



ERT assessment of saline intrusion and the volume of freshwater reserve in the UK Fens aquifer

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The UK's food production relies on the Fens of Eastern England which contributes 11 % of the agri-food economy from just 4 % of England's agricultural land. The success of agriculture is contingent upon the availability of water but, currently, approximately 75% of the UK's arable land is within catchments prone to water stress. The dual challenges of climate change and the UK government's ambition to increase productivity through sustainable intensification is likely to increase this. From work conducted elsewhere we know unsustainable extensive pumping of fresh groundwater can lower the water table significantly, induce seawater intrusion and cause upwelling of saline groundwater into the shallow groundwater system. A comparable aquifer on the coast of the Netherlands is threatened by a rising sea level and over extraction of groundwater and it is predicted severe salinisation will take place.

This is of concern in the Fens because groundwater resources are not well assessed, partly because historically the region has relatively low rates of groundwater abstraction, yet we know from interactions with farmers that more irrigation is anticipated. Thus, the development of an evidence base is critical to assessing sustainable agricultural intensification in the region. Our previous work has highlighted that in the case of acute coastal flooding along the east coast, up to 340,000 ha of cultivated crops could be at risk with an estimate cost of up to about £5,000/ha from the most severe saline inundations. Some estimates have suggested such a reduced harvest would cost the agri-food industry £3 billion annually risking 80,000 jobs and the nation's food security. Groundwater salinization presents a chronic threat of similar nature. The aim of this project is to quantify the freshwater reserve in the shallow Fens and estimate sustainable levels of extraction.

In this project we tackle three research objectives. Firstly, we produce the first basin scale stratigraphic map of the shallow coastal Fens aquifer using high resolution British Geological

Survey borehole records. Secondly, we survey and map the saline boundary and water table within the shallow coastal Fens aquifer using Electro Resistivity Tomography (ERT). Thirdly, we use MODFLOW to create the first groundwater flow model of the shallow coastal Fens aquifer with the data from the stratigraphic and freshwater maps from which we calculate sustainable irrigation extraction for the region.

Acknowledgements: This work was funded by the EU Interreg SalFar project. We thank landowners for their permissions to conduct our survey.