the River Restoration Centre

Working to restore and enhance our rivers

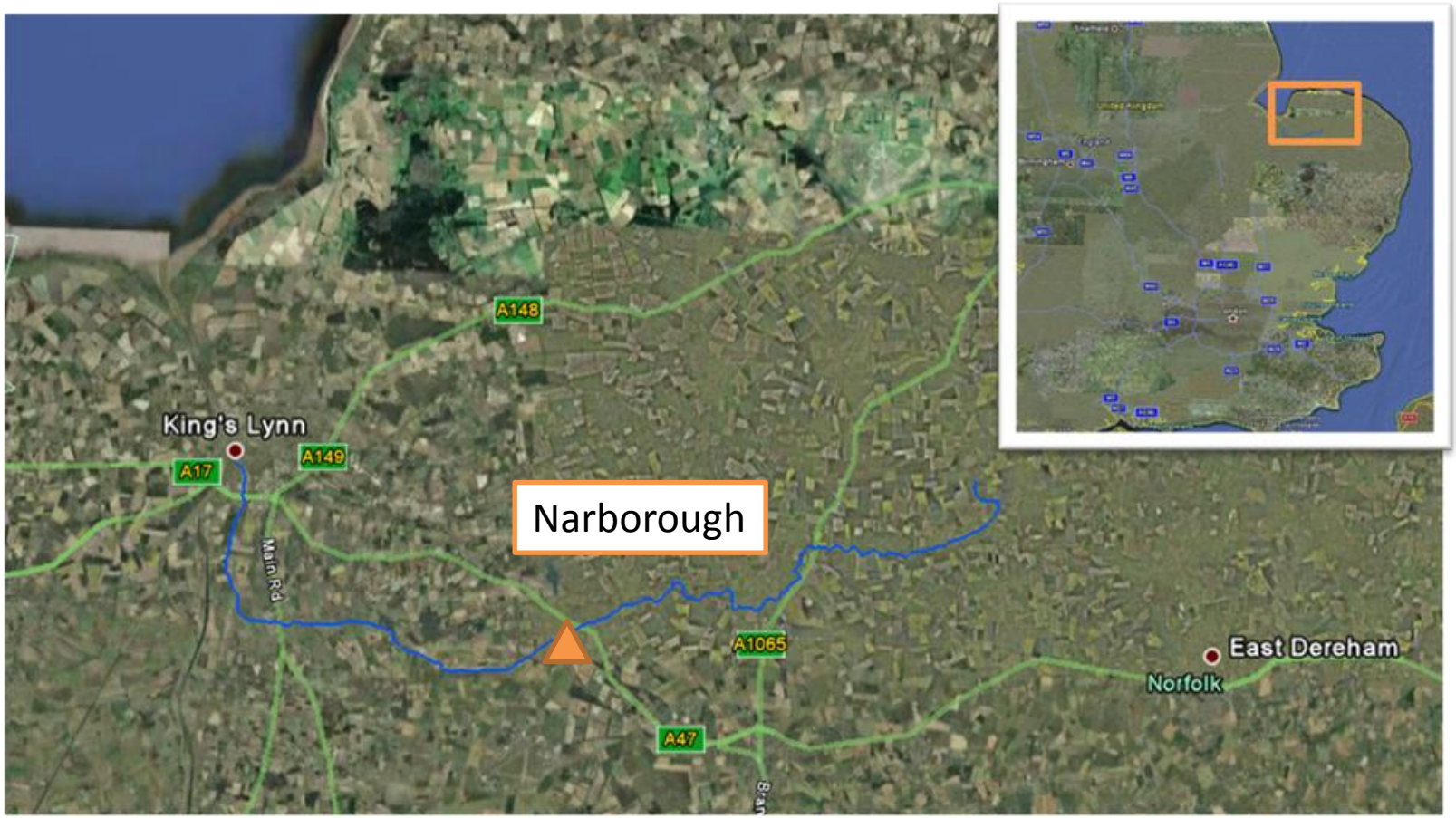
The River Nar SSSI Restoration Strategy and Plan

From sketch to implementation

James Holloway – *The River Restoration Centre*
Karen Fisher – *KR Fisher Consultancy & RRC Board*

Introduction and rationale

- A tale of two rivers



Classic chalk stream upstream of Narborough
-IDB managed

Fen drain downstream of Narborough
-EA managed

Introduction and rationale

- A tale of two rivers
  - IDB (upper chalk stream) and EA (lower fen drain)

- Value of supported wildlife widely recognised
  - SSSI designation

- Recognition of negative pressures and the need for restoration
  - ‘Unfavourable condition’
  - Commissioning of studies

How do you get from a lot of talk and ambition to action on the ground?

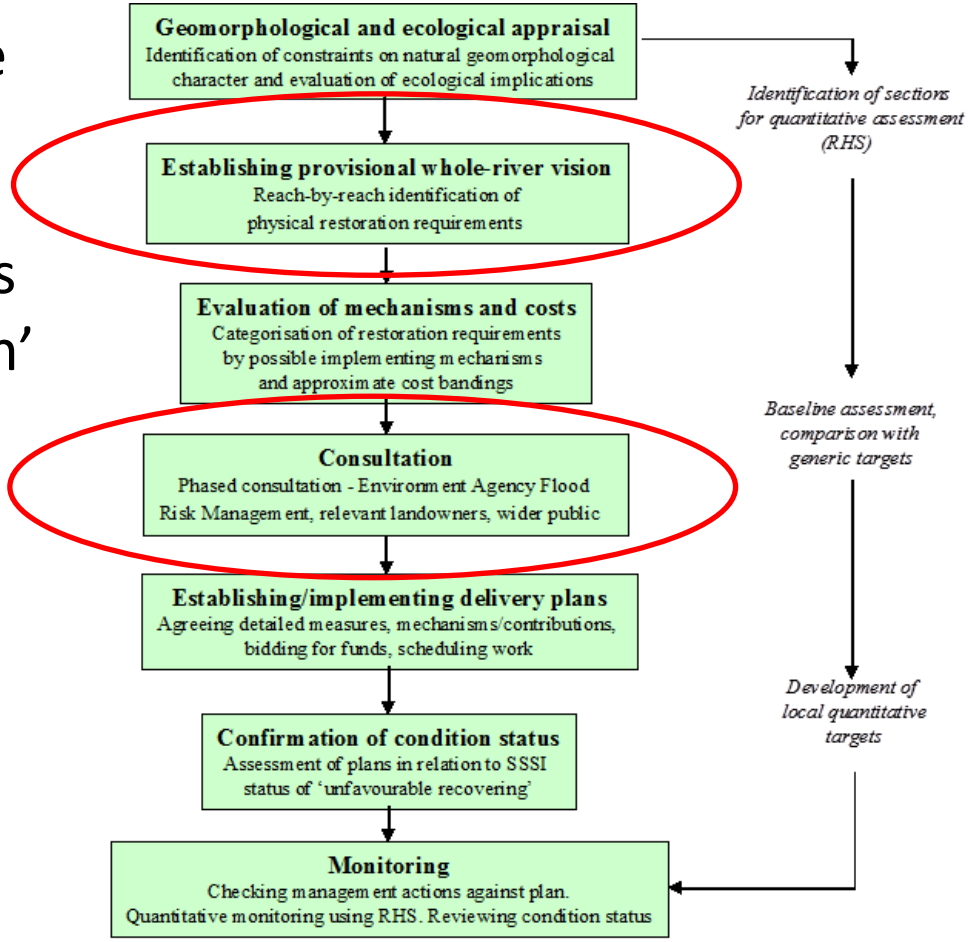
NE/EA SSSI river guidance

Mainstone & Cathcart, 2007

- Sets out key stages in the process
- Obviously geared to SSSIs and 'favourable condition'

