

**EXPLANATORY MEMORANDUM TO**  
**THE NITRATE POLLUTION PREVENTION REGULATIONS 2008**

**2008 No. 2349**

1. This explanatory memorandum has been prepared by The Department for Environment Food and Rural Affairs and is laid before Parliament by Command of Her Majesty.

This memorandum contains information for the Joint Committee on Statutory Instruments

2. **Description**

2.1 The Regulations revoke 13 pieces of legislation relating to nitrate water pollution from agriculture and replace Regulations implementing the 1991 EC Nitrates Directive in England. The aim of the Directive is to reduce the amount of nitrates from agriculture entering waters now and in the future through an Action Programme of controls on the use and management of manures and fertilisers in areas designated ‘nitrate vulnerable zones’ (NVZs). These Regulations increase the total land area designated as NVZs in England and amend the Action Programme measures.

3. **Matters of special interest to the Joint Committee on Statutory Instruments**

None

4. **Legislative Background**

4.1 The Regulations implement European Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (OJ No. L375, 31.12.1991,p1). A Transposition Note is attached at Annex 1.

4.2 The Directive came into force in December 1991 and was implemented in domestic legislation in the following Regulations which are revoked and replaced by these Regulations insofar as they apply in England:

- The Protection of Water against Agricultural Nitrate Pollution (England and Wales) Regulations 1996
- The Action Programme for Nitrate Vulnerable Zones (England and Wales) Regulations 1998
- The Protection of Water Against Agricultural Nitrate Pollution (England and Wales (Amendment) Regulations 2006

4.3 The Directive establishes a four-yearly review cycle for assessment of areas designated as NVZs and the effectiveness of the Action Programme measures. These Regulations are being made in order to update our implementation of the Nitrates Directive following reviews carried out in 2005/2006. Those reviews were undertaken in the context of ongoing infraction proceedings against the UK, initiated by the European Commission in October 2004, in relation to our implementation of the Directive.

4.4 Following the reviews, an extensive consultation exercise was undertaken in the second half of 2007 to seek stakeholders' views on a number of proposals. This resulted in over 600 responses from stakeholders and prompted two Parliamentary debates and an inquiry by the House of Commons Select Committee on Environment, Food and Rural Affairs. The Government Response to the consultation, which had Cabinet office and cross-Departmental clearance, was published on 21 July 2008 and set out how the Government intended to give the proposals regulatory effect, taking account of stakeholders' comments within the constraints of meeting Directive requirements. The Regulations reflect the approach set down in the Government Response.

## **5. Territorial Extent and Application**

5.1 This instrument applies to England.

5.2 Scotland and Wales will be bringing in similar Regulations which will have similar dates for coming into force as the English Regulations.

## **6. European Convention on Human Rights**

As the Nitrate Pollution Prevention Regulations 2008 are subject to negative resolution procedure and do not amend primary legislation, no statement is required.

## **7. Policy background**

### ***Policy***

7.1 The costs of tackling nitrate pollution are high:

- For the period 2005-2010, the cost to water companies of treatment necessary to meet drinking water quality standards has been estimated at **£288 million** (capital expenditure) and **£6 million per annum** (operating expenditure). These costs are not static and are set to rise as nitrate concentrations in groundwaters continue to increase. Treatment is an energy intensive process which contributes to emissions of greenhouse gases.
- Eutrophication can adversely affect the biodiversity of aquatic habitats and reduce the value of water as a resource (e.g. recreational/amenity use). It has been

estimated that the total annual cost of water pollution in relation to river and wetland ecosystems and natural habitats in England and Wales is approximately **£716 - £1,297million**.

7.2 The reviews undertaken in England in 2005/06 as part of the Directive's cyclical review requirement showed that, despite some localised reductions in recent years, nitrate concentrations in England's ground and surface waters remain high in many parts of the country, with levels often exceeding 50mg per litre (the threshold for taking action established in the Nitrates Directive). There are also a number of water bodies continuing to display signs of eutrophication<sup>1</sup> (another criterion established in the Directive for identifying a polluted water and taking action).

7.3 The conclusion from the reviews was that the NVZ area needs to be increased (from the current 55% to about 70% of England) and that Action Programme measures should be revised to achieve better effectiveness in reducing nitrate loss to water. These Regulations reflect the outcome of the reviews and also take account of points raised by the European Commission in the infraction proceedings. They also reflect that the Directive prescribes certain measures that must be included in an Action Programme covering when, where, how and how much nitrogen from manures and fertilisers is applied to land, although the detail of the measures is left to member states' discretion.

7.4 The prescriptive nature of the Directive limits the scope for non-regulatory action, although the discretions allowed for defining the detail of the rules, have been fully explored and utilised in drawing up the revised Programme. The nitrates controls in these Regulations will sit alongside the many voluntary actions farmers are already taking (for example, through following the Code of Good Agricultural Practice) to adjust farming practices to minimise their impact on water bodies. A revised Code has been developed and is expected to be published at or around the same time as these Regulations.

7.5 The key changes brought in by these Regulations are:

- An annual farm loading limit of 170 kg. per hectare for nitrogen from livestock manures will apply to all land (this controls stocking density by linking manure production on farm to land available for spreading and previously a higher limit was allowed on grassland)
- The 'closed periods' when the spreading of organic manures is banned are longer and are extended to all soil types (only high risk sandy and shallow soils were subject to this control in the current Regulations)
- Storage capacity requirements have been amended to reduce the risk of manures being spread when conditions are unsuitable (for some farmers this will mean an increase in the capacity they must provide and additional capital investment)
- The introduction of forward planning rules to ensure nitrogen applications to land from manures and fertilisers are more accurately balanced to crop needs.

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<sup>1</sup> Excess nutrients, such as nitrogen and phosphorus, can result in accelerated growth of aquatic plants, such as algae and seaweed, leading to an undesirable disturbance in the water environment and deterioration of water quality

7.6 The Action Programme measures established in the Regulations are considered to be sufficient to fulfil our legal obligations under the Nitrates Directive and balance achievement of environmental objectives with a sustainable farming industry. It is worth noting that the revisions bring us into line with the level of action being taken in many other member states.

### *Consultation*

7.7 Proposals to revise the existing Regulations following the reviews were subject to public consultation from 21 August to 13 December 2007.

7.8 From the outset, there has been extensive engagement with stakeholders through workshops and meetings. This continued through a series of regional information events which were held during the consultation period.

7.9 The consultation generated a large amount of interest including:

- A total of 609 written responses, three-quarters of which were from farmers
- Over 2700 attendees at the information events
- Two Parliamentary debates
- An inquiry by the House of Commons Select Committee on Environment, Food and Rural Affairs (EFRA)<sup>2</sup>
- A large number of Parliamentary Questions and letters from MPs to the Department
- Considerable media interest

7.10 A summary analysis of the issues raised by stakeholders in both written responses to the consultation and at the information events was provided in the report published on the Defra website on 19 March 2008

<http://www.defra.gov.uk/environment/water/quality/nitrate/pdf/consultation-supportdocs/summary-responses.pdf> . The responses from the farming sector, while not supportive of the proposals, were generally constructive, focusing principally on the practical implications of some of the measures. Since the consultation closed, there has been further dialogue with representatives of both farming and environmental interests to explore the scope for amending the proposals to take account of stakeholders' views. The Government's response to the consultation can be seen at <http://www.defra.gov.uk/environment/water/quality/nitrate/pdf/gov-responses-consultation.pdf> . It sets down the approach to be taken in the Regulations and includes some changes to the consultation proposals to take account of stakeholders' comments within the constraints of satisfying the requirements of the Nitrates Directive.

7.11 Stakeholder and media reaction to the Government Response has been muted, but a higher level of interest is expected following the laying of these Regulations.

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<sup>2</sup> A report presenting the conclusions and recommendations of the Committee was published on 10 June 2008 (<http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvfru/412/412.pdf>)

*Guidance*

7.12 A comprehensive package of practical guidance material is being developed together with an extensive programme of advice, including workshops and a helpline, to support implementation of the Regulations. This will start to be rolled out in October, well in advance of the Regulations coming into force on 1 January 2009.

**8. Impact**

8.1 An Impact Assessment is attached to this Memorandum.

8.2 No significant impact on the public sector is anticipated.

**9. Contact**

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**Transposition Note for the Nitrates Directive (91/676/EEC) and Public Participation Directive (2003/35/EC) in so far as it concerns the Action Programme established under the Nitrates Directive**

**The Nitrates Directive**

This note sets out how the Nitrates Pollution Prevention Regulations 2008 (the “Nitrates Regulations”) transpose the main elements of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (the “Nitrates Directive”).

The Regulations are made under section 2(2) of the European Communities Act 1972 (the Secretary of State is designated by SI 2008/301 in relation to the environment) and apply only in relation to England. The Devolved Administrations have put in place (or are in the process of putting in place) their own regulations and administrative arrangements for implementing the Directive.

The Nitrates Regulations do not go beyond what is necessary to implement the Nitrates Directive, including making consequential changes to domestic legislation to ensure its coherence in the area to which they apply.

The Nitrates Regulations revoke a number of existing regulations which previously implemented the Nitrates Directive in England, including:

- SI 1996/888 which designated approximately 8% of England as Nitrate Vulnerable Zones (NVZs) and transposed a number of other Articles of the Directive.
- SI 1998/1202 which established an Action Programme within the NVZs and completed England’s implementation of the Nitrates Directive.
- SI 2002/2614 which extended the NVZs to 55% of England.

The main effect of the Regulations is to increase the extent of the NVZs to 70% of England and to reinforce many of the measures contained within the Action Programme.

**The Public Participation Directive**

Directive 2003/35/EC (the “Public Participation Directive”) requires member states to ensure certain measures are in place to allow the public to participate in the drawing up of certain environmental plans and programmes that are required under existing legislation. To that end, the Government has amended various environmental regulations to include provisions which allow for the participation of the public.

Amongst the various amending regulations made to implement the Public Participation Directive is SI 2006/1289 (The Protection of Water Against Agricultural Nitrate Pollution (England and Wales) (Amendment) Regulations 2006). This amended the regulations which established an Action Programme within NVZs in England (SI 1998/1202) and established the public’s right to participate in the drawing up of amendments to that Action Programme.

The Nitrates Regulations revoke SI 2006/1289 but carry over the relevant provisions to ensure continued implementation of the Public Participation Directive and to maintain the established rights of the public to participate in the drawing up of amendments to the Action Programme.

## Nitrates Directive

Article	Objective	Implementation	Responsibility
3(1) and (2)	<p><b>Designating Nitrate Vulnerable Zones</b></p> <p>Requires member states to identify polluted waters (in accordance with criteria laid down in Annex I of the Directive) and to designate as nitrate vulnerable zones all areas of land draining to these polluted waters and contributing to the pollution.</p>	<p>Regulation 7 designates the areas of England marked on the set of maps entitled “Nitrate Vulnerable Zones (England 2008)” as Nitrate Vulnerable Zones.</p> <p>The definitive version of the maps is available in the Departmental library and can be viewed for illustrative purposes on the internet via <a href="http://nvz.adasis.co.uk/maps">http://nvz.adasis.co.uk/maps</a>. The NVZs cover approximately 70% of England’s land area. A description of how the polluted waters in England, and the land draining to the polluted waters, were identified will be provided in a paper available on the Department’s website entitled “Implementation of the Nitrates Directive 91/676/EEC) - Description of the methodology applied in identifying waters and designating Nitrate Vulnerable Zones in England (2008)”</p> <p>Regulations 8, 9 and 10 provide owners or occupiers of holdings with land in NVZs a process for appealing against the designation of their land as an NVZ.</p>	Secretary of State
3(4)	<p><b>Review of NVZs</b></p> <p>Requires member states to review their nitrate vulnerable zones at least every four years.</p>	<p>Regulation 11 sets out when and how NVZs will be reviewed in England.</p> <p>NVZs were originally designated in England in 1996 (SI 1996/888). These were reviewed and additional designations were made in 2002 (SI 2002/2614). These were reviewed in 2005/2006 and these new Regulations give effect to this review by making the relevant designations (Regulation 7 as described above).</p>	Secretary of State
3(5)	<p><b>Exemption from designating NVZs</b></p> <p>Establishes that member states are exempt from designating nitrate vulnerable zones if the Action Programme is applied throughout their national territory.</p>	<p>Following consultation the decision was taken to apply the Action Programme within discrete NVZs and <u>not</u> throughout the whole of England. Therefore this provision does not apply in England.</p>	Secretary of State
4	<p><b>Establishing a code of good</b></p>	<p>No provision is required in the Regulations as the code of good agricultural practice is voluntary.</p>	Secretary of State

