Improving WFD status at the catchment scale: The role of Natural Flood Management

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Running order

1) Sustainable Catchment Management
2) NFM
3) NFM links to WFD
4) NFM Experience at Belford
5) Conclusions
6) Mini Workshop

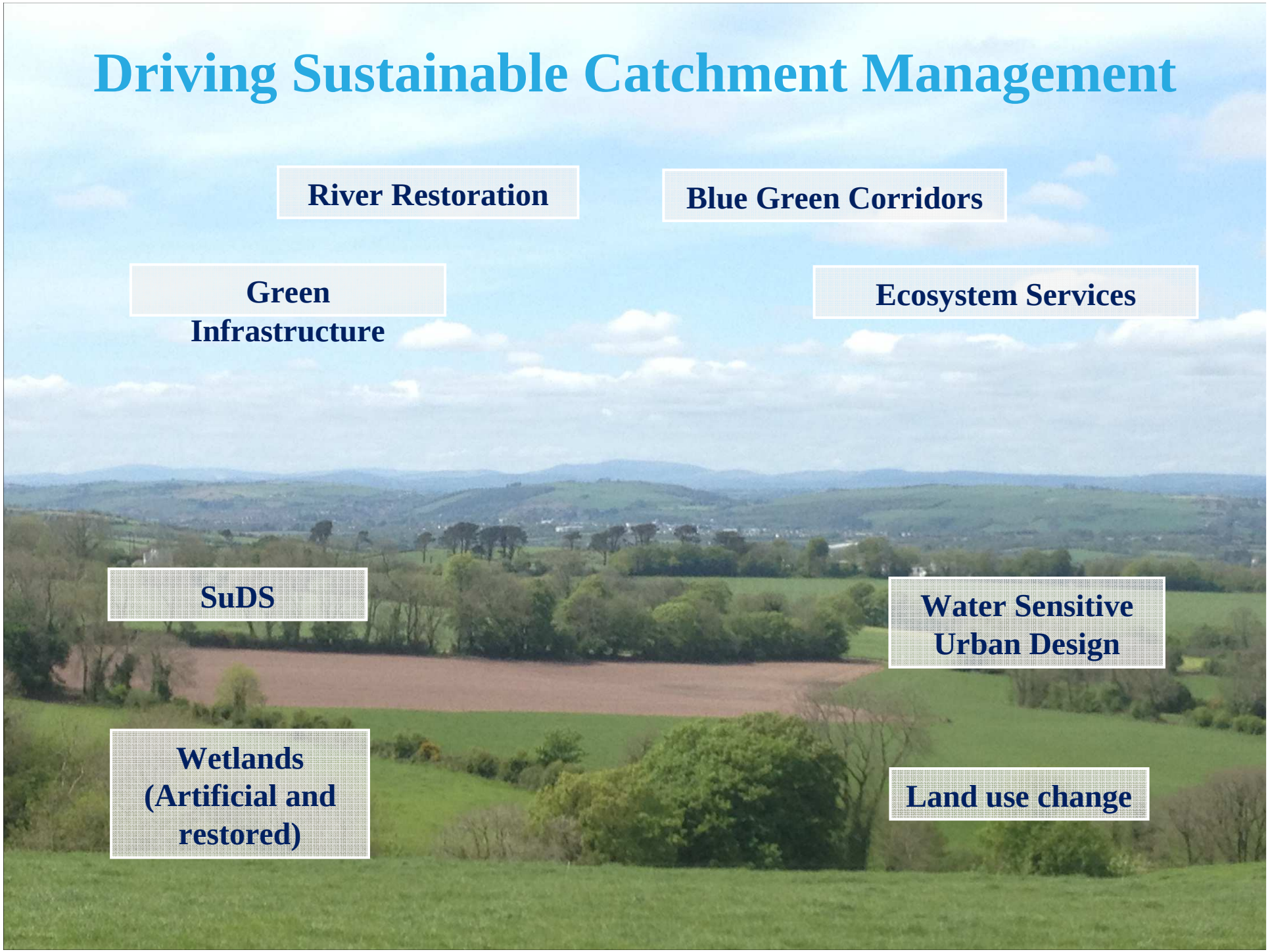
   (Barriers and enablers by geography)

