



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Geoscience for our changing Earth

Catchment characterisation – the importance of conceptual flow modelling

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Objectives of the DTC Programme

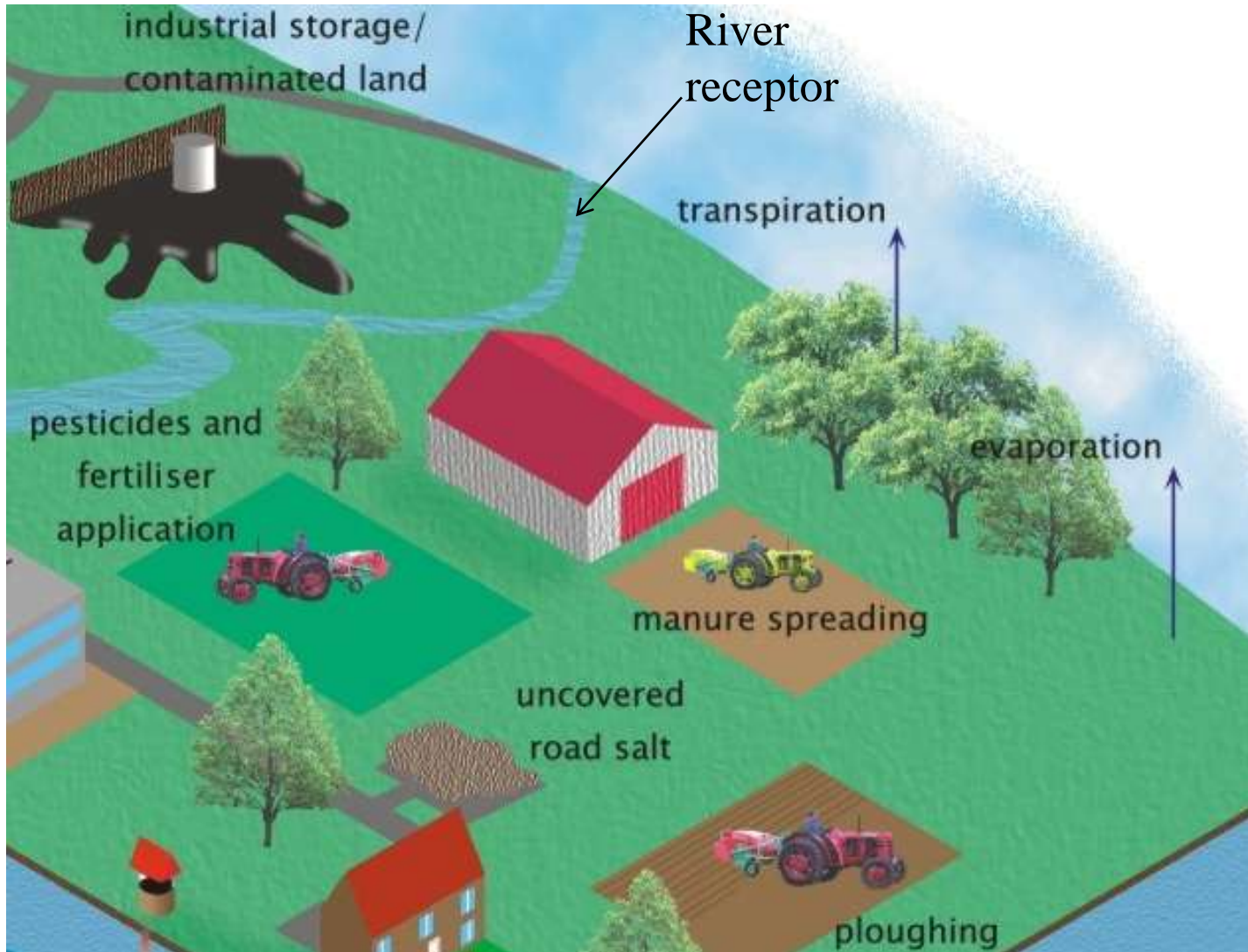
- **To test the hypothesis that it is possible to cost effectively reduce the impact of agricultural diffuse water pollution on ecological function while maintaining food security through the implementation of multiple on-farm measures**
- To develop a research platform to host collaborative research
- To explore a new model for catchment management centred around local knowledge and understanding