	<p><b>agricultural practice</b> Requires member states to establish and promote a voluntary code of good agricultural practice which contains at least the measures set out in Annex IIA of the Directive (measures listed at Annex IIB are optional).</p>	<p>A code of good agricultural practice for the protection of water, containing a section on nitrate loss, was first published in England in 1998. This contained all the mitigation measures set out in Annex IIA of the Directive and thus was considered to implement this Article of the Directive.</p> <p>A revised version of the code will be published in autumn 2008. This too will include a section on 'minimising nitrate loss to water' which will contain all the measures set out in Annex IIA of the Directive.</p>	
5(1)	<p><b>Establishing an Action Programme</b> Requires member states to establish and implement a mandatory Action Programme within the designated nitrate vulnerable zones for the purposes of achieving the objectives of the Directive.</p>	<p>An Action Programme was established within designated NVZs in England in 1998 (SI 1998/1202).</p> <p>The Regulations revoke SI 1998/1202 and replace it with a revised Action Programme within NVZs in England (Parts 3 – 8 of the Regulations).</p> <p>Part 10 of the Regulations also provide the following provisions relating to implementation of the Action Programme in England:</p> <ul style="list-style-type: none"> <li>• Identification of the Environment Agency as the body responsible for enforcement of the Regulations (Regulation 49)</li> <li>• Identification of what constitutes an offence and to whom the penalties apply in the case of an offence (Regulation 48).</li> </ul>	Secretary of State
5(2) and (3)	<p><b>Drawing up an Action Programme</b> Highlights that an Action Programme may relate to all vulnerable zones, or different Programmes can be established in relation to different zones and requires member states to take into account available scientific and technical data and the environmental conditions in the relevant regions when drawing up the Action Programme(s).</p>	<p>No provision required in the Regulations.</p> <p>Relevant scientific and technical data, and consideration of the environmental conditions present in England, were taken into account when drawing up the revised Action Programme. The evidence underpinning the Action Programme is available in a series of papers published on the Department's website <a href="http://www.defra.gov.uk/environment/water/quality/nitrate/directive.htm">http://www.defra.gov.uk/environment/water/quality/nitrate/directive.htm</a></p>	Secretary of State

5(4) and (5)	<p><b>Content of an Action Programme</b> Requires member states to include within their Action Programme(s):</p> <ul style="list-style-type: none"> <li>the measures contained in Annex III of the Directive plus the measures contained in the code of practice (except where they are superseded by Annex III measures)</li> <li>such reinforced actions or additional measures as they consider necessary if it becomes apparent that the measures listed in Annex III are not sufficient for achieving the environmental objectives of the Directive.</li> </ul>	<p>The original Action Programme, established by SI 1998/1202, contained all the measures listed in Annex III of the Directive and contained in the code of good agricultural practice. However, the measures failed to have a significant effect on nitrate losses from agriculture and it was concluded that they were insufficient to achieve the objectives of the Directive. It was therefore considered necessary to revise and reinforce these Action Programme measures</p> <p>The Regulations contain all the measures listed in Annex III of the Directive and contained in the code of good agricultural practice (Parts 3 – 8 of the Regulations). These measures are reinforced versions of those contained within the original Action Programme.</p>	Secretary of State
5(6) and (7)	<p><b>Review of the Action Programme</b> Requires member states to establish a suitable monitoring network for assessing the effectiveness of the Action Programmes and to review the effectiveness of their Action Programmes at least every four years.</p>	<p>Regulation 46 sets out how and when the effectiveness of the Action Programme will be reviewed.</p> <p>A research project was set up in England in 2004 to monitor the effectiveness of the NVZ Action Programme measures. A review of the original Action Programme (SI 1998/1202) was undertaken in 2006 which led to the conclusion that the measures should be reinforced. The project is ongoing and will inform the next review of the new Action Programme. The approach taken under the project is closely aligned to that recommended within the EC Monitoring Guidelines drafted under Article 7 of the Directive.</p>	Secretary of State
6	<p><b>Monitoring waters for nitrate pollution</b> For the purpose of designating nitrate vulnerable zones, requires member states to monitor nitrate concentrations in</p>	<p>Regulation 11 sets out that freshwaters will be monitored regularly over a period of one year at least every four years, and also requires the review of the eutrophic state of waters. A reference to the methods of measurement set out in Annex IV is also provided in Regulation 11.</p>	Secretary of State

	freshwaters over a period of one year, and to repeat this monitoring at least every four years. It also requires member states to review the eutrophic state of their fresh surface waters, estuarial and coastal waters. Member states are to use the reference methods of measurement set out in Annex IV.		
10	<b>Reporting requirements</b> Requires member states to submit a report to the European Commission every four years regarding the state of implementation of the Directive.	No provision required in the Regulations as this has been implemented through administrative means.  UK sent last report in 2004. Next report will be sent later in 2008.	Secretary of State, Scottish and Northern Irish Executives, Welsh Assembly

#### **Public Participation Directive**

<b>Article</b>	<b>Objective</b>	<b>Implementation</b>	<b>Responsibility</b>
2	Requires that member states ensure the public is given early and effective opportunities to participate in the preparation and modification or review of the plans or programmes required to be drawn up under the provisions listed under Annex I (this included the EC Nitrates Directive)	Regulation 47 sets out that the public will be given early and effective opportunity to participate in the four yearly review of the Action Programme .	Secretary of State

## Summary: Intervention & Options

<b>Department /Agency:</b> <b>Defra</b>	<b>Title:</b> <b>Impact Assessment of proposals to revise the Nitrates Action Programme and extend the Nitrate Vulnerable Zones (NVZs)</b>	
<b>Stage:</b> Implementation	<b>Version:</b> Final	<b>Date:</b> August 2008
<b>Related Publications:</b> Consultation on the implementation of the Nitrates Directive (August 2007), plus supporting papers including the partial Regulatory Impact Assessment.		

**Available to view or download at:**

<http://www.defra.gov.uk/environment/water/quality/nitrate/index.htm>

**Contact for enquiries:** Simon Dawes

**Telephone:** 020 7238 5494

**What is the problem under consideration? Why is government intervention necessary?**

Nitrate pollution is of concern because it can make water unfit for drinking unless expensive pre-treatment is available, it can damage the aquatic environment, and reduce aesthetic value so that waters are no longer suitable for recreational use. Agriculture is the source of a substantial proportion of nitrogen entering surface waters. The negative impacts of this pollution are external costs, since they are not taken into account by farmers in their production and land management decisions. Intervention is therefore justified to 'internalise' this externality and prevent pollution reaching undesirable levels.

**What are the policy objectives and the intended effects?**

To revise NVZ designations and Action Programme measures, to secure greater protection of the water environment against nitrogen pollution from agricultural activities in England, in order to meet specific objectives of the Nitrates Directive and the wider, long term environmental objectives of the Water Framework Directive.

Intended effects: reduce nitrate pollution from agriculture to a level consistent with full compliance with the Nitrates Directive.

**What policy options have been considered? Please justify any preferred option.**

Options are based on combinations of NVZ coverage and targeting of Action Programme measures:  
NVZ coverage: 55% i.e. do nothing (NVZ Option 1); 70% (NVZ Option 2); 100% (NVZ Option 3).

Action Programme: do nothing (AP Option A); Revised, uniform measures (AP Option B); Revised, targeted measures (AP Option C); Revised measures with further targeting (AP Option D).

**AP Option D with 70% NVZ coverage** is the chosen option as it delivers similar benefits to the other options, but at a lower cost, as it concentrates on delivering nitrate reductions where there would be

**When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?** The Nitrates Directive requires a review of the NVZs and Action Programme every four years. The next review in England will commence in 2010, finishing in 2012.

**Ministerial Sign-off** For final proposal/implementation stage Impact Assessments:

*I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.*

Signed by the responsible Minister:

Phil Woolas

.....Date: 1st September 2008

## Summary: Analysis & Evidence

**Policy Option: NVZ  
Option 2, Action Plan  
Option D**

**Description: Increase NVZ Coverage from 55% to 70% with revised action plan measures, targeted where benefits are greatest.**

<b>COSTS</b>	<b>ANNUAL COSTS</b>		Description and scale of <b>key monetised costs</b> by 'main affected groups' Most costs will be borne by the farming industry, and range from 1-30% of farm business profit. Possibility of reducing costs by £16.9m - £21.7m per annum if we are successful in our application for a derogation for dairy farmers. These do not include enforcement costs to the EA of £2.4m - £3.4m per annum. Costs are discounted over 20 years at 3.5% discount rate.	
	<b>One-off</b> (Transition)	<b>Yrs</b>		
	£			
	<b>Average Annual Cost</b> (excluding one-off)			
	£ 48.5m – 68.6m		<b>Total Cost (PV)</b>	£ 655.1m - 1009m
Other <b>key non-monetised costs</b> by 'main affected groups' Costs to farmers of obtaining planning permission for new buildings where necessary, for example for storage facilities.				

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>		Description and scale of <b>key monetised benefits</b> by 'main affected groups' Market benefits to water companies and consumers of reduced drinking water treatment, monetised reduced environmental externalities of diffuse water pollution, both ecological and to recreational users of water courses. Benefits are discounted over 20 years at 3.5% discount rate.	
	<b>One-off</b>	<b>Yrs</b>		
	£			
	<b>Average Annual Benefit</b> (excluding one-off)			
	£ 1.77m – 18.4m		<b>Total Benefit (PV)</b>	£ 28.1m - 274.2m
Other <b>key non-monetised benefits</b> by 'main affected groups' The principal non-monetised benefit is of reduced nitrate pollution in coastal waters				

**Key Assumptions/Sensitivities/Risks** There are large uncertainties around the values both for the environmental impacts, and costs to farmers. This is because the impact of a tonne of nitrates and other pollutants is site specific. Costs to farmers are also uncertain and volatile, and also depend on their behavioural response. This is reflected in the large ranges for costs and benefits, and means that no best estimate of the net benefit can be provided.

Price Base Year 2006	Time Period Years 20	<b>Net Benefit Range (NPV)</b> £ -380.9m to -980.8m	<b>NET BENEFIT (NPV Best estimate)</b> £ N/A (see above)	
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What is the geographic coverage of the policy/option?				70% of England	
On what date will the policy be implemented?				1 January 2009	
Which organisation(s) will enforce the policy?				Environment Agency	
What is the total annual cost of enforcement for these organisations?				£ 2.4m - 3.4m	
Does enforcement comply with Hampton principles?				Yes	
Will implementation go beyond minimum EU requirements?				No	
What is the value of the proposed offsetting measure per year?				£ N/A	
What is the value of changes in greenhouse gas emissions?				£ 744k to £957k	
Will the proposal have a significant impact on competition?				No	
Annual cost (£-£) per organisation (excluding one-off)		Micro	Small 62 - 3336	Medium	Large
Are any of these organisations exempt?		No	No	N/A	N/A

<b>Impact on Admin Burdens Baseline</b> (2005 Prices)				(Increase - Decrease)	
Increase of	£ 0.4m-2.6m	Decrease of	£ 0	<b>Net Impact</b>	£ 0.4m-2.6m

Key:

Annual costs and benefits: Constant Prices

(Net) Present Value

## Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

### The Nitrate Pollution Prevention Regulations 2008

#### 1. Purpose and intended effect of proposal

##### 1.1 Objective

To implement the EC Nitrates Directive (91/676/EEC) through the introduction of Regulations which:

- Designate areas of England as Nitrate Vulnerable Zones (NVZs),
- Establish an Action Programme of measures within the NVZs, and
- Establish the transitional arrangements, enforcement powers, monitoring and review requirements, public participation obligations, and appeals mechanisms necessary for implementation of the Regulations.

The objective of the policy is to reduce water pollution caused by nitrogen from agricultural sources. This is an important step towards achieving the wider, long term environmental objectives of the Water Framework Directive and will help achieve other national environmental commitments (e.g. target of getting 95% of Sites of Special Scientific Interest (SSSI) into a favourable or recovering condition by 2010).

##### 1.2 Background

###### 1.2.1 The Nitrates Directive

The Nitrates Directive, adopted by the EU in 1991, aims to reduce water pollution caused by nitrogen from agricultural sources and to prevent such pollution in the future.

The Directive requires Member States to:

- (under Article 3) designate as vulnerable zones all land draining and contributing to waters that are identified as polluted. Annex I of the Directive lists the criteria to be used in the identification of polluted waters. Member States are exempt from this obligation if they choose to apply the Action Programme throughout their national territory.
- (under Article 4) establish a voluntary code of good agricultural practice for all farmers throughout their national territory. Annex II of the Directive lists the measures to be included within this code.
- (under Article 5) establish action programmes, in respect of designated vulnerable zones, for the purposes of achieving the objectives of the Directive. The Action Programme is to contain those measures listed in Annex III of the Directive and those included in the code of good agricultural practice.
- (under Articles 3 and 5) review the extent of their vulnerable zones and the effectiveness of their Action Programmes at least every four years and to make amendments as appropriate.

## **1.2.2. Implementation of the Nitrates Directive in England**

### *Code of Good Agricultural Practice (COGAP)*

Paragraphs 284-295 of the Code of Good Agricultural Practice for the Protection of Water (the "Water Code") (1991, MAFF) are aimed at providing all waters with a general level of protection against nitrate pollution.

The Water Code is currently being updated with a consultation on the revised code (which will incorporate measures to protect water, soil and air) launched in August 2007 (now closed). This will contain a specific section on 'Minimising Nitrate Loss', which we intend to use to fulfil our obligations under Article 4 of the Directive.

### *Nitrate Vulnerable Zones (NVZs)*

To date, England has chosen to designate discrete NVZs, which currently cover approximately 55% of land in England. Interactive field boundary maps of these designations are available on the Defra website.

A review of NVZ designations, as required under Article 3 of the Directive, indicates the need to increase the designations to approximately 70% of England. This Impact Assessment (IA) considers the impact, in terms of costs and benefits, of this increase.

### *Action Programmes*

An Action Programme of measures for farmers in NVZs was established in 1998. Further detail of these measures can be found in the Defra booklet "Guidelines for Farmers in NVZs – England" (PB5505).

A review of Action Programme measures, as required under Article 5 of the Directive, indicates the need to revise existing measures. This Impact Assessment considers the impact, in terms of costs and benefits, of proposed amendments to Action Programme measures that apply in NVZs in England.

