Wetland Water Balance

Linking hydrogeological processes to ecological effect

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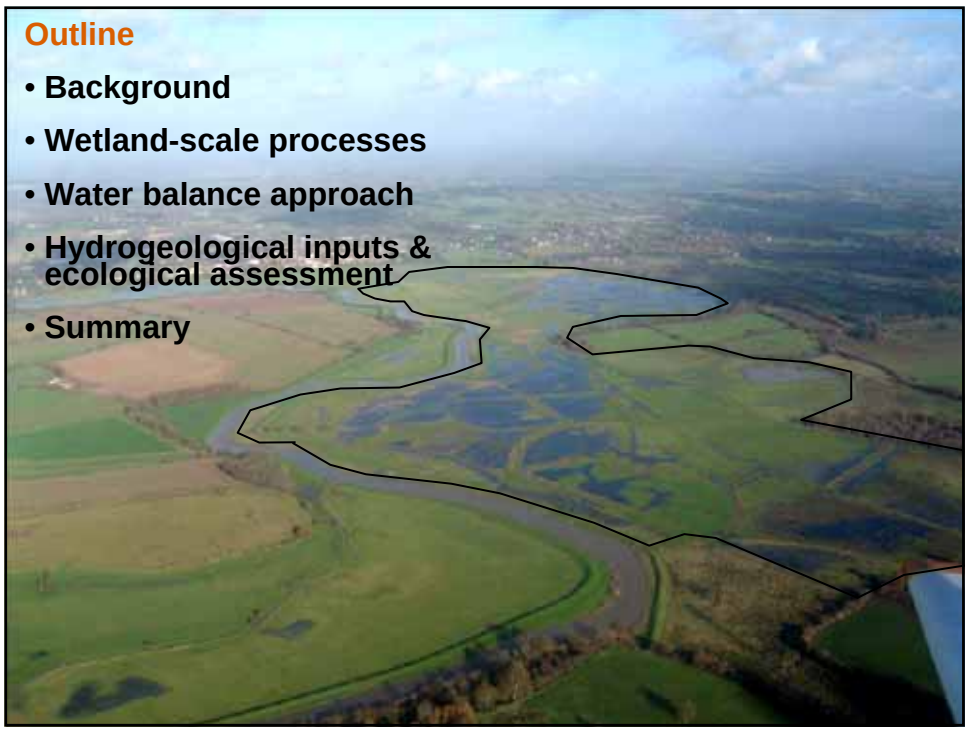
ATKINS

Plan Design Enable

Outline

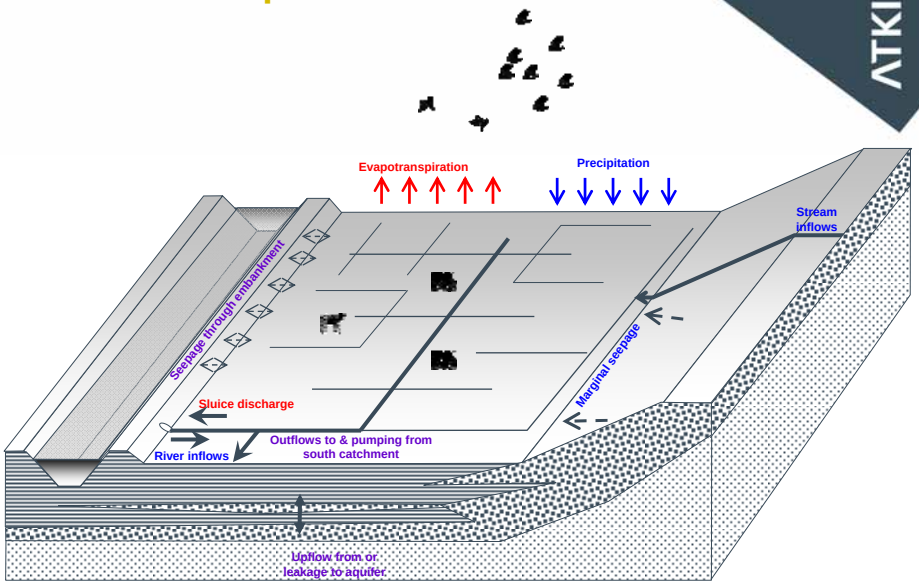
- Background
- Wetland-scale processes
- Water balance approach
- Hydrogeological inputs & ecological assessment
- Summary



