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TECHNICAL FINAL REPORT

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LIFE Project Name
WAgriCo

Project Data

| | |
|---------------------------------------|---|
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Data on Beneficiary

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|----------------------|--|
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2 List of abbreviations

| | |
|-------------------|---|
| ADAS | ADAS UK Ltd |
| AG | Arbeitsgruppe (working party) |
| AK | Arbeitskreis (working group) |
| AONB | Area of Outstanding Natural Beauty |
| ATKIS | Amtliches Topographisches-Kartographisches Informationssystem (Official Cartographic Information System) |
| Autumn N_{\min} | Mineral nitrogen concentration available in soil in autumn |
| BÜK | Bodenübersichtskarte (soil overview map) |
| CIWEM | Chartered Institution of Water and Environmental Management |
| CPD | Continuing Professional Development |
| CSF | Catchment Sensitive Farming |
| Defra | Department for Environment, Food and Rural Affairs |
| DENUZ | Name of a transport model |
| DGs | Directorate-Generals |
| DipCon | Conference on Diffuse Pollution |
| DWI | Drinking Water Inspectorate (UK Regulator for drinking water quality) |
| DWPA | Diffuse Water Pollution from Agriculture |
| EA | Environment Agency |
| ECSFDI | England Catchment Sensitive Farming Delivery Initiative |
| EC WFD | EC Water Framework Directive |
| EGU | European Geosciences Union |
| ELS | Entry Level Stewardship |
| EMAS | Eco- Management and Audit Scheme |
| EPLR | Entwicklungsplan für den ländlichen Raum (rural development plan) |
| ESF | Environment Sensitive Farming |
| EU | European Union |
| FAL | Bundesforschungsanstalt für Landwirtschaft (Federal Agricultural Research Centre) |
| FWAG | Farming and Wildlife Advisory Group |
| FZJ | Forschungszentrum Jülich (Research Centre Jülich) |
| GAP | Good Agricultural Practice |
| GROWA | Name of a water resources management model |
| GW | Groundwater |
| HLS | Higher Level Stewardship |
| IACS | Integrated Administration and Control System |
| LBEG | Landesamt für Bergbau, Energie und Geologie (State Agency for Mining, Energy and Geology) |
| LS | Lower Saxony |

| | |
|------------------|---|
| LSG | Local Stakeholder Group |
| LFG | Local Farmer Group |
| LWK | Landwirtschaftskammer Niedersachsen (Lower Saxony Chamber of Agriculture) |
| ML | Niedersächsisches Landwirtschaftsministerium (Lower Saxony Ministry of Agriculture) |
| MU | Niedersächsisches Umweltministerium (Lower Saxony Ministry of Environment) |
| N | Nitrogen |
| NAU | Niedersächsisches Agrarumweltprogramm (Lower Saxony Agri-environmental Scheme) |
| NFU | National Farmers' Union |
| NITRABAR | Remediation of Agricultural Diffuse NITRAte Polluted Waters through the Implementation of a Permeable Reactive BARrier |
| NLWKN | Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz (Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency) |
| N _{min} | Available soil concentration of mineral nitrogen |
| NVZ | Nitrate Vulnerable Zone according to Nitrates Directive |
| Ofwat | Water Services Regulation Authority |
| OSPAR | Oslo-Paris-Commission |
| PoM | Programme of Measures |
| RSPB | Royal Society for the Protection of Birds |
| SCI | Society of Chemical Industry |
| SMN | Soil Mineral Nitrogen |
| UK | United Kingdom |
| UKWIR | UK Water Industry Research Ltd |
| vTI | Johann Heinrich von Thünen-Institut, Federal Research Institute for Rural Areas, Forestry and Fisheries |
| WAgriCo | Water Resources Management in Co-Operation with Agriculture |
| WPZ | Water Protection Zone |
| WW | Wessex Water Services Ltd |

3 Executive Summary



The LIFE project WAgriCo with financial assistance from the EU started on 01.10.05 with a duration of three years. Its purpose was to draw up and implement integrated measures and to come up with programmes of measures in accordance with the EC Water Framework Directive (EC WFD) to reduce diffuse inputs caused by the agricultural sector. Various, German and British, authorities and research institutions were involved and worked together as partners in this project (cf. Section 5).

One of the important key issues at the beginning of the project was to build up efficient project structures (e.g. kick-off events with all project participants, development of communication and dissemination strategies, designation of pilot areas, establishment of a model farm measuring network, etc.). A further step was to define target areas on the basis of technical criteria for the implementation of water protection and mitigation measures within the pilot areas in Lower Saxony (LS) and United Kingdom (UK).

In parallel with this, a list of measures for action-orientated and result-orientated water protection measures was drawn up in a broadly based discussion process between farmers and project partners. In LS a successful implementation of these measures was made in autumn 2006, spring 2007, autumn 2007 and spring 2008 and contractually agreed between NLWKN and farmers in the pilot areas.

The UK partners worked closely with individual farmers on a one-to-one basis in the sub-areas within the three UK pilot catchments in order to promote a strong working relationship. Current and historic farm, fertiliser and manure management data were obtained to provide baseline information for the project. A risk assessment was carried out in order to categorise high, medium and low risk areas in the pilot catchment sub-areas for identified mitigation measures which farmers entered into agreements during 2007.

Development of the website, the further development and implementation of measures, and the use of synergies with other protection objectives were also important steps. Another task, in the context of an agro-economic analysis, was to assess the measures undertaken and to check its integration into river basin management and agri-environmental schemes. In view of the potential of the implemented measures to reduce nitrogen (N) inputs the range of the emission and immission reduction was assessed by applying different modelling systems. Acceptance of single measures was reported and teaching material was produced and provided to vocational schools. Furthermore, on the basis of the three-tier project structure, intensive networking activities were going on during the life-span of the project to assure an optimal exchange of project outcomes from local to international level and reverse. With reference to the international level 4 International Steering Group meetings took place with a focus on mutual farm visits and intensive discussion in working groups (cf. Section 7.10). In addition to that an EU workshop was performed in the pilot area Große Aue (LS) to present the main outcomes and key messages of the LS and UK partners to a broader audience and to enhance the transfer of results to other EU member states (cf. Section 7.10)

This report was drawn up on a cooperative basis by all of the participants.

4 Introduction

The increasing eutrophication of waters (rise in nutrient input) poses considerable problems for man and the environment: it gives rise to rapid plant growth in rivers and lakes. The increased quantities of dead plants and their subsequent decomposition consume excessive amounts of oxygen; the shortage of oxygen can in turn cause disturbances in the ecosystem. The groundwater is not only relevant as one of the main input paths into surface waters for nutrients, but may itself influence water-dependent ecosystems and may also become unusable for drinking water purposes.

A sufficient and well balanced supply of essential nutrients, such as nitrogen, is fundamental for maintaining good crop yields but nutrient loss from agriculture is also recognised as a significant contributor to diffuse water pollution. Although fertiliser use has dropped in the past 10 years and there have been many changes in farmer practice and behaviour, there is still potential room for improvement.

Various international conventions seek to reduce inputs of nutrients into water: one of the aims of the EC WFD is to reduce inputs of nutrients into groundwater and surface waters in all Member States of the European Union. The Nitrates Directive aims to control losses of agricultural sources of nitrogen. The Oslo-Paris-Commission (OSPAR) also sets out to protect the marine environment of the north-east Atlantic from increasing eutrophication, among other things.

To date, specific measures to reduce nutrient and pesticide inputs have been developed and applied in drinking water abstraction areas in particular. The cooperation that has been successfully cultivated for over ten years in LS between the water management, the agricultural and forestry sectors and the water suppliers has demonstrably helped to reduce inputs into the groundwater and surface waters. There have been a number of localised landcare type voluntary initiatives in the UK but generally there is much less evidence of this type of co-operative approach. However, it was the review of these types of activities, along with the introduction of the Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS) grant schemes that prompted Defra to develop and pursue the England Catchment Sensitive Farming Delivery Initiative (ECSFDI) programme which commenced in April 2006.

The purpose of this project described here was to:

- draw up and implement, on the basis of water conservation experience to date, effective programmes of measures whose large-scale use would be calculated to bring about a decisive reduction in the input of agricultural pollutants (nutrients and pesticides) to water bodies and make a major contribution to achieving the aims of the EC WFD;
- promote a consistent and sustainable approach to integrated water resource management and demonstrate the large-scale implementation of extended measures (water-conserving agricultural production and management methods) as well as innovative cooperation approaches (multilateral cooperation) in the field of water conservation; and
- develop strategies for integrating the programmes of measures in agri-environmental programmes.

Description of technical/methodological solution:

- a broadly based participation process due to a three-tier project structure with intensive involvement of farmers in six pilot areas, three in the UK and three in LS;

- assessment of environmental and economic impacts on the basis of impact scenarios and cost-effectiveness analyses of the measures at individual farm and state level; and
- widespread dissemination of results to introduce findings and proven methods into a debate about implementation of sustainable water management methods in the context of the EC WFD at different administrative and political levels and in other EU Member States.

Effective results and positive environmental benefits were expected:

- continuing development of the actors and stakeholders and increased acceptance of water protection measures through integration of the topic “Water Conservation” into initial and further engagement with, and training in the agricultural sector;
- identification of the potential reduction in diffuse pollution from the agricultural sector;
- catalogue of efficient measures as part of an integrated Programme of Measures (PoM) including also consultancy service and impact monitoring;
- integration of the programmes of measures into river basin management and into agri-environmental schemes;
- concept for using synergies between water conservation activities and other protection targets (e.g. nature conservation areas, flood areas); and
- promotion and use of project experience and outcomes by actors, stakeholders and decision makers from local to international level (UK and LS) and also in other EU Member States.

5 LIFE Project Framework

The WAgriCo project has been carried out by five German and five UK partners (cf. Annex 1-LS/UK):

- ADAS UK Ltd (ADAS, UK);
- Chamber of Agriculture Lower Saxony (LWK, LS);
- Environment Agency (EA, UK);
- Johann Heinrich von Thünen-Institut (vTI, LS) [former: Federal Agricultural Research Centre (FAL)];
- Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (NLWKN, LS);
- National Farmers Union (NFU, UK);
- Research Centre Jülich (FZJ, LS);
- State Agency for Mining, Energy and Geology (LBEG, LS);
- UK Water Industry Research (UKWIR, UK); and
- Wessex Water Services Ltd (WW, UK).

Work on the objectives targeted by the WAgriCo project was characterised by good cooperation between these partners and the other parties involved, and good linkages between individual tasks to make a coherent programme.

Cooperation and project structure:

Local/central: The interaction of local Working Groups and central Steering Groups (national and international) ensured feedback between proposals for national procedures and methods and local implementation experience.

Practical/theoretical: Work on individual tasks was carried out jointly in various working parties and expert groups with the participation of farmers, civil servants responsible at ministerial, regional or local level for implementing the EC WFD and agri-environmental programmes, and research institutions. The principal aim here was to cater for the various demands made by politics, administration, research and the public affected.

The following project structure was put in place for this cooperation:

A three-tier project structure was established for implementing the project: international, national and regional bodies ensured integration of the actors in decision making processes at all levels and active exchange of information within and between the levels.

Working Groups were set up at the regional level in the 3 project areas in LS and in 6 sub-areas in the UK (cf. Section 7.1).

These Working Groups fostered ongoing cooperation with local interest groups and acceptance of individual regional responsibility with regard to the problems associated with diffuse pollution and their solution (cf. Section 7.2). They coordinated all working steps and their results. The Working Groups were managed by the local branches of NLWKN in LS and of UKWIR in association with the NFU in UK.

National coordination of the work in the project areas was handled by a National Steering Group in each country, consisting of representatives of the project partners and of the Working Groups. The Steering Groups drew up national guidelines and fed the project results into the political and administrative decision processes at national level (cf. Section 7.9).

Close links between the project work in the UK and LS were maintained at the level of the International Steering Group and through international expert teams (Annex 3-LS) and additional workshops, which not only ensured up-to-date sharing of interim results, but also promoted contacts between farmers.

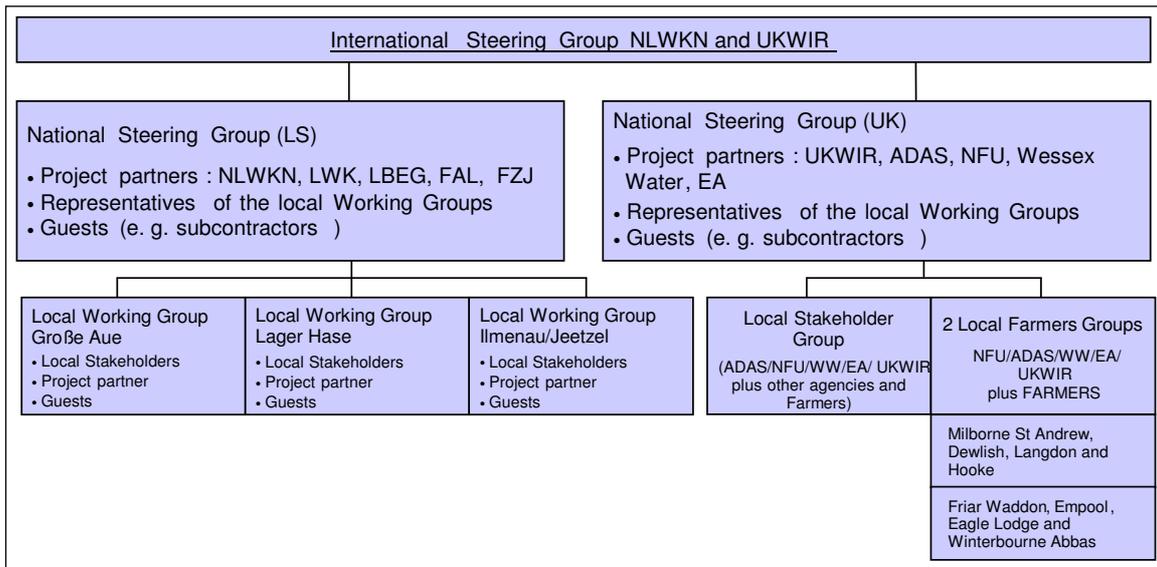


Fig. 1: Project structure

Numerous meetings have been held at all levels since the kick-off events. A list of the meetings can be found in Annexes 4-LS and 4-UK.

The NLWKN as beneficiary and as overall lead partner was responsible for the implementation of the project according to the time schedule, organization of the communication between partners and reporting to the EU. NLWKN is also responsible for the follow-up of the project's finances (cf. Section 11). Therefore, NLWKN signed Partner agreements setting out the tasks, rights and responsibilities of the participants with UKWIR and with the German partners (Annex 5-LS). Similar agreements have been agreed and signed between UKWIR and the UK partners (Annex 5-UK). Thus, UKWIR acted as the principal UK partner in relation to NLWKN.

Project phases: linking tasks

The aim of the project was to create a basis for effective achievement of the objectives of the EC WFD with regard to reduction of diffuse substance inputs from the agricultural sector.