  … but in this case …

- Importantly:
  - ❑ Whole-river vision
  - ❑ Consultation





Who does what?
Building the team

- Establish a Steering Group at the start:
  - Project Sponsor (IDB in this situation)
  - Project Manager
  - Environment Agency
  - Natural England
  - Major stakeholders
  - Other team members as required

KR Fisher Consultancy

- Establish guiding principles (steering group responsibility)
- Translate these into clear objectives for the project team

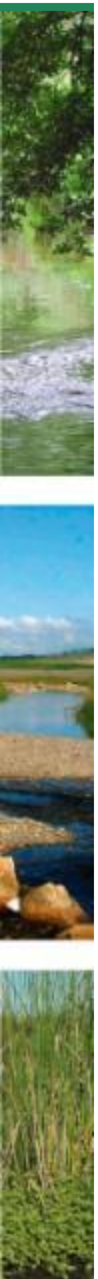
- Realistic time frames
- Timely consultation - who needs to be consulted and when?
  - Landowners etc., vs. Public at large



Stage 1: Complete assessment of the current state of the river

- **Desk-based** synthesis of key information from…
  - Previous investigations, reports and ecological surveys
  - Old and new mapping, LiDAR and topo surveys
  - EA surveillance monitoring
  - Current river and catchment initiatives
  - Management plans
  - Academic literature

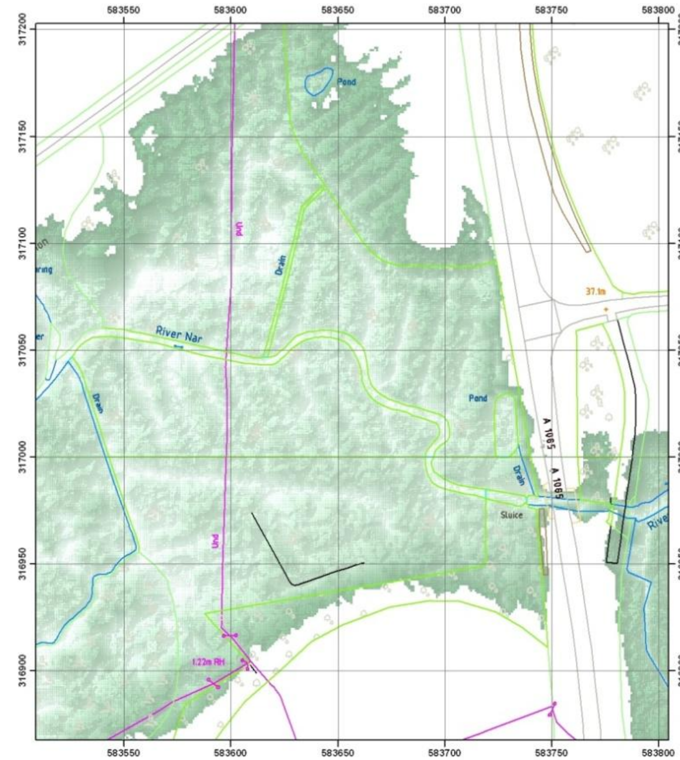
English Catchment Sensitive Farming Delivery Initiative
Historic mapping, including early Ordnance Survey and William Faden's 1790-94 survey
Contemporary mapping
Contemporary and historical aerial photography
LiDAR elevation data
Topographic surveys (long- and cross-sections)
EA ecological surveillance monitoring
EA hydrometric surveillance monitoring
Previous EA River Habitat Surveys
Norfolk Wet Woodlands Project
Wild Trout Trust habitat assessments
Scheduled Ancient Monuments
Protected and invasive species
Local Nature Reserves
River basin management planning
IDB and EA records of recent works
River Nar Improvement Scheme (flood storage and diversion channel)
Academic literature, including degree theses
Flood risk management planning
Various water resource planning documents
Conservation planning documents
Norfolk Biodiversity Partnership
Norfolk Wildlife Trust
Nar Ouse Regeneration Area (Borough Council of King's Lynn & West Norfolk)



Stage 1: Complete assessment of the current state of the river

- **Desk-based** synthesis of key information
- **Walkover survey**
  - Ecological and morphological characteristics
  - Modifications
  - Constraints
  - Complete photographic record

… field maps for note-taking →



Map 27

Stage 1: Complete assessment of the current state of the river

- **Desk-based** synthesis of key information
- **Walkover survey**
- **Consultation** with the *key* local stakeholders
  - Land and river **owners/managers/tenants**
  - **Major users**
    - Angling and shooting clubs
  - **Other initiatives**
    - Catchment Sensitive Farming;
    - Norfolk Wet Woodlands project
    - etc.

Stage 2: Development of a Vision for the restored river

- What would it have been like without human intervention?
- What would we like it to be in the future?
  - For wildlife
  - For ecosystem services
  - For people

  (from consultation)

I. A river that is dynamic

II. A river that is a haven for wildlife

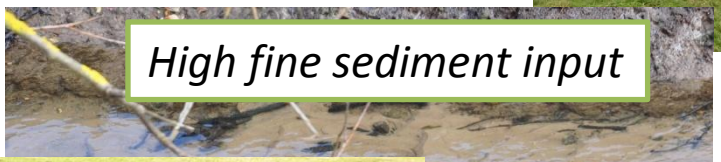
III. An integrated, functioning river corridor

IV. A river that reflects its heritage

V. A system that is resilient to change

Stage 3: Generic problems and solutions

- Identification of '**issues**'
  - What prevents realisation of the Vision?



Stage 3: Generic problems and solutions

- Identification of '**issues**'
  - What prevents realisation of the Vision?

- Identification of '**options**'
  - Solutions to the issues

	0 Natural	1 Predominantly natural	2 Partially natural	3 Practically Un-natural	4 Un-Natural
0 Unmodified	Protect & Monitor	Protect & Monitor	Assist natural Recovery	Restoration	Restoration
1 Predominantly Unmodified	Protect & monitor	Protect & Monitor	Assist natural Recovery	Restoration	Restoration
2 Obviously Modified	Conserve & Monitor	Assist natural Recovery	Rehabilitation	Rehabilitation	Enhancement
3 Significantly Modified	Conserve & Monitor	Assist natural Recovery	Rehabilitation	Rehabilitation	Enhancement
4 Severely Modified	Conserve & Monitor	Assist natural Recovery	Rehabilitation	Rehabilitation	HMWB

Stage 3: Generic problems and solutions

Natural wood structures

Restoration/creation of meandering planform

Channel remnant in adjacent woodland

- Identification of '**options**'
  - Solutions to the issues

Setting back flood banks

'Pseudo-sinuosity' in straightened channel

Before

After

Stage 3: Generic problems and solutions

- Identification of '**issues**'
  - What prevents realisation of the Vision?
- Identification of '**options**'
  - Solutions to the issues
  - Means of delivery
- Identification of **constraints**
  - What might prevent or hinder the implementation of solutions?

