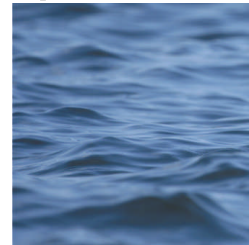
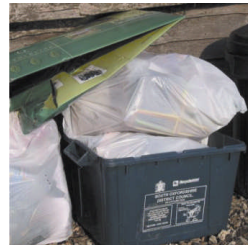


# Partnership working to tackle diffuse phosphorus pollution

**Ian Codling (WRc, UK), Paul Withers (Bangor University, UK), Rachael Dils (Environment Agency, England & Wales) and Michael Payne (NFU, England)**



Catchment Science 2011, The Mansion House, Dublin,  
Ireland 14th to 16th September 2011



# WFD River Basin Management Plans (RBMPs)



- WFD encourages everyone with an interest in water to work together to protect and improve the quality of every aspect of the water environment



- The Environment Agency as the 'competent authority' is responsible for implementing the Directive in England & Wales.



- However, many other public, private and voluntary organisations have a part to play to deliver the work set out in the plans.



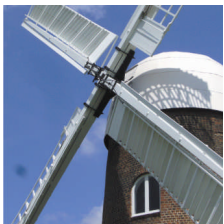
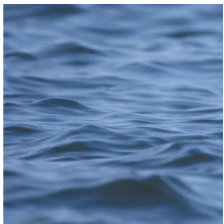
- Agriculture is a partner in the WFD process at all levels – national, regional and local projects



## Why a joint voluntary initiative?

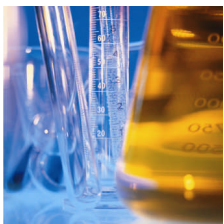
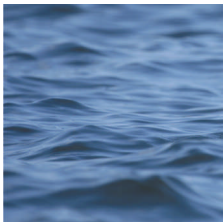


- Agriculture is a responsible industry which aims to comply with legislation
- Project provides opportunity to scrutinise the evidence jointly, with the help of experts, to ensure the problems are genuine and the real sources are identified
- Legislation is available as a last resort to ensure compliance but tends to be costly for all concerned, so is best avoided wherever possible
- Voluntary approach allows greatest flexibility, helping to minimise costs





## Why phosphorus (P)?



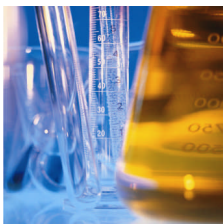
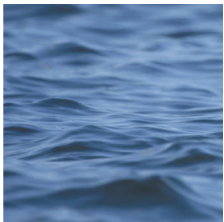
- P is one of the largest single causes of failure to achieve Good Ecological Status in surface freshwater bodies in E & W
  - 41% river water bodies
  - 64% lake water bodies
- Damage due to freshwater eutrophication in E & W was conservatively estimated at £54m to £96m per year (in 2001).
- Agriculture is a significant source of P
  - rural landscape has many 'diffuse sources' which are not from agriculture e.g. septic tanks
  - catchment specific
  - spatially & temporally variable



## Project objective



- To develop an evidence base to enable the regulator and the industry to have sufficient confidence to introduce cost-effective, proportionate measures to tackle P pollution
  - Scope: sources, pathways, water quality and ecological impacts and cost-effective mitigation measures
  - Range of spatial scales – a tiered approach
- To use the evidence base to inform farmer led catchment interventions to tackle P pollution

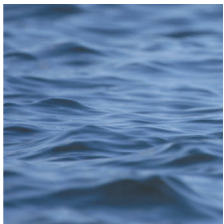




# Why a tiered approach?



- Tier 1 - E&W
  - Use to inform policy discussions with Government and the agriculture industry and for NFU to promote voluntary measures to wider agriculture stakeholders



- Tier 2 – Anglian RBD
  - Use to implement the RBMP in Anglian RBD and address one of the largest single issues