## **1.3 Rationale for Government Intervention**

### **1.3.1 The policy argument**

Water pollution caused by nitrogen (N) is of concern because it can make water unfit for drinking unless expensive pre-treatment is available. It can also damage the aquatic environment and reduce aesthetic value so that waters are no longer suitable for recreational use.

An apportionment study (WRc, 2003) has estimated that around 60% of N entering surface waters in England and Wales comes from agriculture. This is perhaps unsurprising given that agriculture covers around 75% of the land area of England and that substances that cause water pollution (manufactured fertilisers, organic manures, even the soil itself) are essential, integral elements of the farmer's business.

The apportionment study also shows that the amount of N (kt/yr) in waters that derives from agricultural land appears to have risen by about 15% since 1983, offsetting some of the N reduction achieved through improved discharge standards at sewage treatment works during

the same period. Although there have been some localised reductions in recent years, nitrate concentrations in ground and surface waters remain high in many parts of England, with waters often exceeding 50mg/l nitrate. 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 potential.

ADAS (2007b) was commissioned to assess the effectiveness of current Action Programme measures, combining modelling with on-farm measurements of N leaching from commercial farms within NVZs. Analysis of data from this project indicates that the current Action Programme, fully implemented, would reduce N by 5 - 15%, in sandy and shallow soil areas with livestock, and by about 2-7% overall. Reductions are expected to be very small in areas with no livestock.

The greatest changes are predicted on sandy and shallow soils, which typically overlie groundwaters. These changes are important, but in most cases cannot yet be directly measured because changes in leaching from the land will take many years to be fully reflected in the water sampled at the borehole. In surface water catchments, changes are expected to be smaller, and are difficult to detect against the background variations in nitrate concentrations in sampled waters. There is also difficulty attributing discernible impacts to individual agricultural policy measures or other factors such as the weather, economic changes or animal disease outbreaks.

The conclusion is that nitrate levels are still high and that the current Action Programme measures, 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.

### **1.3.2 The legal argument**

We have a legal obligation to implement the EC Nitrates Directive. The Directive requires Member States to review and, if necessary, revise NVZ designations and Action Programme measures at least every four years. Action Programmes must contain all of the following mandatory measures:

- the measures in Annex III of the Directive,
- those measures which Member States have prescribed in the code(s) of good agricultural practice.

Member States must take additional measures or reinforced actions as deemed necessary to achieve the objectives of the Directive. This includes tightening the existing measures or introducing new measures beyond those stated in the Directive. Failure to do so may result in infringement proceedings by the European Commission and significant financial penalties for non-compliance.

Furthermore, compliance with the Nitrates Directive is a Statutory Management Requirement under the Cross Compliance component of the Single Farm Payment Scheme and a basic measure under the Water Framework Directive (WFD). Action Programme measures under the Nitrates Directive will form part of a wider package of measures (including voluntary schemes) developed under the Catchment Sensitive Farming programme to deliver WFD objectives (i.e. good chemical and ecological status in waters).

### **1.3.3 The economic argument**

As stated above (Section 1.3.1), agriculture is the source of a substantial proportion of N entering surface waters. The negative impacts of this pollution are external costs, since they are not taken into account by farmers in their production and land management decisions. In other words, farmers generally only consider their own private costs when making these decisions, and do not factor in the wider impacts on society.

Intervention is therefore justified to 'internalise' this externality, with the aim of enabling farmers to face the true costs of their farm practices and thus adjusting resource use to a level that is consistent with the social (rather than the private) optimum.

Two particular types of intervention may be justified in this instance, corresponding to two types of market failure. The first is a continuation of the external costs argument above, and follows from the 'polluter pays principle' – namely that, as the source of N pollution, the agriculture sector should bear the costs of moving from the current situation towards the social optimum. This suggests the use of a mechanism such as a regulation or tax to increase the costs of polluting activity, hence driving positive behavioural change in farmers (the polluter) that subsequently reduces the number of activities causing the release of nitrogen into surface waters.

The second relates to information failure – the idea that farmers may undertake an activity which causes the release of nitrogen into surface waters because they are unaware of the consequences of this activity. This calls for the provision of information and advice to help farmers take better account of their actions.

## 2. Proposals

### 2.1 Options for Consultation

A number of options were developed and assessed in relation to potential revisions to the extent of NVZ designations and the measures contained within the Action Programme. These were the subject of a consultation, launched in August 2007, on implementation of the Nitrates Directive in England.

#### 2.1.1 Nitrate Vulnerable Zones (NVZs)

Three options were considered:

NVZ Option 1: “Do nothing” – This option involves retaining the existing NVZ designations in England, which cover approx. 55% of land. Costs and benefits of the other options are incremental to this option.

NVZ Option 2: Increase NVZ designations to give effect to the outcome of the recent review, which indicates the need to increase in NVZ coverage to approximately 70% of land in England.

NVZ Option 3: Applying the Action Programme measures to all land in England (100% NVZ coverage)

#### 2.1.2 Action Programme (AP)

Four options were considered:

AP Option A: Do nothing – This option involves retaining the existing Action Programme measures. Costs and benefits of the other options are incremental to this option.

AP Option B: Introduce revised, uniform Action Programme Measures – This option involves adjusting the requirements of the current Action Programme and apply the revised measures to the same stringency in all NVZs. Specifically:

- Reducing the whole farm loading limit for all livestock manures to 170kgN/ha.
- Establishing a storage capacity requirement of 26 weeks for pig and poultry units and 22 weeks for cattle (high available N manures only).
- Extending the closed periods for organic manures with high available N to all soil types and increasing their length as outlined in Table 1 below.
- Introducing a range of measures limiting the use and application of manufactured nitrogen fertilisers and organic manures in NVZs.

**Table 1:** Option B closed periods

Grassland	Arable land
5 months (1 Sept – 1 Feb)	6 months (1 Aug – 1 Feb)

AP Option C: Introduce revised, targeted Action Programme Measures – As option B but this option makes use of the flexibility, allowed under Article 5 of the Directive, to take account of environmental conditions in different regions of the Member State. Specifically, this option introduces soil type as a factor affecting the length of closed periods (see Table 2).

**Table 2:** Option C closed periods

Grassland		Arable land	
Sandy and shallow soils	All other soils	Sandy and shallow soils	All other soils
5 months (1 Sep – 31 Jan)	4 months (1 Oct – 31 Jan)	6 months (1 Aug – 31 Jan)	4.5 months (15 Sep – 31 Jan)

AP Option D: Introduce revised, targeted Action Programme Measures – the same as Option C except that rainfall was also accounted for when setting the length of closed periods (see Table 3).

**Table 3:** Option D closed periods

Average annual rainfall	Grassland		Arable land	
	Sandy and shallow soils	All other soils	Sandy and shallow soils	All other soils
Up to 1050 mm	3.5 months (1 Sep -15 Dec)	3 months (15 Oct – 15 Jan)	5 months (1 Aug - 31 Dec)	3.5 months (1 Oct – 15 Jan)
Over 1050 mm	4 months (1 Sep -31 Dec)	4 months (1 Oct – 31 Jan)	5.5 months (1 Aug – 15 Jan)	4.5 months (15 Sep – 31 Jan)

A full summary of the proposals that were consulted upon can be found in the consultation paper (Defra, 2007). The accompanying partial Regulatory Impact Assessment provided a full assessment of the costs and benefits associated with each option (Defra, 2007a).

## 2.2 Outcomes of the Consultation

The consultation closed on 13 December 2007. A summary of the responses received from stakeholders is available on the Defra website. Of the options described above, Defra has decided to implement NVZ Option 2 together with AP Option D as the partial RIA included with the consultation (Defra, 2007a) clearly highlighted it delivered similar benefits to the other options put forward, but at significantly lower cost. This option is the minimum enforcement necessary to ensure comply with the Nitrates directive.

Some additional refinements have been made to the proposals under these Options to take account of stakeholder comments – a full description of how stakeholder comments have been taken into account in developing the final policy is also available on the Defra website.

This Impact Assessment considers the impact, in terms of benefits and costs, of the final package of proposals.

## 2.3 Sectors and Groups Affected

The main private sector group that will be affected by revisions to NVZ designations and Action Programme measures will be farmers and, in particular, livestock farmers. Costs are associated with the obligation to comply with Action Programme measures in NVZs (further details on costs can be found in section 4.2). There is potential for these costs to be partially offset, for example by a reduced need for manufactured fertiliser where manure management is optimised (see Section 4.3).

There are also potential costs and benefits to the water industry. For example, an increase in NVZ coverage and the associated requirements of a revised Action Programme, notably the longer closed periods covering all soil types, may make it more difficult to spread sewage sludge on agricultural land thus potentially increasing disposal costs. In contrast, improvements in water quality brought about by revisions to NVZ designations and the Action Programme could potentially benefit both water companies and consumers by reducing the need for costly treatment of drinking water.

There are also wider potential benefits associated with improved water quality brought about by the Action Programme, notably for biodiversity, recreation, and tourism.

## **2.4 Unintended Consequences**

Measures aimed at reducing nitrate losses to water may also affect losses of other pollutants, notably ammonia to air and phosphorus to waters. In some cases, measures may help reduce these losses but there is a risk that some measures may exacerbate losses (a phenomenon known as pollution swapping). For example, the requirement to spread manure on land in the warmer Spring/Summer months following longer closed periods is likely to lead to an increase in the volatilization of manure nitrogen into ammonia gas. It has been estimated that 117,000 tonnes of ammonia (N) was emitted by UK agriculture in 2005, with a revised Action Programme leading to a slight increase in that total (see Section 3.2.2 for details).

This 'pollution swapping' may impact on our ability to achieve other environmental objectives (e.g. under the Water Framework Directive and the Gothenburg Protocol). Work has been undertaken to evaluate the extent to which the proposals to revise Action Programme measures could affect losses of other pollutants. The Action Programme measures have been designed to minimise the risk of pollution swapping occurring.

As a guide, ammonia damage costs from agricultural and non-agricultural sources combined are currently estimated to be about £1493 - 2175 per tonne (AEAT, 2005) although this may be an underestimate because only human health impacts are considered – ecosystem and climate change effects are not accounted for. In order to help mitigate some of this ammonia loss, incorporation of organic manures into the soil within 24 hours will be a mandatory requirement in the revised Nitrates Action Programme.

Measures that restrict the use of organic manures on farm, will present risks associated with bio-security (due to the increased transport of manures) and a reluctance to accept organic manures (including sewage sludge) on to the farm. In addition the export of manure to land outside the NVZ designation (e.g. dumping of excess manure outside NVZs) may cause new pollution problems and lead to additional NVZ designations in the future.

Designating discrete NVZs may also impact on land values within the NVZ and raise issues of competitiveness between NVZ and non-NVZ farmers (see Annex 2 for competition assessment).

There may also be cost implications for developing soils policy. If such policy promotes increasing soil fertility/organic matter content, then it must do so within the spreading restrictions of the Nitrates Action Programme or alternatives to the use of organic manure for such purposes would have to be promoted/developed.

## 3.Environmental Impacts

### 3.1 Principal Environmental Benefits

The principal intended benefits of revising the NVZ designations and Action Programme measures are associated with a reduction in losses of nitrate (and indirectly other pollutants), achieved by:

- controlling the amount of nitrogen applied to land in fertilisers and organic manures;
- controlling timing of fertiliser and organic manure application;
- controlling methods of fertiliser and organic manure application; and
- taking steps to manage other risks of pollutant loss.

The main benefits from a reduction in the amount of nitrate entering waters are likely to be:

- improved natural habitats resulting from a reduction in nutrient enrichment of waters and associated eutrophication
- a potential reduction in drinking water treatment costs where abstractions occur from surface or ground water.

#### 3.1.1 Improved natural habitats resulting from a reduction in N enrichment

Eutrophication is defined by the Nitrates Directive as: “the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of water concerned”. It occurs in natural freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters, and currently affects a range of priority species and habitats identified under the UK Biodiversity Action Plan. A recent OECD report<sup>3</sup> identified farm chemical contamination of coastal waters as a major problem in most regions as nutrients cause rapid growth of algae and damage marine life.

A large body of research has shown that there are considerable uncertainties involved in quantifying such damages caused by eutrophication. For example, there is no absolute threshold when N enrichment begins to have an adverse effect on a water body (Pretty et al., 2002). A given level of N in one water body may give rise to eutrophication with associated costs, but in another water body, or the same one at a different time, there may be no effects and no costs.

The Environment Agency (2007) estimates that the damage cost of water pollution from agriculture in England and Wales is in the region of £445m – 872m per year, of which around £196m - 497m accounts for the impact of agriculture on river and wetland ecosystems and natural habitats.

Reductions in nutrients (nitrogen, and, indirectly, phosphorus) obtained through the revision of Action Programme measures will, in theory, result in a reduction in the damage costs associated with water pollution, and may help contribute to Defra’s target of getting 95% of Sites of Special Scientific Interest (SSSI) by area into a favourable or recovering condition by 2010.

The environmental benefits associated with a reduction in nitrate to groundwater which feed surface waters and terrestrial ecosystems will likely take longer to accrue, as discussed in the following section.

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<sup>3</sup> Environmental Performance of Agriculture in OECD countries since 1990

### **3.1.2 Reduced levels of drinking water treatment**

If nitrate losses from agriculture to surface and ground waters were reduced, water companies would be able to reduce their treatment costs through reduced operating expenditure and/or reduced capital expenditure on additional nitrate removal technology.