This project aim was being pursued in two processes which are closely connected:

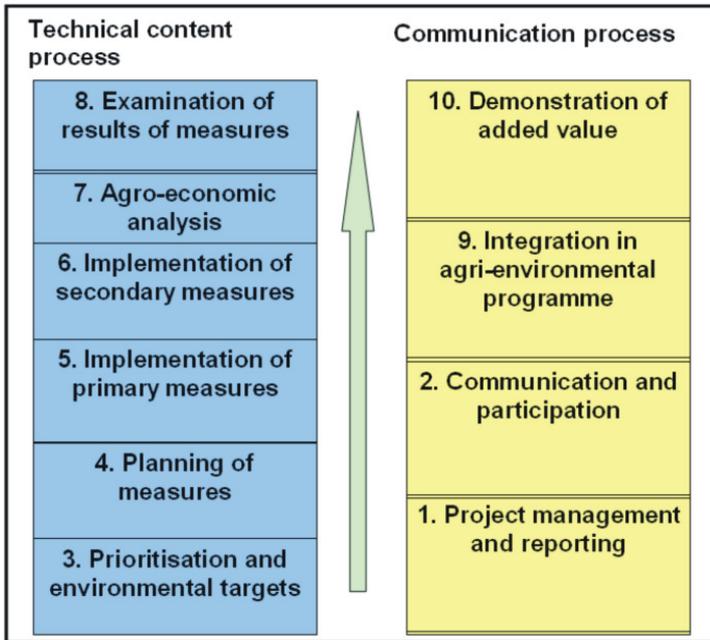


Fig. 2: The ten main tasks of the WAgriCo project

The course and interconnections of the technical work are described in the following Section 6, and details of the individual tasks and results can be found in Sections 7.3 to 7.8. The elaboration of these technical tasks was accompanied by a communication process supported by all participants throughout the duration of the project. In addition to establishment of the project structure (cf. earlier in this Section), the individual tasks set were “Communication and Participation” (Section 7.2), “Integration of measures in agri-environmental programmes” (Section 7.9) and “Demonstration of the added value created by the project” (Section 7.10).

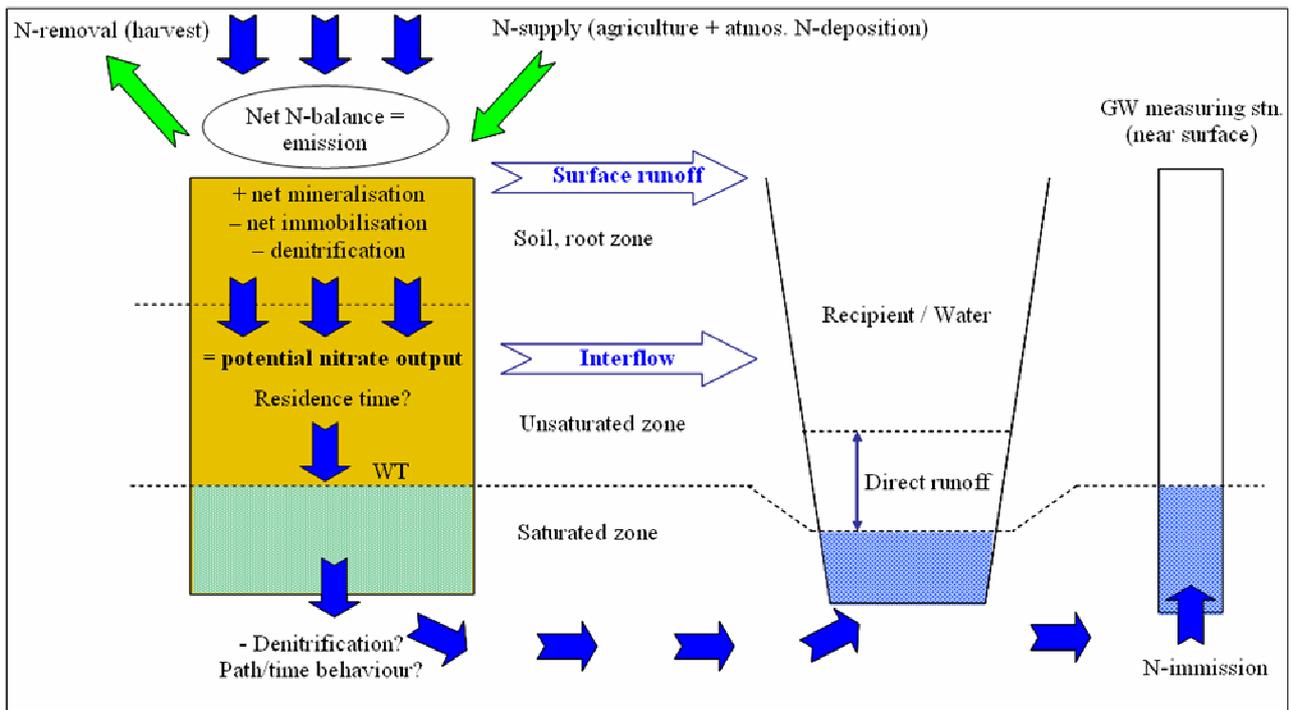


Fig. 4: Simplified integrated pedologic-hydrogeologic concept model

The natural characteristics can be described on the basis of the geological and hydro-geological conditions of a groundwater body. These include the hydrological “building blocks” such as hydraulics (e.g. groundwater regeneration, permeability coefficients), groundwater resources and the ratio of groundwater to surface water (i.e. an estimate of the time the water takes from seeping into the groundwater-bearing rock until it emerges into the surface water). It is also necessary to consider the geologically determined characteristics such as the protective potential of the groundwater cover and permeated subsoil and the natural chemical quality of the groundwater.

For the state-wide quantification of the actual status of diffuse nitrogen inputs in groundwater and surface water in LS an N-balance/hydrologic/N-export model system, applicable to the entire State of LS, is used. The N-balance model estimates the mean nitrogen excess at the scale of local administrative units based on official agricultural statistics. Hydrological variables (e.g. seepage, groundwater recharge) are calculated with the hydrologic model GROWA according to natural conditions (climate, soil, topography) and land use. Nitrogen export variables (e.g. nitrogen degradation in soil, nitrogen load and concentration in seepage water) are calculated with the DENUZ model on the basis of the land use map (50 x 50 m grid), the calculated nitrogen excess, soil characteristics and the outputs of the GROWA model. The combined models provide the actual status of nitrate concentrations in seepage water for entire LS on a 50 x 50 m resolution. The results are used as the basis for the state wide predictions of the effects of measures on the reduction of nitrogen emissions and nitrate inputs in groundwater and surface water.

Proceeding from this understanding of the system, geographical priorities and environmental targets were decided (cf. Section 7.3) and used as a basis for drawing up programmes of measures (cf. Section 7.4). The model system was also used to evaluate the effects of the measures implementation (Section 7.8)

7 Progress, Results

Working from a common basic understanding, the individual tasks of the project application were implemented in Lower Saxony and the United Kingdom in line with the respective framework conditions. The joint analysis was used to draw conclusions that would support the transfer of the findings to other Member States. The main outcomes of this project were put into nine key messages (cf. Annex 52-LS), a nontechnical leaflet (c.f. Annex 54-UK) and the Layman`s Report (c.f. Section 13).

7.1 Project management and reporting, establishment of project structures

The basic project structure is described in Section 5. The management of the project was the responsibility of the beneficiary, NLWKN in Germany and supported by UKWIR in the UK. All essential decision processes were carried out at the three levels of the project. Accordingly, this final report has been drawn up in cooperation with the partners, having regard to the process of coordination with the National and the International Steering Groups.

As an important step in the establishment of the project structure, it was necessary to designate six pilot areas, the principal features of which are described below. The participation process used in the pilot areas is outlined in Section 7.2. The LS memoranda in which the members of the Regional Working Groups officially agreed the project targets as a basis for their significant participation in the project are attached as Annex 6-LS. In the UK, the Local Farmers` Groups (LFG) were established as well as a Local Stakeholder`s Group (LSG) which comprised of other interested agencies. At the meeting of this Group held in January 2007, local farmer were also represented (Annex 6-UK). The meetings were held on a presentational workshop basis. The Annex 11-UK and 45-UK describe the participation process of the LFG and LSG.

The three pilot areas in unconsolidated rock (Grosse Aue, Lager Hase, Ilmenau/Jeetzel) selected in LS differed considerably in terms of farm types, livestock density, soils and precipitation rates. This ensured the development of a methodology that is applicable throughout the region.

Agricultural use in the Grosse Aue area is characterised by pig and dairy cattle farming with the associated fodder growing, plus a considerable proportion of cash crop farms. Compared with the relatively heterogeneous nature of the Grosse Aue area, production in the other two pilot areas displays a more clearer individual focus: the Lager Hase area is dominated by livestock farming including fodder growing, while the emphasis in the Ilmenau/Jeetzel area is on cash crop farms.

In the UK, the three pilot areas were the Frome, Piddle and Wey river catchments in Dorset and are geographically bordering, unlike the LS pilot areas which were geographically quite separate. In terms of geology, the upper parts of the Frome and Piddle catchments are both chalk. These then flow out onto the Tertiary sediments composed of sands, gravels and clays that overlay the chalk before entering Poole Harbour. In contrast, the River Wey flows across Jurassic limestone and Sandstones (Purbeck and Portland Units) and Kimmeridge Clay before it enters Weymouth Bay.

In terms of land use, the three UK pilot areas were similar, with farm enterprises consisting of arable, intensive dairy, intensive beef, sheep and a small number of pigs. The majority of the farms were within a Nitrate Vulnerable Zone (NVZ) so the amounts of organic nitrogen fertiliser (and manures/slurries) that can be applied are regulated. Whilst the project gave consideration mainly to nitrate, in the areas within the Wey sub-area of Friar Waddon the major concern was one of pesticides (Annex 43-UK).

Further details of the physical classification, land use and pollution situation of all pilot areas are set out in Annexes 7-LS and -UK.

Conclusion

The three-tier-project structure which was established at the beginning of the project was very beneficial for the project management. This structure promoted strong stakeholder participation and formed the basis for an active bottom-up and top-down decision process. Being member of the local Working Groups and by taking part in the implementation of measures farmers played a key role as multipliers for other farmers to get interested in the objectives of WAgriCo and the EC WFD. Results from the local level and also from the partners were bundled on state level by the National Steering Group. Upcoming questions not to be dealt with in the National Steering Group were delegated to special expert groups (e. g. measure planning, modelling, N-balancing). To ensure an active exchange between the LS and UK partners there have been international meetings (e. g. expert group modelling).

The international exchange of results and experiences with all project partners was ensured by mutual visits in the United Kingdom and Lower Saxony during the meetings of the International Steering Group. Besides the partner presentations the field and farm visits in the respective pilot areas were a major aspect to enhance the mutual understanding between the project partners and the farmers.

7.2 Communication and participation process

Communication and dissemination strategy

The basic principles of the communication and dissemination strategy were developed by NLWKN and UKWIR during the workshop at the beginning of February 2006 and at the meeting of the International Steering Group in March 2006. On the basis of these ideas, each country drew up a dissemination plan that was agreed by the National Steering Groups (LS and UK).

The core of the LS dissemination strategy (Annex 8-LS) is the definition of which target groups are to be reached with what content. In addition to general information on the project and the financial assistance from the EU, the main aim was to describe the practical added value that the various target groups gain as a result of the project: the general public as the first target group is basically to be informed about the project in the context of the EU LIFE assistance programme (EPLR). As a second target group, farmers are to be informed about the connections between agriculture and water quality and about the ways in which water-protecting farming can make an important contribution to conserving and improving water bodies. As members of the Working Groups and in the National Steering Group, farmers play a key role in designing possible means of supporting the implementation of the EC WFD in this project. Through several publications of technical articles on the WAgriCo project in the specialist journal "Land&Forst" at least 50% of farmers in LS are informed about the project aims (cf. Annex 10-LS). The experts, as the third target group, were not only involved to receive this information, but also to be informed about the basic principles drawn up within the project for the key topics of setting priorities and planning and implementing measures. In addition, the experiences gained with regard to necessary structural and administrative limiting conditions was useful to support the experts in their task of advising politicians.

The UK approach was similar to that of LS and the approved UK strategy is set out in Annex 8-UK. The strategy identifies the target audiences and covers the communication areas of press work i.e. news releases, trade journals and newsletters. From the dissemination perspective, the strategy covers such areas as the internet, technical newsletters, presentations; farm visits, field walks and training talks/workshops. The strategy also identifies the Local Farmers' and Stakeholders' Groups. Through these Groups the UK partners were able to share, along with other organisations that have an interest in catchment/farm management, the opportunity to combine farm visits and training talks/workshops.

Both the LS and UK strategies were kept under continuous review to monitor how each group communicated and disseminated through its media interaction the nature and benefits of the project. After the conclusion of this project, the communication and dissemination strategy will concentrate on the After Life Plan (cf. Section 10).

Beneath several instruments like press work an informative central website (www.wagrigo.de and www.wagrigo.org) with numerous technical downloads was created as one of the most important for various stakeholder groups. But there were also reports about WAgriCo on the individual partners' websites (e.g. NFU: www.nfuonline.com/x12724.xml and LWK: www.lwk-niedersachsen.de). The project has regularly published newsletters and produced general and technical flyers.

Annexes 9-LS and 9-UK provide a complete list of all communication instruments used in LS and the UK.

Numerous meetings and workshops were held at local, national and international level between the parties directly involved in the project. A list can be found in Annex 4-LS and Annex 4-UK.

All participating institutions have presented the WAgriCo project at internal meetings and to some extent in staff circulars.

Generally, the profile of the project is high amongst policy makers, stakeholders, scientists and catchment practitioners. This is a result of communication about the project through a range of media and by a range of approaches. For example, ADAS UK Ltd had regular meetings with Defra when the opportunity to discuss WAgriCo was taken. In addition there were specific presentational meetings in May 2007 and July 2008 when Defra was briefed on progress and outputs. As a result of the May 2007 meeting Defra integrated one of the WAgriCo Programme of Measures into their ECSFDI programme. Copies of the presentations are given in Annex 44-UK and the July 2008 presentations were also given to Defra ECSFDI South West team.

The main instruments used for communication with technical audiences outside the immediate project context were workshops, seminars and conferences on national and international level, at which the project partners presented not only the WAgriCo project as such, but also details of the technical results. A list of these conferences can be found in Annex 9-LS and 9-UK.

Participation Process

In accordance with Article 14 of the EC WFD, it is necessary to ensure active participation by the public, including the users, at an early stage. In the interests of broad acceptance of the management plans that have to be drawn up, there is therefore a need for cooperative involvement and integration of the parties concerned (including land users, authorities, associations) with a view to establishing efficient structures.

Important cornerstones of cooperation within the meaning of the EC WFD, which is intended to ensure a broadly based participation process, include:

- an initiator as “driving force” and overall coordinator (e.g. NLWKN, ...);
- defining the areas concerned (e.g. river basin area, sub-basin area);
- addressing and integrating the relevant social groups (see above);
- defining an internal circle of participants for cooperation meetings and regulating the inclusion of external multipliers;
- regulating responsibilities and tasks (e.g. drawing up rules, producing minutes of meetings, terms of reference); and
- drawing up a communication and dissemination strategy.

The basic principles of this process and the experience gained are described in the “Guide to participation process” (Annex 11-LS). In LS, the structures of the ‘Cooperation Model for Drinking Water Protection’ and the many years’ experience gained were used as a basis and starting point. These bilateral cooperations between the water sector and the agricultural sector are potentially suitable forums for expansion to take in the interests and requirements of the EC WFD. The above mentioned structures were used for WAgriCo. At the initiative of NLWKN, Working Groups were set up in the 3 pilot areas on the basis of the cornerstones described above. A list of the participants in the Working Groups is attached in Annex 12-LS. The Working Groups met at regular intervals. Due to the requirements of the EC WFD and the results of the initial characterisation, the Working Groups supported all main steps in the project, e.g. the preparation of action plans which were then implemented in previously prioritized target areas as part of a coordinated procedure.