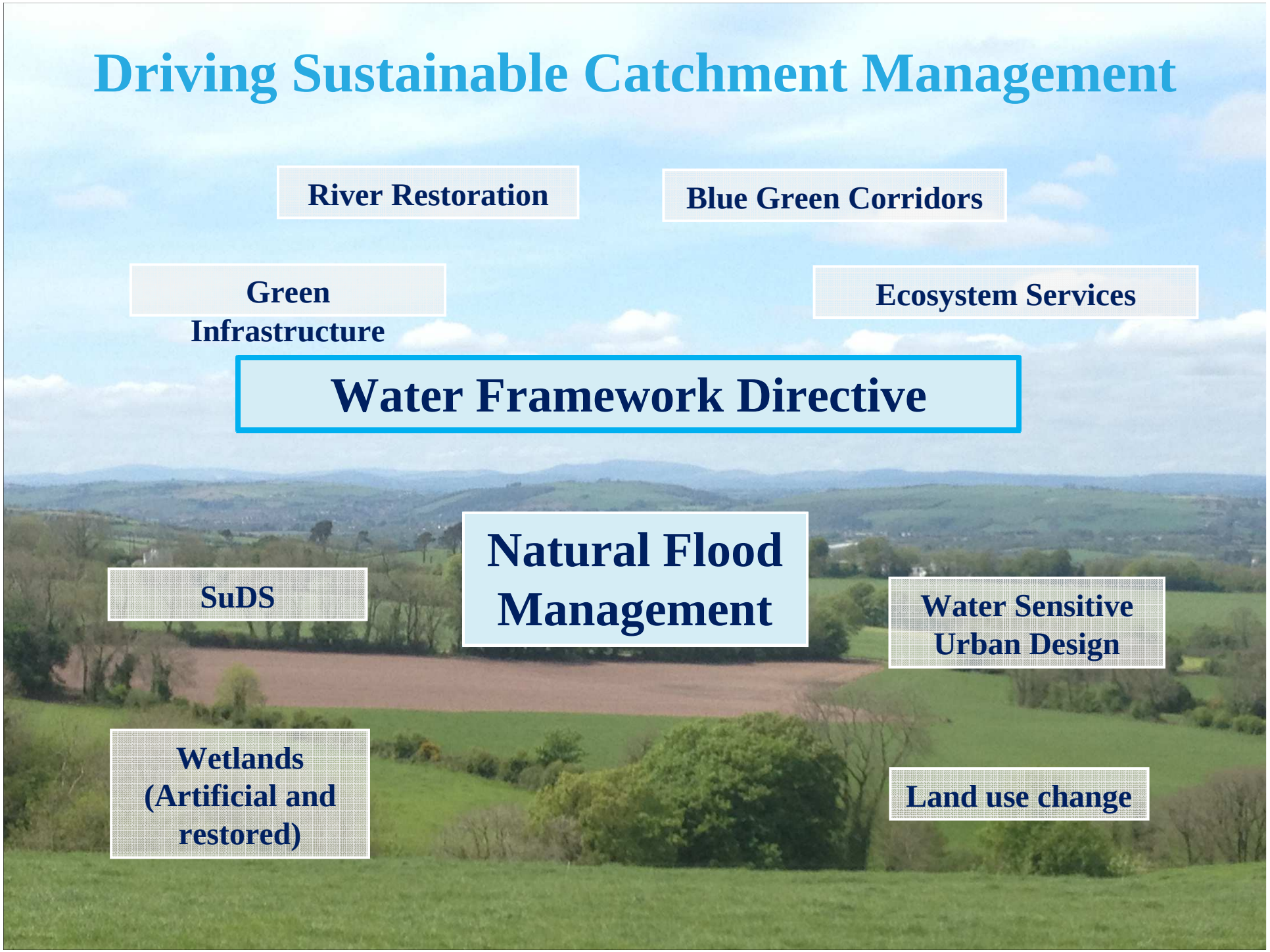
By restoring damaged rivers are we focussing on the symptoms, rather than the cause?

Sustainable Catchment Management (for WFD)

- **“Working With Natural Processes”;**
- **As far as possible, restoring the catchment in its natural state;**
- **Where its not possible restore, look to mimic or replicate (or over-naturalise?);**
- **Taking advantage of natural recovery, vegetative development and geomorphological change;**
- **Become more resilient to Floods, Droughts and Geomorphological change;**

Driving Sustainable Catchment Management




Driving Sustainable Catchment Management
River Restoration
Blue Green Corridors
Green Infrastructure
Ecosystem Services
Water Framework Directive
Natural Flood Management
SuDS
Water Sensitive Urban Design
Wetlands (Artificial and restored)
Land use change

