Using SWAT to support the Habitats Directive- a case study from the east of England

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Overview

- The Thurne catchment
- Habitats Directive
- The Review of Consents procedure
- SWAT modelling
  - Initial attempts
  - Current simulation

The Thurne catchment

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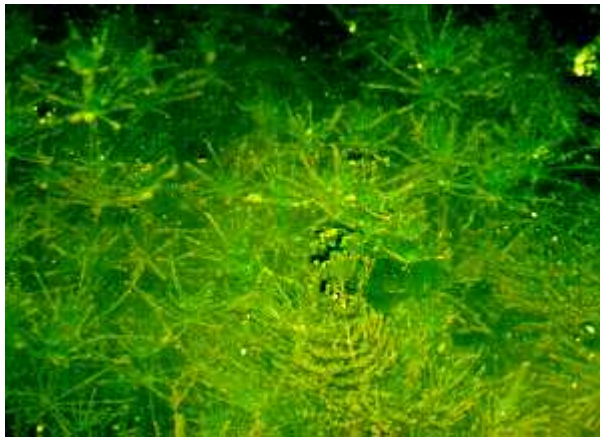
Habitats Directive

- The EC Habitats Directive (Directive 92/43/EEC)
- Aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and species at a favourable conservation status.
- 189 habitats and 788 species listed in the Directive are protected by a network of protected sites (SAC's).

Habitats Directive

- Upper Thurne includes part of the Broads SAC
- Primary designation as “Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.”
- Hickling Broad which is the richest *Chara* spp. site in the UK
- Hickling Broad is currently in “unfavourable declining” status



Review of Consents

- A tiered procedure for assessing whether discharges (and abstractions) have an impact on designated sites
  - **Stage 1** - identification of permissions that are relevant to the site
  - **Stage 2** - assesses which permissions, either alone or in combination are likely to have significant effect on the European site
  - **Stage 3** - “Appropriate Assessment” to assess whether permissions can be concluded not to have an adverse effect
  - **Stage 4** - permissions are affirmed, or modified or revoked, subject to appeal

Modelling challenges

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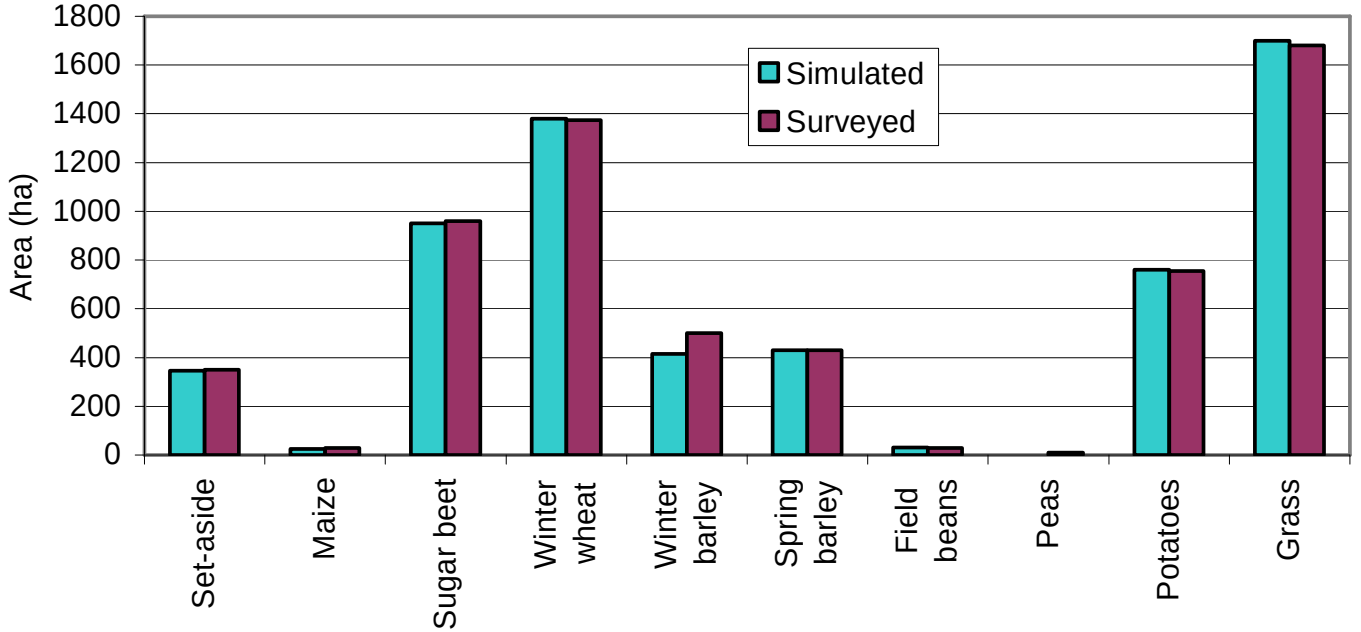
Challenges to SWAT modelling the fluxes in the catchment:

- The relief is subdued with a height range of about 23 m
- The water level in Hickling Broad is on average only +0.4 m above sea level, yet the eventual outlet to the sea is over 20 km away;
- Shrinkage of the alluvium has left the river flowing above the marshes;
- All of the marshes are artificially pumped drained;
- Water levels are between -1 and -3 m **below** sea level
- Most of the river flow is due to land drainage pump discharges and tidal movements.

Initial model build

SWAT model successfully calibrated and validated in neighbouring 'normal' catchments

Parameterization largely transferred to Thurne.



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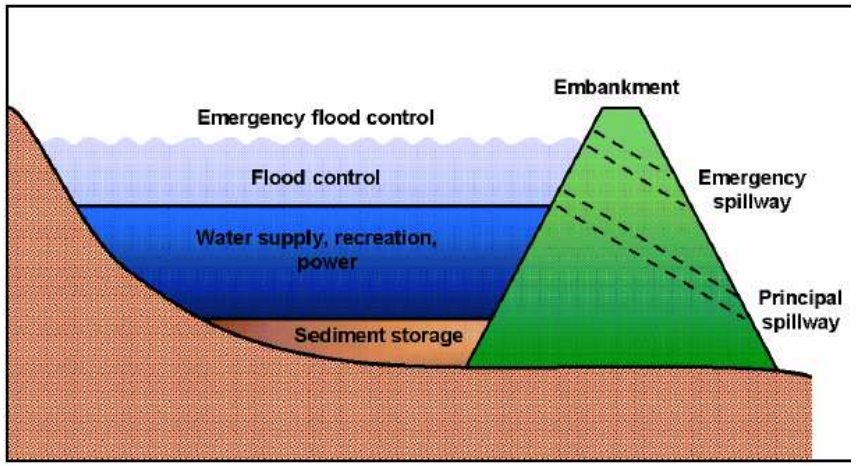