In the UK, the co-operative alliance between Agriculture and Water Resource Managers towards common goals is a relatively new concept. This was therefore developed within the WAgriCo project and the approach used is detailed in Annex 2-UK. In the first instance, both WW and ADAS made ‘preliminary’ approaches to the local farmers. WW made direct approaches to local farmers within the ‘sub area’ pilot catchments they were managing. However, ADAS’s approach was different in that they wrote to all the farmers in their sub-area pilot catchments and then followed up with one to one contact. This enabled both organisations to develop the ‘routine’ and ‘detailed’ levels of engagement and participation. This approach enabled the establishment of the 2 Local Farmer Groups to cover each of the sub-areas, one for the WW managed sub-areas, the other for the ADAS managed sub-areas; these groups were subsequently combined.

Based on the knowledge and experienced gained through the project, the UK partners developed their ‘Guide to Organising Participation Process’ entitled ‘Stakeholder Facilitation Guide’ (Annex 11-UK). Recognising the different approaches developed in the UK the Annex 45-UK describes and discusses these approaches in more detail and makes comparison with the ECSFDI approach.

Conclusion

The realised communication structures and adopted instruments for participation were one of the key issues to involve agricultural practitioners and stakeholders on the one hand and political decision makers and general public on the other hand. The experiences of this process will be used to implement water protection measures in accordance with the EC WFD and the high standards of participation defined in Article 14 of the EC WFD (c.f. Annex 39-LS).

7.3 Geographical prioritisation for planning of measures and environmental objectives

Geographical prioritisation

In order to prioritise within the pilot areas, LS and UK use information about impact and utilisation of resources to identify areas with high priority for measures.

In LS, numerous measurements showed that by comparison with other uses, nitrate levels in seepage water were highest under arable fields (often in excess of 100 mg/l). This was also reflected by the results of the initial characterisation, which were presented and discussed in the pilot area Working Groups.

For the delineation of areas with high priority for measures within the pilot areas, a GIS-based methodology was applied. On the basis of the land use map of the official cartographic information system (AKTIS-DLM 1) and the soil overview map 1:50,000 (BÜK 50), all arable land with a low nitrate degradation potential in the soil was designated as potential target areas. The hydrologic/hydrogeologic model GROWA was then used to undertake a differentiation of total runoff into direct runoff and groundwater recharge. In a further step, this was used to identify target areas for groundwater conservation (high level of groundwater recharge) and areas for conservation of surface waters (high direct runoff). These target areas formed the planning basis for the selection of farms for the implementation of measures. The methodology is described in detail in the guide to setting geographical priorities (Annex 13-LS).

The described working steps gave rise to the following land categories in the pilot areas:

- target areas for groundwater conservation measures: arable land with low nitrogen degradation potential and large share of total runoff going to groundwater;
- target areas for surface water conservation measures: arable land with low nitrogen degradation potential and large share of total runoff accounted by direct runoff, plus 50 m-wide riparian strips alongside surface waters; and
- areas with low priority for measures (all other areas).

The target areas for the first two one of these categories are shown in the maps in Annex 14-LS.

For the examination of the results of the measures implementation on a state wide level target areas based on groundwater bodies endangered to fail the good chemical status due to nitrate pollution and their hydrogeological subdivisions were delineated. These target areas which focus on the protection of groundwater were selected based on the nitrate pollution in the groundwater monitoring sites and an estimation of the nitrate concentration in seepage water based on the model described in Section 6.

In the UK, the Piddle and Frome river catchments were selected because of the existing nitrate problems in these catchments and the amount of work that had already been undertaken by WW and other agencies on catchment management issues. The River Wey was selected, (Annex 43-UK) as there has been in recent years an increasing problem of significant pesticide peaks. The maximum permissible level for each individual pesticide is 100 mg/l while the total pesticide level is 500 mg/l. At Friar Waddon, there had been historic individual pesticide peaks of 2500 mg/l (April 2002), 1250 mg/l (November 2002), 400 mg/l (November 2003) and 250 mg/l (November 2004).

The specific target sub-areas within these three catchments were based on eight public water supply sources, Empool, Hooke, Langdon, Eagle Lodge and Winterbourne Abbas in the Frome, Dewlish

and Milborne St Andrews in the Piddle and Friar Waddon in the Wey. These sources were considered to be the ‘endangered water bodies’ on the basis of their rising nitrate trends, or pesticide in the case of the River Wey. They represent a mixture of borehole and spring abstractions. The nitrate peaks on which WW performance is measured, were running close to the permissible levels defined in the EC Drinking Water Directive . The areas around these sources were further defined by the Environment Agency’s Source Protection Zones. These zones were defined on the basis of the assessment of experienced hydrogeologists and groundwater modelling. Further details of the justification for these sub-areas are given in Annex 7-UK and Annex 16-UK. These pilot catchments were identified at the UK project launch and at the LFG first workshop.

Environmental Objectives

Definition of environmental objectives is an indispensable precondition for assessing the required amount and efficiency of water conservation measures. If, when deciding on these environmental objectives, one regards the groundwater/surface water as an asset to be protected, then the anthropogenic substance inputs should be low enough to achieve “good status” of the waterbody and ensure it on a long-term basis. In view of the limited project period of 3 years, there was a need to make a distinction between objectives for the reduction of these inputs (emission) that could be achieved in the “short-term” and set out on an annual basis, and possible “long-term” objectives for the quality of groundwater in particular (immission).

The environmental targets for chemical status of groundwater bodies according to the EC WFD are specified in the Groundwater Directive (Directive 2006/118/EC). In LS, a large number of groundwater bodies are at risk of being classified as bad chemical status because the quality standard of nitrate is exceeded in parts of the groundwater measuring stations. Other diffuse pollutants associated with agriculture (pesticides, etc.) have only a small importance. For this reason the definition of environmental objectives is focussed on nitrate only. It was assumed that environmental objectives concerning other chemical substances can be derived in a similar way.

In the WAgriCo project it was considered necessary to use the assessment criterion “nitrate concentration in seepage water” (calculated or measured) as a basis for the definition of environmental objectives. In particular, this parameter permitted a rapid estimate of the attainable immission objectives that makes it possible to show compliance with the ban on quality deterioration or, ideally, a trend reversal even in the short-term, i.e. within the project period. In LS the nitrate concentration in seepage water was considered as the environmental target for nitrogen reduction measures. A value of 50 mg/l was used as a conservative starting point. This value, however, was not to be applied to each individual site, but is regarded as an average value for a larger area defined by the groundwater bodies and their hydrogeological subdivisions. The average value for the actual situation is calculated on the basis of a detailed map of nitrate concentrations in seepage water which is the result of a coupled agro-economic/hydrologic-hydrogeologic/N-export model system.

As discussion on environmental targets proceeds, it may be necessary to change the average value of 50 mg/l in seepage water dependent on the magnitude of observed nitrate concentrations in the groundwater of the individual hydrogeological subdivisions in order to regard the denitrification process. The defined quantitative values will be used for the assessment of the probability of achieving the environmental targets (Section 7.8).

In the UK catchments of the Frome, Piddle and Wey, one of the main environmental drivers was the reduction of nitrate concentrations to an acceptable level in order to protect the public water supply

sources. In the Wey catchment, WW is faced with having to install expensive, environmentally unsustainable treatment works to remove pesticides. In cooperation with the Drinking Water Inspectorate (DWI), it has been agreed that treatment could be deferred by setting up formal agreements with the three farmers that prohibits the use of any pesticide on the immediate catchment area. The environmental objective is to reduce or remove the pesticide contamination from the surface and groundwater with the ultimate objective of removing the need for any treatment at this site.

Interactions with surface water were also considered, since this has potential to impact ecological status. In other parts of the wider catchments (i.e. outside the sub-areas), the priority was sediment and phosphorus loss to surface waters – this is being addressed under the Defra’s England Catchment Sensitive Farming Delivery Initiative (ECSFDI). The UK partners were in close contact with this ECSFDI to allow investigation of synergies between approaches and resources. There was also a need to understand the actions being undertaken in the other initiatives and how they impacted on the WAgriCo pilot sub-areas. To aid this, the EA river water quality data was monitored to identify any discernible changes or trends.

Conclusion

The environmental objectives in LS and UK were defined for different scales. Whereas in LS nitrate concentration in the groundwater bodies within the pilot areas and state wide was the objective, UK concentrated on nitrate concentrations in specific drinking water boreholes. Due to these different scales approaches for geographical prioritisation are concentrating on GIS-based techniques in LS on the side and the selection of specific farms and hydrogeologically defined source areas in drinking water catchments in the UK on the other side. In both countries the prioritisation and the environmental objectives are the basis for planning and implementation of effective programmes of measures.

Key Message: Procedure to determine target setting and areas (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- Individual water bodies have to be considered separately.
- Methods for prioritisation target areas and for defining objectives have to be as simple as possible and set based on sound techniques (e. g. GIS-based), with a justifiable evidence base. This is likely to ensure better ‘buy in’ from stakeholders.
- Objectives may be set on ecological targets or health targets; thresholds are likely to be different (50 mg/l are regulated by the EC WFD)

7.4 Measure planning and compilation of programmes of measures

In Lower Saxony

- Action-oriented measures for water protection

The aim was to implement action-oriented water protection measures into practice already in the first project year in LS to allow two years of practical demonstration during the project time. Therefore, a selection was performed on the basis of water protection measures already applied under practical conditions to reduce nitrate inputs into ground- and surface water in LS (e.g. voluntary agreements in water protection areas, cooperative approaches, agri-environmental scheme

NAU) supplemented by information from other German Federal States. A catalogue of 42 possible technical-organisational measures for practical testing was compiled and assessed by experts from LWK, NLWKN, vTI and farmers collaborating in the Working Groups in the three pilot areas with regard to their ecological effectiveness, economic efficiency, acceptance and controllability (Annex 17-LS). Out of this catalogue, measures were selected that allowed a progress review after only one year which displayed the best possible ratio of cost to effectiveness while offering good acceptance and good controllability. The selected measures had to be suitable for an action-oriented approach (prior measures for arable land use) and were defined regarding the management conditions and the level of compensation payments (4 Working Group meetings organised by vTI; cf. Annex 4-LS and Annex 12-LS). The National Steering Group agreed on the implementation of six measures for autumn 2006 and five measures for spring 2007. In 2006, 52 farmers signed water protection agreements (Annex 19-LS and Annex 20-LS) with about 1.300 ha contract area (Annex 21-LS). In spring 2007, the selected measures were reviewed, first with the farmers in the pilot areas and then in an Expert Group meeting (21 May 2007). Due to the experience of the farmers with the eleven measures, few modifications in the management conditions and the contract sheets (Annex 20 –LS) were undertaken for the practical testing in 2007/2008. Furthermore the catalogue was enlarged by two new measures to reduce nitrate leaching over winter (Annex 18-LS). Based on the experiences made, a list of action-oriented and investive measures was set up as a suggestion for the implementation into agri-environmental schemes during the Expert Group meeting in February 2008 (Annex 4-LS). The further process is described in Section 7.9.

- Result-oriented measure

In addition to adjustments of existing action-oriented measures, an innovative result-oriented approach was developed within the project: The objective is to reward farmers for the improvement of nutrient management at the farm level. This approach has potentials to increase positive environmental impacts and cost-effectiveness. Farmers have free hand in their adjustments to fertilizer usage, fodder and crop growing. The idea was firstly presented in March 2006. After a number of consultations in the pilot areas and Working Group Meetings of project partners, representatives from the pilot regions, advisers and farmers a consensus was achieved by mid-January 2007 on the design of the result-oriented measure to be tested in 2007 (6 expert group meetings organised by vTI; cf. Annex 4-LS and Annex 12-LS). With the result-oriented measure farmers were actively involved in a water protection scheme and could show entrepreneurial behaviour (Annex 22-LS). The calculation of improvements to be rewarded was based on a farm gate balance, with additional information about on-farm use of fodder and organic fertiliser. Coefficients for N-efficiency were calculated separately for mineral and organic N to allow a documentation of efficiency improvements independent from structural changes. All farmers that signed for the basic agreement (Annex 19-LS) took part in this measure. First experiences and definition of suitable parameters on which rewarding and monitoring could be based were discussed during several expert group meetings in 2008 (Annex 4-LS).

Besides the practical testing of measures, Annex 23-LS gives an overview of different water protection measures. Additionally measures for mitigation of diffuse inputs into surface waters were discussed (Annex 24-LS). Annex 25-LS includes the aspect of costs-effectiveness of the measures practically tested. The fact sheets developed here have been further advanced according to administrative costs and acceptance. This is an important step to agro-economic analysis and the implementation into agri-environmental schemes.

In UK

- Action-oriented measures for water protection

Previous studies undertaken in the UK for Defra (NT2511 - Cost curve of nitrate mitigation options; PE0203 - Cost curve assessment of phosphorus mitigation options relevant to UK agriculture; and ES0121 COST-DP - Cost effective diffuse pollution management) had identified a range of measures that could be adopted to reduce diffuse water pollution from agriculture. Along with the 'Inventory of Measures to Control Diffuse Water Pollution from Agriculture (DWPA)' handbook, these projects described a list of 44 potential mitigation methods that farms could adopt. These reports can be accessed from the following web site:

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=ProjectList&Completed=0&ContractorID=591>.

These were tailored specifically to the WAgriCo project and it was accepted that this list would be used within the UK WAgriCo project and formed the 'tool-box' of measures (Annex 23-UK). This list was kept under review and could be modified as appropriate. For example, this initial list did not include fertiliser spreader calibration, although the WAgriCo project identified this as a potential priority area. Furthermore, an additional review of measures that was undertaken for Scottish Government identified several additional measures that focused on slowing surface water run-off, thus reducing losses of phosphorus and soil-bound pollutants (see Annex 46-UK). However, these measures were more appropriate for upland pasture rather than lowland arable agriculture and were not deemed appropriate for implementation in the WAgriCo project.

In order to obtain an unified understanding across the UK sub-areas, a Field Work Plan was developed and all partners signed up to it, thereby ensuring a consistent approach by all, when assessing individual farms (Annex 26-UK).

Following the detailed analysis of many of the farms within the sub-areas (Annex 27-UK), results from nutrient budgets and farm audits illustrated that there were very few radical mitigation methods that needed to be imposed on the farms. The assessment was that it was more about less demanding changes in practice. An appropriate and meaningful initial range of mitigation methods (catalogue of measures) that would be suitable to be undertaken on the farms within the study areas was identified as the central approach (Annex 23-UK). These methods were discussed and accepted by the farmers at a workshop subject to a minor change which the UK partners accepted.

The analysis also suggested that (a) there were few examples of poor practice that could be immediately identified as being the cause of diffuse pollution problems within the sub-areas and that (b) not all the implications of management practices on nitrate in the catchment (e.g. unlined slurry lagoons) were fully understood.

In summary, the audit concluded the mitigation methods that could be implemented could be categorised thus:

- Good Agricultural Practice (GAP);
- Enhanced GAP; and
- Infrastructure Changes.

These three categories were broken down further to form a total of six measures for possible implementation, depending on the individual circumstances of a farm. Each measure was reviewed and a support and co-operation approach was detailed in 'Programme of Measures for the Priority

Catchments' (Annex 23-UK). The measures were used as the basis of identifying and agreeing with farmers what they would undertake within the project. The implementation programme for these measures was determined and is shown in 'Programme of Measures – Implementation Programme' (Annex 28-UK).