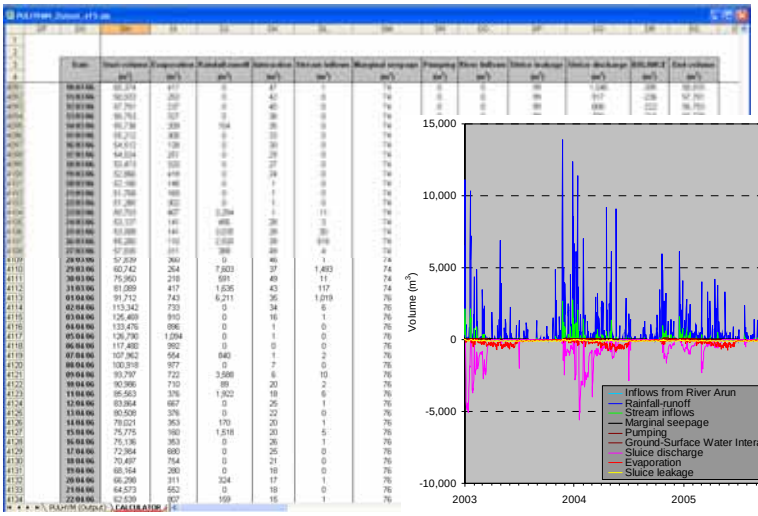
Background

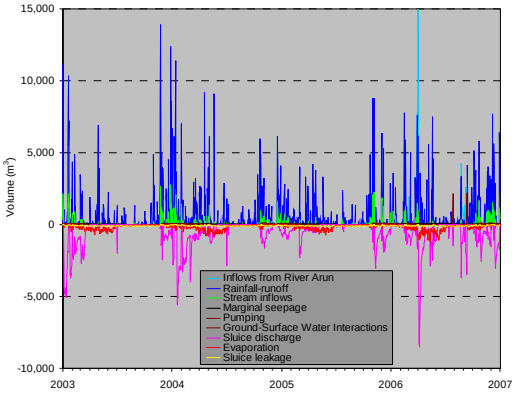
- Approach based on existing methods and research
  - Armstrong (1993)
  - Gowing and Spoor (1998)
  - Gasca & Acreman (1999)
  - EA/NE Hydro-ecological guidelines (2004), etc
- Aim: to integrate these into a practical and adaptable tool
  - Habitats Directive assessments
  - WLMPs
  - Habitat Creation
  - ….
- Illustrated by: Arun Valley SPA Sustainability Study