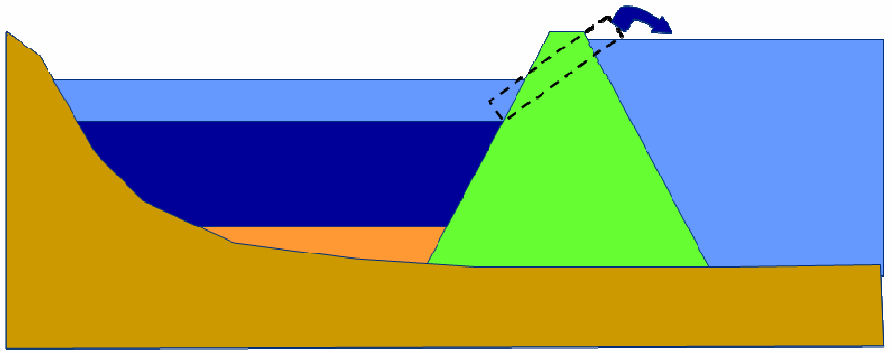

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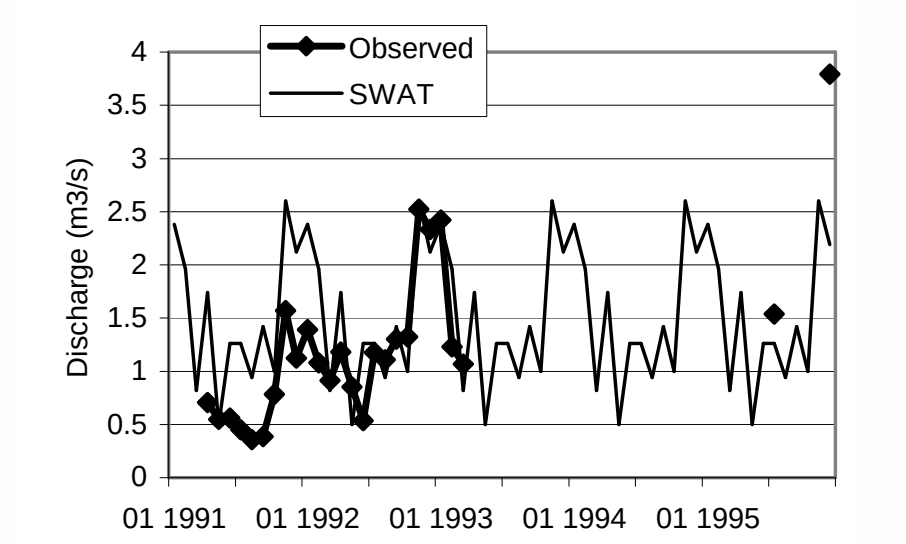