- **Result-oriented measure**

Similar to LS, the UK also investigated the potential of a result-oriented approach. Within the framework of this project, this could only be an initial investigation given that the approach is so different to the usual input-based restrictions that form the basis of many measures, for example, the Nitrates Directive Action Programme.

The UK partners, similarly investigated the use of a farm N-balance/N-efficiency calculation. This investigation formed the basis of the first year's work of the PhD student funded by the project through ADAS who acted as the industrial supervisor. There were several steps to the approach:

- Development of a methodology to calculate farm N efficiency. Various approaches were considered. A major difference between the LS and UK approach was that the UK methodology aimed to use more farm-specific data. This has challenges in terms of data collection, but might be a better basis of assessment for individual farms.
- Calculation of 'baseline data' for farms based on previous farm management data.
- Introduction of the concept of managing N to improve efficiency at a workshop and through a technical newsletter.
- Calculation of N efficiencies at the end of the project for participating farms.

The overall conclusion is that this approach may be a useful supporting tool to advise farmers on how better to manage N on the farm, but we are a long way from being able to introduce this as a specific measure. Annex 47-UK provides more detail. Annex 60-UK gives an alternative result oriented approach developed in New Zealand.

Conclusion

The planning, implementation and assessment of measures was a key issue for the agenda of the local stakeholder groups and the International Steering Group meetings in LS and UK. The discussion was about special technical criteria of the action and result oriented measures. In addition the partners discussed questions of acceptance and impact monitoring at the farm and state level. As a result, LS and UK declared that there were administrative constraints which could have a negative impact on the acceptance of the measures being provided. It was also agreed that an effective monitoring network (farm and state level) is indispensable.

LS and UK developed a set of measures for implementation in their respective countries, as described above. An analysis of these measures showed:

- The emphasis was on source control, which means managing correct inputs to the systems (fertilizer and manure management).
- The nature of the measures was broadly similar between countries: any differences could be explained by differences in soils (sand vs. silts) and crop rotations (emphasis on maize in LS) between the two countries.

Furthermore there was consensus between the LS and UK partners in terms of the effectiveness of the implemented measures. Both the UK and LS estimated the effectiveness (kg/ha N reduction on

field basis) of the developed catalogue of measures. Even though LS and UK had worked with different models, it was evident that the estimates of effectiveness broadly agreed in both countries.

In this context LS and UK partners agreed that the reduction potential of the action oriented measures would not be sufficient in all cases where diffuse inputs have to be reduced. As a result, there was a common understanding that an efficient implementation of measures has to be supported with a consultancy service in order to have a technical support for the farmer and to obtain necessary data for the impact monitoring.

From the administrative and agrarian policy point of view LS and UK partners underlined the importance of the voluntariness and the flexibility of measures to allow a fast adjustment to altering natural, economical and legislative circumstances.

The apparent reliance on action oriented measures is a feature of the Nitrates Directive and indeed, within the WAgriCo project most of the measures focused on action oriented measures. Both LS and the UK explored result-oriented approaches in addition. Although they show some potential, there are still many challenges that need to be addressed if this approach was to be adopted.

Key Message: Measure planning and implementation (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- PoMs including efficient mitigation methods for groundwater protection and considering synergies with other programmes
- An improved mitigation of nutrient inputs due to consultancy service and efficient measures planning and implementation
- A quantitative analysis of the likely effectiveness of measures is required at an early stage

7.5 Implementation of primary measures

Model farm measuring network

In the LS pilot areas the project succeeded in recruiting a total of 52 model farms. A cartographic overview of the farm locations is shown in Annex 29-LS. The farms reflected the representative farm types in the regions. In the Lager Hase pilot area, there were 22 farms taking part in the project, mainly livestock breeding farms, with an average size of approx. 71 hectares. Cash crop farms formed the bulk of the model farms in the Ilmenau/Jeetzel area. Here, there were 17 farms with an average size of around 135 hectares taking part in the project. In the Grosse Aue area there were 13 farms with an average size of about 110 hectares taking part in the project. The main farm types here were fodder growing and livestock breeding farms.

Measures application in LS was accompanied by determination of Soil Mineral Nitrogen (SMN) in autumn and occasionally in spring, analyses of manure and provision of recommendations for nutrient management. This was part of the consultancy service provided by the staff of the Lower Saxony Chamber of Agriculture. Furthermore extensive data acquisition took place from the year 2004 to the present. These data were fed into especially developed calculation tools for nutrient-balancing. This was the basis for the result-oriented measure and the development of an approach for an improved nutrient management at farm-level (Section 7.8).

In the UK, a range of samples were taken during the project (Annex 30-UK). The sampling was controlled by the Field Work Plan, agreed by all UK Partners (Annex 26-UK). The measurements were:

- Soil nutrient status 0-15 cm arable; 0-7.5 cm pasture;
- Soil mineral N, 0-90 cm, autumn and spring;
- Borehole/well /spring/stream water sampling; and
- Nitrate leaching during autumn winter, measured using porous ceramic cups.

The plan was to use these measurements for several purposes within the project: supporting farmers and their co-operation in the project, assessment of effectiveness, identifying problems and demonstration of effects to farmers.

Implementation of measures from 2006 to 2008

In the UK, implementation of the primary measures has initially targeted on those farms that fell into the 'high' and 'medium' risk categories, as identified by initial farm visits and audits (described earlier). Farmers falling within these categories were sent individually tailored 'farm packs' (see Annex 48-UK). These packs contained general information on the primary measures, which were identified under task 4. Further detailed information tailored to the individual farm outlining the suitable measures which could be undertaken on that farm, the payment structure for each of these measures, and the potential technical support available to them was also included, along with a range of sampling results which had been taken on that farm.

The catchment advisers followed up the 'farm packs' with visits or telephone calls to each of the farms to discuss their primary mitigation measure options and to answer any questions the farmer might have had. Farmers were asked to enter into an Agreement with UKWIR for the duration of the project and to be provided with a Grant for undertaking the mitigation methods.

Out of the 74 farmers targeted by the project, a total of 52 (70%) farmers agreed to take up one or several of the measures. The majority of the farmers used fertiliser recommendations provided by the advisers (73%) and, where appropriate, manure management plans were developed (46%). 37% of farms took advantage of the free fertiliser spreader calibration. Only 31% of farmers have decided to grow cover crops, but this was due to the predominant use of winter crop rotations which makes the use of cover crops inappropriate. Moving from autumn to spring application of manures also had a very small uptake (10%) as many farmers do not have sufficient storage facilities to store manures over the winter. A total of 62% of farmers provided data for the use in farm N-efficiency calculations.

Primary measures were put in place in spring 2007 starting with 'fertiliser spreader calibration' in early February. After the interim assessment in July 2007 (Annex 58-UK) this exercise was repeated in January/February 2008, and coincided with fertiliser and manure recommendations being prepared for all the farms within the priority catchments. Cover crops were planted by the farmers in autumn 2007 with a destruction date either late December 2007 or early February 2008. Participating farmers were asked to move from autumn application (after October 15th) to spring application (after January 31st) of both slurries and poultry over the winter of 2007/08. Farm N efficiency calculations were based on 2007/08 harvest year data with baseline calculations based on 3 years prior farm management 2004 – 2007.

Farmer feed back on the measures were also sought, the results from this can be seen in Annex 49-UK and 58-UK.

Extend of measures application in LS is shown in Annex 21-LS. The first catalogue of measures was set up in autumn 2006 and contained 11 measures. It was reviewed and contemplated by two further measures in spring 2007 by the expert group, also involving statements from the Local Working Groups and the National Steering Group. During four seasons measures were applied on more than 5000 hectare. 52 farmers took constantly part in the different measures. Catch crops are famous in all three pilot areas, whereas the Cultan method is regionally concentrated in the pilot area Ilmenau/Jeetzel (mostly arable farming). On the contrary the extent of towed hose application is more applied in Große Aue and Lager Hase. Detailed description of the development and acceptance of the measures in the pilot areas can be found in Annex 21-LS.

Intensive advice and the slurry demonstration trial have contributed to the implementing of the measures for slurry side dressing for maize in the pilot area Lager Hase, on two model farms. All farmers took part in the results-oriented measure. The data acquisition and data quality was a main topic during several meetings (Annex 4-LS). Results and findings are described in Section 7.8.

Initial and further training

In the course of field inspections and specialist events in LS (e.g. crop protection days, see Annex 32-LS), agricultural apprentices and technical college students as budding farmers, and also farming community representatives as multipliers, were informed about the objectives and significance of WAgriCo. Ways and means of groundwater-conserving farming were presented and discussed at these events, and extensive additional information material was handed over. In addition, further information material was prepared and sent to all vocational schools for the agricultural sector in LS (for lists of schools, events and materials see Annex 32-LS).

The measures included in initial and further training by WAgriCo in LS focus on basic measures under the EC WFD. Relevant topics such as use of fertilisers and pesticides are increasingly discussed from the point of view of water conservation. A start has also been made on teaching apprentices and technical college students specialised technical knowledge about water conservation with regard to supplementary measures under the EC WFD.

To ensure optimum integration of the teaching materials developed by the project in the official vocational training of farmers and to guarantee intensive use by teachers and students, the materials developed to date will be tested in lessons, and they will be corrected and supplemented if necessary. Additionally a catalogue of assessment questions has been developed in the WAgriCo project. It will guarantee the integration of water protection issues into the assessment preparation during the agricultural apprenticeship.

The “Practical Guide to Continual Improvement of the Environmental Performance of Farms” was supplemented with additional water conservation aspects (Annex 31-LS) and tested by provision to the farmers in the Local Working Groups. This guide can be a valuable contribution to advisory services, but good educated advisors are essential for supporting farmers in improving their on-farm nutrient management.

The UK Steering Group considered developing training material that could be disseminated through Defra’s Environmental Sensitive Farming (ESF) initiative being delivered by ADAS. This approach provided a platform for:

- Consistency of message and advice; and
- Easily accessible information.

The UK's approach is set out in more detail in Annex 15-UK.

The programme for initial and further training was discussed with the Local Farmers Group in November 2006 and March 2007 and the Local Stakeholders Group in January 2007 as it was considered the farmers were key to identifying training needs. The training could be shared with the other local stakeholder groups who are working in the catchments. This would ensure that there is participation by both farmers and other agricultural advisers thereby extending engagement in the participation process. It was agreed at the Local Stakeholders' meeting that the local agricultural college, Kingston Maurward College, would be invited to participate in that Group because of its educational and training links.

Some initial training was undertaken as part of one-to-one contacts with the farmers at which WAgriCo was explained and the beneficial outputs that could be expected were outlined. This was expanded further through specific workshops such as the PLANET Workshops held in April 2007 and a N-efficiency workshop held in November 2007. These workshops were run to discuss the requirements of Nutrient Management Planning and had a high content of 'hands-on' work using the PLANET interactive software version of Defra's 'Fertiliser Recommendations (RB209)' publication. In addition, as part of the Fertiliser Calibration contract the benefits of maintaining good calibration was explained to the farmers.

Most events were registered with training bodies (e.g. BASIS) to include 'Continuing Professional Development' (CPD) points as a part of technical registration schemes for those farmers attending an event. It was also considered that technical newsletters served as training aids. Training material is being developed, and this will tie in with other projects which are underway in the priority catchments e.g. ECSFDI and ESF. This ensures a consistency of message, something that was identified as critical to successful diffuse pollution advice (cf. Stakeholder Facilitation Guide, Annex 11-UK).

During the fertiliser spreader calibration exercise undertaken in February 2007, the opportunity was taken to explain to the farmers the process and the need for calibrating spreaders on a one to one basis. Furthermore, at the farm at Kingston Maurward College students attended the spreader calibration being undertaken as they were interested in the methodology used as calibration is part of their course and this provided the opportunity to see it being undertaken first hand. At this time the WAgriCo project was also explained to both the lecturer and students.

Conclusion

The practical testing of measures had an ecological effect itself. But the discussion on the measures application at actual framework conditions enabled the experts to include important aspects into the modelling work as well as the political discussion processes. Especially during the 4th International Steering Group some main outcomes could be formulated together: measures must be site-specific and flexible during the commitment period to allow adjustments to fast altering framework conditions. Furthermore simple measures on voluntary base are very important for a good acceptance. One of the most important points is the demand for good consultancy services,

especially with regard to an improved nutrient management. Consultancy needs to accompany the measures implementation in agri-environmental schemes.

Key Message: Implementation of primary measures (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- Simple and flexible measures are essential for acceptance (under voluntary schemes)
- good consultancy service needs to accompany measures implementation
- competent advisors and training for farmers is essential
- Monitoring of effectiveness of measures is an essential part of the process to proof changes

7.6 Implementation of secondary measures

In order to have a great benefit from synergies to support the aims of the EC WFD a close cooperation between all relevant planers and land users in a special area or region is essential. That means authorities being responsible for measures planning were determined, and planning projects with other protection objectives (e.g. nature conservation) that can at the same time serve water conservation interests have to be identified. An initial analysis of areas with other protection objectives that were also capable of being turned to account for water conservation under the EC WFD (nature conservation areas, landscape reserves, water conservation areas etc.) was made for the three pilot areas in LS in November 2006 in consultation with the NLWKN and LBEG, and is shown in first planning maps with potential compensation areas (for maps see Annex 33-LS).

Planning maps for joint target areas were prepared, in accordance with the project application in cooperation with the planning authorities. In preparation for this, the relevant rural districts and land consolidation authorities were integrated in the project activities through a joint information event run by NLWKN and LWK in the individual project areas.

- Lager Hase – 13 December 2006
- Große Aue – 29 January 2007
- Ilmenau/Jeetzel – 08 February 2007

An intensive exchange of views and information with the aim of identifying and developing possible synergies followed, as is increasing networking of the regional actors.

Potential compensation areas have been selected and agreed in all three pilot areas in accordance with the project application in cooperation with the planning authorities. Planning maps were prepared, funding and planning areas with potential synergies of water protection were demonstrated (example Lager Hase, cf. Annex 32 LS).

Following possible synergies were identified and discussed intensively with the stakeholders in the different regions. The results were presented to and discussed with all involved persons/authorities during information events in the three pilot areas:

- Lager Hase – 27 September 2007
- Große Aue – 10 December 2007
- Ilmenau/Jeetzel – 14 January 2008

A report about the proceeding of identification and involvement of stakeholders is enclosed as D 6.2 and D 6.3 (Annex 42-LS).

In the interest of timely and continuous exchange and, where appropriate, coordination with state-wide specialist bodies, a presentation of the results took place at the end of 2006 at the Lower Saxony Environment Ministry with regard to the project focus “Synergies with the relevant bodies for the implementation of the EC WFD”.

A detailed description of the activities, results to date and steps planned, and also the maps mentioned, can be found in the report on Deliverable 6.1 in Annex 34-LS.

There is a national initiative across ‘priority catchments’ within England ‘The England Catchment Sensitive Farming Delivery Initiative’ (ECSFDI) started just after the WAgriCo project. As part of the ECSFDI, the Frome and Piddle catchments were identified as 2 of the 40 ‘priority catchments’ and Natural England (an agency of Defra) appointed local Catchment Sensitive Farming Officers (CSF Officers), one of whose responsibilities included the Frome catchment and one whose responsibilities included the Piddle catchment. However, the ECSFDI priority objectives related to surface water quality, particularly sedimentation of the river beds. The UK WAgriCo Steering Group formally agreed with the CSF Officers to share the knowledge gained from the WAgriCo and ECSFDI projects. This was an excellent outcome because it linked the WAgriCo project directly with the Government initiative on improving water quality.