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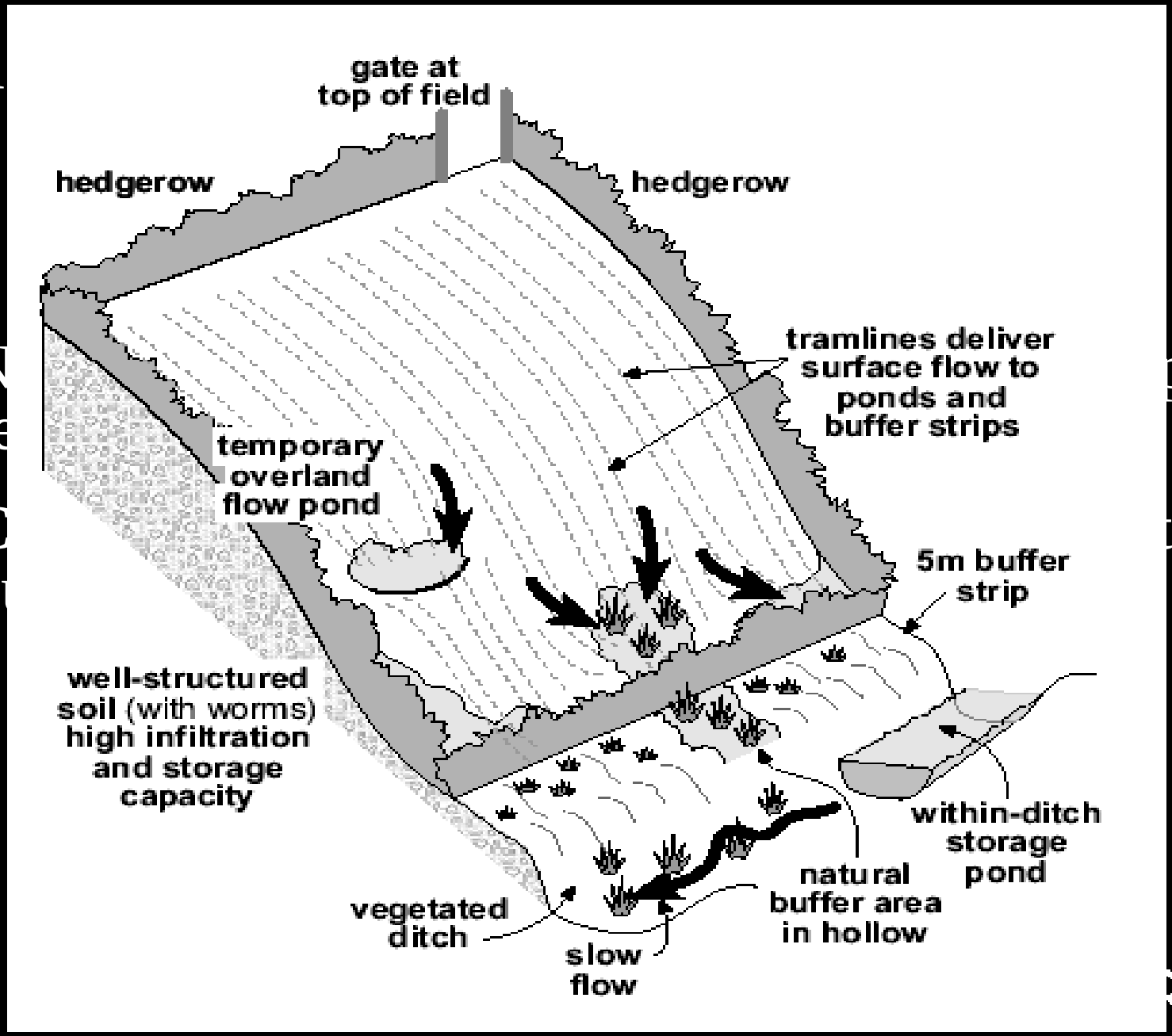

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WFD aspects related to NFM

- **The “Catchment Waterbody”**
  - **Hydromorphology;**
  - **Water Quality;**
  - **Ecology.**

- **WFD Mitigation Measures (non-exhaustive list):**
  - **Physical Restoration;**
    - Remeander, Regrade, Reconnect rivers.
  - **Sediment Management;**
    - Buffer Strips, alter land use regime, fencing,
  - **Alter Flow Regime;**
    - Ensure appropriate baseline; flow manipulation;

NFM benefits for WFD

- Hydromorphology
  - Reduced low flows and “naturalisation” of flood peak and frequency;
  - Improved habitat diversity and dynamism in restored reaches;
  - More wetland and backwater habitat;
  - Improved floodplain connectivity;

- Water Quality
  - Increased residence time of waters +
  - Increased vegetation and surface area =
  - Increased natural treatment and filtration

- Sediment Management
  - Reduced/naturalised energy levels and sediment delivery;
  - Reduced velocities and increased deposition/vegetation;
  - Increased vegetation and “locking away” of sediment;
  - Interaction with farms to maintain features and reuse sediment.