Wetland-scale processes

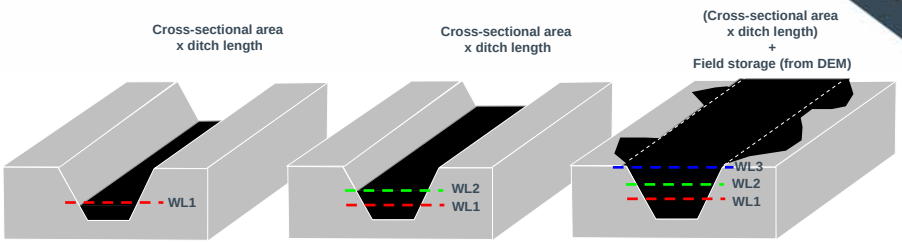


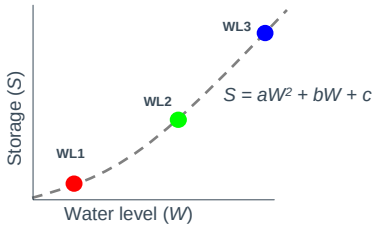
Water balance: open water



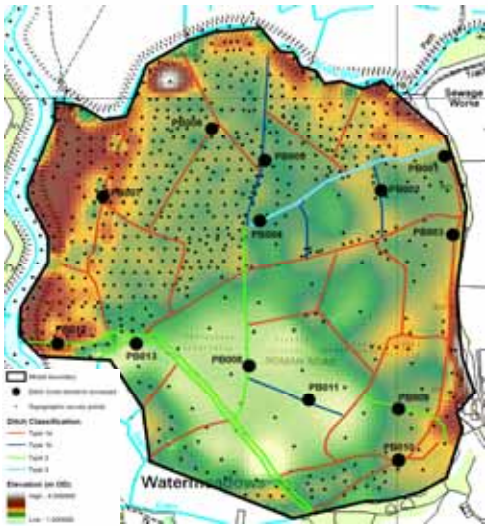


Open water: volumes to levels



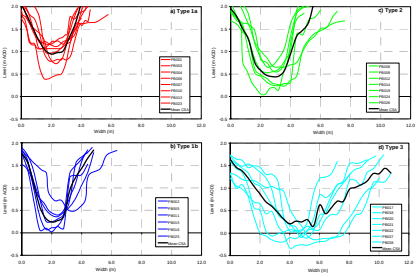


Open water: volume-level data needs

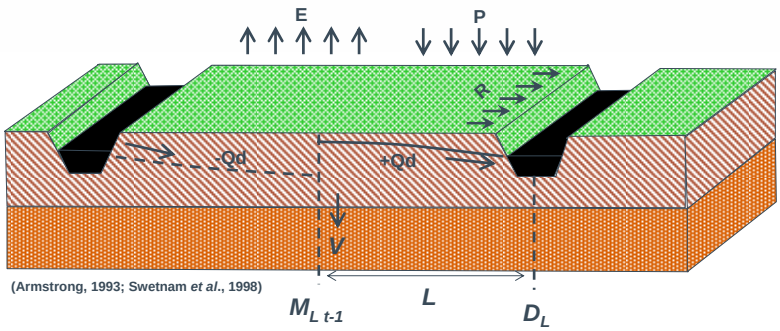


For over-bank storage: DEM

For ditches and permanent ponds/lakes: topographic transects



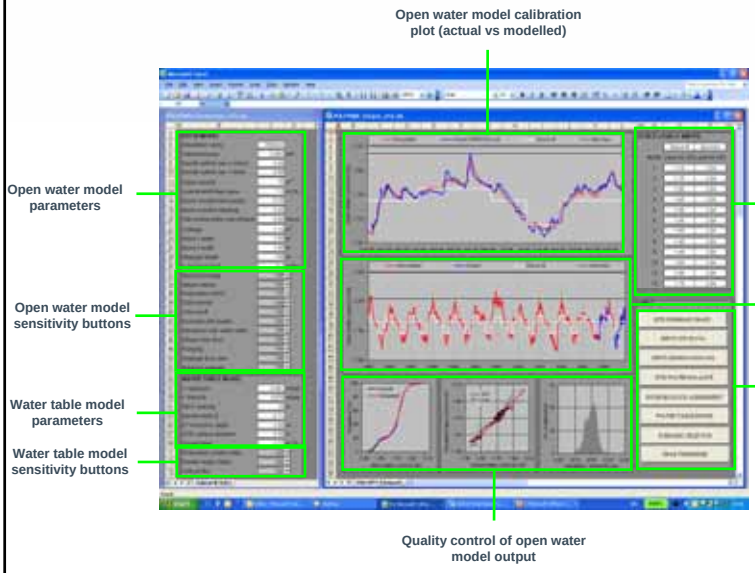
Ditch – field water table interactions



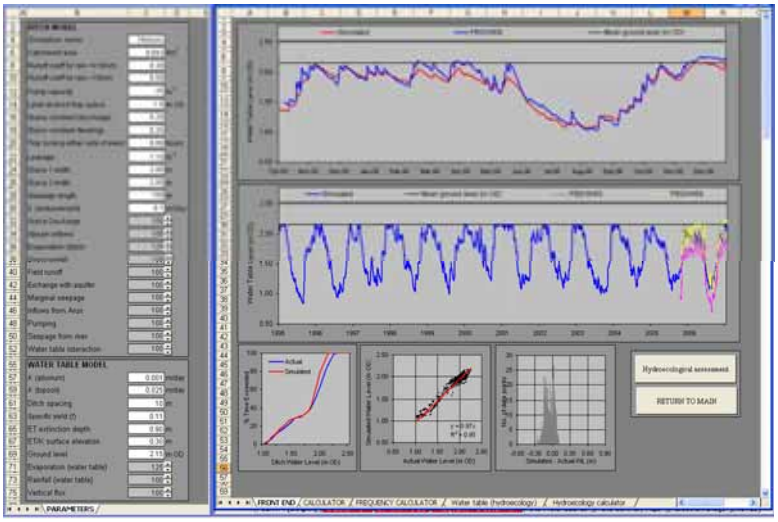
(Armstrong, 1993; Swetnam *et al*., 1998)

Includes water-table level dependent evapotranspiration (same basis as MODFLOW EVT)