Within these priority catchments, the Farming and Wildlife Advisory Group (FWAG) were commissioned by the riparian owners to engage with farmers to help address the sedimentation issues. These relationships were extended through the Local Stakeholders Group. There was also an interest group in the Wey catchment concerned with the sedimentation of a Site of Special Scientific Interest. This site is managed by the Royal Society for the Protection of Birds (RSPB). Through the Local Stakeholders’ Group it was identified that within Dorset there is an AONB Grassland Project.

It was identified that secondary measures could also potentially be implemented through the Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS), which are part of Defra’s Environmental Stewardship schemes. These two stewardship schemes encourage a large number of farmers across a wide area of farmland in England to deliver simple yet effective environmental management with some benefits to water quality. For those farmers wishing to undertake either of the secondary measures then advice and help with the application process was given through either the WW or ADAS catchment advisers.

To identify all potential secondary measures that could be used to deliver improved water quality in the catchments, an external assistance contract was undertaken. The aim was to review a range of environmental schemes to identify what secondary measures relating to water quality were embedded in the schemes, particularly their beneficial effects on groundwater. The approach was to carry out a desk top study of schemes, one-to-one interview with a small number of farmers and then a postal questionnaire in the catchments of the Frome, Piddle and Wey. The report is given in Annex 33-UK.

This work showed that there is a wide range of secondary measures that can contribute to reducing the leaching of nitrate through the soil profile into groundwater aquifers and contamination of surface water. However, of the 34 secondary measures identified, only 13 are currently available within existing voluntary schemes.

In addition, continued work within ADAS on other policy related projects allowed further investigation of other secondary measures that Defra considered for water protection policy. This included:

- Use of nutrient trading schemes
- Use of water protection zones (WPZs)
- Use of fiscal instruments based on nutrient surplus

The outcome of this analysis was that nutrient trading and fiscal measures were not effective policy mechanisms, but that the use of WPZs would be well suited to the mandatory introduction of some mitigation methods. The concept of WPZs went to public consultation in 2008 and the likelihood is that this policy measure will be adopted for water quality protection. Annex 50-UK provides further information on the policy options.

Conclusion

The different activities in both countries give evidence that there is a high potential in bringing planners, land users and those being responsible for conservation programmes together to join forces in order to gain optimum effects for the environmental protection. The experiences made in the project are an important contribution especially in terms of addressing potential stakeholders and for the technical intersection of different information levels. In addition the approach of using synergies promotes the general awareness that plans and conservation programmes always should be considered in a broader context.

Key Message: Secondary measures (cf. Annex 52-LS)

What WAgriCo recommends:

- Cost saving use of synergies with other conservation and planning programmes.
- Using positive ecological impacts for the implementation of the EC WFD by maps with target areas for all planners and by discussion and definition of targets in local or regional panels.

7.7 Agro-economic analysis

In order to allow the start of practical measure testing in autumn 2006 in LS, it was necessary to define payment levels for the offered measures. For this a consensus on compensation payments for the eleven action-oriented measures was determined (Annex 18-LS). A uniform payment per hectare for each measure was defined although similar existing measures offered within water protection areas in the three pilot areas display a variety of payment levels and management conditions, and despite considerable differences in the production structure of the three pilot areas. This was possible because for most selected measures an expenditure-related compensation is paid. They show only minor variations between farms, unlike measures with a direct impact on crop yields. Independently from the agreement for practical testing, where the payment per hectare ranges between 15 €/ha*year and 125 €/ha*year, it is necessary to follow defined calculation methods, especially for a successful implementation of new or improved water protection programmes. An overview on payment calculation methods at farm level for agri-environmental measures and weaknesses and potentials for improvements is given in Annex 35-LS. The total amount per hectare was not a useful indicator, only in combination with information about reduced nitrogen inputs/N-

efficiency improvements it was possible to make cost predictions at the level of the individual farm, region, river basin district and state and to select cost-effective measures. A concept for a cost estimation approach is presented in Annex 36-LS. The problem of information availability, a fundamental condition for a realistic cost prediction, is considered, too.

To overcome the problem of missing data to assess the cost-effectiveness of measures put into practice in the pilot areas for the participating farms, a detailed inquiry was conducted (Annex 29-LS). Furthermore, plot-information about the ecological effects were collected (cf. Section 7.8).

In the result-oriented approach the outcome indicator “N-efficiency improvement” was directly rewarded. As the costs of this measure were considerably influenced by production alignment and intensity a tender approach has been discussed. However, it was not acceptable for farmers to put this approach into practice during the project. Farmers who take part in the result-oriented reward scheme received a fixed amount per kg nitrogen reduction (1.20 €/kgN). But only improvements in fertilization efficiency were rewarded, no reward was given for structure-induced changes (cf. Annex 37-LS).

For assessing the effects of different water protection strategies, impact scenarios are defined and calculated in Annex 38-LS. The scenarios include different objective functions and constraints (e.g. maximum ecological effect, limited budget) as well as considerations about potential areas and measure acceptance and uptake by farmers. The restrictions and assumptions of all WAgriCo-measures are documented (cf. Annex 47-LS). Farm data from the Integrated Administration and Control System (IACS) were used to identify the potential measures area in the target regions. The National Steering Group decided that farmers can participate in the Programme of Measures (with their whole farm land) if at least 25 % of their farm land is located within the target area. A package of measures was offered based on an integrated consultancy approach that considers an improved farm management and supports a higher N-efficiency. The most important result of this simulation study is a realistic estimate of the amount of N-reduction that can be realized by implementation of the action-oriented measures. Thereby 10 kg nitrogen per hectare on average can be reduced and the mean cost-efficiency amounts to 4 €/kg N-reduction including consultancy service (38 %) and administration (6 %). In this study it was assumed that the implementation of measures is accompanied by technical advice offered free of charge, which could contribute to additional N surplus reductions. The results show also that the selected action-oriented measures can improve the nitrate problem substantially, but the target of 50 mg/l in the leachate cannot be achieved in every target area. Therefore, the project recommendations of future agri-environmental programmes include, in addition to the consultancy service as mentioned above, further steps towards implementation of the result-oriented approach that has been developed in the WAgriCo-Projekt (cf. Annexes 37-LS, 43-LS, 47-LS and 48-LS). In addition, the suggestion for programmes of measures outlines the availability of N-balances of farms in target areas as an essential tool not only for the result-oriented approach but also for the monitoring of success of the entire activities. Ambitious efforts of all participants are necessary to achieve the overall objectives of an improved N-efficiency and less N-leaching in agricultural land use patterns. This also contributes to climate protection through reducing N₂O emissions. Beyond certain, high level of N efficiency, it will not be possible to reduce N emissions within the existing farming systems. For further reductions, structural changes or measures at landscape level (e.g. flooding of lowlands) would be necessary.

In the UK, the farmers entered into an Agreement with UKWIR for receiving a Grant for actively participating in the project (Annex 19-UK), notably implementing changed practices and providing data and feedback on the mitigation methods taken up. As part of the Agreement, the farmer had to,

in return, provide real time costs of the impacts of the measure implementation to allow a true agro-economic assessment to be made. This approach was undertaken for both action and result-oriented mitigation methods. It was important that the economic effects on individual farm businesses in the WAgriCo catchments were taken into account.

Initially, analysis of the cost of farm mitigation methods was based on generalised farm costs using representative or model farms, which allowed an initial assessment of the likely costs (to the farmer) and effectiveness of the mitigation methods (cf. Annex 31-UK). This work also linked closely with an assessment of the cost and effectiveness of a range of policy instruments that ADAS has undertaken for Defra, and this information fed into the overall findings for WAgriCo (see Section 7.9).

Although the use of generalised farm costs, as described above, was a good starting point for understanding the economic issues surrounding the UK mitigation methods and their implementation, a more detailed study was commissioned (Annex 39-UK).

It was clear from the analysis in this report that:

- Farmers should be strongly encouraged to adopt mitigation methods which can be introduced at no net cost;
- A facilitation approach is a relatively low-cost way of informing farmers to reduce diffuse pollution; and
- Measures based on reducing fertiliser usage below recommendations or converting arable land to extensive grass are increasingly expensive to implement as grain prices rise.

Although the focus of the WAgriCo project has been on the cost-effectiveness of measures, it is also important to consider wider benefits from clean water (reduced treatment costs and the financial benefits of water with good ecological status). This was beyond the scope of the WAgriCo project, but Governments are considering environmental economics and the wider benefits of a cleaner environment. These considerations need to be factored into discussions under the EC WFD of 'disproportionate costs'.

Conclusion

Developing the data basis and considering the estimated ecological and economic effects of voluntary measures is one of the keys to get a common understanding for the problem of raised N-input. And this process is the basis for a mutual proposal of solution. The compiled outcomes of this process passed through within WAgriCo are now used to select cost effective measures and to show the political decision makers expected effects as well as necessary resources to implement these measures.

Key Message: Ecologic and economic evaluation (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- Use of ecological and economic evaluation within the decision making process especially to select cost effective water conservation measures. Costs need to be balanced against benefits, including wider benefits to the environment of clean water.
- Simulation of different scenarios to show the expected absolute effects
- Consideration of synergies, e.g. with climate change mitigation and biodiversity conservation in decisions
- Adopting a ‘cost curve approach` for ranking of measures

7.8 Examination of the results of the Programme of Measures

A central task in the WAgriCo-Project was the examination of the potential of the Programme of Measures to reduce nitrate pollution. This objective was addressed both by monitoring programmes on the local scale (fields, farms) and by model applications on the regional scale (catchments, groundwater bodies).

Based on the farms participating in the Programme of Measures the model farm measuring network was installed in LS.

The results of the measures to reduce the use-related pollution pressure are to be shown in terms of emission reductions that are – as far as possible – quantifiable. In the selection of measures, a distinction has been made between two impact categories (cf. Fig. 5), namely: a) measures that have a largely “Nmin reducing impact in the autumn” (known as action-orientated measures), and b) measures with a more “N-excess reducing impact” (based on result-oriented rewards). The development of “action-orientated measures” (especially winter hard catch crops) has been completed. The implementation of measures on the model farms in the pilot areas of LS including 4 seasons started in autumn 2006 and ended up in spring 2008. The potential of these measures for reducing substance levels can be monitored to a considerable degree by means of the nitrate concentration in the soil (autumn Nmin value). For this purpose, 81 Nmin-samples in November/December 2006, 43 Nmin-samples from February until May 2007 and 13 samples of manure were taken on the model farms. In addition to this the samples have been analysed. All the results have been discussed with local actors. These samples make it possible to compare sites with measures and sites without measures implemented. In October and November 2007 152 additional Nmin-samples were taken and analysed. In Spring 2008 23 manure samples and 41 Nmin-samples were taken and analysed for fertilizer planning purposes. The monitoring of the effects of action-oriented measures on nitrate discharge is based on the soil samples mentioned above as well as data (samples of Soil Mineral N and data on nitrogen concentrations in seepage water) resulting from long-term monitoring programmes in water protection zones.

The model farms are also offered measures to reduce N excesses in conjunction with the result-oriented approach. Effects in reduction of N excess are monitored on farm level based on N-balances. The basic agreement signed with the model farms (Annex 19-LS) includes not only special consultancy services by the Chamber of Agriculture to improve farm-specific nutrient management, but also contributions by the farmer (e.g. provision of data for calculating N-balances). According to the legislation until 2005 (Nitrate Directive – implemented by the fertilizer ordinance in LS) the farms were allowed to provide N-balances either on the basis of farm-gate-

balancing or on the basis of field-stall-balancing. To demonstrate effects before and after measure implementation and to estimate the potential for reduction of N-excess in the pilot areas, the two balancing methods have to be made comparable. For this purpose, a software tool for the combined calculation of farm-gate and field-stall balances was provided to the farmers and agricultural advisers of the model farms. Based on this tool calculations of N-balance, estimations of fertilizer requirements, degrees of usage of N as well as assessments of manure application based on mineral-N-equivalents were provided on the model farms. The results of N-balances before (2004-2006) and after (2007) measure application were discussed in working groups with project partners and farmers.

Methods and results of N-balances before and after measure application as well as the procedure and the results, e.g. the selection of model farms in the WAgriCo-Project are described in Annex 45-LS . Based on the experiences in the project a concept for a farm monitoring network designed to examine the results of measures was developed (Annex 44-LS) .

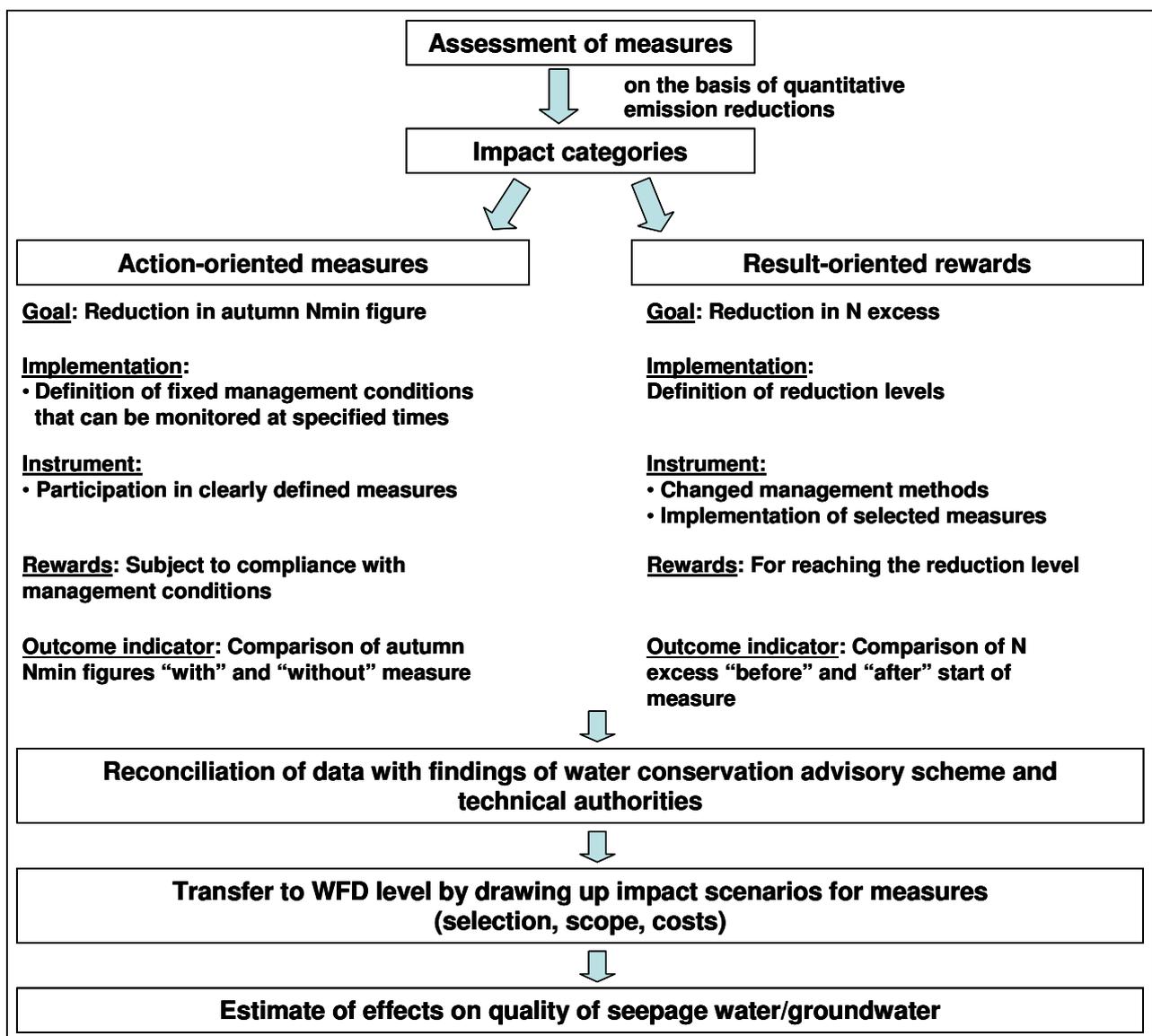


Fig. 5: Assessment scheme for action-oriented and result-oriented approaches

In the pilot area Working Groups and the National Steering Group there was a (large) high degree of agreement about the reduction potentials (nitrogen pollution causes) to be achieved by means of the

existing measures and the forthcoming counselling. Based on this agreement a proposal for a programme of action oriented measures was developed. The overall effect of this Programme of Measures on seepage water quality (as a precursor to groundwater) at the geographical level of the EC WFD (river catchments, groundwater bodies) and the associated costs necessary were estimated by drawing up impact scenarios for model simulations (see Section 7.7).