- ***Abstraction and climate change***
- ***Flood risk***
- ***Infrastructure***
- ***Current land and river use***
  - *Grazing*
  - *Arable*
  - *Aquaculture*
- ***Protected species***
- ***Cultural heritage and landscape***
- ***Recreation***

Stage 4: Reach-specific recommendations

Restoration Unit 09 West Lexham Banks

Current state

Grid references (u/s; d/s)	TF85541682; TF84891690	
Reach length	930 m	
Terrestrial SSSI units & assessed condition	Unit 17	Unfavourable, no change (inappropriate water levels)
	Unit 18	Favourable
Issues	Straightened and very deeply ditched, upstream. Heavy riparian shading in parts, completely absent in others (upstream).	
Constraints	Land use - grazing	

Indicative photographs

Multi-criteria analysis outputs (Sear et al. 2005)

Fluvial audit reach code(s)	510	509
Modification score	22	0
Naturalness score	37	31
Reach status	Degraded	Recovering/Semi-natural
Management class	Rehabilitation	Enhancement
Indicative restoration options	Manage riparian margin to provide gaps and woody debris; Introduce bed morphology; Raise bed levels using gravels from dredgings; Allow woody debris to remain in channel; Monitor silt accumulation.	

Long-term aspirations

Measures	Cut new sinuous channel (restoring to old course where evident) through bottom of valley to south (upstream reach). Allow establishment of open native wet woodland mosaic. Allow woody debris and natural adjustment in downstream wet woodland in conjunction with long-term aspirations for downstream West Lexham Hall lakes (Restoration Unit 10).
Impacts:	
Geomorphology	More active sinuous channel. Restored floodplain sediment sink.
Ecology	Increased physical habitat diversity, with areas of both scour and deposition, leading to more varied community structure. Reduced in-channel weed growth in previously open sections. Restoration of open wet woodland tree community and dynamics, supporting associated flora and fauna. Increased cover should lead to improved populations of fish, mammals and birds.
Flood risk	Increase in flooding frequency (upstream), but no properties at risk.
Amenity	Quarry for shooting likely to increase. Aesthetics likely to improve. Woodland could be managed for harvesting.
Management	None further to establishing woodland. Drier open woodland may be grazed at low stocking densities.
Cost level	£10,000 - £100,000 (depending on desired timeframe)
Possible implementation	EA/IDB capital works European or lottery funding Direct Defra funding Environmental Stewardship Local landowners/interest groups

Stage 4: Reach-specific recommendations

Reach map and photos

Summary of MCA outputs

Summary of current state, issues and constraints

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Pragmatic recommendations

Measures	Manage existing riparian trees and allow development of open riparian woodland, providing gaps and woody debris. Create high-flow overspill into West Lexham Hall lake at downstream boundary.
Impacts:	
Geomorphology	Opportunity for channel adjustment due to debris. Sediment deposition in downstream lake and subsequent channel adjustment.
Ecology	New wet woodland habitat. More diverse in-channel macrophyte cover structure. Local raising of water table due to woody debris may increase areas dominated by Rushes.
Flood risk	Possible local raising of water table due to woody debris.
Amenity	Quarry for shooting likely to increase. Improved aesthetics.
Management	May be possible to continue low-intensity grazing in dry open woodland, with watercourse fencing. Woody debris may have to be managed in the vicinity of Street Farm.
Cost level	> £10,000; < £100,000
Possible implementation	Environmental Stewardship EA/IDB capital works Local landowners/interest groups

Interim measures

Measures	Manage existing riparian trees to provide gaps and structural diversity. Manage livestock access to watercourse and allow development of woody riparian vegetation where currently absent. Withdraw in-stream weed removal. Allow woody debris to remain in channel downstream.
Impacts:	
Geomorphology	More actively evolving channel due to woody debris and weed growth. Sediment-trapping and gradual bed-raising due to weed growth.
Ecology	More varied physical habitat in both channel and riparian zone, increasing niches for plants and invertebrates.
Flood risk	Gradual local raising of water table.
Amenity	Aesthetic improvement.
Management	None further to measures.
Cost level	± £10,000
Possible implementation	EA/IDB maintenance Environmental Stewardship

Stage 4: Reach-specific recommendations

Prioritized actions:
- Long-term aspirations
- Pragmatic recommendations
- Interim measures

For each:
- Brief description of measures
- Interpretation of ecological and other impacts
- Rough cost (high/med/low)
- Potential delivery mechanisms

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Stage 5: Wider consultation

- Draft approved by steering group
- Invitations to more extensive group of stakeholders, plus advertisements

Community centre invasion:

- All steering group on hand
- Displays – posters, exhibits
- Maps for scrawling on
- Tea, cake and a nice sit-down!

Objectives:

- Inform and engage
- Any missed opportunities or constraints?
- Ensure first round consultees' views were represented



Next up…

- (Hopefully) minor amendments
- Sign off
- If you can lay your hands on some money…

…get stuck in!

For video clip, please see:

http://therrc.co.uk/Deflector%20to%20berm%20in%2030%20seconds.wmv

Improving the calibration of River MImAS for catchment-scale planning and management