Flooding in Belford

Unnatural rates of run off and sediment delivery due to agriculture impacting on all 3 WFD elements (hydromorphology, water quality and ecology)

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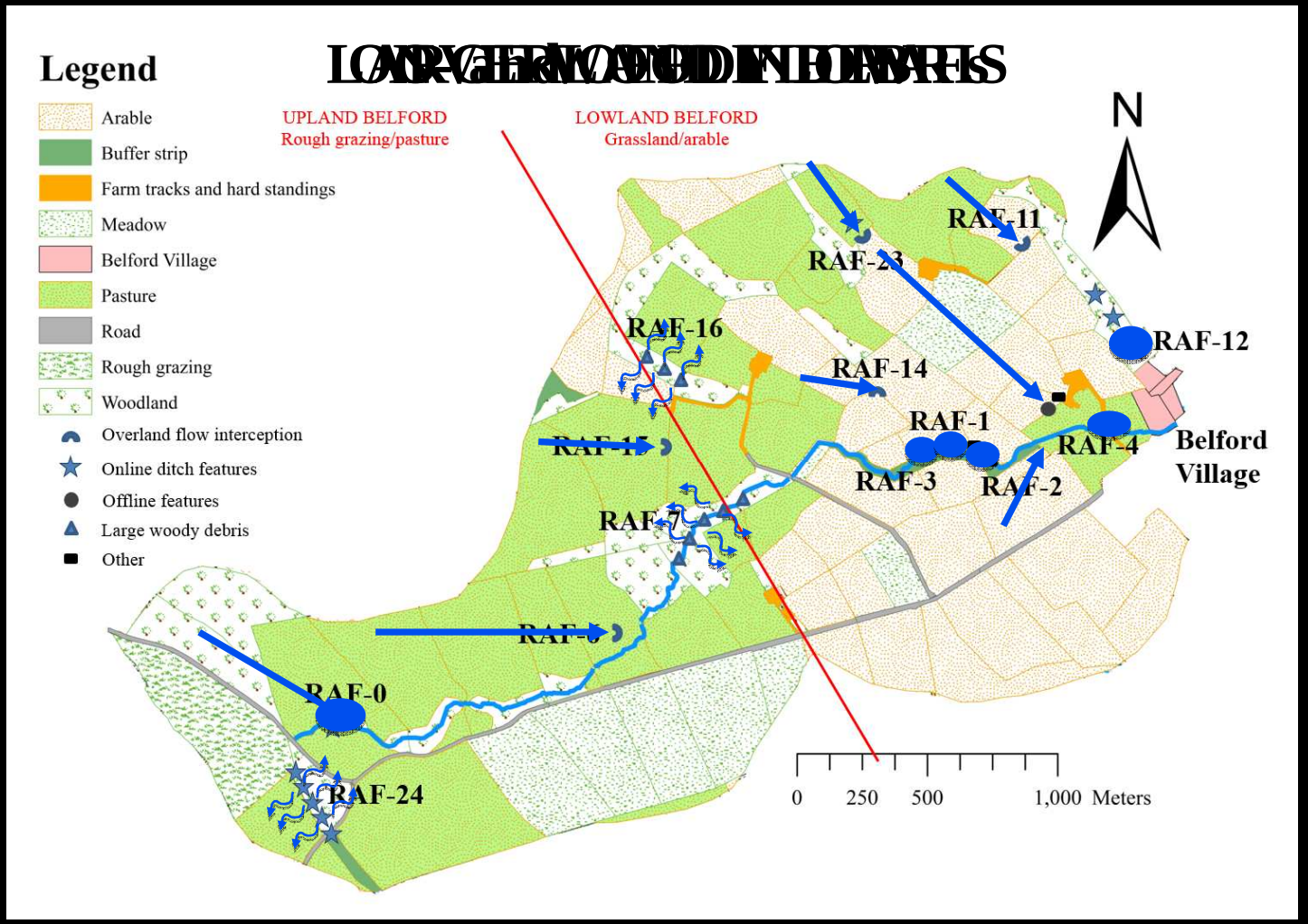
Mitigation Explained



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Runoff Attenuation Features (RAFs):

Key design attributes of RAFs:

- easily accommodated in the landscape;
- do not impact on farming;
- typically small (<500m^3), or located within a ditch or small stream;
- designed as an extension of farming and land drainage (i.e. not solely flood engineering projects);
- provide multiple benefits, e.g. nutrient transport (Barber & Quinn, 2012)

