A case study of catchment systems management using Runoff Attenuation Features (RAFs)

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Introduction

There is great potential for agricultural management to become a major part of improved strategies for controlling runoff – through altering key hydrological flow pathways, at key times.
Catchment Systems Management

“Catchment Systems Management is an interventionist approach to managing water quantity and water quality at the catchment scale”

Pond 3 Runoff Attenuation Feature (RAF)

RAFs SLOW, STORE and FILTER --- e.g. making buffer strips do more
How much water do we have to manage?
Which flow pathways do we have to mitigate?

1 mm/hour
Multiple benefits of RAFs

- Improved farm drainage, lowering of ponding duration but with increased flood storage when needed

Stone barriers – improve trafficking on the farm, lowering poaching and increased flood storage
RAFs that allow crop production to go ahead

A buffer strip converted to a flood storage zone and a sediment trap

Small flood inundation zones are planted with Willow
Large Woody Debris – in any woodland area

Removal of sycamore trees and replaced with oak
Netherton Flood scheme - Phase I mitigation

Three-tier RAF sediment trap

• Water storage capacity ≈ 280 m³
• 70 ha contributing area
• Improve water quality
• Slow sedimentation rate in main flood attenuation pond
• Easy removal of sediment
• Fully instrumented

During a flood
RAF performance – Three-tier sediment trap

Retention (% concentration)

- SS: 25 – 67 (49% net retention)
- TP: 16 – 44 (33% net retention)
- NO₃: 5 – 85 (18% net retention)
Impact of a Pond?

- Volume capacity = 560m$^3$
- Inlet height = 0.55m
Pond Network Model:
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Pond Network Model:

Volume capacity = 560m
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30 Ponds
35% Reduction
Overland flow pathways and corner of field barriers
Ditch management, barriers, and ditch widening
On and offline ponds and
Large Woody Debris
River engineering

Obvious overland flow pathways
Ditches
Small channels (below 2km²)
Larger channels (above 2km²) with small floodplain

Conceputal Catchment Systems Management Plan

Hillslope or Field scale attenuation
Ditch level attenuation
Small channel attenuation
Main channel
River and floodplain engineering
Conclusions

• Target where and when to modify flow pathways on farms
• It's not about storage size, it is about flow attenuation and buffering
• RAFs are cheap and multi-functional
• Networks of RAFs can modify the catchment system function
• RAFs will need ongoing management

http://research.ncl.ac.uk/proactive/