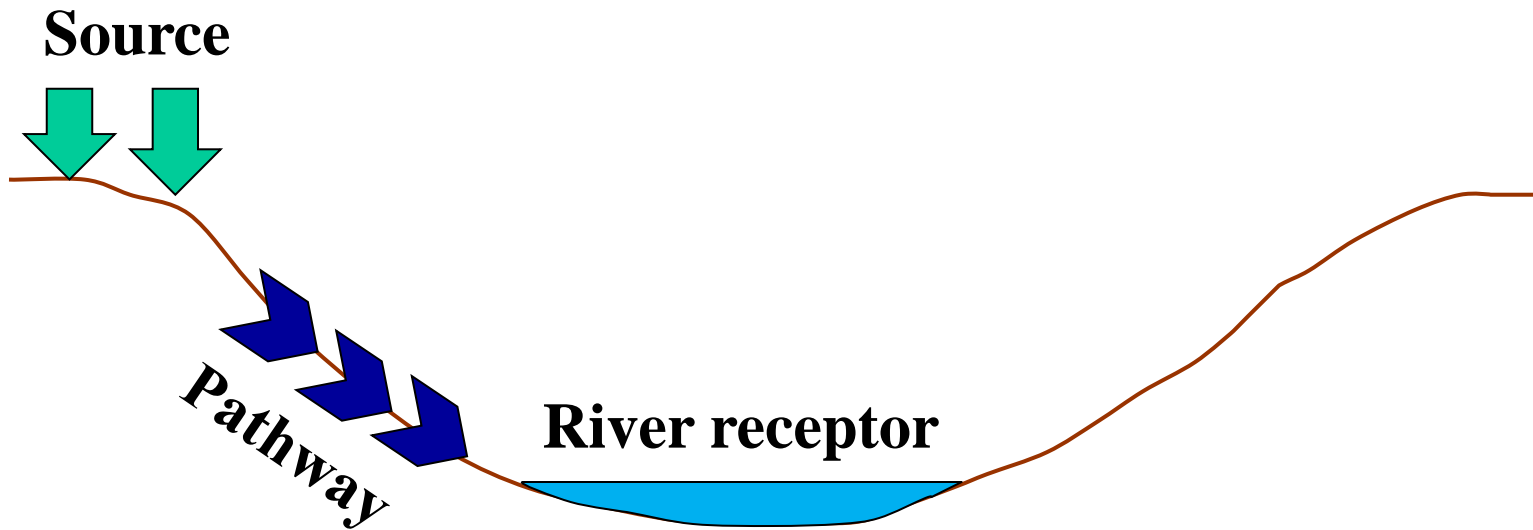
How do we know if measures are effective?

- Need to understand the nature of the link between the measure and its effect on a monitored receptor (source-pathway-receptor link)
- DTC approach principally involves catchment outlet monitoring (i.e. river receptor)