Ofwat (2004) estimated that the water industry cost to reduce high nitrate levels caused by diffuse pollution in drinking water supplies would be £288 million (capital expenditure) and £6 million per annum (operating expenditure) for the 2005-2010 period. Given that agriculture is recognised as a major contributor to diffuse nitrate pollution, the revised Action Programme could significantly reduce treatment costs. However, the effect it has on treatment costs up to 2010 would depend on how quickly water bodies respond to lower nitrate inputs. It may be that the effect of the Action Programme is only seen after 2010 by which point new costs would be assigned to treatment depending on policy priorities and water price limits set for the period 2010-2015.

It is likely that any immediate reduction in nitrate levels would be seen in surface water bodies. This is because self-purification of groundwater is a slow process that can take decades. The unsaturated zone (the area that extends from the ground surface to the water table surface) plays a very important role in controlling the migration of pollutants from the surface down towards the water table. This includes the degree to which pollutants are diluted or attenuated due to chemical, physical and biological processes. Travel times through the unsaturated zone can vary depending on soil type, underlying geology and rainfall recharge (drainage volume). For example, the time required to achieve a 25% response in groundwater nitrate concentrations to change in inputs at the surface is estimated as six months to 53 years, whilst achieving a 90% reduction could take from 18 to 240 years (WRc, 2000).

Accordingly, any reduction in nitrate leaching resulting from the proposed changes to the Action Programme measures may take some time to result in significant changes to the concentrations in abstracted groundwaters. It could therefore take several decades before the full benefits in terms of reduced water treatment costs will be realised.

### **3.1.3 Secondary benefits associated with reduced phosphorus, pathogen, ammonia and greenhouse gas emissions.**

#### *Losses of phosphorus and pathogens to water*

Implementation of some of the revised Action Programme measures may lead to a slight reduction in phosphorus losses by up to 122 tonnes per year (see Table 6).

It is also anticipated that a revised Action Programme could deliver reductions in manure bacteria (pathogens) that can impair human health at bathing waters and contaminate shellfish waters. Pathogens follow a similar pathway to watercourses as phosphorus so some of the Action Programme measures are likely to have a beneficial effect. Furthermore, the heat generated through manure storage kills off pathogens so an increased storage time brought about by a longer closed period increases the likelihood of bacterial die-off prior to spreading.

#### *Greenhouse gas emissions*

The revised Action Programme will also impact emissions to air. For example, it is estimated that 4.15 million tonnes of greenhouse gases (CO<sub>2</sub> equivalent) are emitted by the water industry each year (Water UK, 2005), a proportion of which is a result of clean water pumping and treatment processes. Therefore, a reduction in nitrate levels should reduce the need for treatment and cut greenhouse gas emissions from this source.

Greenhouse gas emissions (in particular nitrous oxide) from agricultural land may also be affected by the Action Programme. It is estimated that the revised Action Programme measures will reduce annual greenhouse gas emissions by 28,100 – 36,100 tonnes CO<sub>2</sub> equivalent (Uni. of Hertfordshire, 2008).

### *Ammonia emissions*

It is expected that there will be no benefit to ammonia emissions. In fact there may be a slight increase in emissions due to the longer closed periods in a revised Action Programme leading to more manure being spread in warmer months of the year when ammonia loss to the atmosphere is more likely. Due to the high damage costs of ammonia, even a small increase could cause a significant environmental cost.

## **3.2 Specific environmental impacts of the action programme**

There are significant losses of nitrate (183kT N), phosphorus (2.7kT P), ammonia (117kT N) and greenhouse gasses (52.62MT CO<sub>2</sub> e) from agriculture every year. An estimate of the impact of extending NVZ coverage and revising Action Programme measures on losses these pollutants has been made (ADAS, 2007; Uni. of Hert., 2008).

Impacts have been measured relative to the existing NVZs and Action Programme and have focused on key measures being revised, notably the:

- whole farm manure limit for livestock manure of 170kgN/ha;
- closed period for organic manure;
- closed period for manufactured fertiliser; and
- crop requirement limit.

### **3.2.1 Whole Farm Limit for Livestock Manures (170kgN/ha)**

Proposals to reduce the whole farm limit for livestock manure to 170kg of nitrogen per hectare will predominantly impact dairy farms. This is because most pig and poultry manure is applied to arable land where, under the current Action Programme, the whole farm limit of 170kgN/ha already applies. Other cattle farms (e.g. beef) tend not to be stocked at livestock densities sufficient to exceed a whole farm limit of 170kgN/ha.

Whilst the impacts of this measure on pollutant losses may be large on individual farms (e.g. a 45% reduction in nitrate losses), the environmental benefit at the national scale is a small reduction in losses of nitrate, phosphorus, ammonia, and greenhouse gas (see Table 4).

**Table 4:** Change in pollutant loss (tonnes per year) achieved by the whole farm limit

Nitrate	Phosphorus	Ammonia	Greenhouse gases (CO <sub>2</sub> e)
0 to -915	0 to -13.5	0 to -351	-2,800 to -10,800

These reductions are due to a redistribution of livestock manures to land outside of the farm or, in some western areas of England, a shift in livestock production (i.e. a reduction of livestock numbers on more intensive farms and a corresponding increase on less intensively stocked farms). This results in a greater proportion of nitrogen and phosphorus uptake by the crop and removal in product, as an average over the whole NVZ area.

### 3.2.2 Closed Periods (organic manures)

ADAS (2007) modelled the impact of existing closed period and concluded that, although it delivered a 15% reduction in N losses in areas with sandy soil, it did not deliver an overall reduction in N losses at the national scale because sandy soils account for less than 10% of the total NVZ area.

The key environmental benefit of extending the current closed periods (3 months (grass) and 4 months (arable) on shallow and sandy soils) to 4 – 5 months on all soils is improved efficiency of nitrogen uptake by the crop. This is primarily due to a shift in applications of manure away from times of year which pose the greatest risk of loss (Autumn/Winter) to when the crop is actively growing (Spring).

In addition, cost savings can be made from improved adjustment of manufactured fertiliser for the nitrogen supplied by manures (see Section 4.3). This adjustment is already required under the existing Action Programme but the magnitude of benefit will be greater as a result of the extended scope and duration of the revised closed periods.

Table 5 below shows the effectiveness of the closed period rules. To note, the figures appear low because, in practice, manures are only applied to approximately 1/6th of the NVZ area.

**Table 5:** Change in pollutant loss (tonnes per year) achieved by the closed period

Nitrate	Phosphorus	Ammonia	Greenhouse gases (CO <sub>2</sub> e)
-549 to -1,647	0 to -108	+468 to +2,340	25,300

### 3.2.3 Closed periods (manufactured fertilisers)

The existing restriction on applying manufactured fertilisers between September and February will be carried over largely unchanged into the revised Action Programme. It is therefore likely that any future reductions in N losses as a result of this requirement will only be seen in areas affected by the extension in NVZ coverage.

Compliance with this particular NVZ measure has reduced the number of unjustifiable Autumn applications for winter cereals, although Autumn applications represent <1% of total fertiliser nitrogen input. Consequently, this measure is only likely to deliver a reduction in annual nitrate losses by up to 1,830 tonnes.

### 3.2.4 Crop requirement limit

Limiting the quantity of applied nitrogen to crop requirement is another Action Programme measure to be carried over into the revised programme. This measure applies to nitrogen from all sources (soil, manufactured fertiliser and organic manure) but, like the closed periods for manufactured fertiliser, is only expected to help deliver nitrogen loss reductions in newly designated NVZ areas.

Adherence to crop requirement recommendations, as outlined in Defra's Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209), could potentially help deliver significant nitrogen loss reductions locally. For example, comparison of fertiliser inputs against RB209 recommendations has shown that some fields can receive 100 kg N/ha or more in excess of these recommendations (ADAS, 2007b). Overall, though, it is expected that this measure will deliver a reduction in annual nitrate losses of between 1,830 and 10,980 tonnes.

### 3.3 Summary of Environmental Impacts

The benefit of changes to the Action Programme measures is a reduction in nitrate loss from farms that, in turn, will potentially reduce both eutrophication of waters and costs of water treatment for drinking water supplies. However, nitrate is not the only pollutant of concern, and further benefit may be accrued from the impact of the Action Programme on phosphorus (P) and pathogen losses and greenhouse gas emissions (CO<sub>2</sub> e).

Consideration of available evidence suggests that there will be environmental benefits from the main Action Programme measures but some environmental costs too, as outlined in Table 6 below.

To note, that only the impact of the main Action Programme measures has been quantified (it is not possible to quantify the other measures). Therefore, the figures provided in table 6 are likely to be an underestimate.

**Table 6:** Summary of the environmental impacts of the revised Action Programme measures: Change (tonnes per year) in nitrate (N), phosphorus (P), ammonia (N) and greenhouse gas (CO<sub>2</sub> e) losses

Measure	Nitrate	Phosphorus	Ammonia	Greenhouse gases
Whole farm limit	0 to -915	0 to -14	0 to -351	-2,800 to -10,800
Closed period (manure)	-550 to -1,650	0 to -108	+468 to +2,340	-25,300
Closed period (fertiliser)	0 to -1,830	~	~	~
Crop requirement limit	-1,830 to -10,980	~	~	~
<b>Total</b>	<b>-2,380 to -15,375</b>	<b>0 to -122</b>	<b>+117 to +2,340</b>	<b>-28,100 to -36,100</b>

~ benefit not quantified

### 3.4 Monetisation of Environmental Impacts

Warwick HRI reviewed the evidence on the monetary value for the external costs of diffuse water and air pollution from agriculture, including nitrate, phosphorus and ammonia. This work looked at both the non-market environmental impacts, including the impact on drinking water quality, river water quality (amenity), fishing, eutrophication, ecosystems and bathing water quality. It also included market impacts, specifically cost savings to the water industry, of lower treatment costs as a result of reduced pollution levels.

The impact of nitrate and phosphorus on water is not homogenous; it varies spatially according to the characteristics of the site it is released, and the specific nature of the impact, whether for example is it on drinking water or river habitats. Therefore it is not possible to establish one consistent central value for the monetary cost of nitrate pollution, as it has been for example with carbon emissions. Additionally, it is impossible to be precise about exactly what the proportion of observable harm is being caused by each pollutant, and how much from

agriculture, due to the complex interactions within ecosystems, and lag times between the contamination event and the observable damage that can be in the region of several years. Due to the lack of definitive evidence, the weightings for the level of damage attributable to agriculture were arrived at by expert opinion. An example of the way the damage costs per tonne of nitrate were calculated is shown in appendix 4.

Due to these uncertainties the report provides upper and lower bounds for the likely range of the monetary impacts of agricultural pollution. These have been applied to the modelled changes in pollutant levels, to produce overall monetised environmental impact of the policy. As the policy has an adverse impact on ammonia emissions it is actually possible that the overall impact could be negative, given the high human health impacts of ammonia. The figures in Table 7 below show the range from the maximum environmental cost if the upper bound for ammonia is used, and lower bounds for phosphorus and nitrate, to the maximum environmental benefit if the lower bound for ammonia is used, and upper bound for nitrate and phosphorus. It is not possible to say where within this range the actual benefit is likely to lie, as the evidence reviewed by Warwick HRI does not recommend central points.

As mentioned previously these only include the effects of the main action programme measures, and do not include reduced farm chemical contamination of coastal waters.

**Table 7:** Total range of monetised environmental impact using low benefit/high cost and high benefit/low cost

	<b>Low Benefit/High Cost</b>	<b>High Benefit/Low Cost</b>
Nitrates	£1,041,050	£13,739,494
Phosphorus	£0	£3,786,426
Ammonium	-£3,425,058	-£235,076
Greenhouse Gases	£744,363	£957,266
<b>Total</b>	<b>-£1,639,644</b>	<b>£18,248,110</b>

## 4. Agricultural Costs and benefits

### 4.1 Principal Costs

The main financial costs associated with implementation of the Action Programme fall on the agricultural sector. External costs were described in the previous section; the costs to farmers stem from:

- the reduction in the whole farm livestock loading to 170kgN/ha
- the extension of the closed periods
- the increased storage capacity requirement
- restrictions on spreading techniques
- administrative burdens

Sewage sludge and other biosolids that are usually recycled to land will be subject to the revised closed period restrictions. This will primarily impact the water industry, which would need to either increase its storage capacities where necessary or consider an alternative means of biosolid disposal. The Landfill Directive now prohibits the disposal of organic matter to landfill leaving incineration as an alternative to storage for spreading. It has been estimated that incineration costs the water industry £278 per tonne of sewage sludge compared with £185 per tonne for recycling to land.

Additional costs to Government and the Environment Agency will also be incurred. These cost estimates, discussed in more detail in Section 6, include the costs of enforcement, mapping the new NVZ boundaries, water quality monitoring and analysis, and provision of advice to farmers.

However, the greatest costs associated with the proposals will fall to the agricultural industry and are consequently the main focus of this Impact Assessment. Estimating the costs of the proposals to farmers is complex owing to the interaction between the various measures and the number of possible practical responses. Entec (2008) have undertaken detailed economic modelling to estimate the cost to agriculture of the proposals (summarised below in Sections 4.2 – 4.4).

