassland</td>
<td>land on which the vegetation consists predominantly of grass species</td>
</tr>
</tbody>
</table>

| Crop requirement | the amount of nitrogen fertiliser which it is reasonable to apply to land in any year having regard to the foreseeable nitrogen requirement of the crop growing or to be grown on the land and the nitrogen supply to the crop from the soil and from other sources, including any previous applications of livestock and other organic manures |

| Soil nitrogen supply | the amount of nitrogen (kgN/ha) in the soil that becomes available for uptake by the crop from establishment to the end of the growing season, taking account of nitrogen losses |

## (iv) Land application

<table>
<thead>
<tr>
<th>Land application</th>
<th>the addition of nitrogen fertilisers to land, whether by spreading on the surface of the land, injection into the land, placing below the surface of the land or mixing with the surface layers of the land; this does not include livestock manure that is deposited directly to land by grazing animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading</td>
<td>the addition of nitrogen fertilisers to land by any means other than gaseous or natural atmospheric deposition. It includes land application of nitrogen fertilisers and organic manures and includes deposition of livestock manures and urine directly to land by grazing animals</td>
</tr>
</tbody>
</table>
### (v) General

<table>
<thead>
<tr>
<th><strong>Calendar Year</strong></th>
<th>a period of 12 months starting on 1st January of each year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Competent authority</strong></td>
<td>the Environment Agency</td>
</tr>
<tr>
<td><strong>Farm</strong></td>
<td>an area or areas of land and its buildings, which is used for the growing of crops or rearing of livestock, and includes livestock units and any outlying fields all of which form part of an individual farm business</td>
</tr>
<tr>
<td><strong>FACTS</strong></td>
<td>Fertiliser Advisers Certification and Training Scheme</td>
</tr>
<tr>
<td><strong>Occupier</strong></td>
<td>includes,</td>
</tr>
<tr>
<td></td>
<td>• Owner-occupier</td>
</tr>
<tr>
<td></td>
<td>• Tenant with a full agricultural tenancy –a tenancy agreement normally with lifetime security and subject to the provisions of the Agricultural Holdings Act 1986, including statutory succession tenancies.</td>
</tr>
<tr>
<td></td>
<td>• Tenant with a Farm Business Tenancy –a tenancy agreement taken up on or after 1 September 1995 under the provisions of the Agricultural Tenancies Act 1995.</td>
</tr>
<tr>
<td><strong>Standard reference figures</strong></td>
<td>figures contained within data tables appended to the Regulations for use within mandatory calculations (see <strong>Annex A</strong>).</td>
</tr>
</tbody>
</table>
### Mandatory reference figures for use in calculations

#### A1 – Crops with a nitrogen requirement during the closed period

<table>
<thead>
<tr>
<th>Crop</th>
<th>Maximum nitrogen rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oilseed rape, winter</td>
<td>30</td>
</tr>
<tr>
<td>Asparagus</td>
<td>50</td>
</tr>
<tr>
<td>Broccoli, purple sprouting</td>
<td>100</td>
</tr>
<tr>
<td>Cabbage, over-wintered spring</td>
<td>100</td>
</tr>
<tr>
<td>Cauliflowers, winter hardy/Roscoff</td>
<td>100</td>
</tr>
<tr>
<td>Leeks</td>
<td>40</td>
</tr>
<tr>
<td>Onions, bulb</td>
<td>40</td>
</tr>
<tr>
<td>Onions, over-wintered salad</td>
<td>40</td>
</tr>
<tr>
<td>Parsley</td>
<td>40</td>
</tr>
<tr>
<td>Grazed grass</td>
<td>80</td>
</tr>
</tbody>
</table>

#### A2 – Volumes of livestock excreta and manure N output standards

(i) for pigs:

<table>
<thead>
<tr>
<th>Stock</th>
<th>Age</th>
<th>Liveweight kg</th>
<th>Daily Excreta(^1) kg or l</th>
<th>Annual N output(^2) kg per place/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 sow including litters</td>
<td>Litter to 3 weeks (7kg)</td>
<td></td>
<td>10.9</td>
<td>15.9</td>
</tr>
<tr>
<td>Weaner – 1(^{st}) stage</td>
<td>22-40 days</td>
<td>7-12</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Weaner – 2(^{nd}) stage</td>
<td>41-73 days</td>
<td>13-30</td>
<td>2.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Grower</td>
<td>74-120 days</td>
<td>31-65</td>
<td>3.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Finisher</td>
<td>121-164 days</td>
<td>66-100</td>
<td>5.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Maiden gilt</td>
<td>121 – 200(^{3}) days</td>
<td></td>
<td>6.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Boar</td>
<td>Adult</td>
<td></td>
<td>8.7</td>
<td>17.5</td>
</tr>
</tbody>
</table>