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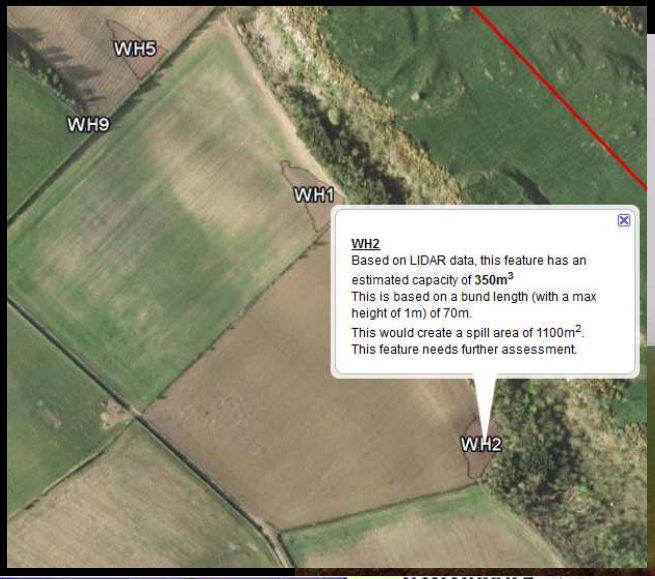
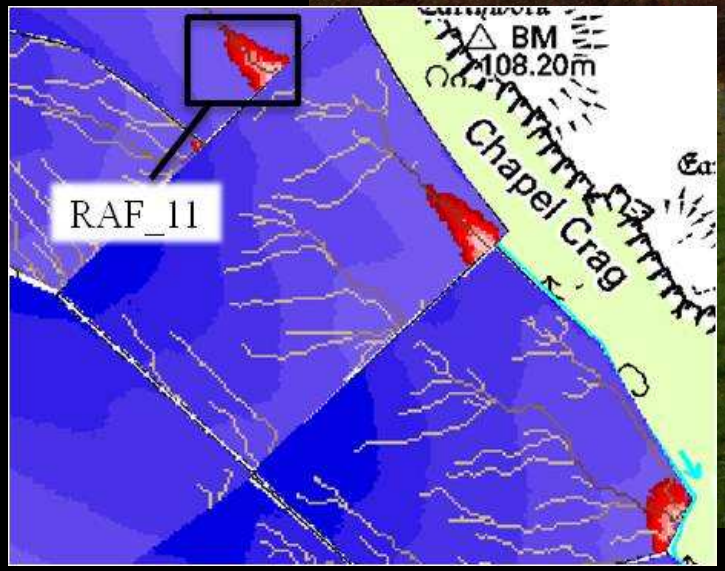
RAF types – Soil interception bund (RAF-11)





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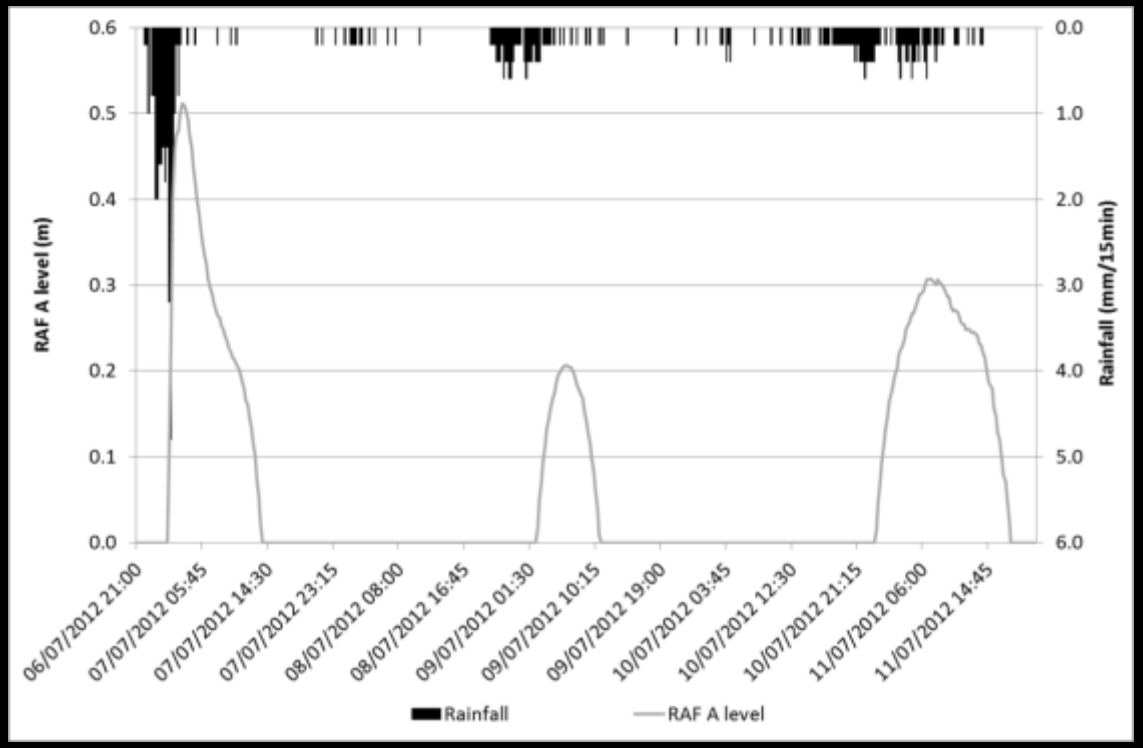
RAF types – Soil interception bund (RAF-11)

- RAF-11 disconnecting rapid runoff in steep arable field 490m^3
- Palmer 2012 estimated 0.99 tonnes of sediment were retained in feature, the equivalent of 91 kg ha^{-1}.