Owing to the complexities and uncertainties in both farmer responses and the financial impacts of compliance, there is a considerable range in the cost estimates. This accounts for unpredictability of farmer behaviour and exactly how many farmers will be affected, and ranges in the variables including reported costs for storage and spreading equipment, and the gross margin made on livestock. As with benefits it is not possible to say where within this range the actual cost will lie, only a low and high estimate can be presented based on sensitivities around the number of farmers and input/output prices. Note that all the cost estimates outlined below are ongoing costs other than the storage costs, which have been annualised over 20 years.

Estimates of the annual costs by farm sector (see Section 4.3) reveal that the dairy sector is likely to be the most significantly affected. Low end cost estimates show the dairy sector bearing almost two thirds of the Action Programme costs.

However, there is potential to reduce the estimated costs to farmers. For example, if Defra is successful in obtaining a derogation from the 170kgN/ha/yr whole farm limit for livestock manures, the costs to the dairy sector will be reduced significantly. Alternatively, farmers may be able to take simple actions that minimise the volume of slurry that would need to be stored on farm thereby reducing the need to invest in greater storage capacity (e.g. diverting rainwater or dirty water away from manure stores, or exporting manure to a Centralised Anaerobic Digestion Plant). These mitigation measures are described in section 4.4

## 4.2 Specific Costs

### 4.2.1 Administrative Costs

A revised Action Programme and extended NVZ area will introduce a statutory requirement on many more farmers (up to 31,000) to:

- maintain records of fertiliser applications,
- calculate manure storage capacity,
- calculate compliance with the whole farm limit for livestock manure and the N max limit, and
- produce risk maps identifying areas of the farm that pose a risk of causing pollution (a Manure Management Plan).

This represents a new administrative burden, the costs of which have been calculated using the Cabinet Office Standard Cost Model (SCM).

The SCM model factored in the number of farmers likely to incur these administrative burdens whilst taking account of the fact that many farmers already maintain their own records and plans for manure and nutrients. The model also included time taken up by these extra burdens and the cost of that time, but factored in Defra's intention to produce standard templates for recording data on fertiliser use and calculating compliance with organic loading limits, which farm consultants agree are very helpful in reducing the administrative burden.

The SCM model also accounted for related policies with similar administrative requirements, notably the array of soil, crop, manure and nutrient management plans, and Defra's Whole Farm Approach which is designed to simplify certain bureaucratic requirements. Consequently, there may be an overall reduction in duplication, so that the additional NVZ burden may be mitigated to some extent.

The SCM model outputs are presented as the overall cost estimates in Table 8 below. The figures in Table 8 show that the burden of a revised Action Programme on existing NVZ farmers is small relative to the significant new administrative burden that will be imposed on farmers in newly designated NVZ areas.

**Table 8:** Expected annual administrative costs averaged over a 10 year period (£k)

	<b>Low</b>	<b>High</b>
55% existing designation	223	1,450
15% coverage extension	216	1,229
<b>Total</b>	<b>439</b>	<b>2,679</b>

Increasing manure storage could, in some circumstances, create additional administrative costs as a result of planning permission costs. Planning permission is needed for all stores if they are within 400 metres of the curtilage of any permanent building outside the agricultural unit that is occupied by people. The cost of planning permission for an average size (254m<sup>2</sup>) above ground steel store for a typical dairy farm of 150 cows is currently £50 but is set to increase to £65/70 according to the latest Planning White Paper. Given that this is a relatively small cost and that the number of farmers affected by such a charge is unknown, planning permission costs were not included in the administrative cost figures in Table 8.

These admin burdens have been rebased to 2005 prices using HM Treasury's GDP deflator for comparison with the admin burdens baseline. In 2005 prices the increase in the burden is £430k - £2,622k.

#### 4.2.2 Whole Farm Limit

The whole farm limit of 170kgN/ha/yr for livestock manure already applies to arable land in NVZs but it will now extend to grassland (and to land in the new NVZs). Therefore, any grassland farmers who apply more nitrogen than this on average per hectare per year will need to reduce it in some way.

There are a few practical responses farmers may take in order to comply with the limit:

- Increase spreading area – more manure must be exported from the farm for spreading elsewhere (which includes outside NVZs) or a farmer could buy or rent more land to spread their manures;
- Reduce the stocking rate - the stocking rate must be reduced to meet the available spreading area per livestock unit (either by acquiring more land or reducing animal numbers); or
- A combination of the above (reducing stock and increasing spreading area).

It is assumed that increasing the spreading area will be the most favoured response amongst farmers, as it is the most cost-effective.

The anticipated costs of implementing the whole farm limit are provided in Table 9 below.

**Table 9:** Costs arising from changes to the whole farm limit (£m)

	<b>Low</b>	<b>High</b>
- additional spreading costs	8.5	11.3
- reduction in stocking rate	17.9	21.8
<b>Total</b>	<b>26.4</b>	<b>33.1</b>

The Department may be able to mitigate some of these costs by applying for a derogation from the whole farm limit. See Section 4.4 for further details.

#### 4.2.3 Storage Capacity

The requirement to provide a manure storage capacity of 5 or 6 months (depending on type of livestock) will act to impose a need for many affected farmers to provide extra manure storage on their farms. The process for calculating compliance with this requirement provides the opportunity for farmers to subtract the following volumes from the required storage capacity:

- Solids separated from slurry
- Poultry manure stored in temporary field heaps
- Manure exported off the holding
- Manure spread to low run-off risk land following the end of the closed period (i.e. land that has a slope less than 3 degrees, is further than 50m from a surface water, and does not have land drains).

Farmers may also be able to reduce the cost of constructing additional slurry storage by adopting some relatively cheap and simple measures aimed at reducing the volume of slurry requiring storage in the first place. These measures include:

- Covering Slurry Stores
- Separating Dirty Water from Slurry
- Collecting roof rainwater
- Mechanical separation of slurry on cattle farms

It is likely that actual costs and savings will depend on a number of site specific factors meaning individuals may experience different costs and savings depending on their circumstances.

The anticipated costs of constructing additional storage facilities to comply with the storage capacity requirement are £12.8m to £16.5m per year.

#### **4.2.4 Crop Nitrogen Requirement – N max**

Nmax for grass is proposed to be set at 330kg N/ha, reducing to 300kg N/ha from 2012. Information from the British Survey of Fertiliser Practice can be used to estimate the area of grassland affected by this reduction (26,000 to 260,000ha). A 10% reduction in N applications to grassland is assumed to incur a cost of £13.00 per hectare for both dairy and beef farmers (Cuttle et al., 2006).

The cost of the reduction in N max for grass (from 2012) has therefore been estimated as £0.3m to £3.4m per year.

#### **4.2.5 Spreading techniques**

The measure prohibiting the use of slurry spreading equipment with a trajectory greater than 4m could lead to either a need to replace spreading machinery, in particular rain guns, or a shift to the use of contractors with the right equipment.

The costs to farmers of this measure have been estimated as £3.7m to £8.4m per year, based on the range in costs of equipment in the Nix farm management handbook, and taking into account the life-span and depreciation of the prohibited equipment.

#### **4.2.6 Incorporation of organic manure**

The costs associated with the requirement to incorporate organic manures within 24 hours in certain circumstances are thought unlikely to be significant. This is because the land would be cultivated and the manures incorporated at some stage anyway; any additional costs are a function of the timing of these cultivations. Further, prudent management should mean that organic manures would only be applied in circumstances where speedy incorporation is required, when this speedy incorporation can be achieved.

### **4.3 Summary of costs**

Table 10 below outlines the estimated net annual costs to the agricultural industry. Note that these annual costs only account for the most cost significant elements of a revised Action Programme. The costs are expressed as both low and high cost estimates.

**Table 10:** Overall annual costs to the agriculture industry (£m)

Cost type	Low	High
Additional storage costs*	12.8	16.5
Reduction in stocking rate	17.9	21.8
Additional spreading costs	8.5	11.3
Spreading techniques	3.7	8.4
N max (from 2012)	0.3	3.4
Admin burdens	0.4	2.7
<b>Total</b>	<b>44.3</b>	<b>65.2</b>

\* storage costs have been annualised over 20 years (expected lifespan of a storage structure) at an interest rate between 7 and 8%.

Annex 1 provides an estimate of the annual costs per farm and Table 11 provides a summary of the costs broken down by agricultural sector. The results show that the dairy sector will have to carry the greatest burden of additional costs arising out of the new regulations (approx. two thirds).

**Table 11:** Breakdown of Costs by Sector (£000)

Cost type	Dairy		Beef		Pigs		Poultry		Other	
	Low	High	Low	High	Low	High	Low	High	Low	High
Organic limits										
- Additional spreading costs	502	956	1,779	2,285	4,183	5,374	2,074	2,664	0	0
- Reduction in stocking rate	17,430	20,819	503	1,015	0	0	0	0	0	0
Additional storage costs	10,147	13,085	345	368	2,231	2,887	118	118	0	0
Spreading techniques	681	1,532	1,380	3,104	1,678	3,776	0	0	0	0
N max (from 2012)	300	3400								
Admin Burden	95	274	134	388	53	152	158	456	704	2,541
<b>Total</b>	<b>29,155</b>	<b>40,066</b>	<b>4,141</b>	<b>7,160</b>	<b>8,145</b>	<b>12,189</b>	<b>2,350</b>	<b>3,258</b>	<b>704</b>	<b>2,541</b>

## 4.4 Mitigating the costs of the Action Programme

This section discusses the following mitigation measures that could be applied to reduce the costs in Table 10:

- Dairy derogation
- Improved manure nitrogen efficiency
- Anaerobic digestion

### 4.3.1 Dairy Derogation

The Nitrates Directive permits Member States to set a different limit to 170kgN/ha/yr for applications of livestock manures (e.g. 250kg total nitrogen per hectare each calendar year averaged over the farm in relation to grazing systems on grassland farms). Defra is currently compiling evidence to underpin a case for such a derogation which will be presented to the European Commission for approval.

Section 6 of the Entec (2008) report includes an assessment of the change in costs for the dairy sector (and total costs across all sectors) given the situation where the dairy sector was not required in the short term to reduce N loading from 250kg/ha to the 170kg/ha.

The costs to the dairy sector are reduced by approximately 60% where the derogation is made compared to the situation where there is no derogation. The derogation reduces total annual costs by £16.9 – 21.7m.

#### **4.3.2 Improved manure N efficiency**

The fact that nitrogen is being leached into watercourses means that the value of the nutrients applied to the land is not being used to full efficiency. It is anticipated a revised Action Programme will reduce the amount of N lost and so should improve efficiency of overall N use. This improved efficiency should be manifest in reductions in the purchases of inorganic nitrogen fertiliser.

#### **4.3.3 Anaerobic digestion**

The Anaerobic Digestion (AD) process has potential to reduce the cost to farmers of reducing diffuse nitrogen pollution and help them comply with the revisions to the NVZ Action Programme. Provided farmers are in the vicinity of a Centralised AD plant and the nutrient rich digestate can be re-distributed to farmers requiring extra nutrient inputs (who then adjust their fertiliser inputs accordingly), anaerobic digestion can help farmers achieve their nutrient balances and reduce the amount of inorganic mineral fertiliser that would need to be purchased.

## 5. Summary of Costs and Benefits

The total cost of the revised Action Programme options on the agricultural industry, and the likely environmental impacts (nitrate, phosphorus, ammonia and greenhouse gas losses) are presented in Table 12 below.

**Table 12:** The costs (£m) of the Action Programme (both financial and external) and environmental benefits

<b>Costs</b>	<b>£ m</b>
Costs to agriculture	44.3 – 65.2
Ammonia external Costs	0.35 – 3.43
Savings from dairy derogation	16.9 - 21.7
<b>Total</b>	<b>27.7 – 46.9</b>

<b>Environmental impacts</b>	<b>Change in pollutant loss (kT)</b>	<b>Monetised benefit (£ m)</b>
Nitrate	-2.38 to -15.37	1.04 to 13.74
Phosphorus	0 to -0.12	0 to 3.79
Greenhouse gases (CO <sub>2</sub> e)	-28.1 to -36.1	0.74 to 0.96
<b>Total</b>		<b>1.77 to 18.4</b>

### 5.1 Ranges in costs and benefits

As previously discussed, there is considerable uncertainty around the values both for the environmental impacts, and the costs to farmers. This arises from complexities in the underlying ecological relationships, and difficulties in predicting both exactly what the impacts will be, and in how farmers will respond to the action programme. The economic modelling therefore included ranges for a number of the variables, so that the final net benefit was calculated as a range between 'high' and 'low' scenarios where any value within this range is considered equally plausible.

As noted in section 3.4 the impact of nitrate and phosphorus on water is highly site specific, for example a given level of nitrogen in one water body may give rise to eutrophication, where in another it doesn't. Furthermore the damage cost also depends upon the specific nature of the impact, whether for example it is to contaminate drinking water, or to pollute river habitats. Therefore it is not possible to establish one consistent central value for the monetary costs. Instead, the range of plausible values has been presented, based on expert analysis of the impacts, an example of which is shown in appendix 4. It has also been assumed that environmental impacts are realised immediately, where in practice there may be substantial lags for some, particularly nutrient reductions in ground water.