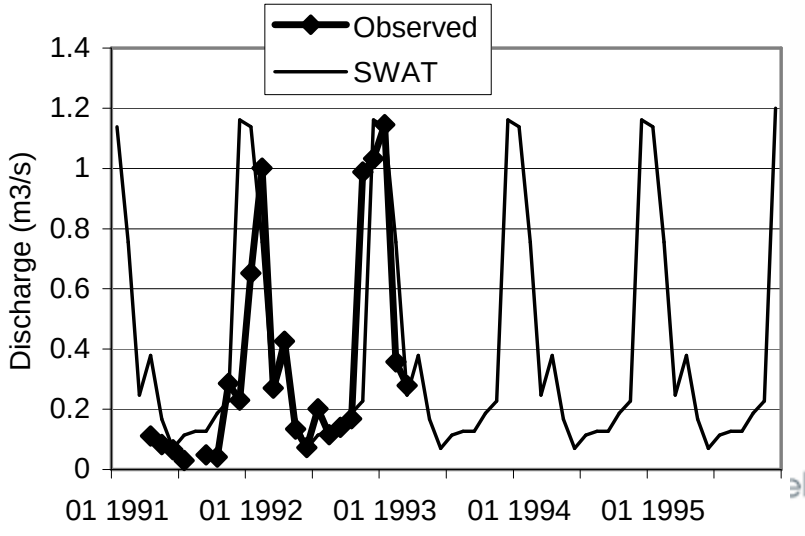

Initial results

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