Open water model calibration



Water table model calibration

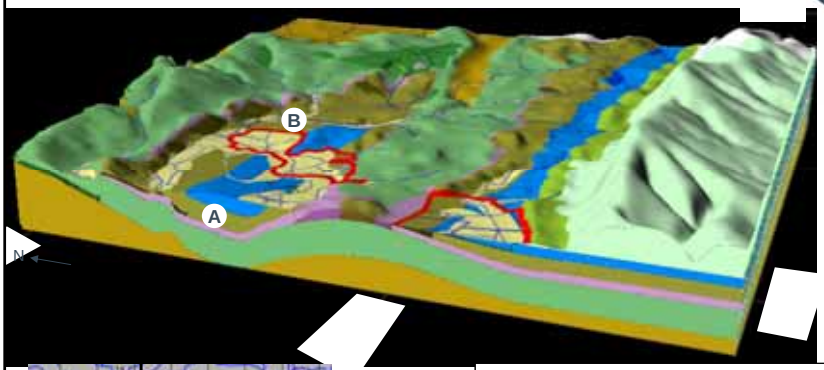


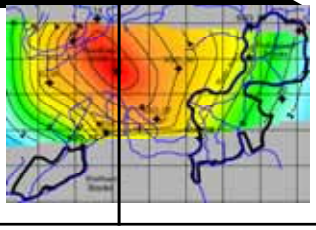
With groundwater models it is hardly ever possible to get to this type of wetland water table representation

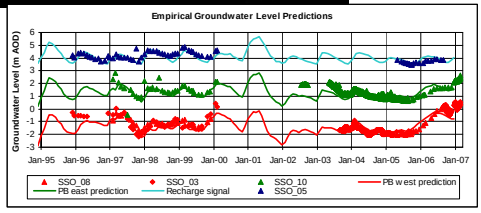
Hydrogeolgical inputs and ecological assessment

e.g. Arun Valley SPA, Pulborough Brooks SSSI

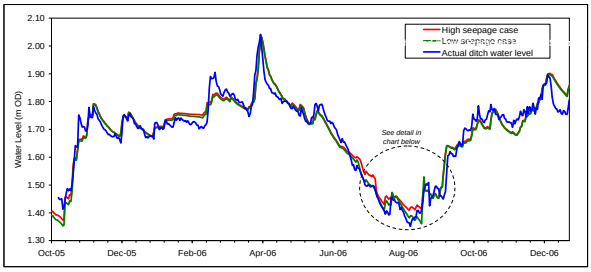
Pulborough Brooks Hydrogeology

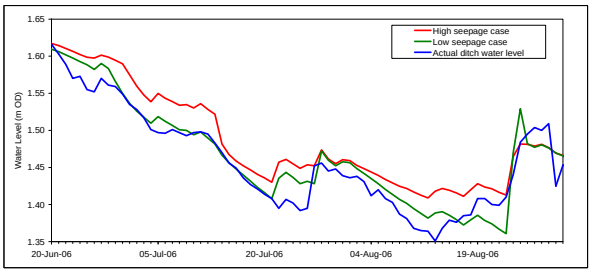






Ditch level sensitivity to seepage rates





Marginal seepage

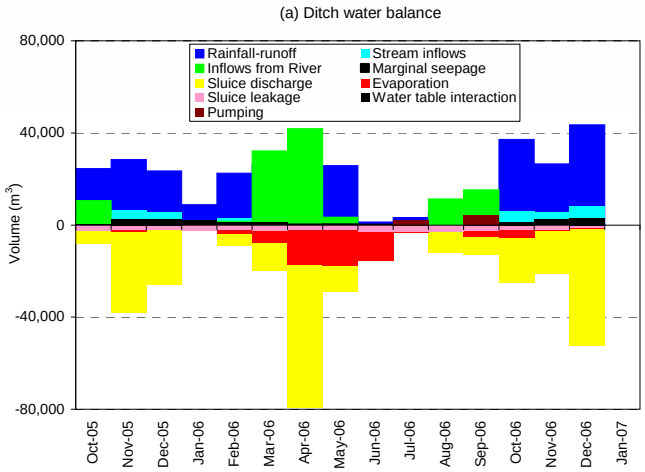
GW levels predicted by empirical model,

but, rates of seepage uncertain.

Attempts to measure rates unsuccessful/equivocal.

Sensitivity studies using wetland model used to constrain upper limit of seepage rate.

Simplified water balance results



Hydro-ecology assessment
Wet grassland

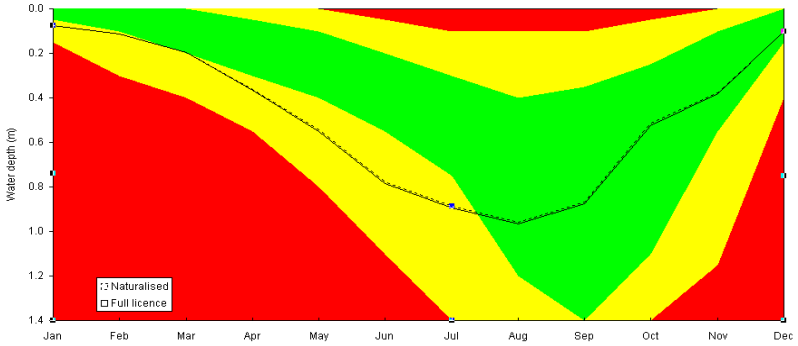
Water table requirements expressed in terms of long term average water table depths (bgl) for months through the year