The increased costs to farmers are also difficult to estimate precisely, owing to the complexities and uncertainties in both farmer responses and the financial impacts of compliance, so again there is a considerable range in the estimates. As there are a large number of independent variables that will affect the cost to each farmer of implementing the action programme, each with its own range of uncertainty, total costs could fall anywhere within this range. The key variables for which a range was used include:

- The number of farms experiencing additional administrative burden ranges from 11,000 at the low end if only livestock farmers are affected, to 31,000 if all farmers are affected
- Gross margins on livestock
- Cost of new equipment or slurry management required for compliance, for example storage facilities and manure application machinery

The economic model also includes a number of assumptions regarding the manner in which farmers will respond to the action programme, in particular how they adapt to the controls on the way manure is spread and the numbers who will invest in particular storage facilities; here farmers have a number of options and their decision, and hence costs, will vary. These assumptions have been made on the basis of farmer surveys where possible, but some have had to use expert judgement where data is not available.

It is not possible to say where within these range the actual cost will lie. It is likely that actual costs and savings will depend on a number of site specific factors meaning individuals may experience different costs and savings depending on their circumstances.

These uncertainties are reflected in the large ranges shown for costs and benefits, and mean that no best estimate of the net benefit can be provided. However, given the ranges already provide for a large degree of uncertainty, it is not thought that any additional sensitivity analysis of any conceivable change in the numbers would add value, especially as it would not change the overall outcome of cost significantly outweighing benefits.

## 5.2 Unquantified benefits and costs

To note, the above figures only reflect the impact of the main measures in the revised Action Programme. A number of benefits and costs to agriculture have not been quantified. These are listed in Table 13, together with a subjective assessment of their anticipated significance.

**Table 13:** Unquantified Benefits and Costs

Unquantified Benefits	Unquantified Costs
<b>Changes to Organic N Loading Limits</b>	
<p>More arable farmers being able to use manures (<b>Low</b>)</p> <p>Benefits of reduced stocking rates for dairy followers and beef (<b>Low</b>)</p> <p>Savings in cost of purchased nitrogen fertiliser where excess N use is avoided (<b>Small</b>)</p>	<p>Costs of manure sampling for those who choose to use this approach (<b>Moderate</b>)</p>
<b>Changes Affecting Storage Capacity</b>	
<p>Registered organic producers able to spread during the Closed Period in certain circumstances (<b>Low</b> overall, <b>High</b> for some organic producers)</p> <p>Greater flexibility in management of slurries and manures where storage capacity has been increased (<b>Low</b>).</p> <p>Reductions in costs associated where double handling of manures is avoided (<b>Low</b>)</p>	<p>Costs of consulting local authority and for obtaining planning approval for additional buildings where needed (Generally <b>Low</b> but <b>High</b> for some)</p> <p>Increase in peak labour demands immediately before and after closed periods (<b>Moderate</b>)</p> <p>Increased management complexity (<b>Moderate</b>)</p> <p>Loss of yield where use of N would have provided economic response in the crop (<b>Low</b>)</p>
<b>Measures Affecting When, Where and How Manures are Applied</b>	
<p>Savings in cost of purchased nitrogen fertiliser where excess N use is avoided (<b>Small</b>)</p>	<p>Loss of yield where use of more N would have provided economic response in the crop (<b>Low</b>)</p> <p>Reduced flexibility in manure management and increase in peak labour demand (<b>Low</b>)</p> <p>Marginal reduction in efficiency of field operations to avoid field heaps (<b>Low</b>)</p>
<b>Administrative Burden</b>	
<p>Better control of fertiliser use (<b>Moderate</b>)</p> <p>Savings from adopting the 'Whole Farm Approach' to record keeping (<b>Low</b>)</p>	<p>Costs incurred by registered organic producers to secure written advice from FACTS adviser for relevant applications within the Closed Period (<b>Low</b>)</p>

## **6. Enforcement, Sanctions and Monitoring**

The proposals in this document represent changes to an existing regulatory regime for which enforcement, sanctions and monitoring are already well established and carried out by the Environment Agency. However, additional enforcement costs are still expected although it is anticipated that there will be some benefits to the Environment Agency derived from compliance checking simplifications.

Preliminary estimates from the Environment Agency indicate that if NVZ coverage was increased from 55% to 70% then they would have to employ and train new staff, increasing annual costs from £1.2m to £1.9m. Coupled to 2003 estimates of other Government costs including Defra staff, monitoring, hard and soft mapping of NVZ boundaries, public consultation, data and trend analysis, and NVZ advice to farmers, it is estimated that total costs will be in the region of £2.4m – 3.4m per year over a four year period (until the next Action Programme review). The higher annual cost would most likely be incurred in the first 1-2 years when Agency staff training, consultation and advice on the revised Action Programme rules is needed, and any NVZ designation appeals take place.

## 7. References

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WRC (2003): Updating an estimate of the sources of nitrogen to UK waters.

## Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

**Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.**

Type of testing undertaken	<i>Results in Evidence Base?</i>	<i>Results annexed?</i>
Competition Assessment	No	Yes
Small Firms Impact Test	No	Yes
Legal Aid	No	Yes
Sustainable Development	No	No
Carbon Assessment	Yes	No
Other Environment	Yes	No
Health Impact Assessment	Yes	No
Race Equality	No	Yes
Disability Equality	No	Yes
Gender Equality	No	Yes
Human Rights	No	Yes
Rural Proofing	No	No

## Annex 1. Small Firms Impact Test

### Introduction

Owing to the structure of the farming industry, virtually all of the farms that are affected by these proposals are expected to be small and medium sized enterprises (SMEs). The analysis has considered the likely regional and sectoral breakdown in the costs; this report looks at how these will impact on individual small firms.

The following section estimates the annual cost to a farmer (annualised over a 20 year period). The estimated annual costs vary depending on the type of farm and the region. Given the significant regional variations for each type of livestock farm, it is not always feasible to produce summary costs.

The maximum cost per farm is based on the situation where the farmer has to reduce stock as well as increase transport and storage capacity. The minimum costs are estimated on the basis of those farmers that only incur a cost for additional storage capacity but do not need to reduce stock or increase spreading to comply with the new organic manure limits. However, even these maxima and minima are averages and some individual farmers may face additional costs over and above the suggested maximum; on the other hand, some may face little or no cost. The potential cost burden to any given farmer will depend on their own individual circumstances.

It is a requirement of IAs to give an indication of impacts on small firms and the figures below provide that indication. The figures are given separately for most of the different measures. It is important that the figures are viewed in this way as adding them together can give a mistaken impression because not all farmers will be affected by all measures (for example, relatively few farmers use rain guns, so it would skew the results to add the costs of replacing rain guns into the typical cost per farm).

Table 2.1 shows the maximum and minimum effects per farm of:

- the additional costs of storage;
- the additional costs of spreading;
- the cost of reducing stocking rates;
- mitigation available from more efficient slurry handling; and
- administrative burdens.

**Table 2.1** Estimated Annual Costs per Farm (£/farm)

Type of effect	Dairy		Beef		Pigs		Poultry		Other	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Main Measures	62	2,913	227	1,235	309	3,336	183	984	0	0
Admin Burden	129	752	129	752	129	752	129	752	129	752
<b>Total</b>	<b>195</b>	<b>3,665</b>	<b>356</b>	<b>1,987</b>	<b>438</b>	<b>4,088</b>	<b>312</b>	<b>1,736</b>	<b>129</b>	<b>752</b>

The minimum costs for dairy are set at zero because, in some regions (Eastern and Yorks/Humber), the analysis shows that there is sufficient low run-off risk land overall to allow late winter spreading, which, if used to the full extent would actually reduce the storage needed. In practice, this is unlikely to occur so it seems more appropriate to set the value at zero.

Table 2.1 figures do not include the costs of replacing rain guns used for slurry spreading. The range of costs arising as a result of measures requiring the replacement of rain guns (which will impact on a relatively small number of farmers) is £2,200 to £7,700, depending on type of rain gun equipment being replaced. If age of equipment is taken into account, the range is between £0 and £15,400.

A small number of grassland farmers will be affected by the reduction in Nmax for grass from 330kg N/ha to 300kg N/ha in 2011. The cost has been estimated as £13/ha, so for an intensive dairy unit of (say) 100ha, the cost of this measure would be £1,300 per annum.

## Putting the costs into context

### *Costs compared to current profitability*

It is important to see these additional costs in the context of the net income of the typical farms within the sectors affected. Information on Net Farm Incomes can be obtained from the Farm Business Survey. The figures used are at 2005/06 values. Relevant data are provided in Table 2.2. These include income and costs from all relevant enterprises on farms in the survey, including figures for agricultural enterprises other than the dominant one, diversified (i.e. non-agricultural) enterprises, agri-environment scheme and Single Payment Scheme payments.

**Table 2.2** Gross Margin, Farm Business Profit and Net Farm Incomes by Sector (£/farm)

Farm Type	Dairy	Grazing Livestock		Pigs	Poultry	General Cropping
		LFA	Lowland			
Total Gross Margin (2005/06)	98,730	44,945	38,285	127,270	238,580	157,070
Farm Business Profit <sup>4</sup> (2005/06)	36,605	15,840	9,658	30,255	93,166	37,346
Net Farm Income (NFI)**	26,280	13,800	5,040	28,540	76,240	31,260

\*\*Average for 5 yrs 2001/02 to 2005/06 at 2005/06 prices

When considering these figures, it should be noted that:

- They include farms both within and outside NVZs.
- Farms are categorised on the basis of enterprise dominance and, in most cases, a farm will have a mix of enterprises.
- Grazing livestock farms will include those farms where sheep dominate, which are likely to be most common in Less Favoured Areas.
- Farms vary enormously in their ability to generate income and profits, and these averages mask a very wide range. It is inevitable that some individual businesses will be impacted upon more significantly than others.

<sup>4</sup> Defra define "Farm business profit" as "for sole traders and partnerships represents the financial return to all unpaid labour (farmers and spouses, non-principal partners and directors and their spouses and family workers) and on all their capital invested in the farm business, including land and buildings. [Note: it does not include off-farm income.] For corporate businesses it represents the financial return on the shareholders capital invested in the farm business. It is used when assessing the impact of new policies or regulations on the individual farm business. Although Farm Business Profit is equivalent to financial Net Profit, in practice they are likely to differ because Net Profit is derived from financial accounting principles whereas Farm Business Profit is derived from management accounting principles. For example in financial accounting output stocks are usually valued at cost of production, whereas in management accounting they are usually valued at market price. In financial accounting depreciation is usually calculated at historic cost whereas in management accounting it is often calculated at replacement cost."

In order to put the costs expected to be imposed by the new regulations into context, it is useful to look at them as a proportion of current levels of performance. Farm business profit (FBP) is one measure, as it takes in a wide range of income streams but the data available cover only one year. There is merit, therefore, in also making comparisons with Net Farm Income (NFI), for which time series data exist, thus allowing a five year average to be used. These comparisons are made in Table 2.3. The average costs per farm from which the percentages are derived do not include any savings through mitigation measures (such as the proposed dairy derogation). Further, they are for stock numbers as at 2005, and do not allow for future scenarios.

**Table 2.3** Effects of Main Effects Regulations relative to Farm Business Incomes by Sector

Farm Type	Dairy		LFA/Lowland		Pigs		Poultry		Other	
	Low	High	Low	High	Low	High	Low	High	Low	High
Costs of NVZ measures	195	3,665	356	1,987	438	4,088	312	1,736	129	752
Farm Business Profit (£)	36,605		15,840/9,658		30,255		93,166		37,346	
Costs as Proportion of FBP (%)	<1	10	2-4	13-21	1	14	<1	2	<1	2
Net Farm Income	24,880		13,060/4,820		27,080		72,840		29,760	
Costs as Proportion of 5 yr average NFI (%)	<1	15	3-7	15-41	2	15	<1	2	<1	3

At the lowest end of the range of estimates, impacts per farm relative to FBP are low, with dairy, poultry and arable/other farms seeing a cost imposition of 1% or less of farm business profit, with pig farmers facing a cost equivalent to 2%. However, at the upper end of the range of estimates, the comparison clearly shows the significant impact that the proposed new regulations could have on dairy and pig farms, reducing their FBP by around 10% and 14% respectively. However, it is beef farmers, particularly in the lowlands, who face the biggest impact; the potential impact at the upper end of the range being a high as 21% of FBP. Because the costs to Poultry and Other farmers are likely to be relatively small, they should experience relatively lower impacts at the upper end of the range of estimates.

Using NFI as the comparator, a similar pattern emerges but (because NFI is generally lower than FBP over the five year period chosen) the impact is seen to be more significant. The exacerbation of the impact is not very pronounced at the lower end of the range of estimates but is more pronounced at the higher end, with lowland beef farmers facing additional costs of over 40% of NFI. Dairy, upland beef and pig farms could face a cost increase equivalent to 15% of NFI. It should be noted that this table covers only the main effects. In addition, farmers faced with having to replace recently purchased rain gun equipment for spreading manure will face a significant loss that is not reflected in the above analysis.

### Additional legislative burdens

Defra have started to collate information about the effects of impending proposals for new legislation and the cumulative burden that these effects (Defra, 2006). This includes a summary table of the latest (albeit early) estimates of the effects of different pieces of legislation. This is reproduced as Table 2.4 (note that footnote numbers do not coincide with those given in the original document).