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RAF types – Leaky barriers (RAF-0)

Photo provided by Mark Wilkinson

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RAF types – Leaky barriers (RAF-0)

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RAF types – Large Woody Debris (RAF-7)

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RAF types – Offline ponds (RAF-1)

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RAF types – Offline ponds (RAF-1)

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RAF types – Offline ponds (RAF-1)

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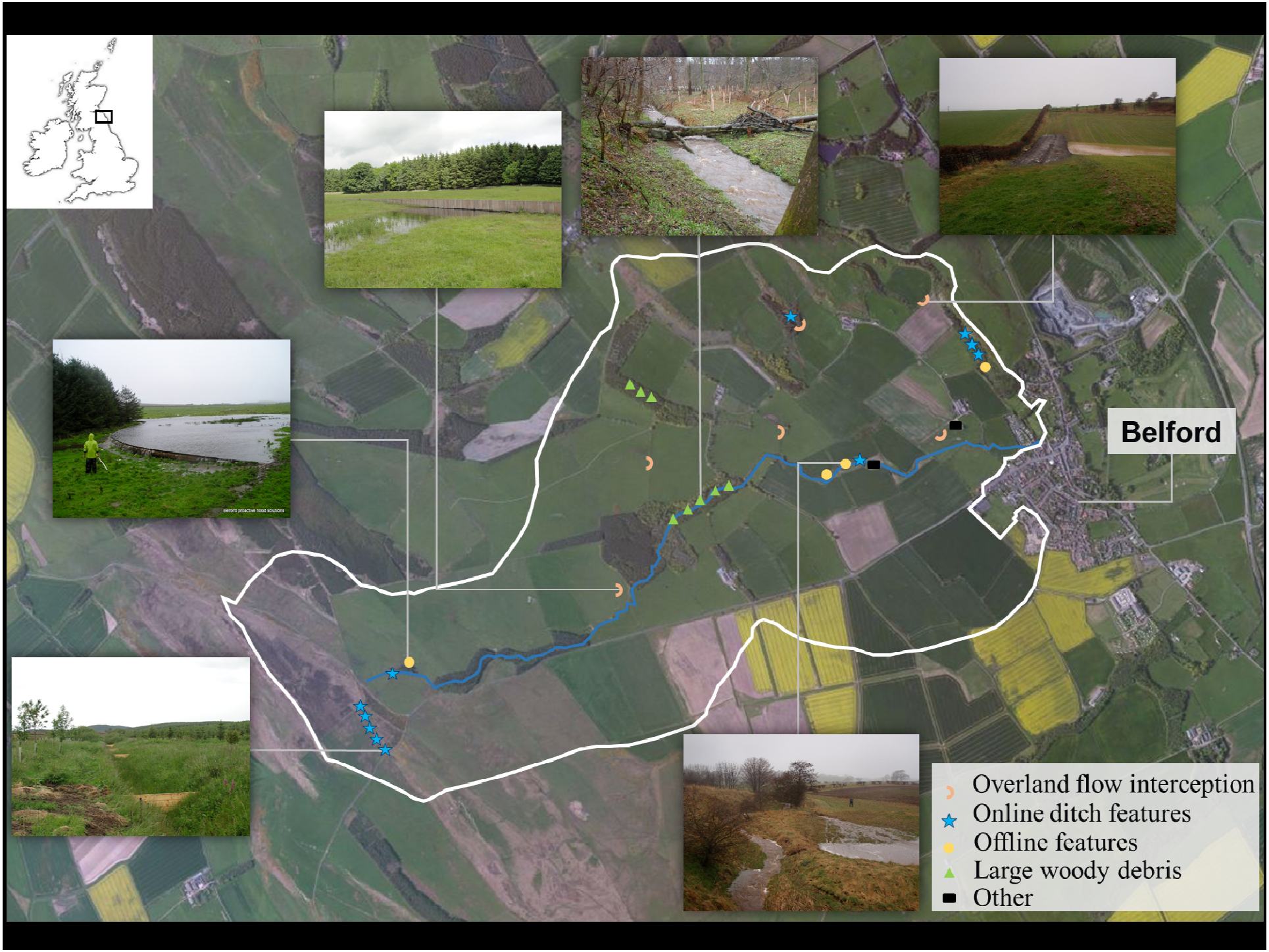
Belford
Overland flow interception
Online ditch features
Offline features
Large woody debris
Other

Features built in Belford and estimates of typical capacity and cost.
(Consultancy and research costs are not included)

Feature type	Number built	Typical min, max storage m^3	Estimated cost
Overland flow interception	5	300-1000	1K-5K
Online ditch features	9	50-150	1K-3K
Offline ponds	5	200-3000	2K-6K
Large woody debris	8	50-150	1K-3K
Other opportunistic sites	3	100-3000	1K-10K
TOTAL	**30**	**Estimate for Belford 8,000m^3**	**£70K-100K**

