Geomorphological & ecological monitoring of the Eddleston

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Scottish Environment Protection Agency

Courtesy of Hugh Chalmers

Acknowledgements

- Lorraine Quinn, John Clayton, Rich Jeffries (SEPA)
- Chris Spray, Andrew Black, Tom Ball (University of Dundee)
- University of Dundee MSc students
- Anna Doeser & Anwen Bill, University of Stirling PhD students

Courtesy of Chris Spray

Courtesy of Chris Spray

Professor Spray in the process of sieving 300kg of gravel and learning the hard way what puts the Physical into Geography.

Biota & hydromorphology: the big picture

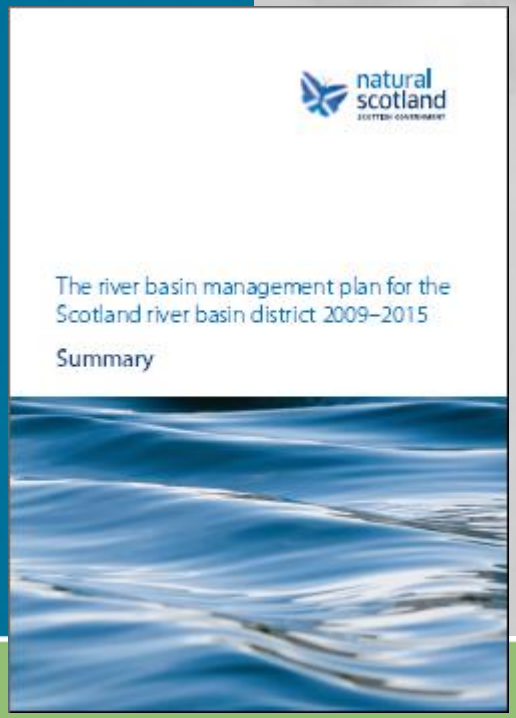

EUROPEAN COMMISSION

Brussels, 14.11.2012
COM(2012) 673 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

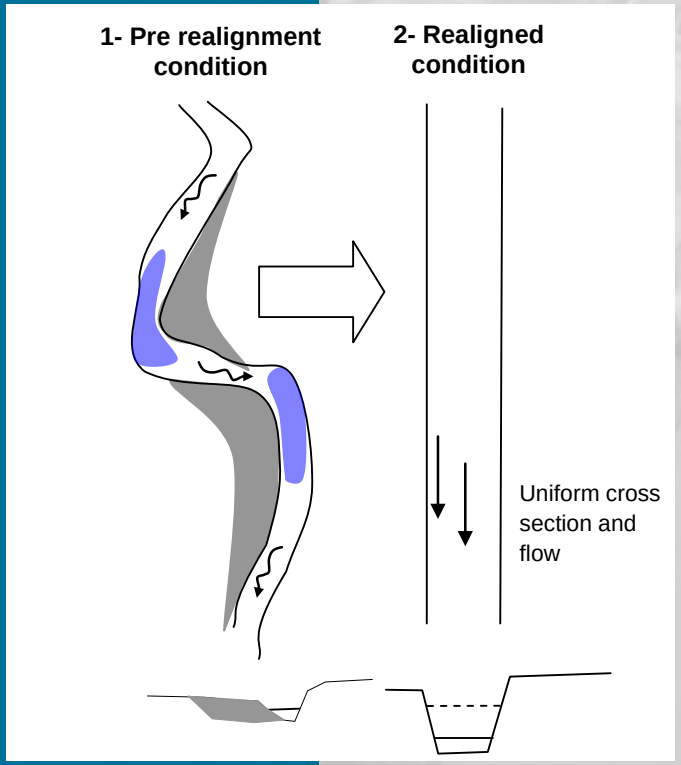
A Blueprint to Safeguard Europe's Water Resources