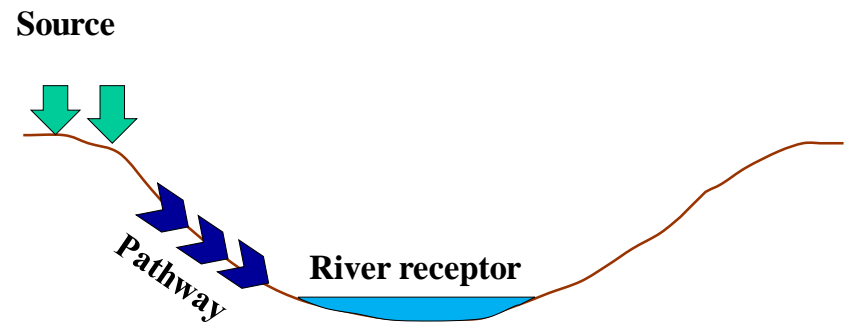
Source-pathway-receptor



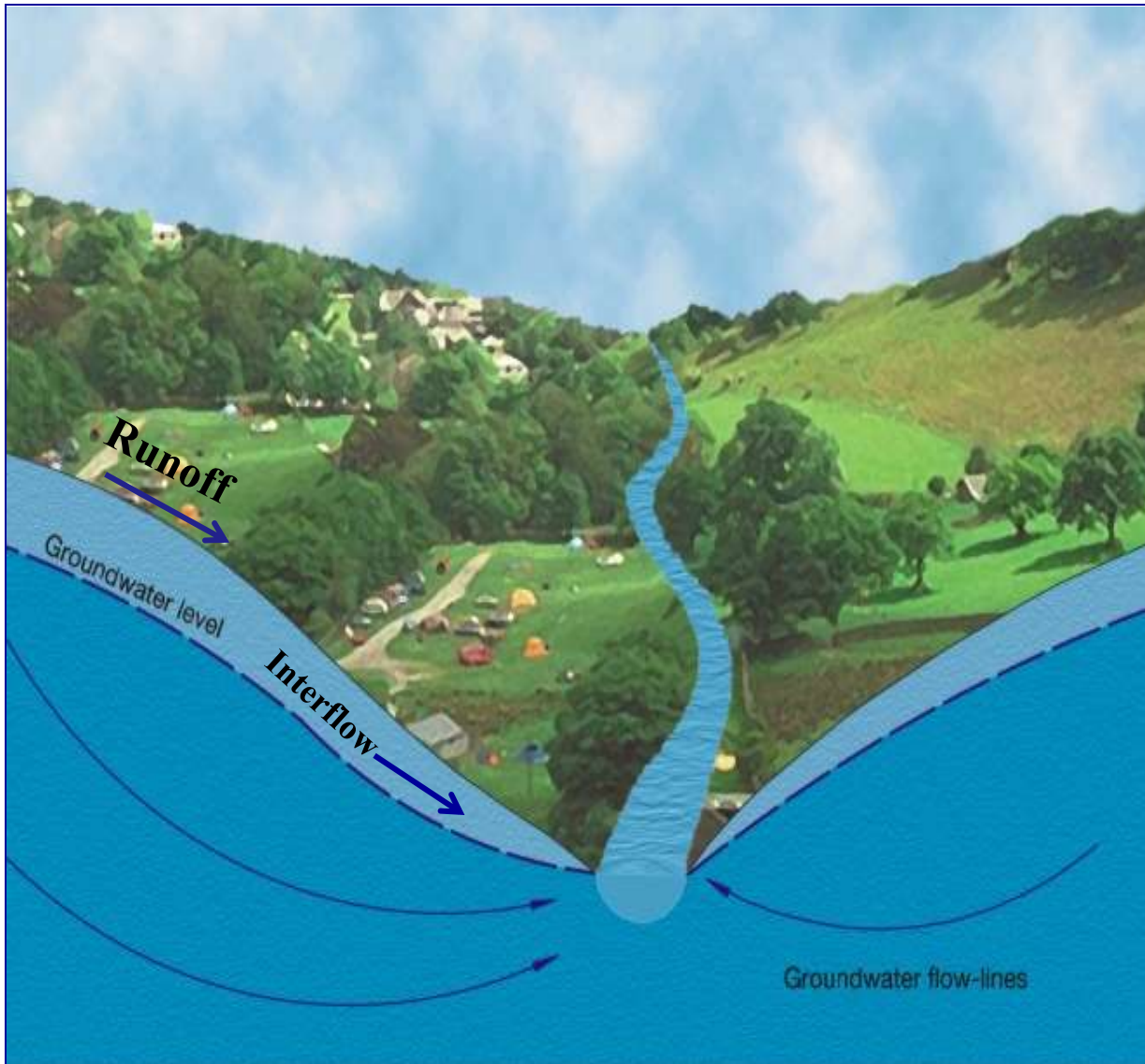
Simple source-pathway-receptor concept



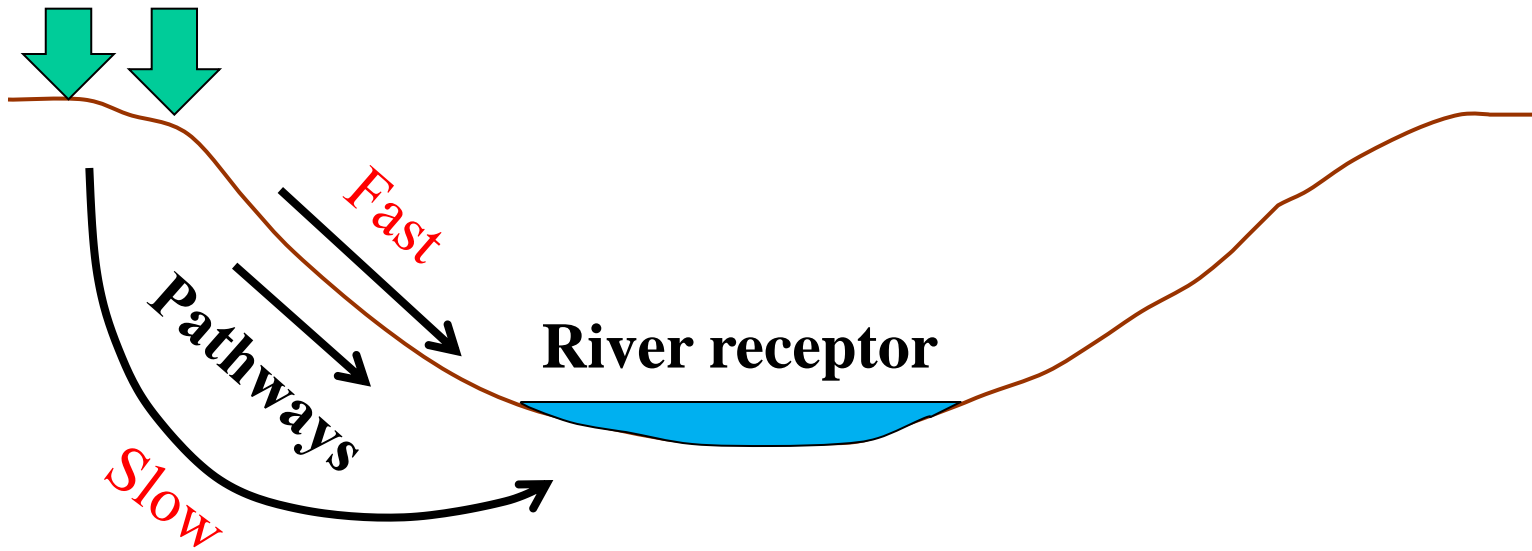
- Need to understand nature of pathways (surface/subsurface) between measure and river
- Flowpath timescales particularly important in order to interpret river monitoring data



Pathways - flow to rivers



Source



What do we know about the DTC catchments?

- Conceptual modelling studies by DTC consortia have shown that:
 - Flow timescales are very variable – range from rapid surface runoff to deep old groundwater flow systems
 - Flow systems are complex spatially



How much DTC river flow is from groundwater?

Baseflow index (BFI) – the proportion of river flow from stored sources (groundwater)

| Catchment | General BFI Range (%) |
|-----------|-----------------------|
| Eden | 26-50 |
| Wensum | 60-83* |
| Avon | 72-94 |