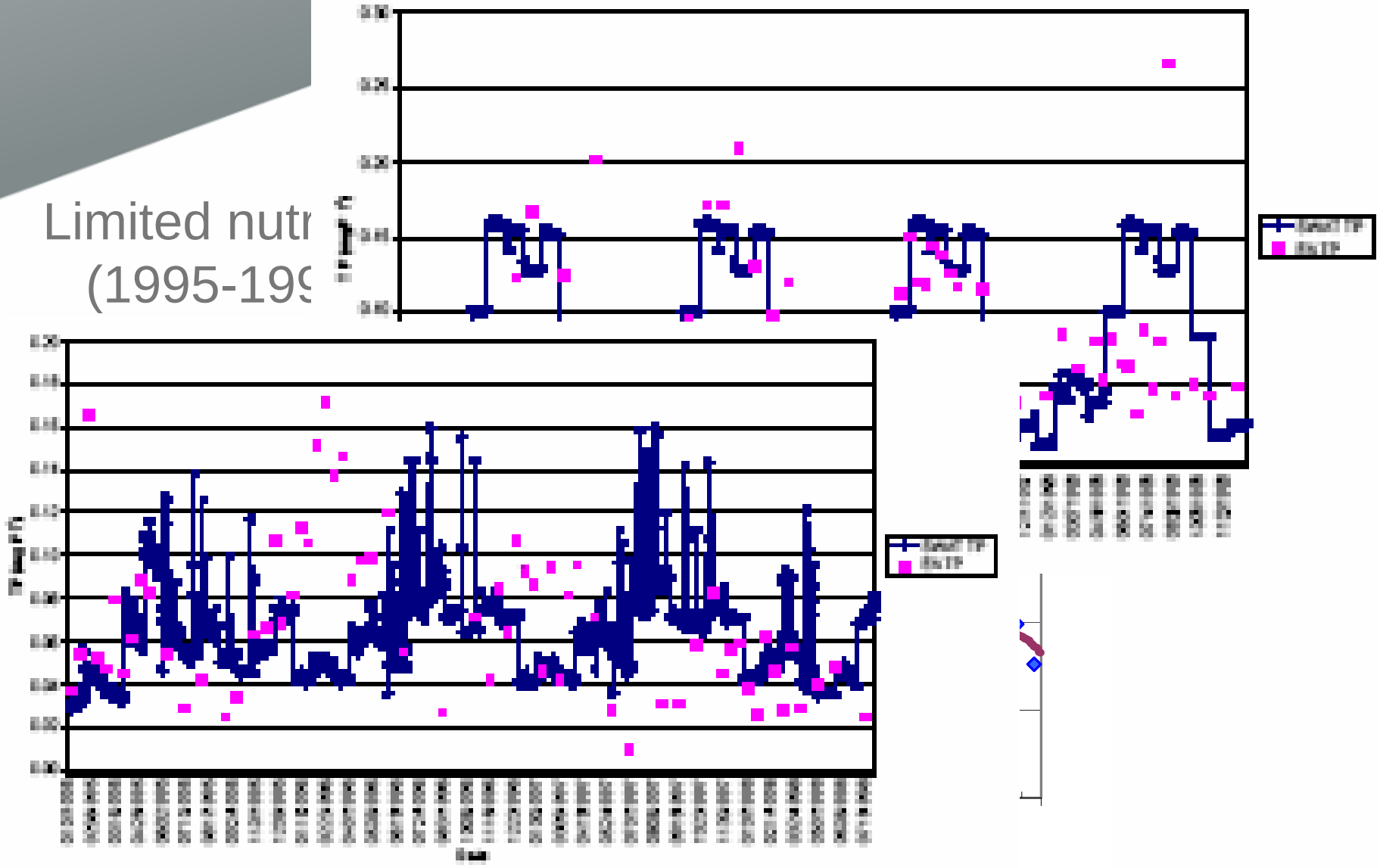
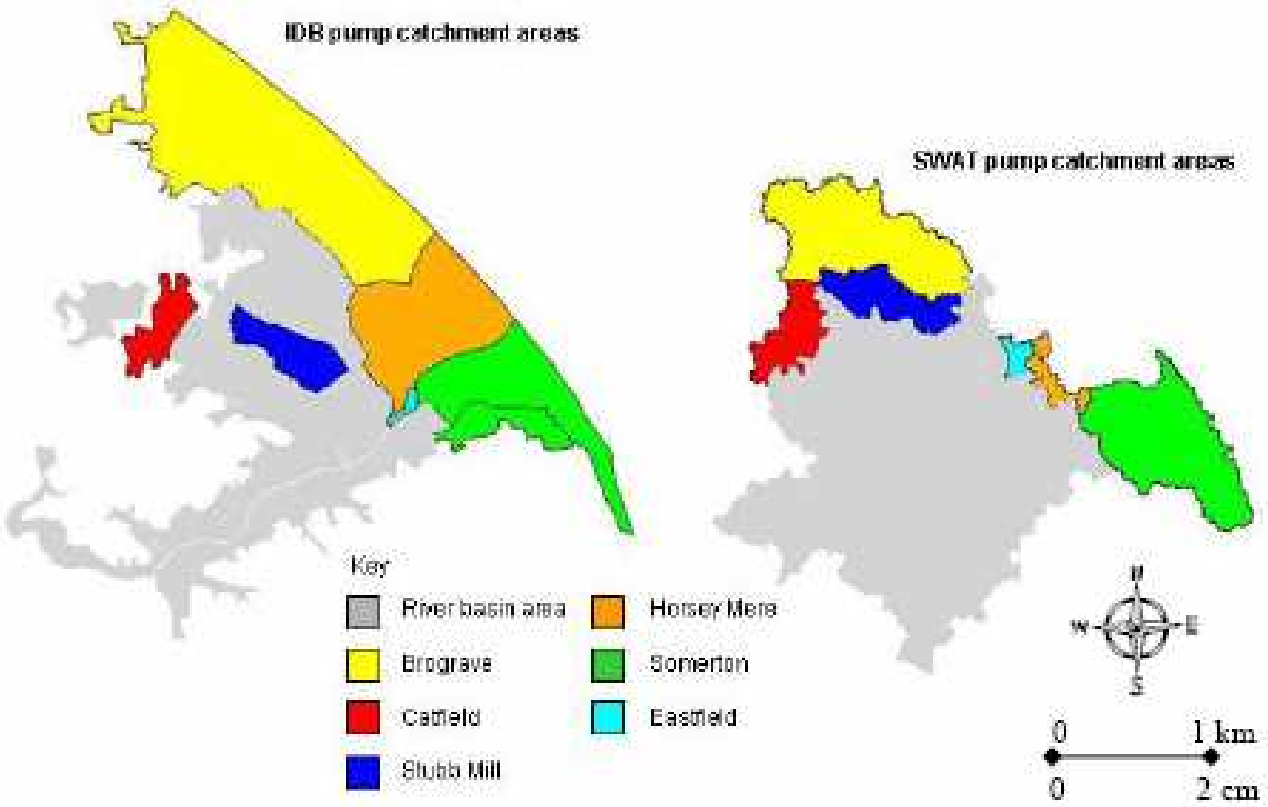