{SWD(2012) 381 final}
{SWD(2012) 382 final}



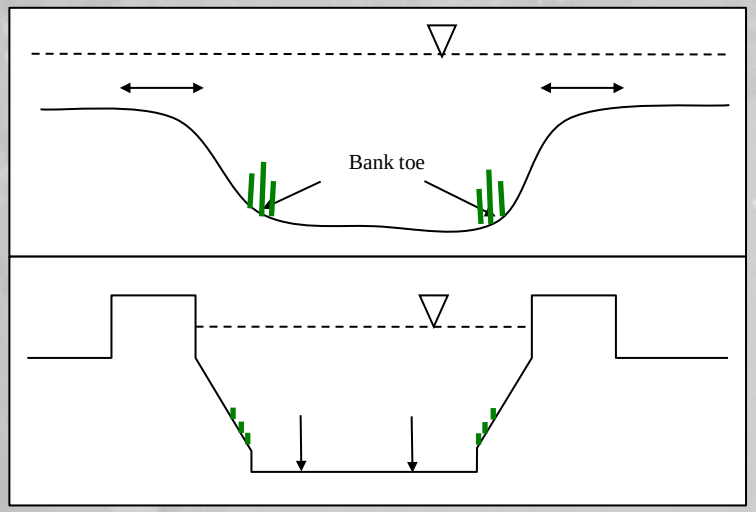
- Hymo pressures most widespread category of pressures in EU (40% of water bodies affected)
- Hymo & diffuse pollution pressures most widespread types in Scotland
- Major programmes of investment required, but…
- …quantitative biotic evidence of restoration benefits lacking
- Multiple strands of R&D ongoing in UK. (UKTAG Freshwater Task Team oversight)
- The Eddleston is one of these!
- Basic research into cause & effect required

Basic approach, from first principles

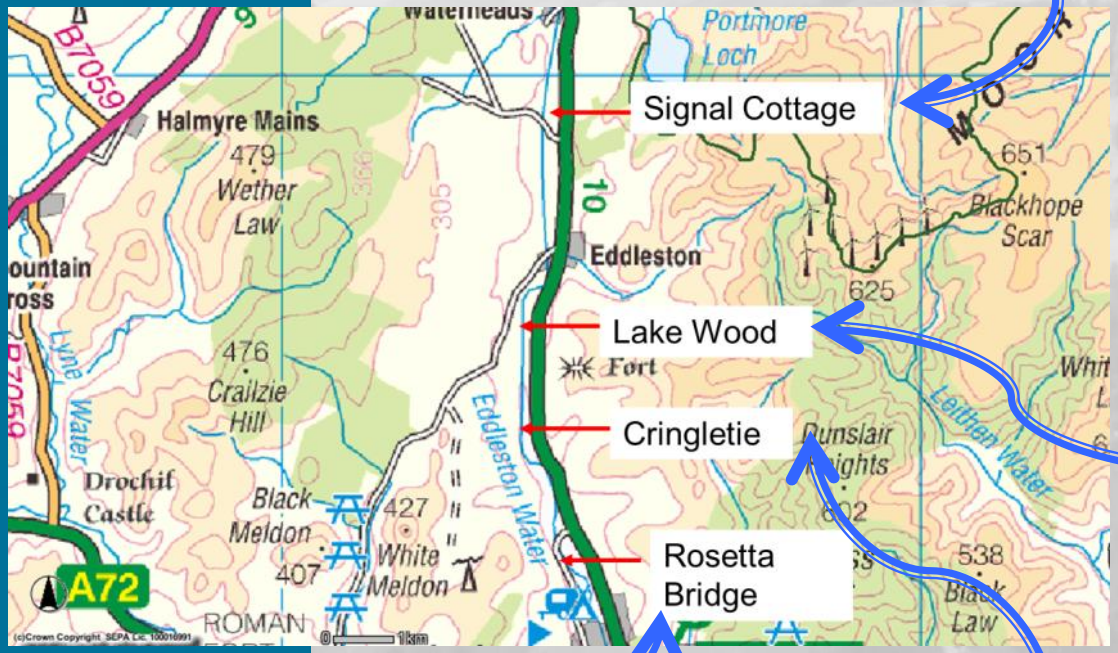


- Hypothesis-driven approach
- Space & time scales of monitoring critical
- Before - After - Control - Impact
- Correlation **and** causation sought