Effects of the individual measures implemented on the model farms on nitrogen excess and nitrogen export (task 8.3) were quantified based on expert knowledge which was available from findings of existing water protection advisory schemes and from findings of the monitoring on the farm measuring network. For the estimation of the effect of the Programme of Measures these effects were combined with the potential area for the individual measures on the regional level (sub areas of groundwater bodies), the associated costs and estimations of their acceptance. The effects of the Programme of Measures according to this scenario were combined with the nitrogen export model (see Section 6) to assess the effects on nitrate inputs in groundwater and surface water (task 8.4). As a mean of all areas investigated a reduction in the nitrate concentration in seepage water of 8,5 mg/l was calculated.

The reductions in nitrate input which are needed to meet the environmental targets defined for the hydrogeological subareas (mean concentrations of nitrate in seepage water, see Section 7.3) were quantified by inverse calculation using the model system described in Section 6. Based on the defined target values the tolerable nitrogen emission on the agricultural land was calculated. By comparing this result to the actual state of nitrogen emission the required amount of reduction was quantified. For the different sub-areas of groundwater bodies the required reduction varies between < 5 and 70 kg/ha. Finally, the probability of achieving the environmental targets (task 8.2) was assessed by comparing the required amount of reduction to the predictions for the overall effects of measures. As a result it was indicated that offering the developed measures in areas with high agricultural pressure the required amount of reduction could only be achieved by 15 to 30 %.

Methodological details and results of the model based estimation of achievable reduction of emission and immission as well as the assessment of the probability of the achievement of environmental targets are given in Annex 46-LS. Based on the experiences gained in the model farm network and the model applications a guide for large scale impact monitoring was developed. This document (Annex 44-LS) proposes a monitoring concept for the measure application in LS.

The UK Steering Group considered it was unlikely that the monitoring network of water measurements would be able to demonstrate changes in water quality during the life of the project due to the long travel times of groundwater through the chalk aquifer and the varying climatic conditions between the sampling years. This is common with most catchment projects and the question of measuring 'effectiveness' is highly relevant to the implementation of the EC WFD. A number of parallel approaches were therefore required, each providing evidence of likely effectiveness, and providing data against which success could be judged. Lessons learnt from the WAgriCo monitoring programme have been drawn together to produce guidelines for future monitoring programmes (Annex 56-UK) and it is envisaged will fit into any revisions to the UK monitoring programme for the EC WFD as defined by the Environment Agency (Annex 59-UK).

The sampling programme for borehole/stream and spring water quality (Annex 51-UK) showed that:

- Nitrate concentrations varied spatially through the priority areas
- Nitrate concentrations ranged from 5 – 140 mg l⁻¹

- Peak nitrate concentrations were seasonal
- There was a strong relationship between peak nitrate concentrations and intensive rainfall
- There was approximately a 1 month lag time between intensive rainfall and observed peak nitrate concentrations in monitored boreholes
- In the majority of cases, high background nitrate concentrations could be linked to historical farm practices and were not a consequence of present day management

The water quality monitoring results indicated that mitigation measures have the potential to reduce peak nitrate concentrations after intensive rainfall during the winter months. However, reductions in high background nitrate concentrations may take years/decades to observe (see modelling work below). Consequently, in some cases it may be better to evaluate the effectiveness of mitigation measures in the root zone through soil mineral N and porous pot sampling or through the use of nutrient budgets and N efficiencies. This is explored in more detail in Annex 51-UK.

In order to further evaluate the success of the Programme of Measures, a PhD student started in October 2006. The aim of the PhD project is *'to compare and contrast selected monitoring methods (water quality measurement, farmer activity and modelling) in assessing the effectiveness of catchment management to control diffuse water pollution at several spatial scales (field, farm and catchment)'*.

A first output has been to compare a range of approaches that can be used for assessing effectiveness (Annex 41-UK). This served as a useful document to inform the project and is also a useful output to share with others.

Activity was also undertaken to link the detailed studies in the priority areas to issues in the wider areas of the Frome-Piddle catchment. At the outset, workshops were held with key stakeholders covering a range of issues in the catchments (e.g. surface water, fisheries, groundwater and conservation), and the conclusion was that collecting previously inaccessible data into a single GIS was a priority for effective catchment management (Annex 52-UK).

Consequently, more than 150 datasets were collated, all of which were relevant to diffuse agricultural pollution, and they were incorporated into a GIS framework. This GIS framework was passed on to workers in diffuse pollution, including the ECSFDI team within the Frome-Piddle. This integrated dataset provided the foundation for the development of the conceptual models (the understanding of how the system is operating) and was an essential precursor to any catchment modelling and integrated catchment management.

Some investigative modelling was also undertaken:

Initially, modelling runs were undertaken to identify hot spots for diffuse pollution risk from both N and P. In order to model the catchments in greater detail and to utilise 'baseline data' collected during the project, a detailed modelling programme was implemented. The field-scale model (Nipper) which is designed to simulate the leaching of nitrate from agricultural land to watercourses was used to test scenarios and to estimate the likely impacts of measures on nitrate leaching (Table 1). Appendix A, within Annex 42-UK describes the structure of the model and the input data requirements.

| Scenario | Predicted leached nitrate concentration | | | |
|---|---|---------------|----------------------|---------------|
| | Arable | | Managed grassland | |
| | mg l ⁻¹ N | % of baseline | mg l ⁻¹ N | % of baseline |
| Baseline | 7.79 | - | 7.06 | - |
| Cover crop | 6.78 | 87.0 | 6.94 | 98.3 |
| Adjust fertiliser for crops | 7.77 | 99.7 | 6.99 | 99.0 |
| Adjust fertiliser for manure | 7.71 | 99.0 | 7.06 | 100 |
| Moving from autumn to spring application of manures | 7.75 | 99.5 | 6.83 | 96.7 |
| Best case (all scenarios) | 6.65 | 85.4 | 6.71 | 95.0 |

Table 1: Modelled nitrate leaching for baseline and mitigation measure scenarios

The output from Nipper model was then used to provide nitrate leaching values for both baseline and mitigation measure scenarios for a model developed by Entec UK Ltd on behalf of Wessex Water. This model was developed to simulate historically measured nitrate concentrations at Wessex Waters groundwater supplies and then forecast the change in nitrate concentrations over the coming years/decades.

The full modelling report for the external assistance contract can be found in Annex 53-UK. In summary, the mitigation measures will have a small impact on nitrate leaching. The best case, with four WAgriCo measures combined, represents reductions in leached nitrate from arable of 15% and from managed grassland of 5%, when compared to the current baseline.

However, modelling shows that overall the groundwater for the pilot areas is typically less than 60 years old, predominantly less than 30 years old for Eagle Lodge, Empool, Hooke, and Milborne St Andres. Friar Waddon has waters in the 30-60 year age range and the other sources have a broader mixture. The slow travel times for the bulk of the water means that the impact of any WAgriCo measures will not be seen on the bulk of the water for decades and in some cases they will be inadequate in stopping historically (1980s) leached nitrate pushing the nitrate concentration above drinking water standards or from a EC WFD perspective stopping the deterioration of water quality in groundwater bodies. For the farmers this means the benefit of any measures may not be realised through monitoring data for decades.

It is predicted that the WAgriCo measures may have a bigger short term effect by reducing concentrations of nitrates (and pesticides) in the rapid recharge water that occurs during and after heavy rainfall. Reducing the spikes in nitrate would make a very big difference to Wessex Water in terms of them needing or not needing expensive water treatment or blending at a number of their sources (Dewlish, Eagle Lodge, Friar Waddon, Milborne St Andrew and Winterborne Abbas). The measures would also provide additional safety for Empool, but on the basis of the model predictions do not appear necessary for the Hooke catchment.

Conclusion

The evaluation of the measures is based on long-time experience and on testing of measures in the pilot areas in both countries. Furthermore the implemented measures have been evaluated by applying different models in each country. As a result of these different levels of estimation (practical implementation and modelling) it is evident that in many cases the impact of measures does not comply with the reduction requirements. Due to the objective in LS (groundwater bodies) a

large scale modelling approach concentrating on seepage water was used. In contrast to this the objective in UK (drinking water boreholes and their catchments) required more detailed modelling approaches. Independent of the applied models in Lower Saxony and the United Kingdom the estimated reduction by the impact of the action-oriented measures is in a range of 10-15 kg/ha nitrogen per hectare on average. In areas with high agricultural pressure the environmental targets cannot be achieved by the application of action-oriented measures alone. Therefore other additional aspects have to be considered. One key issue is the consultancy service to ensure an optimal placement of the measures und also an efficient impact monitoring. In addition the fertilizer management is to be optimized in order, amongst other nutrients, to improve the N-efficiency on the farms.

Key Message: Success evaluation / Impact monitoring (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- To quantify reductions of diffuse nitrate pollution a multi-level monitoring system has to be installed.
- Results of programmes of measures are documented based on monitoring on different scales (local, regional, state-wide).
- The use of models is an essential tool; these models need to be able to use field-based data, but need to be simple enough that their data requirements and parameterisation are not prohibitively expensive.

Key Message: Environmental objective and reduction requirements (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- The environmental objective has to be transferred into a requirement for reduction of nitrate pollution.
- Analysis of a range of mitigation methods suggests that nitrate losses can be reduced by 5-15% - a range which has been similarly reported by other projects.
- Beyond this, 'drastic' changes in land management may be required.

7.9 Integration of programmes of measures under the EC Water Framework Directive in state agri-environmental programmes

One important objective of the project was to reach agreement with the agricultural and environmental authorities on measures or catalogues of measures for integration in state agri-environmental programmes, and to support implementation in EU assistance programmes (e.g. EPLR).

Therefore relevant authorities/ministries were involved in the process of developing measures and assessing them on the basis of the environmental impact and cost of the measures, in order to achieve close consultation with the relevant decision makers

In LS, the Ministry of Environment (MU) and Ministry of Agriculture (ML) were integrated in major decision processes in the National Steering Group. All steps relevant to the progress of the

project were agreed in the National Steering Group. This applies, for example to the selection of the measures offered and implemented in the pilot areas. At various specialist events, staff members from the MU and ML have moreover indicated opportunities for and ways and means of integrating EC WFD measures in agri-environmental programmes. Current individual results of the project for certain measures have already been taken into account in draft planning of the rural development programme (EPLR) for the assistance period 2007-2013 (e.g. environmentally sound application of organic manure (towed hose), catch crop farming).

In addition to the specialist events mentioned above, working meetings between the project management and the representatives of the Ministries (MU and ML) took place to discuss main topics. The topics have so far included the administration and controllability of the measures. As a result of these discussions, the list of proposed measures drawn up within WAgriCo will be used by the Environment Ministry (MU) as a basis for the implementation of the EC WFD in Lower Saxony, and will also form the basis for any necessary additions to the agro-environmental programmes. As an outcome of this cooperation there is a WAgriCo measure implemented in the Lower Saxony Agri Environmental Programme of 2008 for the target areas of the EC WFD.

With regard to the progress review of results-oriented measures and ways and means of using appropriate instruments for demonstrating success, the necessary basic data and the use of a business management system were discussed in a dialogue between the project management and the Ministries. These joint deliberations focused in particular on the use of a business audit system in a cross compliance context. As mentioned within Section 7.5, the “Practical Guide to Continual Improvement of the Environmental Performance of Farms”, which is based on the business management system EMAS, is submitted and available as PDF document to guarantee provision of the most recent know how.

Further important key topics in the dialogue were aspects of agro-economic assessment, data management and data availability, defining of target areas, and criteria for checking N-efficiency.

Due to the structural differences in water policy decision making between LS and the UK, it was necessary to adopt a different approach of engagement for exploring the potential of integrating the findings of the WAgriCo project into UK policy.

At the time of the WAgriCo project, there was considerable activity within UK government on evaluating approaches to tackle ‘diffuse water pollution from agriculture’ (DWPA) which, driven by the EC WFD, is treated as a priority topic for water improvement by Defra (Annex 57-UK). The WAgriCo project informed this process in several ways, and ADAS and other UK partners met with Defra throughout the project period to advise on results from WAgriCo; additionally, a Defra Officer was invited to sit on the project Steering Group.

- Developing the catchment management processes – the WAgriCo project linked well with the ECSFDI initiative, previously described within Section 7.6. The WAgriCo project provided information on best approaches to implementing catchment management. The lessons learnt, combined with experience from ECSFDI provided a powerful learning tool for implementing sustainable catchment management. The local CSF Officers were involved in the Stakeholder Group and there was a regular exchange of information between the CSF and WAgriCo advisers.

- A central point of ECSFDI is the use of agri-environmental schemes to support changes in land management to protect water. Work undertaken within the WAgriCo project was able to advise on best options for water protection, as well as potential options for inclusion in revised schemes.

Use of other instruments – work was undertaken by ADAS staff engaged on the WAgriCo project to investigate the potential of a range of approaches (support/advice through to regulation) to bring about cost-effective changes in losses of pollutants to water. The main conclusion of this work was that supportive approaches alone may not be sufficient to meet water quality objectives and that additional regulatory approaches (‘Water Protection Zones’) may be required in some catchments. The concept of WPZs was put out to consultation in 2008. Annex 50-UK provides more information on the analysis that led to this conclusion.

Conclusion

Although structural differences in water policy decision making between LS and the UK exist, WAgriCo has not only provided important information for the decision makers but also offered an intensive discussion platform between these decision makers and the different partners of the project as agricultural practitioners, scientists and administrations.

This process assisted the potential of integrating the findings of the WAgriCo project into policy.

Key Message: Implementation into assistance programmes (e. g. agri-environmental programmes) (cf. Annex 52-LS)

What WAgriCo recommends:

- Implementing of state agri-environmental programmes on the basis of cooperation between environmental and agriculture decision makers
- Integration of single water protection measures with high acceptance and cost efficiency in the agri-environmental programmes

7.10 Demonstration of the added value created by WAgriCo

Local and regional: The Working Groups in the three LS pilot areas are coordinated by NLWKN staff and are the main compartments for the distribution of WAgriCo results. It also enforces the cooperation between agriculture and water management on regional level. The Working Groups are cooperation bodies on the level of groundwater bodies and are participated by different stakeholders (Annex 12-LS). Meetings took place regularly (Annex 4-LS). Section 5 outlined the intensive involvement of farmers as one of the main purposes in this project. The maintenance of the participation structures was one of the main aspects for the follow-up project in Lower Saxony until 2010 (c.f. Section 10). Annex 39-LS gives an overview of a proven organisational model of regional implementation of the EC WFD regarding the experiences of WAgriCo.