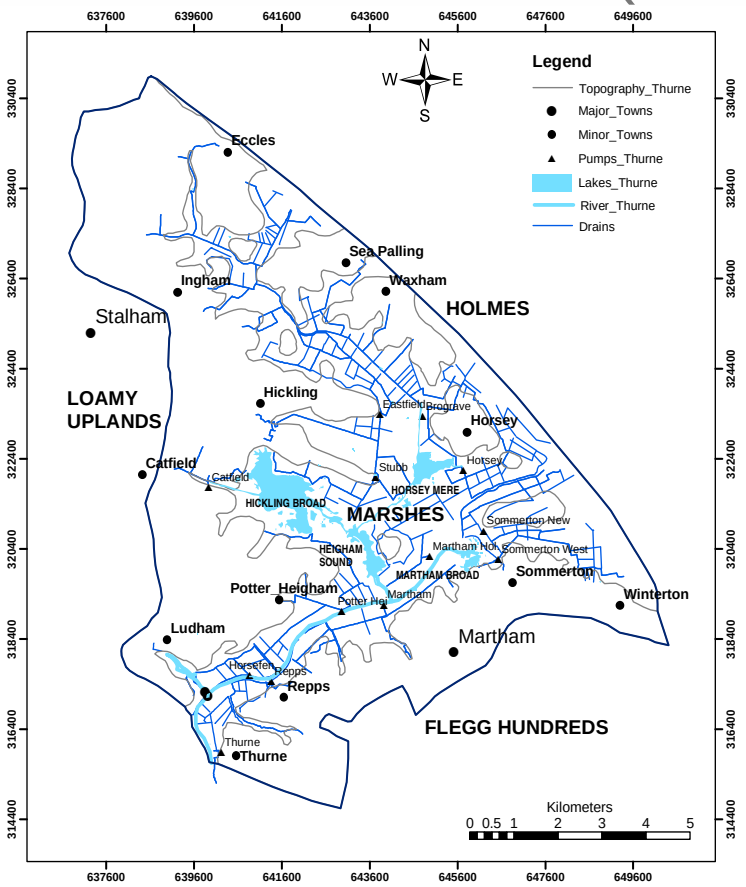
Catchment delineation

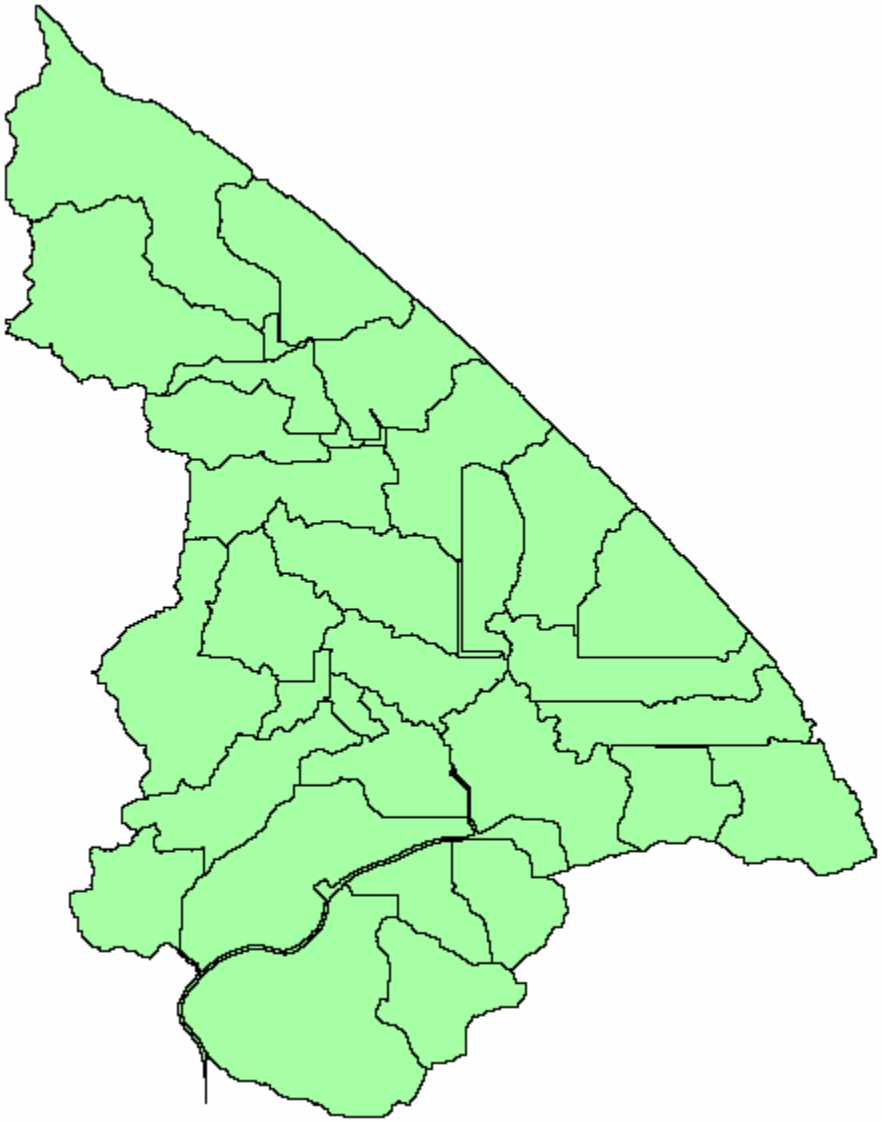
- Initial catchment