Department of Geography and Environment Science

Impact of groundwater abstraction and woodland management on groundwater fed wetlands

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Scenario DOCTORAL TRAINING PARTNERSHIP

south east water

BGS British Geological Survey

Introduction

Fens - groundwater fed peatlands – are an important ecosystem providing clean water and carbon storage, as well as being rich in biodiversity, especially rare species. However, these habitats are often exploited and poorly managed so that their ability to provide these services is reduced. Particularly, as drinking water is in increasing demand, groundwater aquifers are commonly overexploited by water companies which can negatively impact the ecology of the groundwater dependent fen. Afforestation is also a problem for fens caused by, and exacerbating, groundwater decline that can harm fen vegetation. **Presented here are impacts of climate and abstraction on groundwater levels at a lowland fen.**

Study Area

Greywell Fen is a 2 km long, spring fed peatland on the headwaters of the River Whitewater in Hampshire. It is a designated Site of Special Scientific Interest (SSSI), situated above a chalk groundwater aquifer that is used by South East Water (SEW) for drinking water supply.

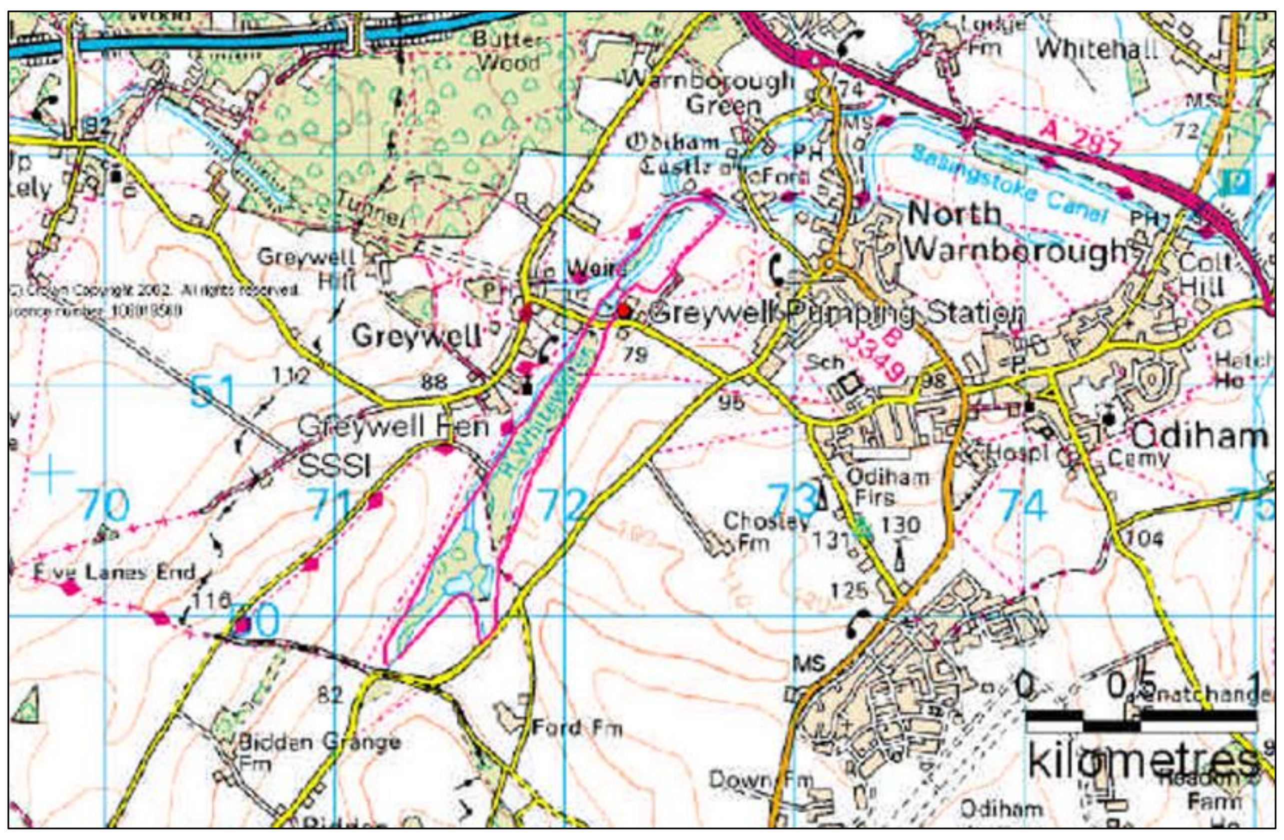

Figure 1. Ordinance Survey map of the area showing the villages of Greywell, North Warnborough and Odiham in North Hampshire, England, with the SSSI outlined in pink. The location of the SEW groundwater pumping station is shown with a red dot[1].