Chris Bromley, Willie Duncan, Fiona Carse

Ecology Partnership & Development Unit

Scottish Environment Protection Agency

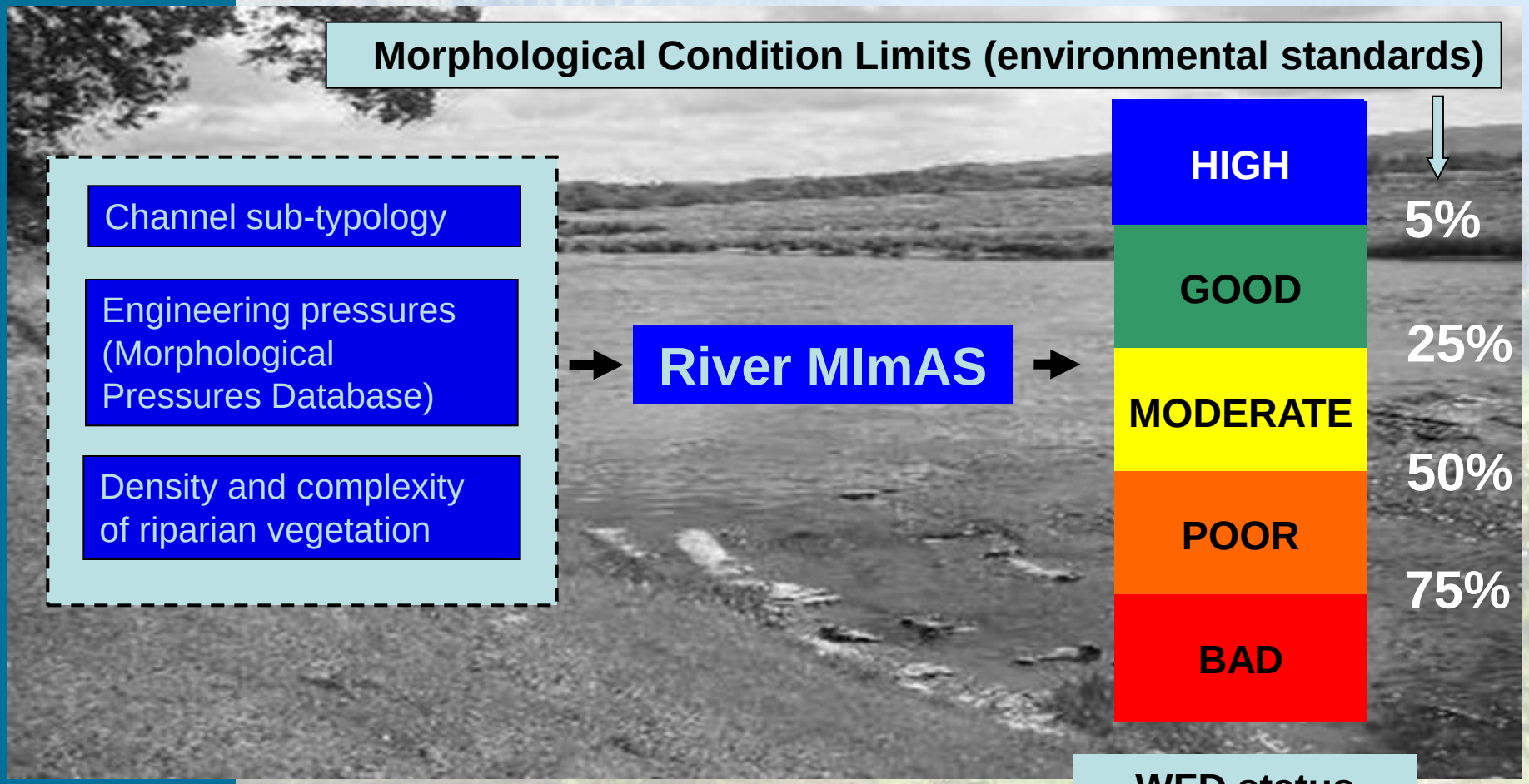
Overview

- River MImAS as a catchment-scale assessment tool
- Towards an improved empirical understanding of the biological impacts of geomorphological /engineering pressures

River MImAS

- WFD Classification
- Regulation under CAR
- Restoration scenario exploration

Morphological Impact Assessment Tool



System capacity calculation

% system capacity used per pressure =

$$\left(\frac{\text{Impact Rating x Pressure Footprint}}{\text{x Water body length}} \right) \times 100$$

River MImAS Impact ratings

Channel Type						
Channel Zone	**A**	**B**	**C**	**D**	**E**	**F**
Sediment Removal	0.25	0.42	0.63	0.71	0.71	0.38
Dredging	0.42	0.67	0.92	1.08	1.08	0.58
Condition of Riparian Vegetation	0.06	0.16	0.22	0.31	0.28	0.09
Embankments & Floodwalls (excludes bank reinforcement)	0.42	0.67	1.67	1.17	1.17	0.58
Set Back Embankments & Floodwalls	0.02	0.04	0.13	0.08	0.08	0.04
Grey Bank Reinforcement	0.16	0.31	0.75	0.56	0.50	0.25
Green Bank Reinforcement and/or Bank Reprofiling	0.06	0.16	0.22	0.31	0.28	0.09
High Impact Channel Realignment (e.g. recent straightening)	0.33	0.58	1.67	1.17	1.17	0.50
Low Impact Channel Realignment (e.g. remeandering)	0.13	0.22	0.31	0.38	0.41	0.19
Culvert with natural bed (e.g. arch culvert)	0.42	0.67	1.67	1.17	1.17	0.58
Culvert with artificial bed (e.g. pipe or box culvert)	0.54	0.81	1.85	1.44	1.44	0.69
Croys, Groynes or other Flow Deflectors	0.13	0.25	0.72	0.47	0.47	0.22
Bed Reinforcement	0.33	0.58	1.58	1.08	1.08	0.50
Impoundments	0.42	0.67	1.67	1.17	1.17	0.58
Piled Structures (including bridge piers)	0.16	0.28	0.88	0.56	0.56	0.25

Banks and Riparian Zone	**A**	**B**	**C**	**D**	**E**	**F**
Sediment Removal	0.00	0.00	0.00	0.00	0.00	0.00
Dredging	0.00	0.31	0.50	0.56	0.31	0.31
Condition of Riparian Vegetation	0.00	0.19	0.31	0.31	0.19	0.19
Embankments & Floodwalls (excludes bank reinforcement)	0.00	0.38	0.75	0.63	0.38	0.38
Set Back Embankments & Floodwalls	0.00	0.00	0.00	0.00	0.00	0.00
Grey Bank Reinforcement	0.00	0.38	0.75	0.63	0.38	0.38
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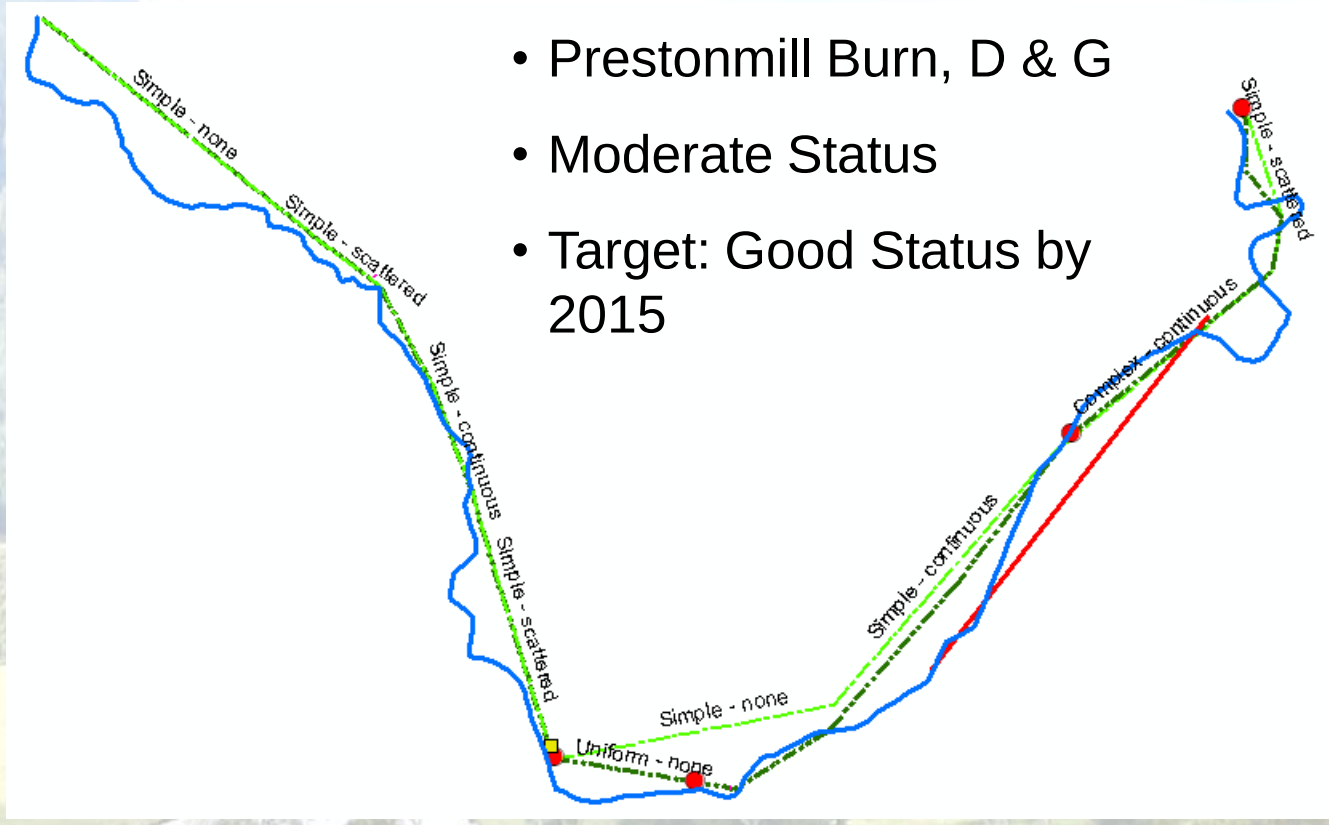
Scenario exploration for restoration