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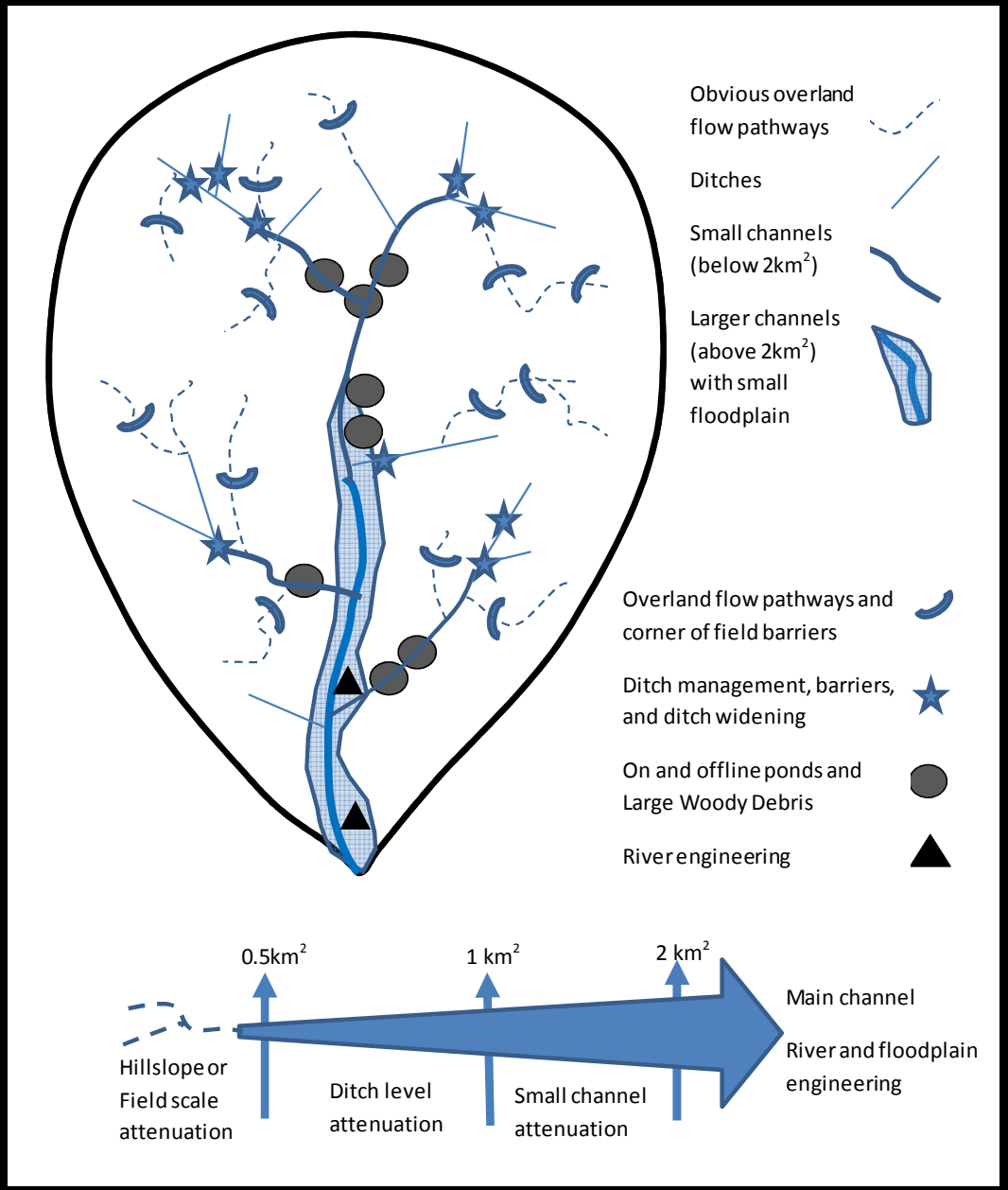
Where should a RAF be located?