Based on monitoring data from research sites, regimes for different communities (MG13 in our case) identified:

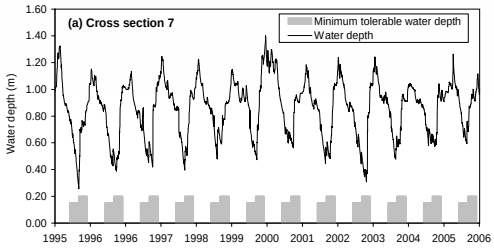
Green: target regime

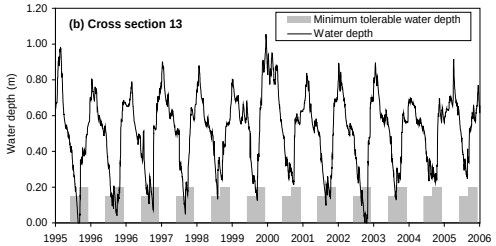
Amber: if experienced for most years community change is likely

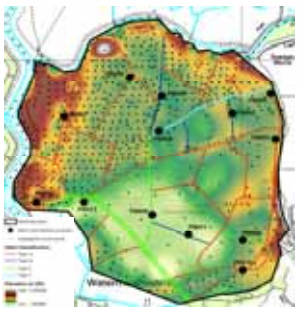
Red: if experienced one year community change is likely



Hydro-ecology assessment
Ditch communities



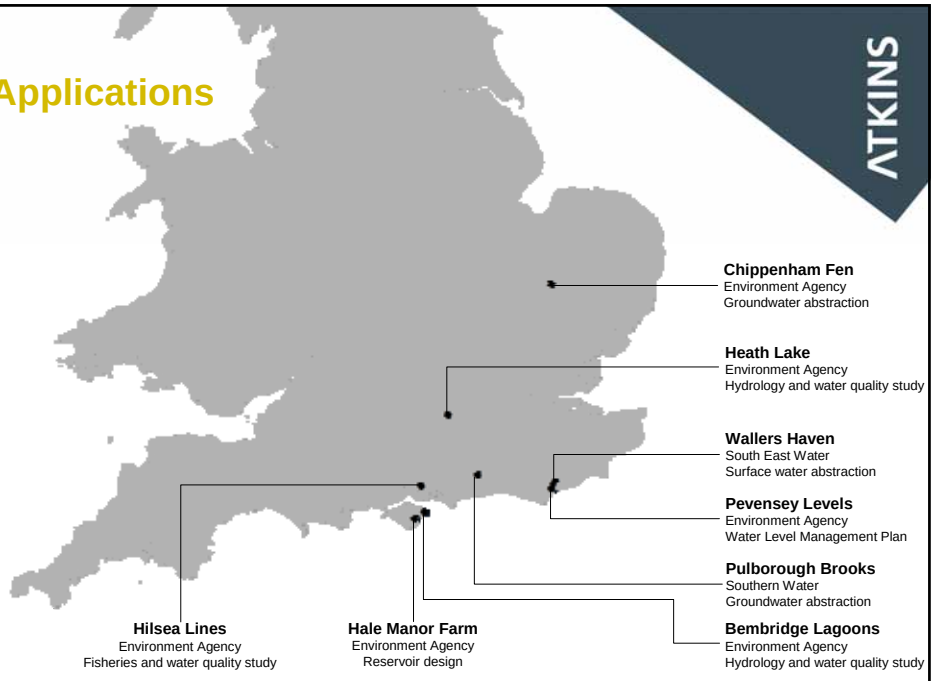




LOW SEEPAGE SENSITIVITY CASE

Abstraction Scenario	Deep				Ditch cross section							Shallow	
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
Actual	0	0	0	0	0	0	0	0	0	2	4	6	7
Zero	0	0	0	0	0	0	0	0	0	0	2	3	4
Fully licensed (FL)	0	0	0	0	0	0	0	0	0	2	4	6	7
FL, sluice leakage at 50%	0	0	0	0	0	0	0	0	0	0	0	0	2

Applications



Summary

- Focus on wetland scale processes
- Understanding gained from12-18 months monitoring data can be hindcast over longer periods
- Ecological requirements can be specified and compliance assessed
- Use wetland water balances to bridge the gap from hydrogeological impacts to ecological effects!

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