Good regulatory & restoration decisions are based on sound classification results



- Prestonmill Burn, D & G
- Moderate Status
- Target: Good Status by 2015

10596	1	High Impact Channel Realignment	22.14	30.04
10596	1	Riparian Vegetation	6.52	30.04
10596	1	Pipe and Box Culverts	0.84	30.04
10596	1	Bridges	0.53	30.04
10596	1	Intakes + Outfalls	0.00	30.04

Towards an improved empirical understanding of biological responses to geomorphological pressures

- Steering group of UK environment agencies
- Hypothesis-driven approach to the….
- Development of new information from:
  - Literature review
  - Re-analysis of existing datasets
  - **Collection of new data**

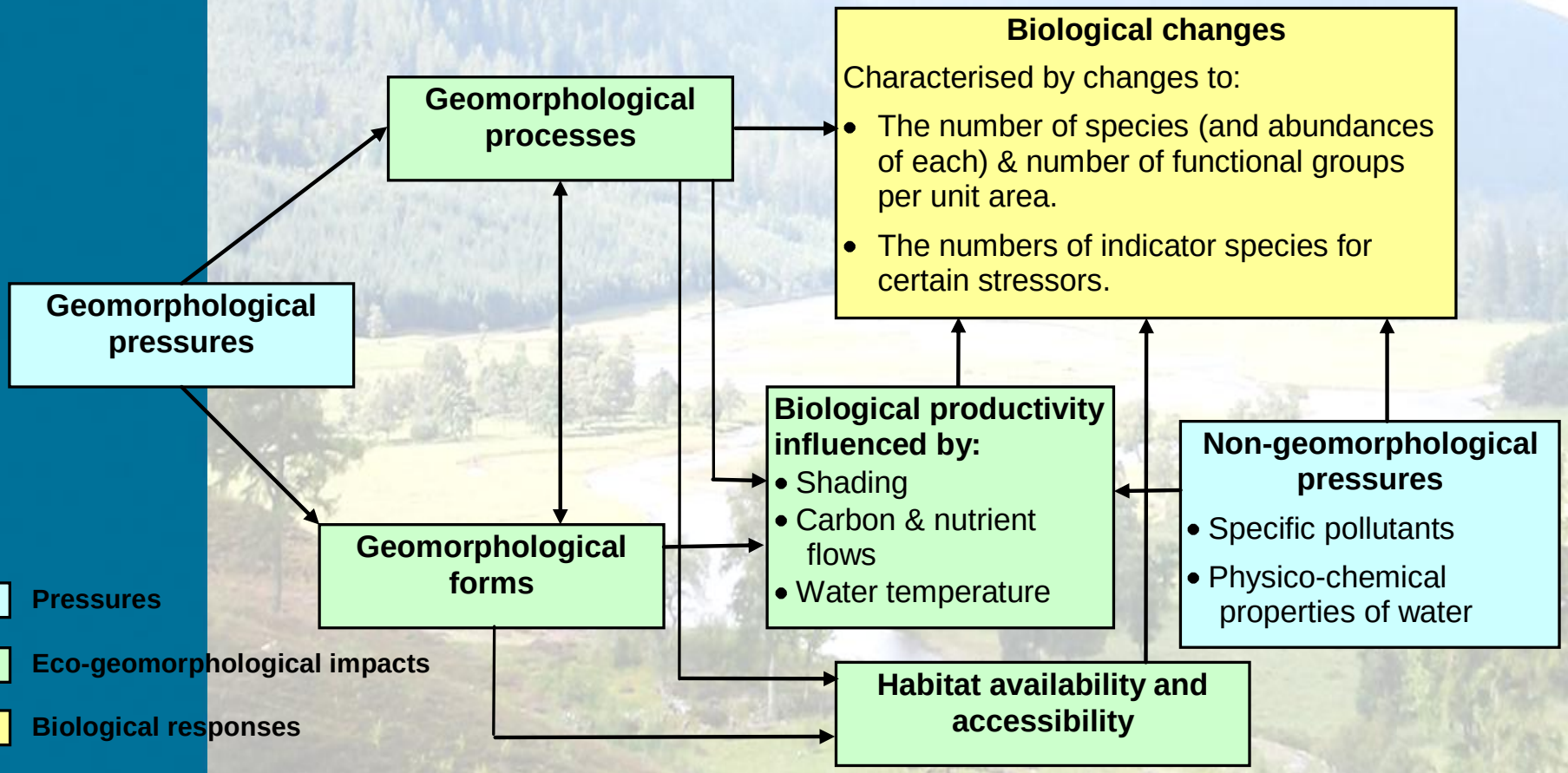
Significant pressure-type pairings

Type	Riparian vegetation modification	Channel realign-ments	Flood embank-ments	Culverts	Impoundments	Hard bank protection	Dredging & removal of in-channel vegetation
A -bedrock -cascade		X	X			X	X
B -plane bed -step-pool		X	X			X	X
C -plane riffle -wandering -braided							
D -actively meandering							
E -ground-water					X		
F -passively meandering					X		
Limestone rivers							

Dealing with complexity

- Multi-stressor environment. Tight control required for other stressors, channel type, riparian land use and sampling locations.
- Difficult to get this control in studies / data sets collected for other purposes.
- New data collection affords this opportunity from:
  1. Sites where new pressures are going to be installed
  2. Sites where pressures are to be removed
  3. Sites where pressures are already in place
- Category 1 & 2 sites offer pre- & post-implementation opportunities for baseline data collection (BACI design).
- Category 3 sites require control sites located elsewhere, preferably nearby upstream.
- Hypothesis-driven approach.

