

Impact of groundwater abstraction and forest management on Greywell Fen



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Introduction

Sustainable supply of drinking water needs to balance demand against other unintentional environmental impacts. Groundwater aquifers that feed lowland wetlands are a commonly used source of relatively clean drinking water for water companies. However, continued abstraction can cause drops in local groundwater depths, with damaging consequences for the health of the ecosystem. Ecosystems which are valuable due to their high biodiversity and ability to store carbon.

South East Water (SEW) have been abstracting groundwater from the chalk aquifer beneath Greywell Fen since the 1900s, but have agreed to cease abstraction due to concerns of declining ecological health. Instead they will abstract water from the River Thames, about 30 miles away. Tree encroachment is also a problem, due to changing wetland management, that could be caused by, or exacerbating, groundwater decline.

This project aims to evaluate the effects of the groundwater abstraction and the management of tree encroachment (cut back and grazing) on the water levels and health of the fen.

Study Area

- Spring fed, lowland peatland
- 2 km along headwaters of River Whitewater in Loddon catchment, Hampshire
- North and South areas with SEW pumping station in between
- On border between chalk and clay bedrock
- Site of Special Scientific Interest (SSSI)
- Important site for plant and invertebrate diversity

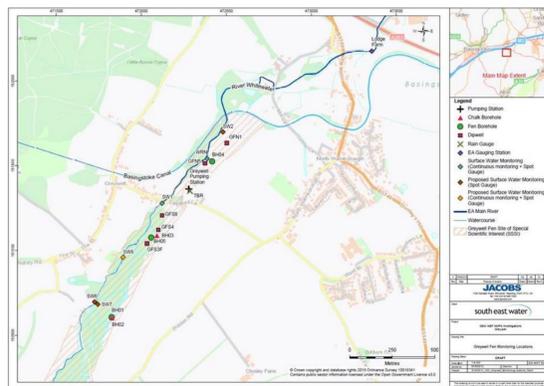


Figure 1. Map of Greywell Fen with monitoring locations (Taken from SEW AMP6/G/03, 2019)

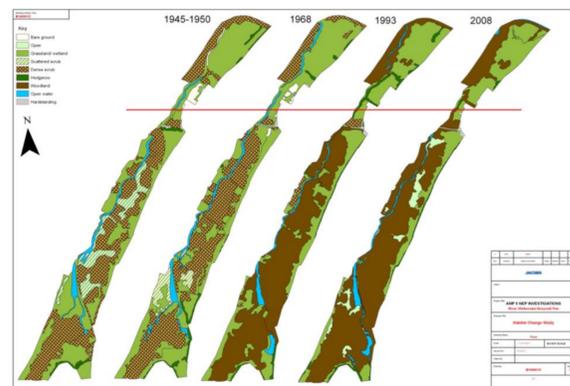


Figure 2. Change in vegetation across the whole site from 1945-2008 (Taken from SEW AMP6/G/03, 2019)

Methods

Data Analysis

SEW have installed boreholes and piezometers to monitor groundwater levels in the chalk aquifer and fen. These, along with weather station data at Odiham, are used to determine changes in depths over time and in response to environmental variables.

Vegetation and invertebrate surveys will be used to establish any change in species or abundance.

Hydrological Modelling

Groundwater and weather data, along with measured soil properties and geological surveys, will be used as inputs for a groundwater-surface water coupled model to determine the hydrological regime of Greywell Fen. Hence the impacts of abstraction and how this may also affect the River Whitewater will be established.

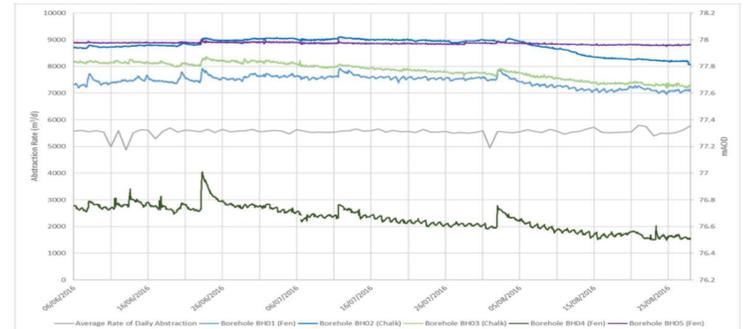


Figure 3. Groundwater levels measured from boreholes in the North and South Fen with average rate of daily abstraction (Taken from SEW AMP6/G/03, 2019)

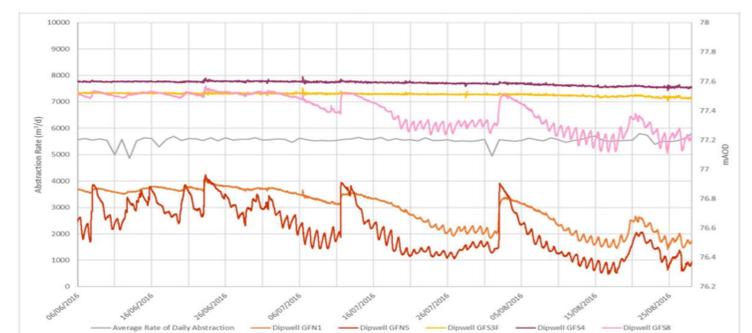


Figure 4. Groundwater levels measured from piezometers in the North and South Fen with average rate of daily abstraction (Taken from SEW AMP6/G/03, 2019)

Different scenarios will be modelled to investigate continued abstraction schemes, management practices and affects of climate.

Forest Management

Vegetation maps over several years will be compared and considered alongside management events. Soil samples will be taken in collaboration with another PhD project (Philip Agredazywczuk) to examine if management practices and changes in groundwater depths are affecting soil properties and vegetation.

Carbon Life-Cycle Assessment (LCA)

LCA of current drinking water abstraction scheme, including potential carbon loss due to drying of fen, will be compared to LCA of proposed drinking water plan of using the River Thames. Wider environmental impacts of each scheme will also be considered.

Summary

- Complete hydrological regime of Greywell Fen will be modelled
- Interactions between groundwater levels, pumping and river flows will be defined
- Effects of forest clearing will be determined
- Recommendations will be made to SEW on the overall most beneficial abstraction site

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