**Table 2.4** Early estimates of the cost of key regulatory proposals to agriculture prior to adjustment and mitigation, selected years, England

<b>Impact on farmers in England (£m)</b>			
<b>Regulation</b>	<b>2006</b>	<b>2011</b>	<b>2015</b>
Changes to the Over Thirty Months rule	-24	-39	-39
EU Waste Framework & Landfill Tax <sup>5</sup>	35	38	38
EU Water Framework Directive			30
Changes to the NVZ Action Programme	37	37	37
Integrated Pollution Prevention & Control (IPPC) compliance costs		22	22
EU Emission Standards for Tractors and Non-Road Mobile Machinery	1	8	27
EU Meat Chicken Welfare Directive		11	11
Sheep Electronic Identification	0	12	12
EU Laying Hens Directive (2005 review)	T.B.D <sup>6</sup>	T.B.D	T.B.D
Regulatory compliance sub-total	48	89	138
Charging / cost-sharing			
Fallen Stock Scheme (subsidy change)	-3	0	0
Exotic Disease Levy	T.B.D <sup>7</sup>	T.B.D	T.B.D
Electronic livestock register		£8m	£8m
Integrated Pollution Prevention & Control (IPPC) charges		£4m	£4m
Charging sub-total	£-3m	£11m	£11m
<b>TOTAL</b>	<b>£46m</b>	<b>£100m</b>	<b>£149m</b>

In addition to the impacts of the NVZ AP, effects at a sectoral level are:

- dairy farmers are expected to benefit significantly from the changes to the Over Thirty Month Scheme but suffer additional costs through the need to comply with measures associated with the introduction of the Water Framework Directive;
- beef farmers are expected to experience cost increases from the Waste Framework Directive; and
- pig farmers will face costs arising out of the introduction of the Integrated Pollution Prevention and Control Directive.

<sup>5</sup> Costings based on the mid-point unit costs for disposal given in the RIA.

<sup>6</sup> To be determined.

<sup>7</sup> A Joint Industry/Government Working Group (JIGWG) has considered the sharing of responsibilities and costs for exotic animal disease. This work has now been subsumed into a wider project looking at responsibility and costs sharing across all aspects of animal health and welfare. A consultation will be launched in early December on a series of principles that will underpin this work.

Table A1 Cost per Farm

	Dairy			Beef			Pigs			Poultry			
Maximum per Farm	Costs	Cost		Farms affected	Cost		Farms affected	Cost		Farms affected	Cost		Farms affected
		Low	High		Low	High		Low	High		Low	High	
North East		£924	£1,664	66	£593	£1,014	236	£1,081	£1,706	37	£437	£826	162
North West		£1,021	£1,878	1,354	£670	£1,235	1,269	£1,049	£1,709	284	£459	£855	1,302
Yorks and Humber		£1,669	£2,684	574	£543	£956	1,122	£2,272	£3,336	619	£502	£909	1,378
East Midlands		£636	£1,323	982	£513	£918	1,702	£1,020	£1,646	636	£544	£961	1,982
West Midlands		£873	£1,599	1,562	£509	£945	1,558	£757	£1,318	439	£458	£852	1,754
Eastern		£2,058	£3,177	224	£565	£983	1,024	£2,051	£3,020	1,174	£562	£984	2,263
South East		£293	£969	487	£553	£969	1,262	£906	£1,460	673	£470	£868	2,032
South West		£1,544	£2,913	1,849	£514	£919	1,900	£808	£1,374	676	£447	£839	2,211
Minimum per Farm	Costs	Cost		Farms affected	Cost		Farms affected	Cost		Farms affected	Cost		Farms affected
		Low	High		Low	High		Low	High		Low	High	
North East		£120	£241	36	£284	£453	127	£566	£815	12	£183	£322	69
North West		£62	£28	767	£391	£704	719	£611	£872	105	£204	£349	513
Yorks and Humber		£120	£241	315	£258	£419	616	£1,453	£1,954	215	£245	£402	572
East Midlands		£120	£241	545	£227	£379	944	£458	£675	225	£279	£446	808
West Midlands		£71	£65	862	£230	£414	860	£309	£484	154	£198	£342	721
Eastern		£119	£241	125	£277	£443	571	£1,303	£1,761	420	£297	£469	916
South East		£119	£240	270	£267	£430	700	£465	£684	239	£214	£362	828
South West		£120	£241	1,037	£229	£382	1,065	£406	£609	245	£192	£334	885

### **Introduction**

The Cabinet Office and Office of Fair Trading (OFT) give guidance on how to undertake a Competition Assessment as part of an IA. The current guidance (Office of Fair Trading, 2007) replaced guidance produced in 2002 (OFT 2002). The 2007 guidance suggests that the initial competition filter should seek answers to four basic questions (see Box 1.1).

#### **Box 1.1** Initial Competition Filter - Key Questions

**In any affected market, would the proposal:**

##### **1. Directly limit the number or range of suppliers?**

This is likely to be the case if the proposal involves:

- the award of exclusive rights to supply;
- procurement from a single supplier or restricted group of suppliers;
- the creation of a form of licensing scheme; and
- a fixed limit (quota) on the number of suppliers.

##### **2. Indirectly limit the number or range of suppliers?**

This is likely to be the case if the proposal significantly raises the costs:

- of new suppliers relative to existing suppliers;
- of some existing suppliers relative to others; and
- of entering or exiting an affected market.

##### **3. Limit the ability of suppliers to compete?**

This is likely to be the case if the proposal:

- controls or substantially influences:
  - the price(s) a supplier may charge; and
  - the characteristics of the product(s) supplied, for example by setting minimum quality standards.
- limits the scope for innovation to introduce new products or supply existing products in new ways;
- limits the sales channels a supplier can use, or the geographic area in which a supplier can operate;
- substantially restricts the ability of suppliers to advertise their products; and
- limits the suppliers' freedoms to organise their own production processes or their choice of organisational form.

##### **4. Reduce suppliers' incentives to compete vigorously?**

This may be the case where a proposal:

- exempts suppliers from general competition law;
- introduces or amends intellectual property regime;
- requires or encourages the exchange between suppliers, or publication, of information on prices, costs, sales or outputs; and
- increases the costs to customers of switching between suppliers.

Note: Suppliers or firms include any private entity, any local authority acting in a private capacity and any not-for-profit firm which is competing in the market.

Source: [http://www.offt.gov.uk/shared\\_offt/reports/comp\\_policy/oft876.pdf](http://www.offt.gov.uk/shared_offt/reports/comp_policy/oft876.pdf)

### **Sectoral Application of the Competition Filter**

The proposed measures do not impact uniformly across all sectors of agriculture. Consequently, it is appropriate to apply the filter (i.e. ask the above questions) to each sector separately. The answers to these questions are given in Table 1.1.

**Table 1.1 Application of the Filter to Different Agricultural Sectors**

Question	Dairy	Beef	Pigs	Poultry	Other
Q1. Directly limit the number or range of suppliers?	No	No	No	No	No
Q2. Indirectly limit the range of suppliers?	Yes	Yes	Yes	No	No
Q3. Limit the ability of suppliers to compete?	Yes	Yes	Yes	Yes	Yes
Q4. Reduce suppliers' incentives to compete vigorously?	No	No	No	No	No

The Impact Assessment identified that the dairy sector will carry the highest share of the additional costs to the agricultural industry and, it is inferred from this that there will be a significant effect on the competitiveness of the sector. When considered on a per farm basis, it is apparent that beef and pig sectors are also likely to be significantly affected. OFT guidance suggests that where the answer to one of the questions is 'Yes', an explanation should be provided. This is provided briefly below.

**Q2: Do the proposals indirectly limit the range of suppliers?**

The proposals may do this in two ways.

Firstly, by raising the costs base for agricultural production in NVZs, there may be a deterrent effect on new entrants (land is often the most limiting factor to new entrants to dairy, who need to run a herd of as many cows as the land will carry in order to spread their fixed costs and achieve economies of scale). Existing producers may be unable to sustain the extra costs and instead would choose to leave the industry (exacerbating a well-established existing trend); for example, evidence from a Milk Development Council survey suggested that a considerable proportion of dairy farmers would contemplate such a move if faced with the need for major capital investment. However, in this case, capital costs (quota, value of cows) and level of competition should drop for remaining producers. Pig farmers are also facing financial difficulties due to increased feed costs (unrelated to NVZ measures) and so will struggle to absorb more costs.

**Q3: Do the proposals indirectly limit ability of suppliers to compete?**

The proposed new legislation raises costs of production to many farmers in NVZs. Those farmers, whether in England, Scotland or Wales who farm outside the NVZs will enjoy a competitive advantage over farmers within the NVZs.

The proposals will limit the suppliers' freedoms to organise their own production processes by setting constraints on the way they handle slurries, manures and organic matter.

### **Implications for Competitiveness**

The most appropriate way to examine the effect of the proposed NVZ regulations on industry competitiveness is to compare the way the regulations have been applied in other areas of the EU. One of the most relevant indicators is the extent of the areas' territories that have been designated as NVZ. This is examined below at European, national and local levels.

### **Competitiveness compared to other European countries**

The Nitrates Directive requires Member States to review, and if necessary revise, NVZs at least every four years. Eight Member States have chosen not to identify specific NVZs but to establish and apply an action programme through their whole territory. Other Member States have increased the extent of their NVZs over recent years (up to 2006):

- United Kingdom (from 2% to 33%);
- Spain (from 5% to 12%);
- Italy (from 2% to 9%);
- Sweden (from 9% to 17%); and
- Belgium (from 6% to 26%).

The position for all Member States as at 2006, including recently acceded states, is shown in Table 1.2.

**Table 1.2 Proportion of Countries' Territory Designated as NVZ**

Country	Area Designated (Total Area x UAA % x NVZ %) (000 ha)	Proportion Designated
Austria	3,262	100 %
Denmark	2,711	100 %
Finland	2,266	100 %
Germany	17,031	100 %
Ireland	4,162	100 %
Lithuania	2,834	100 %

Country	Area Designated (Total Area x UAA % x NVZ %) (000 ha)	Proportion Designated
Luxembourg	129	100 %
Malta	10	100 %
Netherlands	1,924	100 %
Slovenia	509	100 %
Hungary	2,696	46 %
France	13,318	45 %
Czech Republic	1,303	37 %
Slovak Republic	660	34 %
UK	4,914	33 %
Belgium	360	26 %
Sweden	511	17 %
Latvia	260	15 %
Spain	3,084	12 %
Greece	418	11 %
Italy	1,323	9 %
Cyprus	11	8 %
Estonia	58	7 %
Portugal	75	2 %
Poland	318	2 %
<b>EU 25</b>	<b>64,148</b>	<b>42 %</b>

Source: Utilisable Agric Areas (UAA) - Eurostat 2007; NVZ Areas - Defra/EC-DG Environment

The initial competitiveness filter suggests that the dairy sector will carry the greatest proportion of the additional costs introduced by the new regulations, and so it is inferred that this sector will find its competitiveness significantly eroded. It is, therefore, of relevance to compare England's situation with those of others. In practice, the dairy sector can be considered at two levels:

- processed dairy products; and
- liquid milk.

England's main competitors in the dairy products market are France, Belgium, Germany, Ireland and Netherlands. Of these major competitors, Germany, Ireland and the Netherlands have applied NVZ action programme measures to the whole of their territories. France has designated 45% of its area as NVZ. Of the leading competitors, only Belgium has a smaller proportion than the UK - at 26%. By increasing the proportion of England that is designated as NVZ to 70%, with the proportion of other parts of the UK unchanged, then the UK would move alongside France in terms of the percentage of territory placed under NVZ action programme constraints (i.e. 45%).

With regard to liquid milk, it is generally held that England's main competitors are Wales and Scotland, as the relative low value of liquid milk and high cost of transport militate against viable trade from further afield. In a study for Defra (AgraCEAS, 2007), it was concluded that *"There is clear statistical evidence that the UK (British) raw milk market is relatively well integrated with other EU Member States, despite the fact that there is relatively little trade in liquid milk."* However, in the absence of significant trade in liquid milk at present, it is considered reasonable to view the competition for England dairy farmers in the liquid milk market as largely being with Scotland and Wales.

### **Competitiveness within different parts of the UK**

With respect to liquid milk, it is helpful to look at NVZ designations within each of the UK's component countries (see Table 1.3).

**Table 1.3 Area and Proportion of Land Designated as NVZ in UK**

Country	Approximate Area Designated (000 ha)	Proportion Designated (%)
England	5,042	55
Wales	35	3
Scotland	1,126	14
Northern Ireland	1,030	100

Source: England, Wales and Northern Ireland - Defra; Scotland - Scottish Executive 2006.

The bulk of the Scottish NVZs are in the arable/beef production areas along the east coast, with few in the main dairy areas of the South West (i.e. Dumfries and Galloway). It should be noted that the Scottish Executive (SE Environment Group, 2006 and 2005) has proposed no extension to the area of NVZs, although they do propose changes in the AP measures similar to those being considered in England.

The NVZs in Wales are located in the South East and North East and are relatively small, so again represent limited constraints on the Principality's farmers. In Wales, the National Assembly is undertaking a review and has proposed extending the area of NVZ by 15,000ha (about 0.6% of the area of Wales) and introducing some AP measures similar to those proposed for England (NAW, 2007). However, although no decision has been made public as yet, it is unlikely that there will be changes of sufficient scale to affect the ability of the majority of Welsh farmers to compete advantageously with their English counterparts located in NVZs.

A broad conclusion from the above analysis is that English agriculture is already at a competitive disadvantage compared to Wales and Scotland in terms of proportion of its territory designated and the proposals for extending the NVZ area in England would further exacerbate this disadvantage. English farmers outside NVZs are better placed when compared with Northern Ireland, but competition in the liquid milk market from that source is more limited than with Scotland and Wales because of the need for goods to be ferried across the Irish Sea.