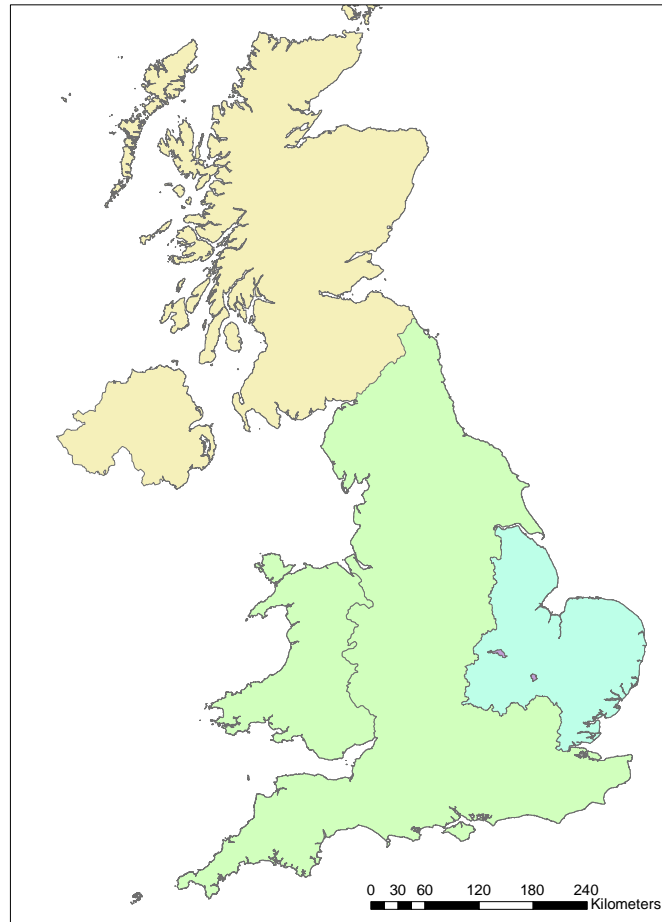
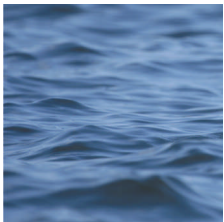
- Tier 3 – Pilot catchments within Anglian RBD
  - Use to undertake practical farmer-led measures in two pilot catchments in Anglian RBD



- Implement measures, monitor effectiveness in pilot catchments and use outcomes to support wider implementation



## Tiered approach



### Why Anglian RBD?

- Joint lowest projected improvement in water bodies achieving Good Ecological Status by 2015 – just 1%
- Predominantly arable, so less improvement expected under NVZ measures

### Why pilot catchments?

- Modelled agricultural P contribution relatively high (35 – 40%)
- No existing initiatives addressing P loss



## Developing the evidence base



- Draw on the available information and data to answer a series of questions at the three tiers addressing:



- Relative sizes of the main **sources** of P
- **Pathways** for delivery to receiving waters
- **Impacts** of P in receiving waters
- Effectiveness and cost of potential **control measures**



- Identify gaps
- The evidence base has undergone scrutiny at a peer review workshop in April 2011 and is currently under review by Environment Agency and NFU.





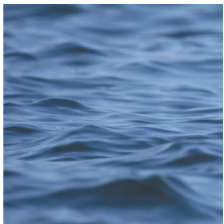


# Sources of P



Source apportionment (load):

- 'Point' sources dominate at all tiers
- Tier 1 (E&W)
  - 70% point, 30% diffuse (agriculture, 0.5 kg/ha/yr)
  - 50% from soil, 50% from fertilisers/manures
- Tier 2 (Anglian RBD)
  - 80% point, 20% diffuse
- Tier 3 (Pilot catchments)
  - Monitoring data suggests point source dominance
  - Modelling suggests 65 % point and 35% diffuse

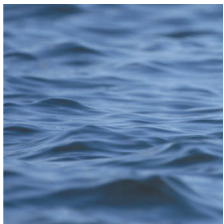




# Pathways

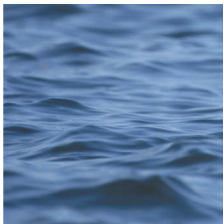


- Evidence base sought to explain the scientific understanding of the pathways and their relative importance
- ‘Point’ sources – direct discharge; septic tanks can contribute to sub-surface/drain flow
- ‘Diffuse’ sources – agricultural sources mobilised from impervious and pervious surfaces and rainfall driven.
- Delivered by overland flow, drain flow, sub-surface flow or soil matrix/groundwater flow.