$$\tau = \rho g R S$$



The Eddleston



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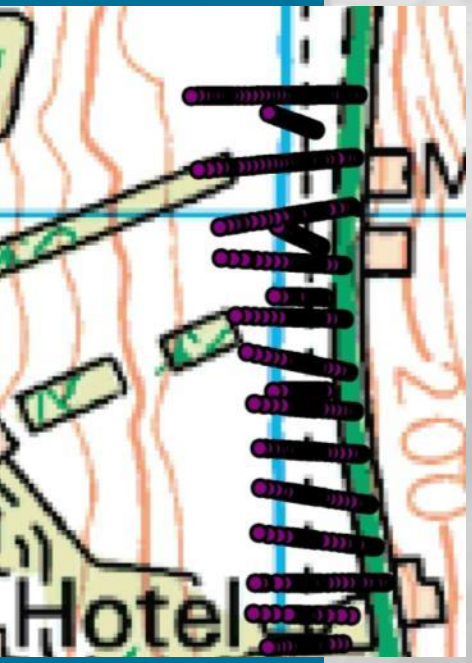
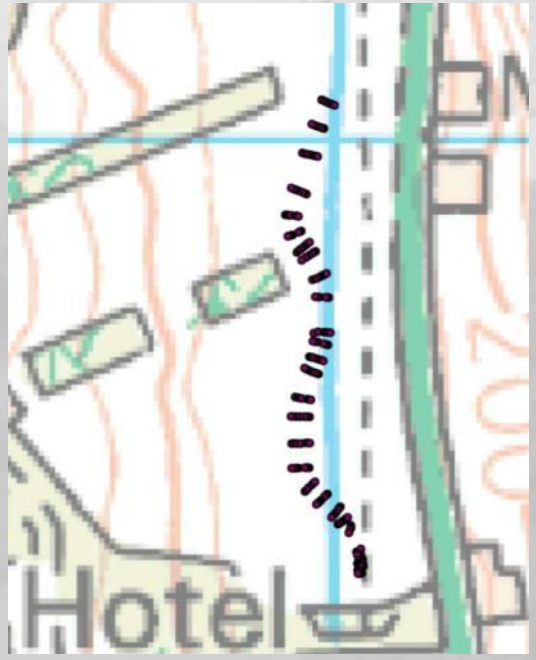
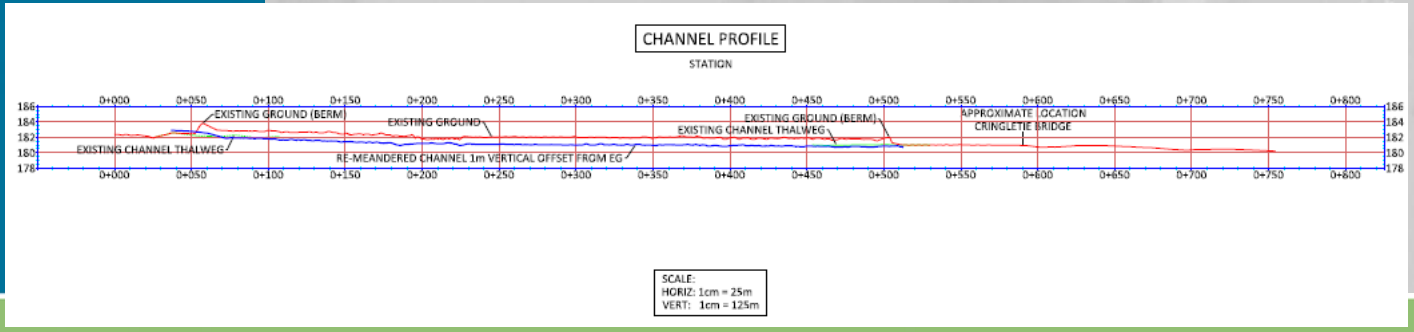
Hydromorphology data collection