High level pressure-impact-response web



Draft hypothesis: realignment of actively meandering channel

- **Geomorphological impacts:**
  - Simplified cross-sectional geometry.
  - Shorter, steeper channel; increased flow velocities, stream power and boundary shear stresses.
  - Reduced variety of bed forms and sediment heterogeneity; general coarsening of substrate in absence of fine sediment inputs.

Draft hypothesis: realignment of actively meandering channel

- **Biological impacts - macrophytes:**
  - Reduction in total number of species and functional groups.
  - Small number of species likely to dominate and functionally be more streamlined.
  - Fewer large emergents.

Draft hypothesis: realignment of actively meandering channel

- **Biological impacts - macroinvertebrates:**
  - Reduction in total number of species.
  - Remaining species functionally more streamlined.
  - Loss of detritus feeders (since less detritus settling & retained in-channel).
  - Loss of shingle beetles (since shingle bars washed out).

Next steps…

- Refinement of hypotheses and sampling design and methods of analysis in light of peer review.
- Rolling programme of data collection by SEPA, other environment agencies, and others (academia)?
- Incremental improvement of knowledge base and MImAS impact ratings.

Catchment Sensitive Farming
A Voluntary Approach to Tackling Diffuse Water Pollution from Agriculture in River Catchments

Alison Tytherleigh, Natural England
Phil Smith, Environment Agency
Alastair Burn, Natural England

A clear solution for farmers
CATCHMENT SENSITIVE FARMING

NATURAL ENGLAND

Environment Agency

defra
Department for Environment Food and Rural Affairs

Funding is from the European Agricultural Fund for Rural Development: Europe investing in rural areas.

Diffuse Water Pollution - The Problem

- Agriculture contributes around 25% of Phosphate to English waters
- 55% of SSSIs rivers and streams affected by DWP
- Organic pollution from farms impacting on river SSSIs
- Up to 75% of sediment input into rivers can be attributed to agriculture
- WFD Reasons for failure: % of times DWPA cited by EA Area staff =18%
- Environmental damage (Water Quality) to rivers £58 million per year

Addressing the Problem
The England Catchment Sensitive Farming Delivery Initiative
2006 to 2011

Primary Objectives

- To **increase awareness** amongst farmers and land managers of the impact of diffuse water pollution from agriculture
- To improve through **voluntary action** soil and land management practices amongst farmers and land managers in Priority Catchments
- To **reduce the pollution of water** caused by farming to help achieve **SSSI** and **WFD requirements**

Increasing Awareness through Farmer Engagement

Approach

- Locally based Catchment Officers working with the community
- Local evidence:
  - photographs,
  - environmental data,
  - bespoke monitoring programmes,
  - farmer participation in water quality monitoring
- Free advice and training:
  - Soil sampling and analysis
  - Nutrient and fertiliser planning
  - Regulatory requirements

Increasing awareness using local evidence
Macro Invertebrates Survey in the River Dove Catchment

Issue

Declining fish and invertebrate populations linked to intensive livestock farms

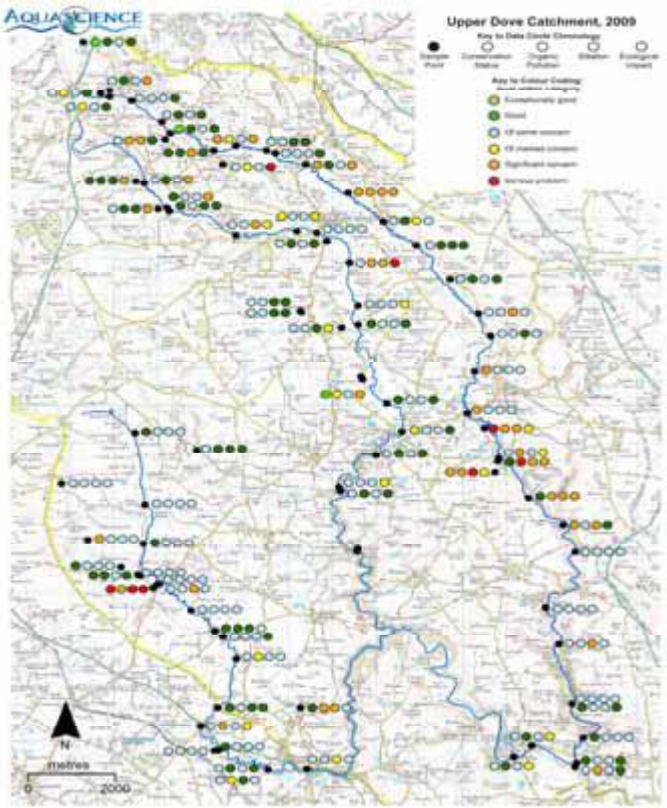
Local Evidence

Detailed macro-invertebrate survey across 89 sites.

Results mapped using a traffic light system

Action

Results used to target holdings upstream of hotspots. Farmers received infrastructure audit and signposted to ECSFDI capital grants scheme



http://naturalengland.etraderstores.com/NaturalEnglandShop/NECR046

Uptake of Advice and Voluntary Action by Farmers

Working with other partners - Culm

Issues – Intensive dairy, arable/beef. Soil compaction, runoff

Solution – CO, NE, FWAG, NT & farmers

- 668 ha under ELS/HLS options addressing diffuse pollution, soil compaction, flooding and archaeology

Cost effective measures - Lugg

Issue - livestock and stream in the same field

Solutions:

- CO working with the farmer better use of fencing, moving a ring feeder, stoning a drinking bay