Notes:-

1 – estimated daily output of dung + urine; with FYM systems, straw addition included
2 – N output in manures per animal place, after estimation of gaseous N losses, during the housing period and manure storage, as appropriate
3 – Age of gilts at first mating
4 – a figure of 18 kg per place/year should be used on farms which use less amino acids.
(ii) for cattle:

<table>
<thead>
<tr>
<th>Stock</th>
<th>Age</th>
<th>Liveweight / Milk yield* kg</th>
<th>Daily Excreta(^1) kg or l</th>
<th>Annual N output(^2) kg / yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cow</td>
<td>&gt; 2 years</td>
<td>High (&gt;9000)*</td>
<td>64</td>
<td>110</td>
</tr>
<tr>
<td>Dairy cow</td>
<td>&gt; 2 years</td>
<td>Medium (6000 – 9000)*</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>Dairy cow</td>
<td>&gt; 2 years</td>
<td>Low (&lt;6000)*</td>
<td>53</td>
<td>75</td>
</tr>
<tr>
<td>Dairy heifer replacement</td>
<td>13 – 24 months</td>
<td></td>
<td>40</td>
<td>59</td>
</tr>
<tr>
<td>Dairy heifer replacement</td>
<td>3 – 12 months</td>
<td></td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>Beef suckler</td>
<td>&gt; 2 years</td>
<td>Large (&gt; 500)</td>
<td>45</td>
<td>82</td>
</tr>
<tr>
<td>Beef suckler</td>
<td>&gt; 2 years</td>
<td>Small (&lt; 500)</td>
<td>32</td>
<td>61</td>
</tr>
<tr>
<td>Grower</td>
<td>&gt; 2 years</td>
<td></td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>Grower</td>
<td>13 – 24 months</td>
<td></td>
<td>26</td>
<td>50</td>
</tr>
<tr>
<td>Grower</td>
<td>3 – 12 months</td>
<td></td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>Bull beef</td>
<td>3 – 15 months</td>
<td></td>
<td>26</td>
<td>54</td>
</tr>
<tr>
<td>Bulls for breeding</td>
<td>&gt; 2 years</td>
<td></td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>Bulls for breeding</td>
<td>3 – 24 months</td>
<td></td>
<td>26</td>
<td>50</td>
</tr>
<tr>
<td>Calf</td>
<td>2 months</td>
<td></td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes:-
\(^1\) estimated daily output of dung + urine
\(^2\) N output in manures per animal place, after estimation of gaseous N losses, during the housing period and manure storage, as appropriate.
(iii) for sheep, goats, deer and horses.

<table>
<thead>
<tr>
<th>Stock</th>
<th>Class or Age</th>
<th>LW kg</th>
<th>Daily Excreta kg or l</th>
<th>Annual N output(^1) kg per place/year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sheep</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill ewe + lamb</td>
<td>Lamb @ 30-35 kg</td>
<td>40 – 55</td>
<td>4.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Lowland ewe + lamb</td>
<td>Lamb @ 35-40 kg</td>
<td>60 – 80</td>
<td>4.1</td>
<td>11.1</td>
</tr>
<tr>
<td>Store lamb – lowland</td>
<td>Short store</td>
<td>35 – 50</td>
<td>1.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Store lamb – lowland</td>
<td>Long store</td>
<td>35 – 50</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Goat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milking goats</td>
<td></td>
<td></td>
<td>4.1</td>
<td>15.1</td>
</tr>
<tr>
<td><strong>Deer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeding hinds</td>
<td></td>
<td></td>
<td>5.0</td>
<td>14.3</td>
</tr>
<tr>
<td>Calves – finishers</td>
<td></td>
<td></td>
<td>3.5</td>
<td>11.8</td>
</tr>
<tr>
<td><strong>Horse</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult horse</td>
<td></td>
<td></td>
<td>24.5</td>
<td>18.2</td>
</tr>
</tbody>
</table>

Notes:-

\(^1\) – N output in manures per animal place, after estimation of gaseous N losses, during the housing period and manure storage, as appropriate
(iv) for poultry:

<table>
<thead>
<tr>
<th>Stock</th>
<th>Age</th>
<th>Daily Excreta(^1) kg or l</th>
<th>Annual N output(^2) kg per bird place/year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement layer pullets</td>
<td>&lt; 16 weeks</td>
<td>0.04</td>
<td>0.21</td>
</tr>
<tr>
<td>Laying hens – cages</td>
<td>17 – 72 weeks</td>
<td>0.12</td>
<td>0.40</td>
</tr>
<tr>
<td>Laying hens – free range</td>
<td>17 – 72 weeks</td>
<td>0.12</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>Broilers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broiler places</td>
<td>40 days</td>
<td>0.06</td>
<td>0.33</td>
</tr>
<tr>
<td>Broiler breeder pullets</td>
<td>&lt; 24 weeks</td>
<td>0.04</td>
<td>0.29</td>
</tr>
<tr>
<td>Broiler breeders</td>
<td>25 – 60 weeks</td>
<td>0.12</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>Turkeys</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>0.16</td>
<td>1.23</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>0.12</td>
<td>0.91</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks</td>
<td></td>
<td>0.4</td>
<td>0.75</td>
</tr>
<tr>
<td>Ostriches</td>
<td></td>
<td></td>
<td>0.78</td>
</tr>
</tbody>
</table>

Notes:-
\(^1\) – estimated daily output of droppings per bird; with litter addition where appropriate
\(^2\) – N output in manures per bird place, after estimation of gaseous N losses, during the housing period
The Protection of Waters against Pollution from Agriculture

### A3 – Maximum nitrogen requirements for crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>N max (kg/ha N)</th>
<th>Standard yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat, autumn or early winter sown</td>
<td>220&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>8.0</td>
</tr>
<tr>
<td>Wheat, spring-sown</td>
<td>180&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>7.0</td>
</tr>
<tr>
<td>Barley, winter</td>
<td>180&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>6.5</td>
</tr>
<tr>
<td>Barley, spring</td>
<td>150&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.5</td>
</tr>
<tr>
<td>Oilseed rape, winter</td>
<td>250&lt;sup&gt;d,e&lt;/sup&gt;</td>
<td>3.5</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>120</td>
<td>n/a</td>
</tr>
<tr>
<td>Potatoes</td>
<td>270</td>
<td>n/a</td>
</tr>
<tr>
<td>Forage maize</td>
<td>150</td>
<td>n/a</td>
</tr>
<tr>
<td>Field beans</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Peas</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Grass</td>
<td>360&lt;sup&gt;f,g,h&lt;/sup&gt;</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**Exemptions**

a. An additional 20kgN/ha is permitted on fields with a shallow soil type.

b. An additional 20kgN/ha is permitted for every tonne that expected yield exceeds ‘standard yield’.

c. An additional 40kgN/ha is permitted to milling wheat varieties.

d. This consists of a maximum autumn application of 30kgN/ha (allowed as exemption to the closed period for manufactured nitrogen fertiliser –see Annex A1) and a maximum spring application of 220kgN/ha.

e. The spring application can be increased by up to 30kgN/ha if expected yield is over 4.0t/ha.

f. An additional 40kgN/ha is permitted to grass to grass that is cut only.

g. An additional 40kgN/ha is permitted to grass in areas of a very good grass growth class.

h. Nmax for grass will be 330kgN/ha after 1 January 2012.
### A4 – Efficiency of nitrogen supply to crops from organic manures

<table>
<thead>
<tr>
<th>N fertiliser</th>
<th>Crop availability (% total N applied) in year of application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From 1 January 2009</td>
</tr>
<tr>
<td>Manufactured</td>
<td>100</td>
</tr>
<tr>
<td>Cattle slurry</td>
<td>20</td>
</tr>
<tr>
<td>Pig slurry</td>
<td>25</td>
</tr>
<tr>
<td>Poultry manure/litter</td>
<td>20</td>
</tr>
<tr>
<td>FYM(^1)</td>
<td>10</td>
</tr>
</tbody>
</table>

\(^1\)N efficiency values do not increase over time as there are no closed periods for FYM (a low available N manure)

Note: Where other organic materials (e.g. biosolids, green waste compost) are applied to land, full allowance should be made for their crop available N supply as outlined in RB209 or as calculated by MANNER or PLANET