The farmers created their own key message focussing on administration at EU-level (Annex 52-LS). This project offered therefore the possibility to farmers making their statements to political decision makers. Some farmers will also join the planned submission of the WAgriCo key messages in spring 2009 in Brussels. The farmers participation during the visit of the EU Commission on 22

September 2008 in the pilot area Lager Hase also proofed their strong interest in WAgriCo and the future implementation of the EC WFD.

In the UK, the two contrasting approaches made by ADAS and WW both ensured engagement by the farmers in the sub-areas. This was recognised by the support towards the project provided by the farmers and the detailed level of base data that we were able to collect from the farmers. Therefore, it was quite clear that the farmers welcomed the project and were happy to be involved. This was reiterated by comments from the farmers throughout the project. In addition, a small number of farmers attended the Local/National launch held in the catchment on the 5 May 2006 at which Defra's Minister of the Environment made the key note address; the Launch helped to stimulate interest.

The current level of engagement was built upon through the Local Farmers' and Stakeholders Groups. As referenced earlier in Section 7.2, there were meetings with the Local Farmers' Group in November 2006 and March 2007, July 2007, November 2007, January 2008, April 2008 and September 2008 and with the Stakeholders' Groups in January 2007, April 2008 and September 2008 following an initial meeting in January 2006. At the four latest meetings the project was discussed including the outputs from the data acquired from the farmers.

The UK Steering Group also explored sharing events with other stakeholders, such as farm visits and workshops so that all parties active in the area could share their experiences and have a common understanding. For example, at a Local Farmers Group and Local Stakeholders Group meeting Defra's ECSFDI local Officer gave a short presentation on the ECSFDI initiative and their activities.

Newsletters were also produced throughout the project, these were provided to farmers at the farmer group meetings and were posted to all the farmers within the identified sub-areas. Further communications involved sending letters about mitigation measures (Programme of Measures), including fertiliser spreader calibration and also farmers' packs relating to the other mitigation measures and how they can get involved with the project. A 15 page A5 leaflet (Annex 54-UK) was also produced to disseminate the project outcomes. This was handed out at the UK workshop on the 26th of September 2008 and the final Local Farmers and Stakeholders meeting on the 29th September 2008 as well as being sent to all ECSFDI Officers, Environment Agency personnel and other interested organisations.

Presentations were also made to the local/regional South West ECSFDI and the local branch of CIWEM.

Supra-regional: WAgriCo did enhance the knowledge exchange and raised awareness outside of the pilot area borders. For example the Lower Saxony Chamber of Agriculture organized a field inspection tour (July 2006) to its Wehnen experimental farm especially for farmers from the pilot areas and for agricultural advisers. A report on this is attached in Annex 32-LS.

The "Day of the Open Farm" in the pilot area Ilmenau/Jeetzel in June 2008, as well as different reports on the International Steering Group meeting in June 2007 and the EU-Workshop in September 2008 raised awareness on WAgriCo and water protection issues in a wider context on a supra-regional level.

On 11 December 2007 a meeting was organised by the NLWKN in Cloppenburg (pilot area Lager Hase) to compare conditions of voluntary agreements in Lower Saxony water protection areas with the future implementation of agri-environmental schemes and discuss improvement suggestions with all farmers participating in WAgriCo. The meetings at supra-regional level are listed in Annex 40-LS.

National: The importance of the National Steering Group is based on its attendees, who transfer the topics of discussion processes to the different stakeholder groups and political decision makers.

Until the end of the project 17 meetings of the LS NSG took place. Its impact as a national steering tool (see also Annex 11-LS) has been underlined by the implementation process of measures into agri-environmental schemes since the middle of the project. The development of a Programme of Measures (PoM) took place in cooperation with representatives of the Ministries for Environment and Agriculture who are participating National Steering Group meetings. A substantial discussion process between farmers, science, public authorities and policies has raised awareness on different geographical and political levels. Important milestones are additional intercalibration meetings with the Ministries in December 2007 and February 2008 (Annex 4-LS) to prepare the integration of measures into agri-environmental schemes.

The project and its suggestion for a PoM are fed into other EC WFD cooperations and processes at state-level. General information on WAgriCo have been submitted to the regional cooperation bodies in LS. The suggested WAgriCo PoM was presented to representatives of the Lower Saxony regional cooperation bodies, who are concerned with water management and agriculture in April 2008 (Annex 4-LS). The follow-up project aims to transfer the experiences made in the WAgriCo pilot areas to the state-level and will interact with the regional cooperation bodies to implement the suggested measures and monitoring concepts (c.f. Section 10).

Information to a wider public were provided at the 11th Groundwater Workshop on October 2006 and the 12th Groundwater Workshop in November 2007 in Hildesheim (LS). These Workshops address representatives of the water resources administration, technical agricultural authorities, farmers, research institutions, water suppliers and engineering offices, nature conservation organisations and maintenance associations, thereby achieving widespread multiplication of the information. The presentation of WAgriCo on such occasions was important with regard to the future implementation of the WFD especially for topics as designation of target areas, PoM and impact monitoring.

The expert groups fed their results into the discussion process on national as well as international level (Annex 12-LS and Annex 4-LS). Large-scale application of PoM, strategies to determine target areas and reduction needs were developed. The results on ecological effectiveness and economic efficiency have been and will be presented by the WAgriCo partners to specialists on national and international level. The interaction of different modelling systems to enable predictions on reduction needs, measures impact and agro-economic investigation on large-scale are innovative approaches that are now transferred to other states.

In the UK, the awareness of the project was widely disseminated through a number of platforms and, consequently, the government and other relative agencies became fully aware of the benefit of such a project.

In addition, at meetings between ADAS and Defra, opportunities to discuss WAgriCo became available through the life of the project because of the close connection with other projects on which ADAS were engaged. This was an excellent method to ensure that government was aware of the project progress and its relevance to other policy work. A representative of Defra was invited to attend the Steering Group meetings in a non technical role which again helped to engage with government. Further, the Defra's national officer responsible for the ECSFDI project met with the UK Steering Group on several occasions to be briefed on, and discuss, the WAgriCo project and the activities to date and those planned.

The profile of the project was also raised by the NFU as it featured in discussions on the future of water management by the Water Group of the Quality of Life Policy Group, who are helping to advise future policy for the Conservative Party. Again, demonstrating engagement at the political level. In a letter sent on the 27 March 2007 from the President of the NFU, Peter Kendall, to the then Minister of the Environment for Climate Change and Environment, Ian Pearson MP, Mr Kendall wrote, *"We consider that water companies have a role to play in working with farmers to bring about improvements to water quality, this benefits the water company, the environment and the farmer. A good example of this is the EU LIFE funded WAgriCo project, which includes the NFU and Wessex Water as project partners and is exploring this very theme. The NFU feel that Ofwat should permit investment in catchment measures to reduce diffuse pollution rather than spending funds on expensive, energy intensive end of pipe solutions. Where customers' money would be better spent on long term catchment measures this has to be the long term sustainable solution. During the last price review, this was not permitted, Wessex have had to fund their own Catchment Advisers and are trying to address this problem themselves. These advisers have integrated well into the farming community and a good level of trust is starting to be built up."*

A presentation was made in July 2006 at the CIWEM meeting entitled 'Progress with Catchment Management Integration and Delivery' at which ADAS presented a paper. At the national CIWEM Land-use and Water series meeting in November 2006 entitled Farming, Water and the Environment – Communicating lessons in practice presentations were made by the NFU and WW which featured the WAgriCo project. The UK Partners sought opportunities to raise and maintain awareness of the project, for example the ADAS Open days and the SCI Agriculture and Environment event. Other activities are given in Annex 9-UK.

In order to continue to ensure the water industry is aware of and engage with catchment management activities UKWIR has produced a Briefing Note (Annex 55-UK) for the Water UK Council. This will also be generally available. The WAgriCo project also features in the December edition of UKWIR which is widely circulated both by e-mail and paper format.

International: Close links between the project work in the UK and LS were maintained at the level of the International Steering Group. Four meetings of the International Steering Group took place in total:

- 1st meeting (launch event): March 2006 in LS
- 2nd meeting: September 2006 in UK
- 3rd meeting: June 2007 in Lüneburg (LS)
- 4th meeting: June 2008 in Dorchester (UK)

All the meetings were attended by project partners, farmers and representatives of the Ministries for Environment and Agriculture. During the last two meetings there were workshops on modelling, measures planning and experience exchange between farmers. These meetings did offer the

opportunity to compare methods and results in both countries, but also to realise different framework conditions and formulate main outcomes and key messages of the project. Besides the Layman report these key messages will be the main tool to distribute the recommendations based on the WAgriCo experiences (Annex 52-LS, Deliverable 10.4).

An important point for results transfer is the interaction with other international projects. Presentations at the European Geosciences Union conference (EGU, April 2006, Vienna) and at the 10th international conference on “Diffuse Pollution and Sustainable Watershed Management” (DipCon, September 2006, Istanbul) by the German partner FZJ, as well as at the enmar conference on “Regional Water Management” on 08 March 2007 by the Lower Saxony Chamber of Agriculture took place.

WAgriCo in general and its outcomes especially on agro-economic analysis was presented during three workshops of the WaterCost Project (a follow-up project of Water4all) by representatives of the NLWKN and the LS partner vTI:

- November 2006 in Newcastle (UK)
- April 2007 in Oldenburg (Ger)
- September 2007 in Assen (NL)

Several additional presentations could be held 2008. All occasions are listed in Annex 4-LS. In May 2008 one presentation was held at a workshop of the L'Agence de l'eau Seine Normandie et Eau de Paris and another one in Norwich, which was organised by the GD Environment. The workshop auf the GroPro project (September 2008 in Denmark) offered the opportunity to present the actual outcomes especially on measure planning and the importance of consultancy services. The altering framework conditions and its influences on agri-environmental schemes was the focus of a workshop in Berlin organised by the Bundesanstalt für Landwirtschaft und Ernährung / Deutsche Vernetzungsstelle Ländliche Räume.

Another good opportunity to distribute the project results was the Green Week in Bruexelles (03 -06 June 2008). Posters, flyers and a pc-application on the EC WFD, water protection issues and the project itself were produced and will be still provided as information source.

The EU-Workshop on 09 – 11 September 2008 in Lower Saxony was attended by different representatives from policy, agriculture and water management. Project results and key messages of both countries were contemplated by the presentation of the Danish EU Life project AGWA and the EU Interreg project WaterCost. The podium discussion underlined the need for regionally adjusted measures, its easy administration and the importance of consultancy services. The project and the workshop itself offered the opportunity to farmers to make their statements and demonstrated that a stronger cooperation between agriculture and water management is needed on different geographically and politically levels. The Workshop is described in Annex 49 and 50-LS.

As referenced earlier, two articles on the WAgriCo project were also written for the NITRABAR newsletter which was disseminated to approximately 2000 people in the UK and Europe.

For a detailed evaluation of international workshops see Annex 51-LS.

Conclusion

The aim to raise awareness and distribute WAgriCo approaches has already reached different levels and will be continued during follow-up projects. It became clear that the involvement of farmers and other stakeholders on an early stage is essential. Due to the participation structures the cooperation between water management and agriculture was enforced.

The inclusion of water protection issues in initial and further training is important for an enhanced acceptance and a sustainable water management. Teaching and information materials that were produced in this project are an added value and will be an important contribution to the implementation of the EC WFD.

The main value of the project are the methodologies and experiences that can be transferred to other states on the one hand. On the other hand it became also clear, how regional discussion processes could be initiated and how its results could be fed into national and European political processes.

Key Message: Statement of farmers (cf. Annex 52-LS and 54-UK)

What WAgriCo recommends:

- Development of programmes of measures geared to practical needs
- Intensified ongoing exchange in information between farmers, politicians and researchers
- Development of simple application forms and a simple processing procedure
- Binding 5-year contract for consultancy service, but not for individual measures

Key Message: Transferability to other (EU-member) states (cf. Annex 52-LS)

What WAgriCo recommends:

- install local working groups involving different stakeholders
- a stronger cooperation between water management and agriculture
- develop participation structure on an early stage and involving political decision makers
- consideration of regional characteristics while developing improvement approaches

8 Dissemination Activities and Deliverables

The Dissemination activities are set out in Section 7.2. The Dissemination Plans can be found in Annexes 8-LS and -UK. The Deliverables can be seen within the List of Annexes (Section 12).

9 Evaluation and Conclusions

In summary this Section will show the implementation and benefits of WAgriCo.

Project implementation

a. The process

For the implementation of this project, efficient structures were built up at local, national and international levels (cf. Section 5). This guaranteed the involvement of local farmers who were affected and their representatives, the relevant authorities and policy makers responsible for future implementation of the EC WFD Programme of Measures and representatives from research and science.

Accompanying this, a dissemination strategy was set up and put in practice (cf. Section 5, 7.2 and Annex 8-LS and 8-UK) by which the information about the objectives and implementation of the project is offered to the public and other farmers who may be affected in the future, and finally, to the political level for which the project will form the basis for future decisions.

b. The project management, the problems encountered, the partnerships and their added value.

The project management was carried out by the NLWKN as the beneficiary and UKWIR as the lead partner in UK (cf. Section 5). An efficient project management was guaranteed by the detailed project management plan and the administrative work of the Steering Groups.

Work on the project tasks was based on cooperation and participation of farmers and partners. This resulted in an excellent exchange of practical experience, scientific know-how and administrative demands according to agri-environmental programmes and it provided a good model for other catchment management initiatives/projects.

c. Technical and commercial application

The development of the measures within the project has shown that measures can in principle be developed at higher levels, but cannot dispense with the inclusion of regional framework conditions (for example, climate and soil conditions, business structures). The experience gained here locally is utilised at national and international levels.

d. Comparison against the project objectives

Project outcomes of every single task in comparison to the formulated project aims are described detailed in Section 7. The Deliverables can be seen within the List of Annexes (c.f. Section 12).

The main cornerstones of the objectives were achieved:

- An effective project structure was used.
- A comprehensive dissemination strategy was created and continuously implemented.
- Spatial priorities for the planning of measures were determined.
- Suitable primary measures were developed in cooperation with practising farmers.
- The developed primary measures were implemented and continuously optimised.

- Planning principles for secondary measures were created and the cooperation with other planning authorities was installed.
- The agro-economic analysis was carried out based on the implemented measures.
- Monitoring of impacts of the measures on soil mineral N in autumn and N-balances was implemented. The direct results relating to effects on groundwater will only be available after several years because of the long flow times.
- For the integration of the measures in agri-environmental programmes, there was an intensive exchange with decision makers in UK and LS.

e. Effectiveness of dissemination activities

The effectiveness of dissemination activities was promoted through the constant updating of the project websites (www.wagrico.de and www.wagrico.org), through participation in international workshops, through numerous newspaper articles in local and technical publications, project notice boards (at the WAgriCo demonstration sites), the newsletter and a general information project flyer (c.f. Annexes 9-LS and 9-UK).

An appraisal of our project website revealed that during the 18 months from April 2006 to August 2007, there were about 2700 visits on it. Accordingly, about 150 visitors look at the project website every month.