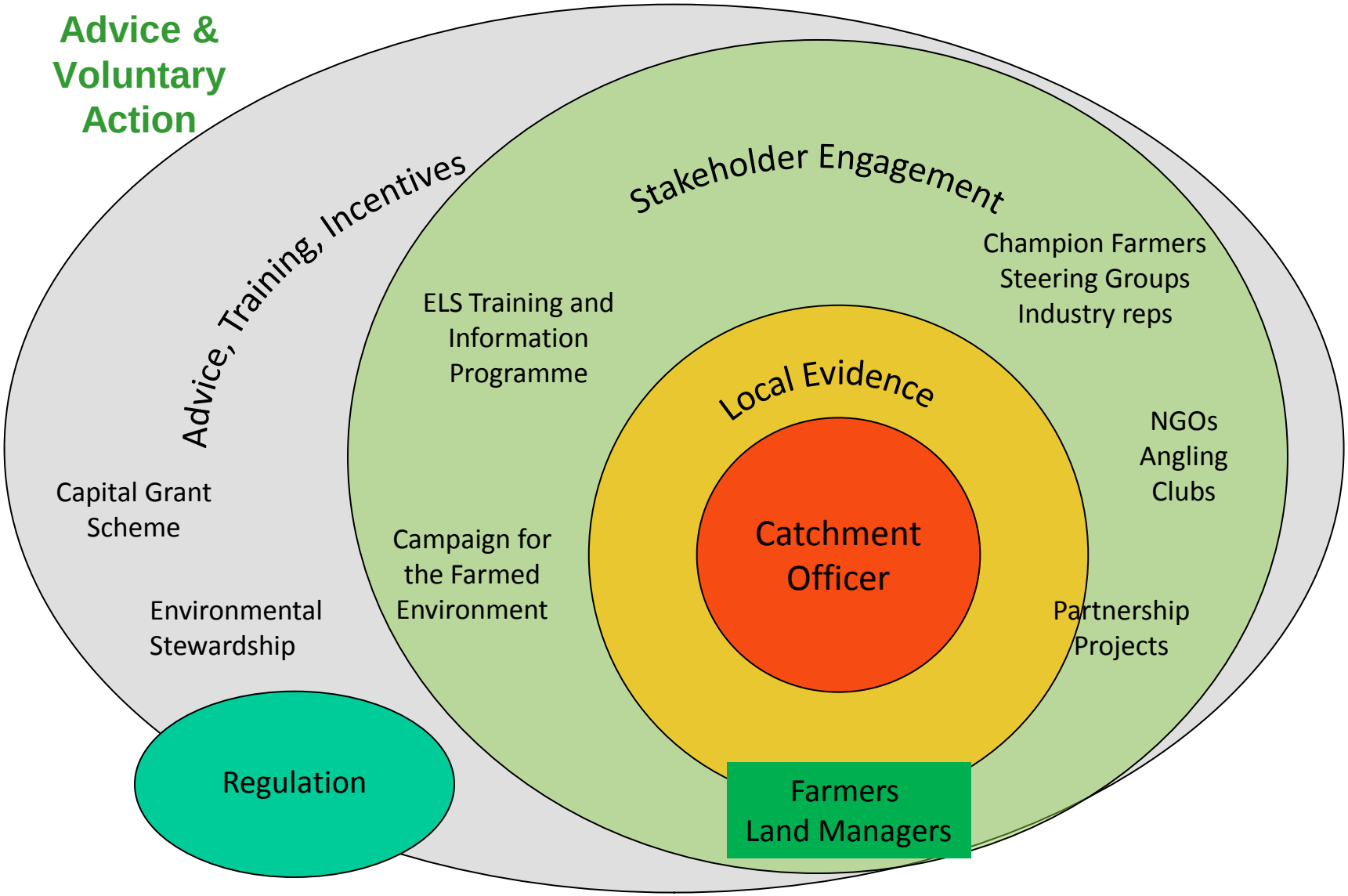
A clear solution for farmers
CATCHMENT SENSITIVE FARMING

NATURAL ENGLAND

Environment Agency

defra
Department for Environment Food and Rural Affairs

Funding is from the European Agricultural Fund for Rural Development: Europe investing in rural areas.


Advice & Voluntary Action
Advice, Training, Incentives
Stakeholder Engagement
Champion Farmers
Steering Groups
Industry reps
ELS Training and Information Programme
Local Evidence
NGOs
Angling Clubs
Capital Grant Scheme
Catchment Officer
Campaign for the Farmed Environment
Environmental Stewardship
Partnership Projects
Regulation
Farmers
Land Managers

Farmer Engagement

February 2011

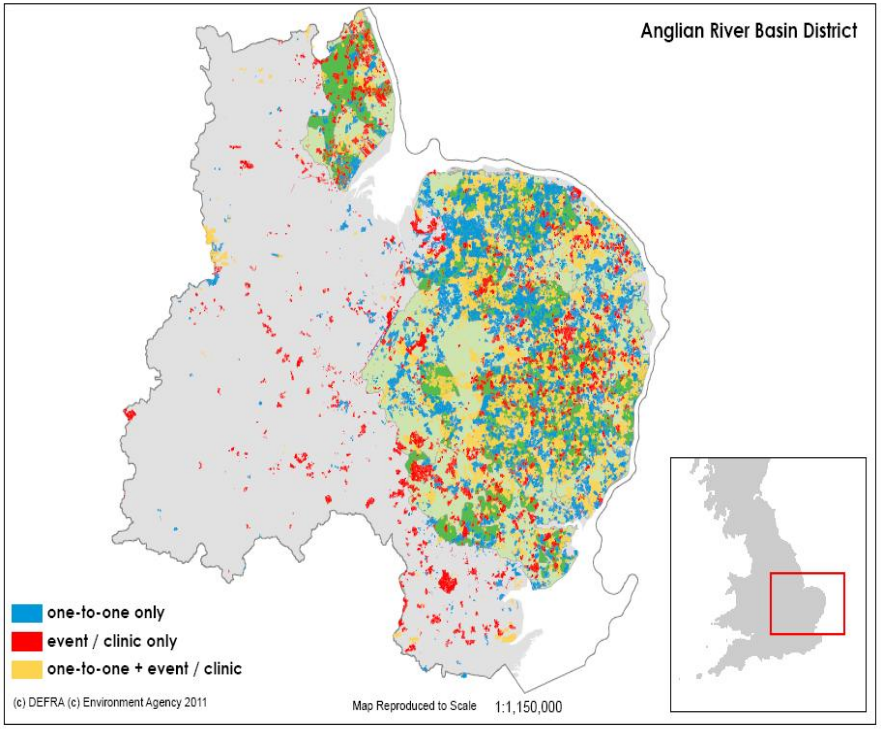
- 9,023 holdings covering 1,320,400 ha

= 62% of holding area within target areas

= 38% of holding area within Priority Catchments

- 1,257 group events
- 373 advice clinics
- 11,157 farm advice visits
- 2,988 sampling visits

(figures exclude multiple engagements of same farmer)