delineation (50 m grid)



Catchment delineation

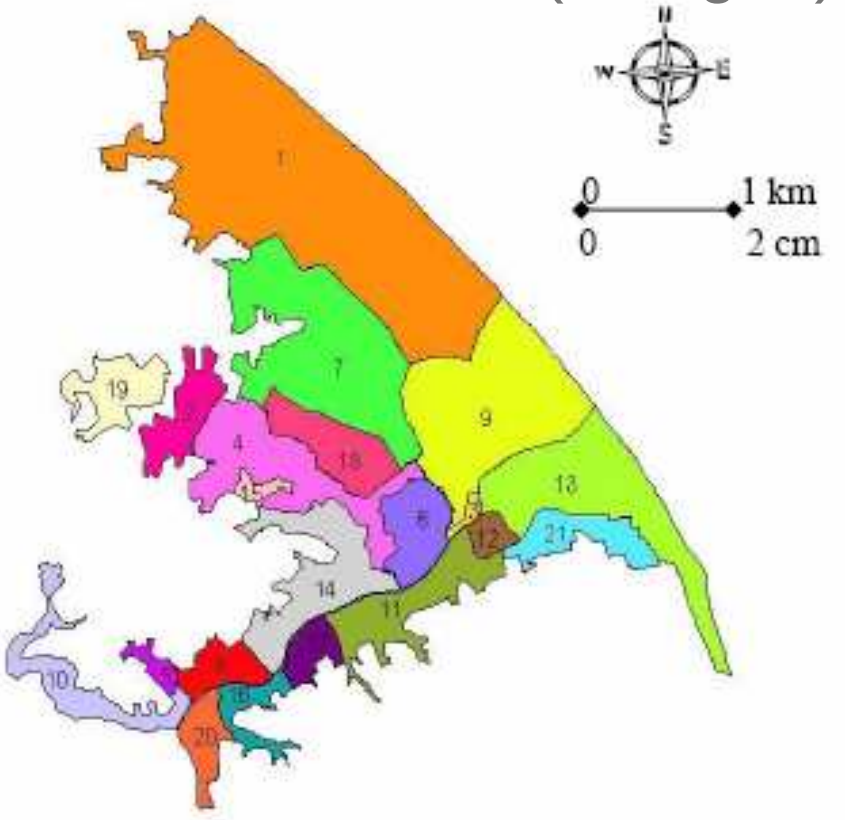
- Initial catchment delineation (5 m grid)