Source: NERC Hydrological data UK, 2003

* Includes data from adjacent rivers



Rapid surface runoff



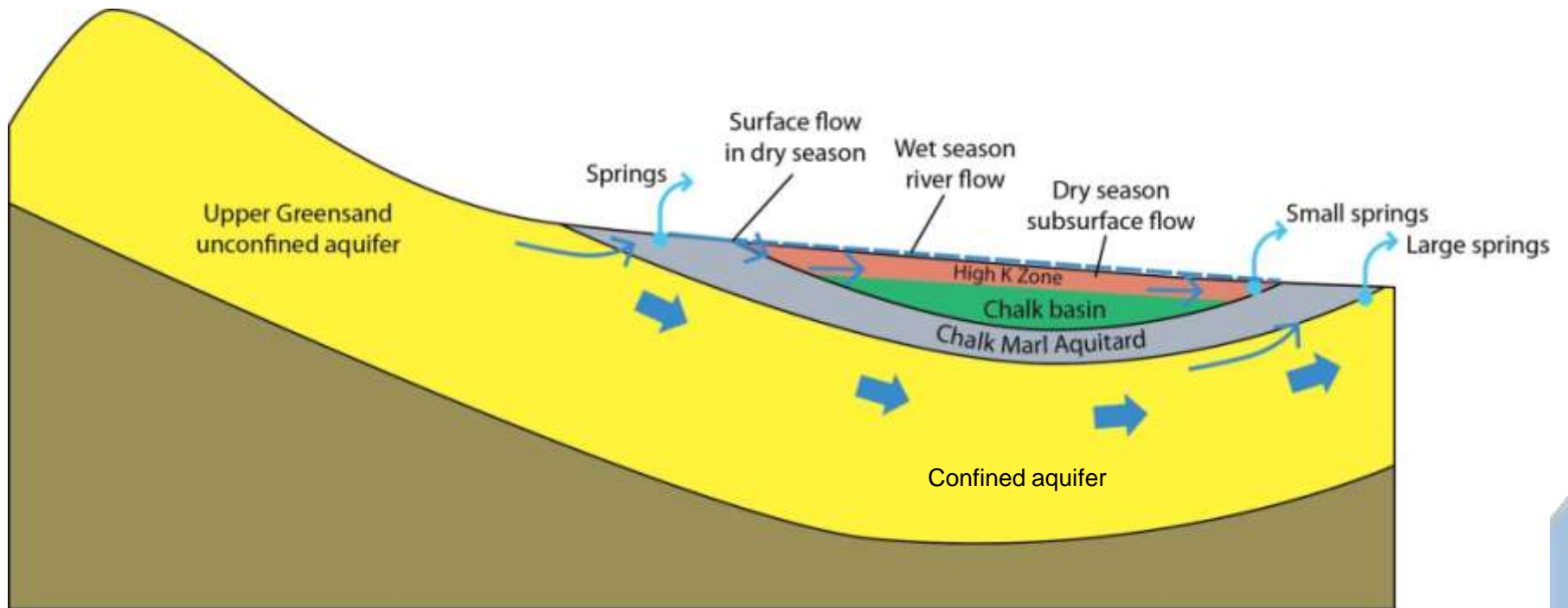
Shallow subsurface flow



Slow groundwater - e.g springs



DTC sub-catchments can be spatially complex

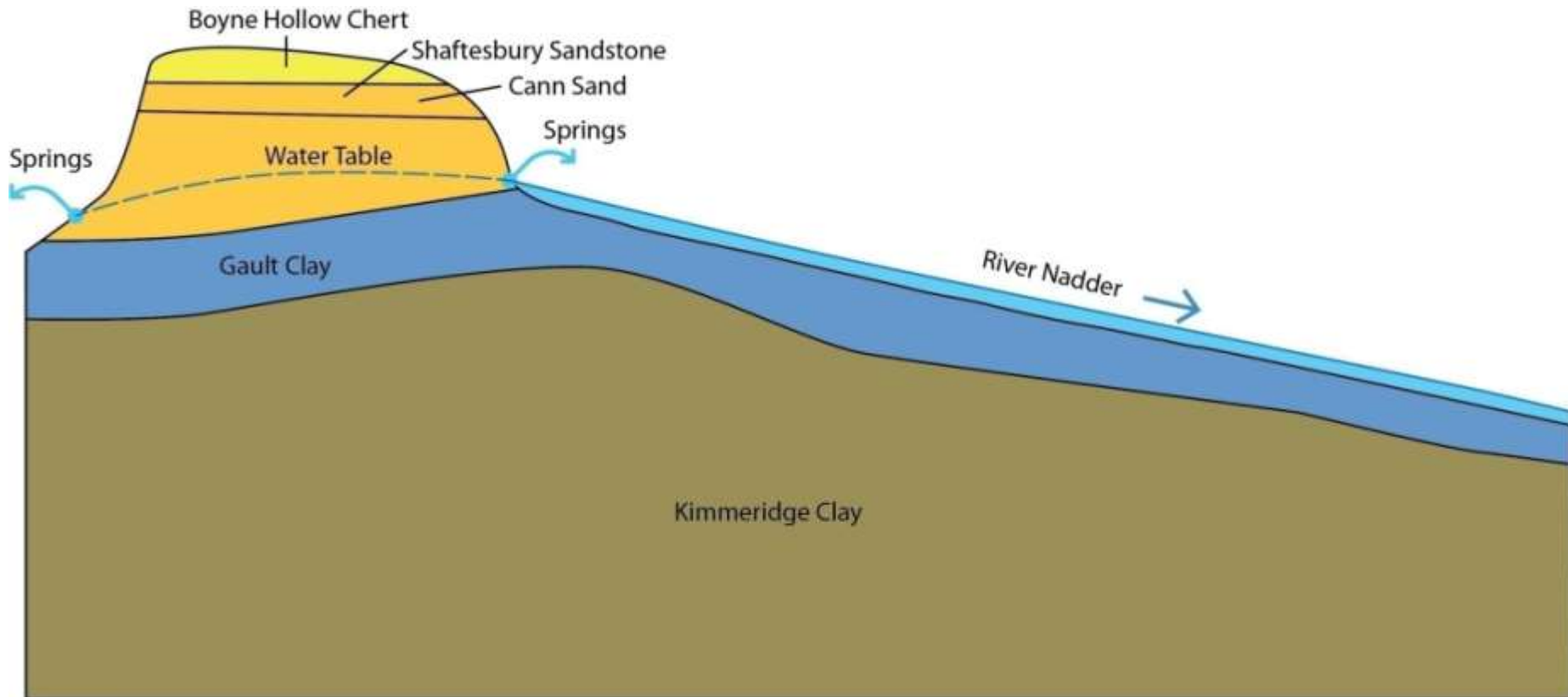


Streams may be substantially fed from springs

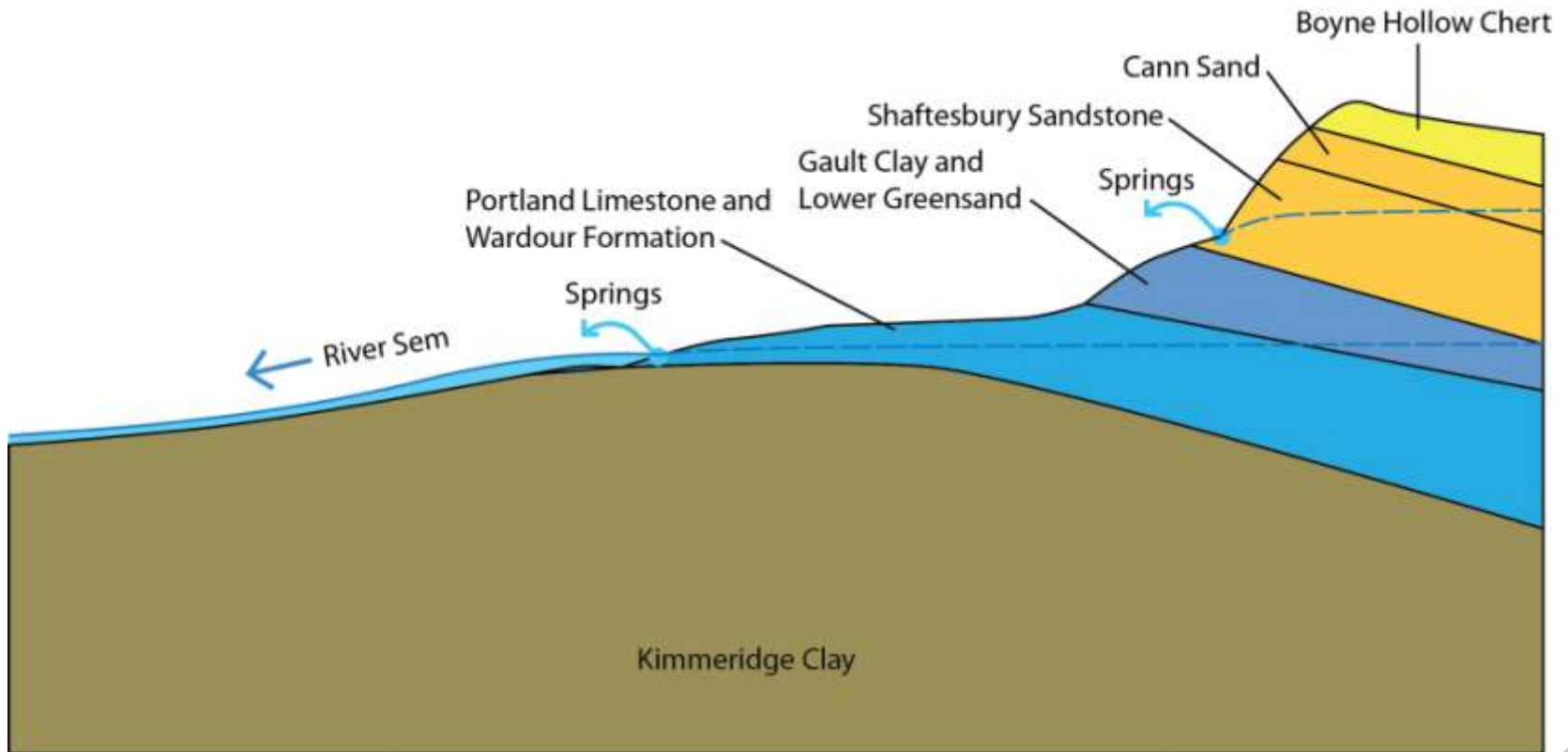


Photo: Dave Allen

Location of measures may affect spring chemistry



Springs may arise from multiple sources



Conclusions

- The DTC catchments are complex
 - Flow to rivers occurs over a broad spectrum of timescales
 - The geometries of the flow systems are often complex
- Proper understanding of the catchments, in the form of good conceptual flow models is essential for interpreting the monitoring data, so that the effectiveness of different measures can be determined.



Further work

- Rivers often do not gain flow uniformly – flow accretion measurements important
- Water age indicators important
- Numerical modelling of systems - hypothesis testing
- Investigation of natural gw quality e.g phosphate

Thank you!