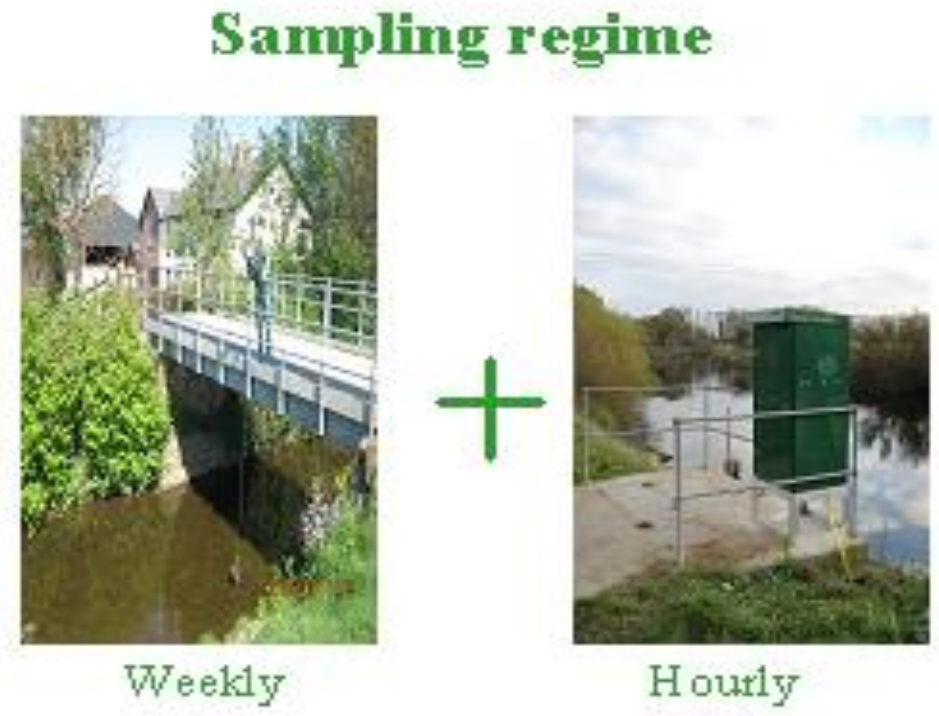


Uptake of Advice and Voluntary Action by Farmers: Achievements

- Implementation of advice increased with time and further engagement
- By early 2011 58% of measures recommended through 1to1 advice had been implemented
- Between 2008 and 2010 there was a 15% increase in implementation of advice provided between 2006 and 2008
- Implementation of measures providing a cost saving was only slightly higher than those associated with net cost
- Nearly £23m Capital Grants to over 3,000 farmers
- Whilst ECSFDI advice and the CGS were key to the implementation of measures other initiatives (NVZ, ES and Farm assurance schemes) also played a part

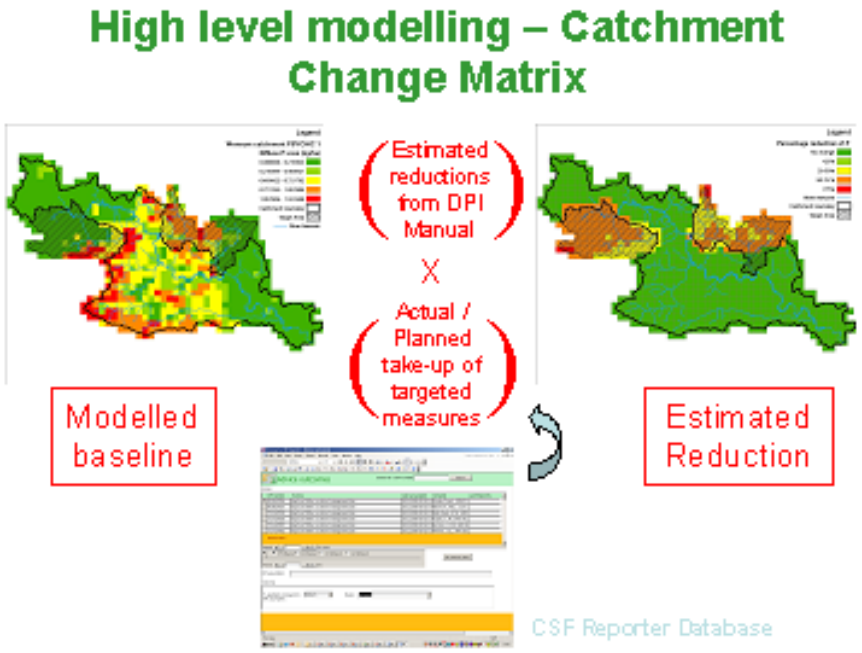
Pollutant losses and Water Quality

- We have implemented multi-pollutant high frequency and storm event monitoring in representative CSF catchments
- This underpins our modelling (development and calibration) and provides a direct measure of environmental change



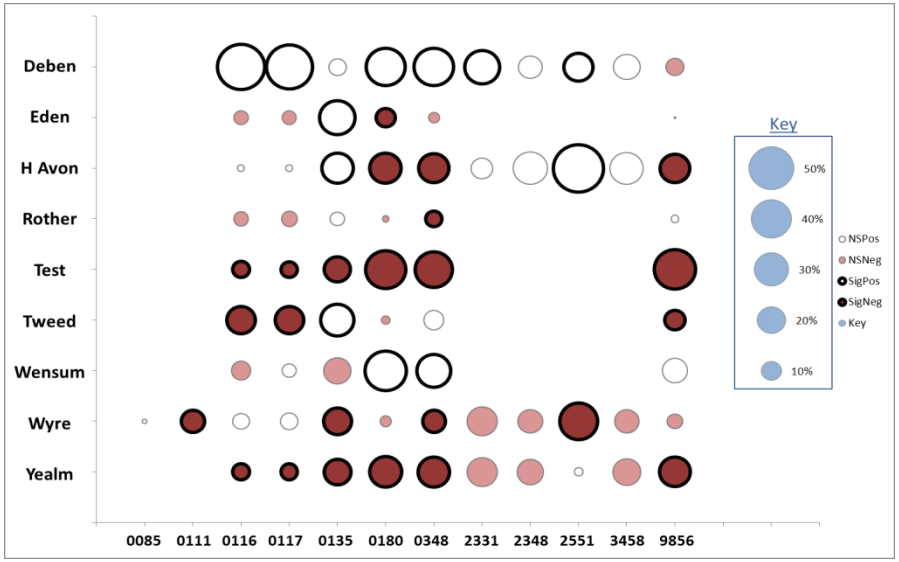
Water quality modelling

- Modelled load reductions and WQ improvements typically 5 -10%
- 30+% reductions predicted in some sub-catchments
- Significant variation across catchments dependent on nature of dwpa issues, practices adopted and significance of agricultural sources



Water quality monitoring - Nutrients, sediment & FIOs

- 6 of 9 catchments showed a reduction in pollutant concentrations for more than half the pollutants
- 9 of 12 pollutants showed a reduction in at least half the catchments
- Weight of evidence indicates that CSF has improved water quality



After accounting for concurrent changes at spatial control sites that factor out broad, catchment-scale changes in flow and land use

Catchment Sensitive Farming
2011 - 2013

- Models and datasets from ECSFDI evaluation used to define Phase 3 target areas
- Further developments to identify most effective combinations of control measures for specific areas
- Ensure the way we work reflects the diversity of our audience
- Maintain a mix of levers – advice, incentive and regulation
- Partnerships at all levels – industry, river basin, local

Synergy & Integration

- **Planning & Implementation:** RBMPs & SSSI DWP Plans
- **Strategic Partnerships** extending and improving advice to farmers and advisers on reducing diffuse water pollution
  - Partners bring a different approach, expertise, networks, contacts, influence
  - Partnership working more sustainable in longer term
  - Lever additional funds from partners and develop new advice tools
  - National & Catchment partnerships with partners with common objectives to ECSFDI
- Joint CSF and EA workshops and farm visits – pollution prevention visits, *Thinksoils,* etc
- Regulation – NVZ, SPR
- Signposting – ES, ETIP, Campaign for the Farmed Environment
- **Projects:** Rural Sediment Tracing, Demo Test Catchments, new EA's Catchment Based Approach, Defra's Strategic Evidence and Partnership Fund Project, Water Industry Periodic Review Programme

Contacts & Further Information

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Information

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