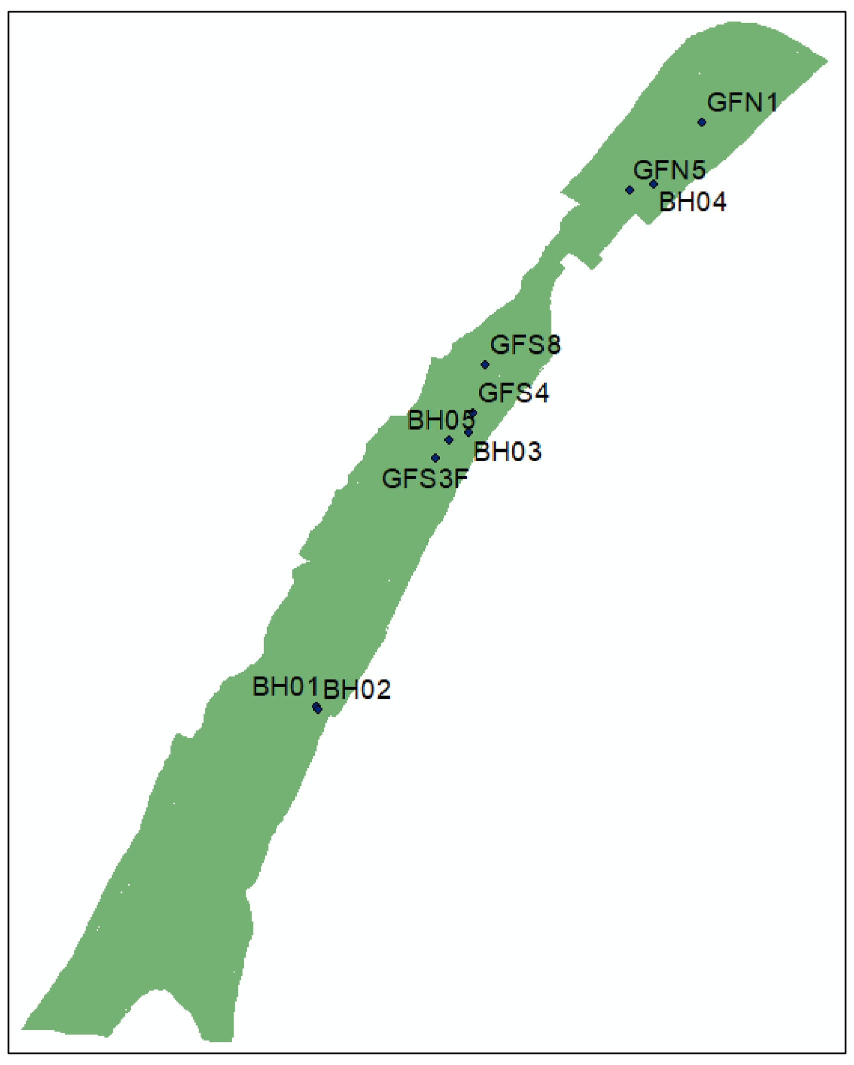

Figure 2. Outline of SSSI showing the location of groundwater observation boreholes (BH) and dipwells (GF).

Table 1. Observation borehole data including depth (metres below ground level), distance from pumping station (metres) and soil/ bedrock substrate the boreholes goes down to.

Borehole	Depth (mbgl)	Distance from pumping station well (m)	Substrate
BH1	2.0	856	Peat
BH2	16.0	856	Chalk
BH3	15.5	304	Chalk
BH4	4.0	246	Mineral soil
BH5	2.5	336	Peat

Methods

- Rainfall, temperature, radiation, wind speed and humidity data acquired from MET Office MIDAS database[2].
- Potential evapotranspiration (PET) calculated from MIDAS data using Penman-Monteith FAO56 method[3].
- Abstraction volumes provided by SEW.
- Groundwater levels measured automatically with pressure sensors in boreholes installed by SEW, in the surface peat and in the chalk bedrock.
- Time series of these data evaluated to reveal how climate factors and abstraction could be affecting groundwater levels.

Results

- Net rainfall (Rainfall – PET) and abstraction are affecting groundwater levels in the fen.
- Biggest responses seen in boreholes situated in the chalk or mineral soil.
- Boreholes in peat show very little response to abstraction volumes or net rainfall amount.
- Net rainfall is decreasing in summer and increasing in winter over the study period, with Summer 2018 being particularly dry.