Four WAgriCo project flyers were produced, each with 1000 copies in German and English. It was given to all partners to enable further dissemination.

Until now, we have received numerous positive comments on the newsletter. It appeared every three months and contained information about the participants, project objectives and current issues concerning the WAgriCo project. The eleven newsletters which have been produced can be downloaded on the website.

Analysis of long-term benefits

a. Environmental benefits

1. Direct / quantitative environmental benefits

The objective of this project was to develop suitable measures in order to reduce the diffuse inputs from agriculture, particularly nitrate. The main starting point here is an enhanced N efficiency (results-oriented rewards) as well as a reduction in direct inputs through suitable action-oriented measures.

The effects of the individual measures within the project were verified through the accompanying monitoring process. The results are shown in Section 7.8.

2. Relevance for environmentally significant issues or policy areas

In accordance with the project proposal, one objective of the project was to support the integration of the developed measures in agri-environmental programmes and with this, the inclusion of environmental concerns in other areas of policy, particularly agriculture, as suggested in the 6th Environment Action Programme.

For this purpose, various focal points are established within the framework of the project:

- The parties concerned, and in addition the wider public, were advised through the information services, particularly by the website, about the quality of the environment and the possibilities for improvement through changes in individual behaviour (cf. Section 7.2).
- The inclusion of economical instruments was supported by enhancement of the Eco-Management and Audit Scheme (EMAS) with an appendix focused on water protection issues (cf. Section 7.9).
- The consideration of environmental concerns in land use planning and regional planning was strengthened through the creation of planning documentation for authorities responsible for measures within other programmes (Section 7.6)

The integration of the Programme of Measures in the agri-environmental programmes is a component of river basin management within the framework of the implementation of the EC WFD. To meet the cross-border demands of river basin management and to develop the pre-conditions for the promotion of environmental protection measures in agriculture within the framework of the common agricultural policy, there is a close meshing between the participating countries/member states involved in the project. Both the structures for participation and the relevant measures have been developed taking into account regional and countrywide adaptations necessary for the project. Therefore its transferability to larger areas and other Member States is granted.

Showing the requirement but also the possibility of integrating water protection measures in agri-environmental programmes WAgriCo could make a contribution to the aims of the 6th Environment Action Programme.

b. Long-term sustainability

1. Long-term / qualitative environmental benefits

The long-term effects of this project are achieved, on the one hand, through the provision of measures developed for extensive programmes of measures in the future, and on the other hand, through the process of joint development of measures between agricultural practitioners, scientists and administrations.

Through this strong process of communication, a common understanding was developed in the countries, forming the basis on which the subsequent programmes can be implemented. Both the political structures involved and the informed public were made aware of the situation concerning nutrient input into water resources through agricultural activities.

2. Long-term / qualitative economic benefits

One of the main topics of the project was the raising of awareness and provision of skill enhancement within agriculture with the objective of improving long-term fertiliser management on farms.

To achieve this, the long-term protection of water was established as a component of vocational and further training, consultancy services were promoted and voluntary agri-environmental measures were offered. The measures and the increase in knowledge support

more effective use of organic fertilisers and at the same time, an associated reduction in the purchase and use of mineral fertiliser.

Because of this, the economic efficiency of the developed Programme of Measures was an aspect of the project, along with ecological effectiveness.

Foresighted and sustainable action will reduce water pollution, meaning that increased water treatment costs in certain regions in some years can be avoided and the supply of qualitatively good drinking water can be guaranteed.

3. Long-term / qualitative social benefits

Through increased awareness within agriculture of the need for water protection, and the intensive exchanges between farmers, water suppliers and authorities, mutual understanding was be strengthened at both, national and international level. This leads to a better acceptance of the various objectives and to the achievement of common solutions.

c. Replicability, demonstration, transferability, cooperation

The concept developed within the project consists of improvements to vocational and further training, increasing synergy effects with other land uses and the provision of voluntary agricultural-environmental measures. It is generally transferable to other areas and member states.

It is based on an improvement in the level of awareness of the environmental pollution situation, chiefly through the education of young people as the central approach for long-term improvements. Supporting agricultural advisers fulfil the function of disseminators.

Parallel to this, the awareness of other planning authorities was strengthened and therefore cost-efficient synergy effects can be supported.

d. Innovation

Based upon the experience available from environmental protection programmes for agricultural areas and drinking water, an approach aimed at results-oriented rewards according to water protection has been developed and implemented in a test phase for the first time in this project.

In this process, the experience of various institutions were be used and combined to set down guidelines (for example, a guideline on spatial priority setting).

10 After-LIFE Communication Plan

Especially with regard to future implementation of measures under the EC WFD, WAgriCo has demonstrated the importance of a project in which the possible measures are developed jointly with the parties concerned. In order to avoid losing the knowledge gained and especially the project structure built up in WAgriCo, efforts are being made in Lower Saxony and the United Kingdom to prepare for the nationwide implementation of measures scheduled for 2010 onwards. In Lower Saxony a follow-up project to WAgriCo, though not funded as an EU LIFE-project, started in October 2008 until 2010 to keep up the local participation process with stakeholders, to continue with the implementation of measures and to promote the state-wide implementation process. At the

same time Wessex Water will continue the consultancy work with farmers in the catchments in the United Kingdom. For details see Annexes 53-LS and 53-UK.

The purpose of continuing the WAgriCo project is to optimize the participation structures and press ahead with premature implementation of the EC WFD measures, including a monitoring system. The farmers representatives in particular stress that they regard a continuation of the project as useful and support it. The main argument here is that the farmer participation in the discussion and decision processes which has been achieved via the established structures should be actively continued. In Lower Saxony, an administrative simplification strategy for future management periods is to be worked out by continuing the work on rewards for results-oriented measures.

The project continuation will ensure further dissemination of the results and experience gained during the WAgriCo project and its continuation. The aim of this dissemination is not only to use the overall results of the project for providing political advice at European level and within the participating Member States, but also to make experience available with regard to practical planning of local on-site measures. The most important dissemination methods in current use (Internet, media design, meetings and workshops etc.) are described in Section 7.2. Annex 8-LS contains our current "Dissemination Strategy". Use of these methods beyond the official end of the project is envisaged as follows:

Internet

The German project website www.wagrico.de, from which the results obtained during the project can be downloaded, is to be maintained and updated for at least five years after the end of the project (e.g. with regard to contacts for further information). The website's target group will continue to include politicians, the general public, the agriculture and water sectors, administration, nature conservation and environmental protection associations, universities and (vocational) schools.

Meetings and workshops

Experience gained during the project will continue to be passed on in national and international conferences and workshops after the end of the project. On the one hand this will involve initiating meetings specifically on the topic of "Results of the WAgriCo Project". In this context it is planned to have a meeting in Brussels in spring 2009 with representatives of the GD Environment and Agriculture, farmers spokesmen and other interested groups. This meeting aims to present the major outcomes and the key messages of WAgriCo in order to have a high rank discussion with politicians and decision makers. On the other hand contributions will also be made to events organised independently of the project. In this case the principal target groups are the political and administrative circles directly involved in implementing the EC WFD, and also the interested public concerned.

Media design

All publications available for downloading from the website will also be kept available for at least five years after the end of the project. Flyers for participants are currently being distributed at meetings and workshops, and this will continue to be done after the end of the project.

11 List of Annexes

| Annex | Submitted with | Deliverable | Title |
|---------------|----------------|-------------|---|
| Annex 1-LS/UK | IR | | Project Partners |
| Annex 2-UK | FR | | UK Project Management Structure |
| Annex 3-LS | IR | | International Expert Teams |
| Annex 4-LS | FR | | Overview of events |
| Annex 4-UK | FR | | List of UK Meetings |
| Annex 5-LS | IR | | Partner Agreements |
| Annex 5-UK | IR | | Partner Agreements |
| Annex 6-LS | IR | 1.1 | Partnership Arrangements |
| Annex 6-UK | IR | 1.1 | Partnership Arrangements |
| Annex 7-LS | IR | | Technical reports by pilot areas |
| Annex 7-UK | IR | | Diffuse Pollution Control in England |
| Annex 8-LS | IR | 2.1 | Dissemination strategy |
| Annex 8-UK | IR | 2.1 | Communication and Dissemination Strategy |
| Annex 9-LS | FR | 2.3 and 2.4 | Public Relations Activities |
| Annex 9-UK | FR | 2.3 and 2.4 | Public Relation Activities |
| Annex 10-LS | IR | | 50 % of the farmers in all pilot areas are familiar with the project's goals [Progress indicator 2.1]* |
| Annex 11-LS | IR | 2.2 | Guide to participation process |
| Annex 11-UK | IR | 2.2 | Stakeholder Facilitation Guide |
| Annex 12-LS | FR | | List of working group (AK) participants |
| Annex 13-LS | IR | 3.2 | Guide to setting geographical priorities |
| Annex 14-LS | IR | 3.1 | Outcome maps with target areas for primary measures in the pilot areas |
| Annex 15-UK | FR | 5.1 | Teaching Materials |
| Annex 16-UK | IR | | Justification for Inclusion of Pilot Areas |
| Annex 17-LS | IR | | Overview of measures |
| Annex 18-LS | FR | | List of measures Autumn 2006 to 2008 |
| Annex 19-LS | IR | | Basic Agreement Autumn 2006 |
| Annex 19-UK | IR | | UKWIR / Farmers Agreement for the Implementation of the Agreed Programme of Measures |
| Annex 20-LS | FR | | Measures Agreement Autumn 2006 to Spring 2008 |
| Annex 21-LS | FR | 5.2 | Extent of implementation of measures Autumn 2006 to Spring 2008 - Acceptance analysis - |
| Annex 22-LS | IR | | Result-Oriented Measures Agreement Spring 2007 |
| Annex 23-LS | IR | 4.1 | Water conservation measures toolbox |

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|--------------|-----------------------|-------------------------------------|--|
| Annex 23-UK | FR | 4.1 and 4.2 | Water Conservation Measures Toolbox – Implication for Implementing Mitigation Methods |
| Annex | Submitted with | Deliverable | Title |
| Annex 24-LS | IR | | Reduction of diffuse inputs in surface waters |
| Annex 25-LS | IR | 4.2 | Action recommendations for priority cost-effective planning of measures |
| Annex 26-UK | IR | | Field Work Plan for the on-farm component of WAgriCo |
| Annex 27-UK | IR | 3.1 and 3.2 | Assessment of Farm Pollution Risk and Opportunities for Mitigation Methods |
| Annex 28-UK | FR | | Programme of Measures – Implementation Programme List of Spring Measures 2007 and 2008 |
| Annex 29-LS | IR | | Map of sites where measures are implemented |
| Annex 30-UK | IR | | Monitoring Measurement Network |
| Annex 31-LS | IR | 5.3 | Further steps in the revision of the Practical Guide |
| Annex 31-UK | IR | 5.3 | Generalised Assessment of Agro-economics |
| Annex 32-LS | FR | 5.1 | Report on and evaluation of measures implemented in the field of initial and further training |
| Annex 33-LS | IR | 6.1 | Planning maps for secondary measures [Progress indicator 6.1]* |
| Annex 33-UK | FR | 6.1-6.3 | Secondary measures for the protection of groundwater – Summary Report; Main Report see Annex 33b-UK on the CD ROM |
| Annex 34-LS | IR | 6.1 | Report on and evaluation of progress on use of third-party land rights for the objectives of the EC Water Framework Directive |
| Annex 35-LS | IR | | Payment calculation methods for agri-environmental measures [Progress indicator 7.1]* |
| Annex 36-LS | IR | 7.1 | Procedures for cost predictions at the level of the individual farm, region, river basin area and federal state |
| Annex 37-LS | IR | | Description of result-oriented measure |
| Annex 38-LS | FR | 7.2 | Report on impact scenarios: Data basis, methods and results of the economic analysis |
| Annex 39-LS | FR | 1.5 | Proven organisational model for regional implementation of the WFD in river basin areas |
| Annex 39-UK | FR | 4.2, 7.1 – 7.3 and 9.1 – 9.2 | Micro- and macro economic analysis |
| Annex 40-LS | FR | 10.5 | Report on reciprocal visits by farmers |
| Annex 41-UK | FR | | Methods of assessment for the evaluation of mitigation methods controlling diffuse nutrient loss from agriculture in England and Wales: A Review |

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|--------------|-----------------------|---------------------|--|
| Annex 42-LS | FR | 6.2 and 6.3 | Report of utilisation of synergies and implementation of multilateral co-operation |
| Annex | Submitted with | Deliverable | Title |
| Annex 42-UK | FR | | Summary of Modelling Activity and Strategy |
| Annex 43-LS | FR | 7.3 | Proposal for national programme of measures |
| Annex 43-UK | FR | 3.1 and 3.2 | Weymouth Groundwater Source – Friar Waddon Summary of Investigations |
| Annex 44-LS | FR | 8.1 | Guidelines for large-scale impact monitoring |
| Annex 44-UK | FR | | Communication with Defra and Other Government Agencies |
| Annex 45-LS | FR | 8.2 | Concept for model farm measurement network |
| Annex 45-UK | FR | 2.2 | Farmer Engagement and Participation |
| Annex 46-LS | FR | 8.3 | Report about the results of catchment and state-wide related emission and input effects of the measures |
| Annex 46-UK | FR | | Additional Mitigation Measures that could be Considered in Catchments Dominated by Upland Pasture and Forestry |
| Annex 47-LS | FR | 9.1 | Catalogue of the measures suitable for agro-environmental programmes, their costs and their environmental impact |
| Annex 47-UK | FR | 10.4 | Summary and Evaluation of N Efficiency Calculations as a Target Orientated Mitigation Measure |
| Annex 48-LS | FR | 9.2 | Report to the EU Commission on expected costs of adequate programmes of measures to be implemented state-wide |
| Annex 48-UK | FR | | Example Farm Pack for Autumn 2006 to Spring 2007 |
| Annex 49-LS | FR | 10.1 | Workshop material for participants |
| Annex 49-UK | FR | | Example of Farmer Feedback |
| Annex 50-LS | FR | 10.2 | Report on conference proceedings |
| Annex 50-UK | FR | | A Summary of Defra Projects on Secondary Measures |
| Annex 51-LS | FR | 10.3 | Report on Evaluation of work-shops and conferences report |
| Annex 51-UK | FR | 8.3 and 10.4 | Results from Monitoring and an Evaluation of Mitigation Methods |
| Annex 52-LS | FR | 10.4 | Report on evaluated WAgriCo methods |
| Annex 52-UK | FR | | Knowledge Transfer in Relation to Catchment Management |
| Annex 53-LS | FR | 10.6 | Report on next steps |
| Annex 53-UK | FR | 8.3 | Modelling Nitrate concentrations with variations in time |

| | | | |
|--------------|-----------------------|--------------------|--|
| Annex 54-UK | FR | 8.3 | Project Dissemination – UK WAgriCo Non-technical Leaflet |
| Annex | Submitted with | Deliverable | Title |
| Annex 55-UK | FR | | Example of Post WAgriCo Knowledge Transfer |
| Annex 56-UK | FR | 8.1 and 8.2 | Guidelines for a large-scale impact monitoring |
| Annex 57-UK | FR | | River Basin Planning in England and Wales |
| Annex 58-UK | FR | 5.2 | Interim assessment of the programme of measures implemented in the pilot areas |
| Annex 59-UK | FR | | The Monitoring Programme for the Water Framework Directive |
| Annex 60-UK | FR | | An Alternative Result Orientated Approach to bringing about Change on Farm |

12 Layman's Report