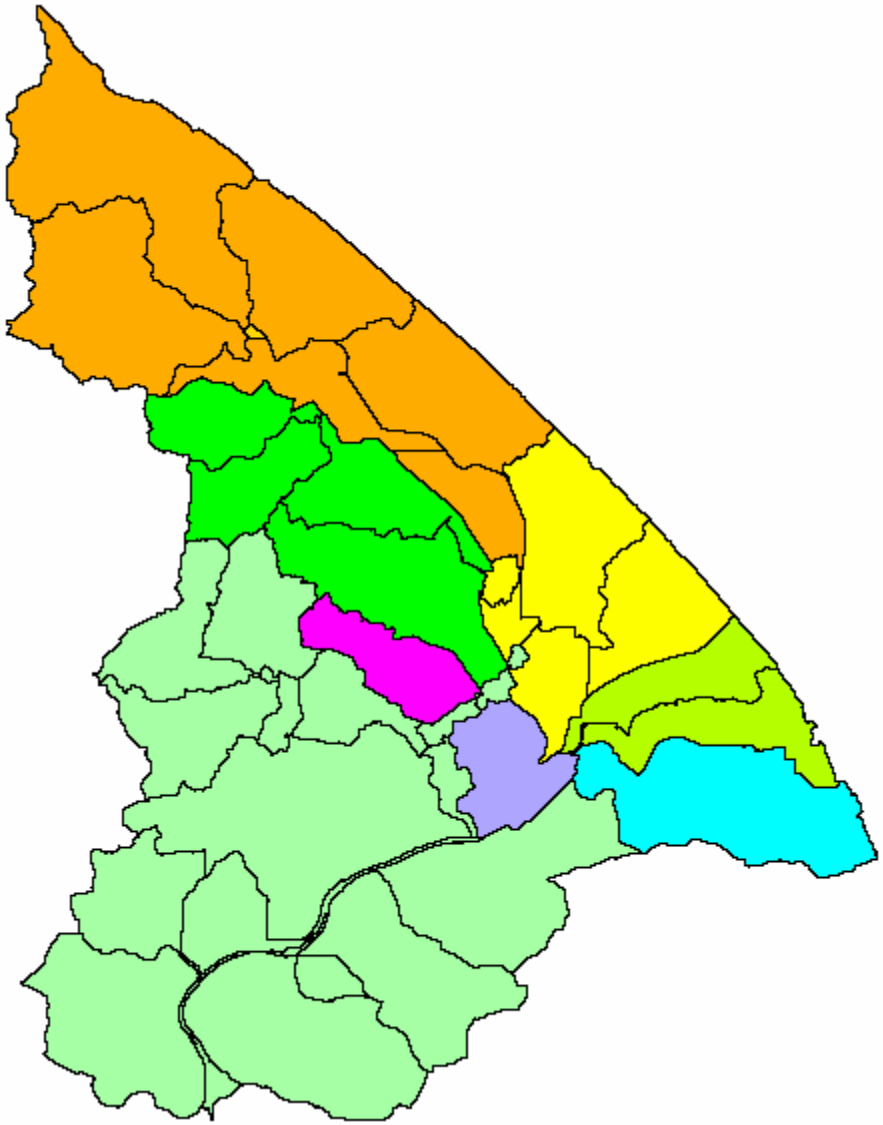




Catchment delineation

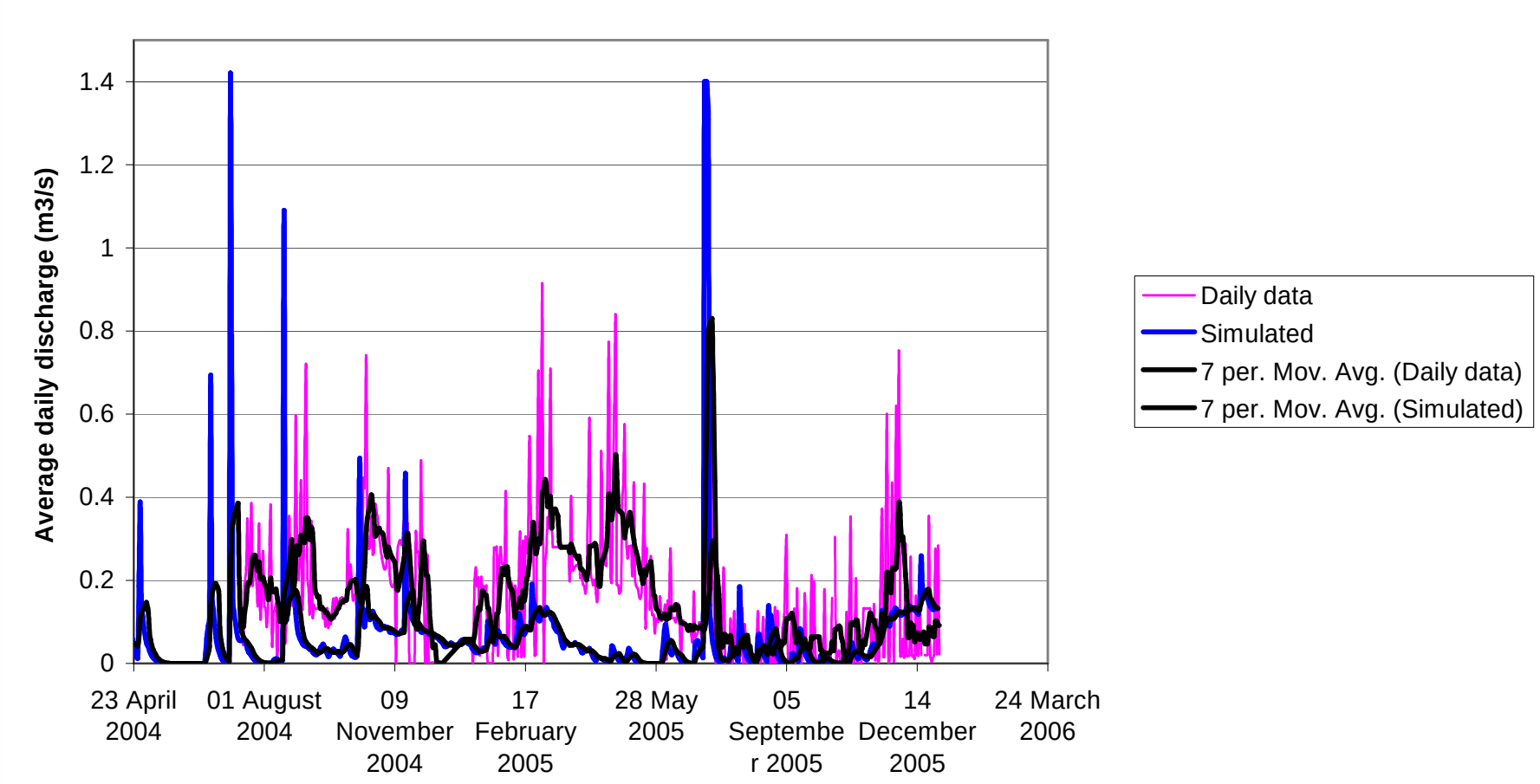
- Final catchment delineation (5 m grid)





Pump operation

- Calibration of pump discharges is hampered by poor data quality



Conclusions

- The Thurne catchment is heavily modified
- Early results suggest that SWAT appears to be able to represent dominant processes:
  - Pump discharges
  - Lake P concentrations
- Ongoing work is trying to increase realism of the model set-up
- Scenarios of point source P control vs diffuse source control