# Impacts



- Impacts in receiving waters measured in terms of P concentrations and eutrophication-related biological measures (diatoms and macrophytes)
- P concentrations assessed against standards – annual average SRP 50 – 120  $\mu\text{g/L}$  in rivers
- Site specific lake standards using a consistent modelling approach – TP annual average
- Diatom and macrophyte metrics

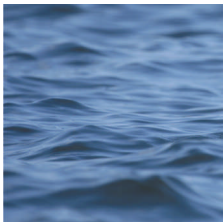


# Overview of current status



- Tier 1 (E&W)

- 37% of rivers in England and 8% in Wales (count of WBs) fail WFD P standards
- 8% of groundwater bodies fail WFD P standards
- Only 18% of WFD lakes failed P standards



- Tier 2 (RBD)

- < 35% pass river WFD P standards
- 80% of RBD as 'At risk' from combined sources of P. Most 'Probably at risk' from agricultural P



- Tier 3 (Catchments)

- Harpers Brook – Moderate status for P
- Bourn Brook – Poor status for P (whole catchment)
- All other ecological determinands (biology, physico-chemical, hydromorphology) pass WFD 'Good' standards; HMWB

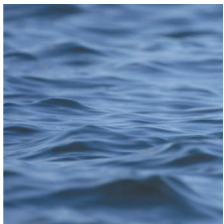




## Control measures



- Key concept of critical source areas  
(high runoff risk, high P risk, the 80:20 rule)
- Catchment appraisal to identify source areas  
(analysis of risk pressure; catchment walks)
- Cost of measures is highly variable  
(net benefit - >£400/ha cost)
- Cost-effectiveness is very site specific  
(Costs/kg P saved often lower on arable farms)
- Direct ecological benefits uncertain but ....





# Targeting measures

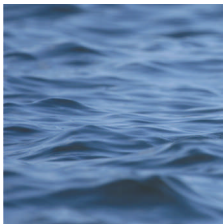


- Tier 1 (E&W)

Target all sectors

Average net cost of £900/kg P saved

5% of farm income



- Tier 2 (RBD)

Target arable cropping, root crops, poultry and pigs

Average net cost £158/kg P saved



- Tier 3 (Catchment)

Target arable cropping, pigs, fertilisers

Identify CSAs

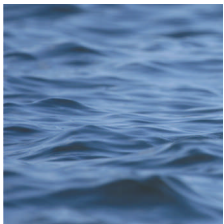




## Gaps in the evidence base



- **Sources** – quantification P load from septic tanks and misconnections (local scale uncertainty)



- **Pathways** – relationship between loads and water body concentrations of forms of P



- **Impacts** – attributing impacts to sources and understanding the potential for restoration



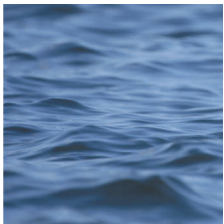
- **Control measures** – understanding the effectiveness of combinations of measures at the catchment-scale



## Next steps



- Reach consensus and agreement on the evidence base
- Initiate baseline monitoring of the pilot catchments to include farmer participatory monitoring to improve engagement
- Identify and agree farmer-led voluntary measures to address P pollution in the pilot catchments
- Monitor and assess effectiveness







# Acknowledgements



- Project Board: Richard Percy (NFU), Andrew Clark (NFU), Paul Hammett (NFU), Paul Tame (NFU), Lynsey Craig (Environment Agency), Gio Pisano (Environment Agency), Paul Hickey (Environment Agency), Rachael Dils (Environment Agency) and Michael Payne (NFU)
- Peer review workshop attendees from academia and the farmer community