### **Local competitiveness**

Farmers outside NVZs will be at a competitive advantage over farmers within NVZs. Dairy farmers are under-represented in the current NVZs - 45% of England's dairy quota is held by farmers in the 55% of England's area currently designated as NVZ. Promar International (Harper, 2007) believe that a significant production cost differential will develop between dairy farmers inside and outside the NVZ areas, resulting in a migration of quota and export of manure into non-NVZ areas (the latter only at the fringes, due to high costs of transport).

### **Mitigating effects of grants**

The effects of regulation can be offset to a degree by the provision of grant support by government. In each country in the UK, a farm waste grant scheme was introduced after the last revision of the NVZ AP. In short, each country's scheme offered 40% grant on capital expenditure, up to a limit of £85,000 per holding in NVZs, on slurry/manure handling facilities. Although times of introduction varied, all are now closed to new entrants (although the Department for Agriculture and Rural Development in Northern Ireland is applying to the EC for an extension to their scheme). Consequently, grant support did not introduce any further differential between NVZs in different parts of England. This may change in the future if any of the devolved administrations decide to provide grants to farmers in areas within their jurisdiction. In addition, some assistance is provided to farmers who participate in agri-environment and catchment sensitive farming schemes to help with nutrient planning but grants are not paid to help comply with legislation.

Defra's position on grants is that there will be no national grant scheme for slurry storage, but the Regional Development Agencies (RDAs) have been given £98m to spend in support of the livestock industry and nutrient management has been highlighted as a priority area. Indications are that some RDAs may fund anaerobic digestion or even slurry storage, but there is no certainty as to which regions will do this or how much budget they have set aside for this purpose.

### **Upstream and Downstream Effects**

It can be expected that the proposed changes will have effects upstream (on the agricultural fertilizer supply sector) and downstream (on the dairy processing industry).

#### **Fertilizer Manufacturers**

It is expected that there would be a net reduction on the sales of manufactured nitrogen fertilizer. The reduction would arise as a result of farmers following the NVZ AP measures and, as a result, making better use of nitrogen that is currently lost to the environment (i.e. as a pollutant).

The measures that could result in a reduction in purchased manufactured N use compared to current levels are:

- introduction of mandatory closed periods for the use of manufactured nitrogen;
- requirement that manufactured nitrogen should not be applied in inappropriate conditions;
- reductions to the per hectare organic loading limit on grassland to 170kgN/ha/yr for the whole farm, and 250kgN/ha/yr for any one field;
- the need to ensure that applications of nitrogen fertilizer should not exceed crop requirements; and
- prohibition on the application of manufactured fertilizer and organic manures in certain locations.

The reduction in fertilizer purchases needs to be seen in the context of the overall market for manufactured fertilizer in the country. The Fertilizer Manufacturers' Association (2006) provides an account of fertilizer use and data for 2005 are provided in Table 1.4.

**Table 1.4 Size of Fertilizer Market ('000 tonnes)**

Type of Fertilizer	England and Wales	Great Britain
Straight N	1,940	2,146
Straight P	35	37
Straight K	91	96
Compound	1,641	2,115

Total	3,707	4,395
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Fertilizer manufacturing is a global business, and figures show that annual sales of fertilizer are around 150 million tonnes per year (International Fertilizer Industry Association). A recent analysis of the state of the fertilizer industry (Entec 2007) shows that the seven main businesses active in the UK fertilizer market are generally operating at a low net margin and with an inadequate return on capital employed. Nevertheless, the expected reduction in use is likely to be negligible in overall terms, and it is concluded that the effect on the fertilizer market would be insignificant.

## ***Manufacturers of Agricultural Structures and Equipment***

### ***Slurry and Manure Storage***

It is expected that the new regulations that would increase the requirement for on-farm storage of slurry and manure. There could be a significant (but short-term) boost to demand for slurry/manure stores, although this will be spread over the transitional period. Earth walled lagoons lined with butyl rubber do not require specialist equipment and so the demand is not likely to have a significant market effect. However, above ground circular tanks are more specialised and the section of the agricultural supply industry that manufactures and constructs such stores should see an increased demand for their products. One way to reduce the storage capacity requirement is to construct a cover over the slurry store, as this will prevent the slurry volume being supplemented by rainwater. Slurry towers will need to be fitted with specialised covers whereas earth walled stores may allow more flexibility.

A significant number of farmers will need to provide additional storage. The period allowed for farmers to acquire any additional storage required will help avoid a surge in demand, with prices rising as a result. Even so, it is expected that there would be a significant and positive short-term effect on this sector of the market.

### ***Parlour Washings and Roof Rainwater Run-off***

Modifying the drainage of parlour washings and roof rainfall does not require specialised equipment or skills and so it is unlikely that there will be any significant effect on this part of the agricultural supply industries.

### ***Manure Spreading Equipment***

The proposed revisions to the NVZ AP would result in the prohibition of use of certain types of equipment for applying slurries and manures. These are high pressure and high trajectory (e.g. rain guns) equipment. According to the Survey of Farm Practices (Defra 2002), the spreading of slurry using high-pressure vacuum tankers is by far the most commonly used technique (80% of all farmers surveyed used this method). The impact will fall mostly on those farmers who use rain guns to spread slurry. Information from the farm practices survey suggests that a relatively small proportion of the slurry is spread in this way (about 7%). Consequently, the proposed prohibition is likely to have relatively little impact on the manufacturers of such equipment.

### ***Slurry Separators and Anaerobic Digesters***

It is possible that the introduction of the revised measures would stimulate interest amongst farmers in machinery such as slurry separators and anaerobic digesters.

Approximately 11% of slurry is stored in weeping wall systems (Defra 2002). No published data have been found concerning other forms of separator, although one supplier contacted during the course of this research estimated that there are around 800-1,000 separators in the UK, with around 600-700 in England. With a 20 year life, this means that around 30-35 separators are purchased each year. This is a relatively small number and a large increase in demand, should one arise in response to the proposed NVZ AP measures, would be difficult to satisfy by current suppliers. Similarly, there are believed to be relatively few anaerobic digesters in the country.

The expectation is that these methods for handling slurry will offer relatively little benefit to farmers in enabling them to meet the new requirements in NVZs (although they may be justified by other benefits). Consequently, it is concluded that the proposed NVZ measures will not significantly affect the market for these types of equipment.

### ***Milk Processing Industry***

The Economic Model suggests that the introduction of the proposed revisions to the NVZ regime will lead to a reduction in dairy cow numbers, where some farmers respond to the AP measures by reducing herd size to fall below the 170kg N/ha organic manure loading threshold. This fall in cow numbers is estimated to lead to a reduction in milk deliveries to dairies of around 0.175 million tonnes per year<sup>8</sup>. In order to assess the significance of this change in terms of milk processing industry's competitiveness, it is useful to consider the projected diminution in supply against the overall market for milk.

Between 1989 and 2005, deliveries of milk to UK dairies have been consistently between 14.0 and 14.5 million tonnes, although the trend has been downwards over the years since 2003. At an EU level (for the EU-15), milk

<sup>8</sup> This is based on the Economic Model's prediction of reductions in cow numbers multiplied by the average annual yield per cow for 2005/06 of 6,800 litres (taken from MDC Datum).

production has dropped from 115 to 114 million tonnes between 2003/04 to 2005/06) (MDC Datum - <http://www.mdcdatum.org.uk/index.html>).

The predicted reduction in milk production represents a small proportion of overall UK supply of just over 1%. However, in regions where reductions are expected to be greatest (i.e. the North West and the West Midlands), the effects could be exacerbated and could lead to short-term difficulties in meeting supply requirements.

In addition to the changes to stocking rates, there is a long-established trend of a decline in dairy farm numbers. It might be argued that the introduction of the new NVZ regime might cause a significant acceleration of this trend (see Harper 2007, for example). However, the reductions arising from underlying structural change over time have not been considered within the main analysis and so not in this Competition Assessment either.

## **Annex 3. Specific impacts tests**

### **Competition Assessment**

See Annex 2 for assessment.

### **Small Firms Impact Assessment**

See Annex 1 for assessment

### **Legal Aid**

The transposing regulations will increase the geographical area under which farmers must comply with the Action Programme measures, from roughly 55 per cent to 70 per cent.

The sanctions available within the Regulations consist of financial penalties on conviction. Since the Nitrates Directive was transposed into UK domestic law there have been no prosecutions. This is most probably due to the fact that prosecution is the last resort in a series of steps whereby the Environment Agency would be in communication with the farmers informing them to comply with the provisions of the Nitrates Directive, as transposed into UK law. Cross-compliance also allows farmers to be penalised through reductions in subsidies that they receive. The financial penalties are just the final step, and as stated above, no criminal prosecutions have been brought since the Directive was first transposed.

Therefore, despite there being a financial penalty available, increasing the geographical area from 55 per cent to 70 per cent under which farmers must comply with the provisions, is unlikely to impact on legal aid.

### **Sustainable Development**

The policy is aimed at reducing water pollution caused by nitrate from agricultural sources. The Action Programme measures are generally accepted as good agricultural practice and, if implemented by farmers, will help ensure that food production is undertaken in a manner that minimises the negative impact on the environment and does not compromise the ability of future generations to meet their own needs.

### **Carbon**

Impacts of the policy on greenhouse gas emissions (as CO<sub>2</sub> equivalent) is summarised in the main section of the Impact Assessment. Full details are provided in a report to Defra (Project Code WT0757NVZ) produced by the University of Hertfordshire, 2008.

### **Other environment**

Impacts of the policy on the losses of a range of pollutants is summarised in the main section of the Impact Assessment together with a description of how this is likely to affect biodiversity, water quality etc. Full details of the impact on pollutant losses is provided in a report to Defra (ADAS, 2007)

### **Health**

Emissions of ammonia and nitrate into the environment can have a detrimental impact on human health.

The health impact associated with the predicted increase in ammonia emissions has been costed and this fed into the 'monetisation of benefits' (section 3.4 of the impact assessment).

Nitrates are removed from drinking water before being supplied to the public for consumption. The policy is aimed directly at protecting public water supplies from nitrate pollution. It is likely to reduce the treatment costs faced by the water industry, which may be passed onto consumers (see section 3.1.2 of the IA).

**Race, Disability, Gender**

An initial screen was undertaken of the regulations' effect on race, disability and gender equality and none were identified.

**Human Rights**

The Regulations provide a process for farmers to appeal against the inclusion of their land within a Nitrate Vulnerable Zone.

**Rural Proofing**

The policy is specifically aimed at the agricultural sector. The impacts have been considered in detail within the IA.

## Annex 4. Example of derivation of monetary values for damage costs

The tables below, taken from Rahn (2007), show how the per tonne values for damage costs of nitrates were arrived at. The first table summarises the environmental impacts of diffuse pollution from agriculture, and the second shows how these were converted into an overall damage per tonne pollutant, assuming that each tonne released is distributed proportionally amongst the impacts. The large bands reflect the uncertainty shown in the first table over the proportion of water pollution that can be attributed to agriculture.

**Table 1: Estimates of the impact of agriculture on water quality in England (£m per year at 2006/07 values) \***

Water quality category	Impact of agriculture (2006/07 values) (£m per year)	Weighting attributed to primary pollutants (% of total)			
		NO <sub>3</sub>	P	FIO <sup>†</sup>	sediment
Drinking water quality (surface and groundwater)	13-71	100	0	0	0
Improved river water quality (amenity)	15-37.5	10	40**	10	40
Improved fishing	15-37	10	10	0	80
Freshwater eutrophication	168-330	10	70**	0	20
Marine eutrophication	Not available (na)	na	na	na	na
Bathing water quality	25-45	0	0	100	0
Ecosystems, natural habitat impacts – rivers etc	370-518	20	40**	0	40
Ecosystems, natural habitat impacts – wetlands	13-42	20	40**	0	40

Note all adjusted to 2006/07 values using the GDP deflator.

\* Adapted from Table 2.7 in WT0706. The title of the original table referred to the Benefit from agricultural mitigation – This cost is being used in reverse for this study as representing the burden of agriculture on for example the cost of removing nutrients from drinking water or the social cost of reduced amenity value of polluted rivers. This is similar to the approach used in the agricultural accounts project Efec (2004).

\*\* In the original IGER study, these weights were reduced to 15.7% as it was concerned with mitigation practices. Here we are concerned with their impact on the environment so figures are used as originally assessed by the expert groups.

<sup>†</sup> FIO Faecal Indicator Organisms

**Table 2 Impact of Nitrate-N on impact categories defined in IGER WT0706 study.**

<b>Impact Category</b>	<b>Expert attribution of impact %</b>	<b>Relative impact LOW £ million</b>	<b>Relative impact HIGH £ million</b>	<b>Cost per t Nitrate-N LOW *</b>	<b>Cost per t Nitrate-N HIGH *</b>
Drinking Water	100	13	71	52	284
River Quality (Amenity)	10	1.5	3.75	6	15
Fishing	10	1.5	3.7	6	14.8
Freshwater Eutrophication	10	16.8	33.0	67.2	132
Marine Eutrophication	na	na	na	na	na
Rivers - Habitats	20	74.0	103.6	296	414.4
Rivers - Wetlands	20	2.6	8.4	10.4	33.6
	<b>Impact kt</b>	<b>England</b>		<b>Per t</b>	
<b>Impact Nitrate-N *</b>	<b>250</b>	<b>109.4</b>	<b>223.4</b>	<b>437.6</b>	<b>893.8</b>

\* Represents the fraction of the total impact attributed to nitrate.  
Costs are at 2005/2006 prices.