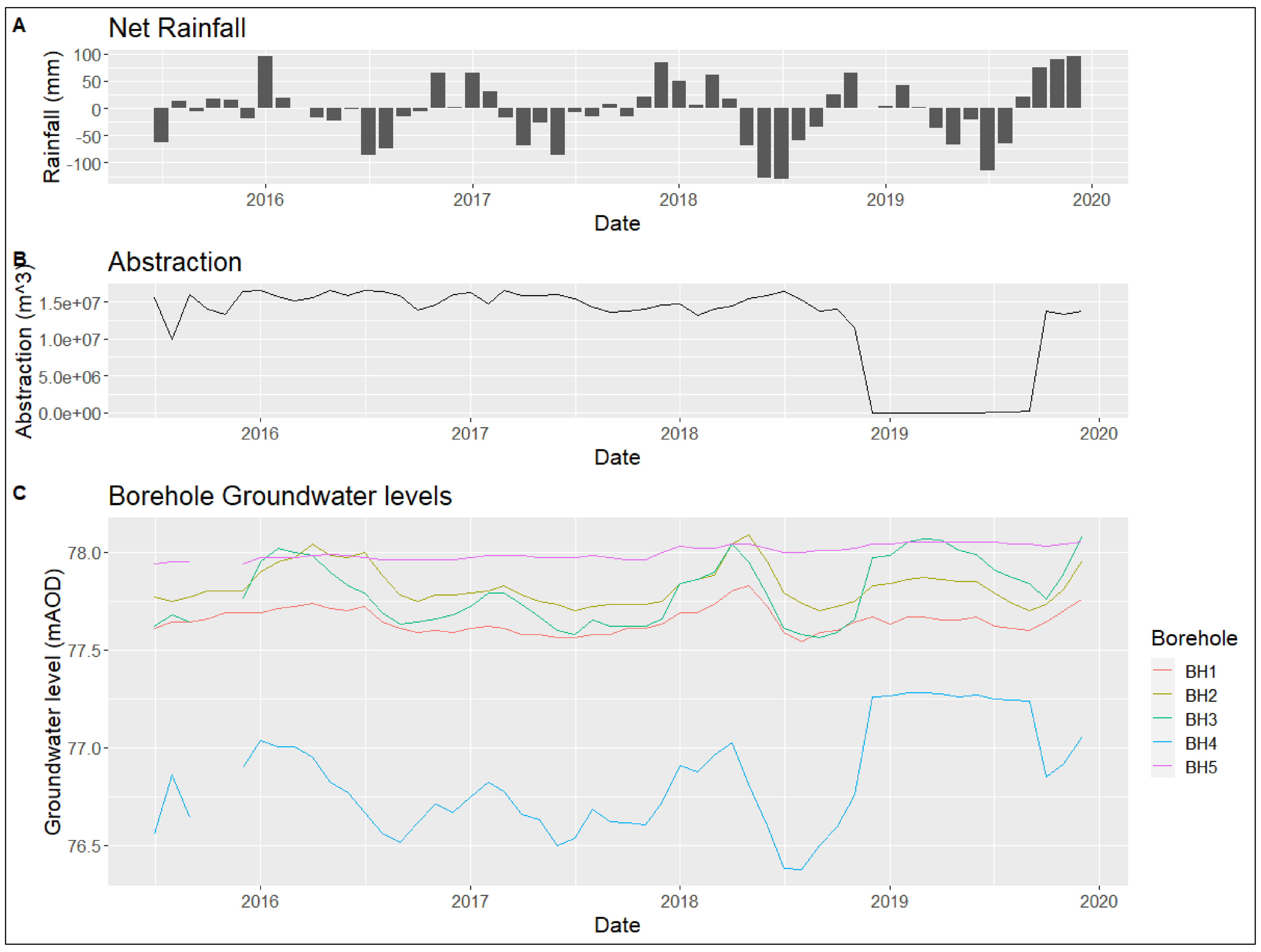

Figure 3. A comparison of **A**) net rainfall (mm), **B**) abstraction volumes (m^3) and **C**) groundwater levels at the five boreholes (metres above datum) from 2015 – 2019.

Conclusions

- Net rainfall and abstraction are affecting groundwater levels.
- No long-term change in groundwater levels.
- The water balance of the fen probably includes another input, such as surface water flow, that is not yet quantified.
- Changing net rainfall may become more important in the water balance.
- A processed based model, SWAP, will be used to fully understand the water balance.

References

1. South East Water (2006) *WHITEWATER ENVIRONMENTAL STUDIES AMP4 RSA PROGRAMME INCEPTION REPORT*.
2. Met Office (2012) *Met Office Integrated Data Archive System (MIDAS) Land and Marine Surface Stations Data (1853-current)*
3. Allen et al. (1998) *Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56.*

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