Pre- and post-remeandering

- Cross-section & long profile survey & bathymetric mapping
- Flow gauging
- Fluvial audit and mapping of morphological units / habitat types (riffle, run, glide, pool, slack)
- Surface & sub-surface sampling of coarse and fine sediment fractions



Macroinvertebrate data collection

	Pool	Slack	Glide	Run	Riffle	
TEST - Cringletie						
10	5	15		80		
9		20	20	60		
8		30	60	10		
7		20	80			
6		50	50			
5		10	90			
4		20	80			
3		20	80			
2		30	70			
1		50	50			
	0.5	**26.5**	**58**	**15**	**0**	**100**

	Pool	Slack	Glide	Run	Riffle	
CONTROL - Rosetta Bridge						
10		40	60			
9		50	50			
8		5	50	15	30	
7		5		60	35	
6		5		10	85	
5		5		95		
4		5		80	15	
3		5		45	50	
2		5		65	30	
1		5		85	10	
	0	**13**	**16**	**45.5**	**25.5**	**100**

- 100m survey reaches
- Invertebrates sampled in spring & summer (pre-) and in autumn (post-)
- All seasons to be sampled in 2014
- 20 kicks taken from each habitat in proportion to % habitat presence…
- …so four types → four samples, each with different no. of kicks
- Three replicates of 20 kicks taken in each 100m reach
- A kick is taken by disturbing the substrate in an area ~0.25m^2 upstream of net
- Sample collected in a standard kick sample net, lower edge 250mm, net aperture 1mm

Macrophyte & other data collection

Macrophytes

- 100m survey reaches
- Macrophytes sampled in summer in each reach using LEAFPACS/ECN procedure
- Two control reaches surveyed in 2011, 2012 & 2013
- Cringletie surveyed in 2012 & 2013
- Lakewood surveyed in 2013 (pre-restoration)

Additional variables recorded (every 10m)

- Wetted width
- Water depth
- Percentage of different substrate types
- Percentage channel shading
- Water clarity
- Bed stability
- Notable in-stream features

Qualitative results: Invertebrates 2013

- Invertebrates analysed to mixed taxon level (mostly to species).

Pre-restoration

- Control reaches have higher diversity than restored reaches
- Many lacustrine-type species within restoration reaches

Post-restoration

- Restored reaches have reduced diversity compared to pre-restoration (only three months post restoration disturbance)
- Restored reaches have increase in *Chironomidae* larvae (tolerant of organic pollution stirred up by restoration?)
- Restored reaches have reduction in lacustrine type species

Qualitative results: Macrophytes 2011-2013

- Data run through LEAFPACS. Still to be run through LEAFPACS2

Pre-restoration

- Control reaches higher diversity than restoration reaches
- Restoration reaches dominated by *Ranunculus sp.* with only minimal marginal species & bryophytes

One year post-restoration

- Marginal species beginning to colonise banks in restored reaches
- Increase in diversity and re-colonisation of *Ranunculus sp*. in restored reaches

Qualitative summary

- Pre-restoration, restored stretches were fairly homogenous

One year post-restoration

- There is greater physical habitat heterogeneity
- Connectivity with wetlands greatly improved in restored reaches
- Substrate still unstable in restored reaches
- Loss of some species and reduction of diversity due to effects of recent works and lack channel stabilisation

Next steps

- Post-restoration morphology surveys to be undertaken
- 2D hydraulic modelling still to be undertaken
- 2014 invertebrate samples to be analysed
- Macrophytes colonising well, introducing new habitats and some stability of banksides
- Rapid assessments indicate increase in diversity of inverts and macrophytes
- Ongoing surveys, sampling and analysis required