From: Quinn, P., O'Donnell, G., Nicholson, A., Wilkinson, M., Owen, G., Jonczyk, J., Barber, N., Hardwick, M., & Davies, G. (2013). Potential use of Runoff Attenuation Features in small rural catchments for flood mitigation: Evidence from Belford, Powburn and Hepscott. Joint Newcastle University, Royal Haskoning and Environment Agency Report. Retrieved from http://research.ncl.ac.uk/proactive/belford/newcastlenfmrafreport/reportpdf/June%20NFM%20RAF%20Report.pdf

Get the right feature in the right place. In the field, in the ditch, in the small channel… Offline ponds for larger channels and any opportunistic sites

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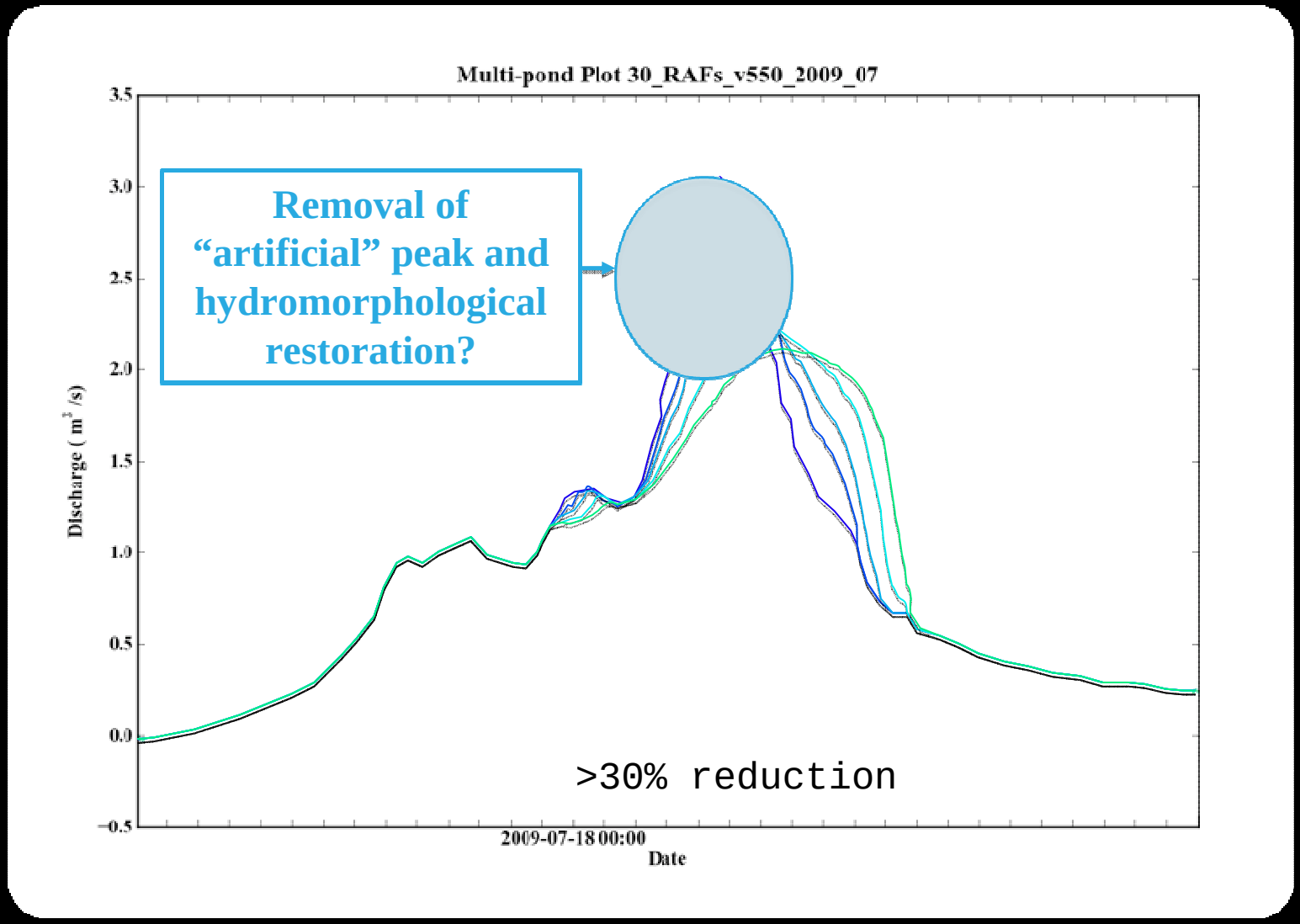

NFM simulated hydrographs:

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Summary

- NFM is a sustainable way of managing runoff & has low cost and offers multiple benefits;
- Disconnection of runoff pathways at source reduces flood peaks locally and captures sediment. Maintenance is needed to preserve pond volume.
- The network of RAFs provides downstream benefits.
- Intrinsic WFD benefits of NFM for all 3 elements;
- More research is needed on the specific / quantified benefits of NFM for WFD (requiring risk aversity and a “leap-of-faith”.
- Why are we not doing more NFM?.....

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Workshop task

What are your key barriers to NFM implementation?

- Take 10 coloured dots each;
- Place dots against listed barriers (as many as you like if you feel a barrier is important);
- Add a post it note (with a comment) to barriers if you think that it particularly applies to your country;
- Add post it notes to the solutions section if you have ideas;
- Keep talking….!!

Results will be summarised and circulated afterwards.

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