Broads Authority response to the Environment Agency's Groundwater report

17/04/14

Summary of Areas of Concern

A. **An inadequate groundwater model development process has been followed, failing to use the Environment Agency modelling guidelines;**

B. **More detailed conceptual models required, especially for the fens;**

C. **Inappropriate mesh spacing of groundwater model – Technical Note prepared for the Environment Agency indirectly demonstrates that the 200m mesh spacing model cannot reproduce important processes within fens;**

D. **Lack of sufficient suitable observed groundwater level data to confirm the reliability of the model;**

E. **Need to develop a computational methodology for representing actual groundwater and surface water conditions in the fens;**

F. **Given the shortcomings of the conceptual models and computational modelling, the results from the modelling are not reliable and should not be used for licence determination;**

G. **Errors and assumptions about site hydrology of Sharpe Street Fen;**

H. **Anecdotal assessment of the role of site management without reference to Broads literature;**

I. **Gaps and lack of consideration of water level and Ellenburg values;**

J. **Lack of ecological evidence to base the 1986 abstraction as acceptable.**

Sections within this response:

1. Conceptual groundwater model
2. Community change and recognition of site complexity in ecological and hydrological terms
3. Management
4. Lack of modelling and omitted data
5. Use of 1986 as date for defining acceptable abstraction
6. Levels of certainty
7. Decision tables

1. Conceptual groundwater model

1.1 An independent review of the Environment Agency groundwater summary report has been commissioned by the Broads Authority. The comments in the review have been prepared in discussion with the Broads Authority and this review should be considered as part of the Broads Authority response in full. The main points of concern are summarised above and also provided in detail within the file named 'BA review by Ken Rushton Apr 2014'. In summary the Broads Authority considers that the Environment Agency has further work to do in preparing quantified and conceptual models which will address the complex hydrological conditions in the Broadland fens and provide confidence in decision making.

1.2 In addition to these comments we add that the model does not identify the influence of surface water and exchange via drain networks which are essential aspects of the ecohydrology of the designated features of the area (such as oxygen concentrations in flowing ground water on the characteristic species of the key vegetation types and of fen orchid in particular).

1.3 Furthermore, the drainage network not being considered in the model, the substrate is also been proven to be more complex than the model is able to represent. Evidence presented in Dr Parmenter's stratigraphy report to Mr Harris (May 2013) details the complexity of the substrate underlying the fen. We note that this research shows Unit 11 has some semi-floating vegetation on former turberies but also areas of solid peat and Unit 3 is characterised by semi-floating vegetation located on former turberies. Given that the surface layers are complex and this complexity is important to water transfer and vegetation community, the ground water report is oversimplified. We believe it is incorrect to assume that the site is dominantly impacted by clay layers.

2. Community change and recognition of site complexity in ecological and hydrological terms

2.1 The report contains errors and assumptions of the hydrological regime found at Sharp Street Fen and Sutton Broad. Both these sites are influenced by the river and are not fully comparable with Catfield and the report requires amendment to correct these errors and assumptions. Using the lack of presence of sphagnum growth at Sharp Street to indicate a lack of impact from water abstraction, despite the model demonstrating that there is a modelled impact from decreased groundwater recharge at this site, is an oversimplification. We support the comments made by Natural England 1-6, particularly in regards to the lack of information on the role of rainwater and groundwater interaction which is critical for fen sites. Further exploration of this is needed to increase confidence in decision making.

3. Management

3.1 The way that management treatment affects fens is described in some detail in Rodwell (1991b, 1995, 2000), Wheeler and Shaw (1987), Shaw and Wheeler (1990), and in terms of species-richness, Wheeler and Shaw (1991). More of a Broadland context is provided in Lambert (1965), George (1992), Tolhurst (1997) and Moss (2001). Only one of these references is cited in the AMEC report on Practical Management March 2014.

3.2 There has been an increase in long rotation conservation management at both Reedham Marshes (and many other sites in the Broads) along with Catfield Fen over the past twenty years. Both Reedham and Catfield have long had acid Sphagnum areas; however this species is only recorded as actively expanding at Catfield. Thus it would appear that if current conservation management practice were a contributory factor in the expansion of Sphagnum over fen areas (as stated in the AMEC report on Practical Management March 2014) this would be replicated in other areas, such as Reedham Marsh.

3.3 If current conservation management practices under ESA and HLS were resulting in Sphagnum increase or community change this may be evident in the Fen Ecological Survey (2005-2009). The Broads Authority commissioned an assessment of 'Vegetation Responses to Management at Five Broadland Fen Sites' in 2010. Data collected for this survey was compared with previous data sets. From this report firm conclusions were difficult, since the earlier data sets were too sparse and samples inaccurately located. In addition, management records were often insufficient or too inaccurate to interpret the change that was recorded. In short, wider scientific evidence for community change as a result of management is lacking a scientific basis and only anecdotal information is available.

4. Lack of modelling and omitted data

4.1 There is no hydrological data provided on the groundwater fed SAC, SSSI fen closest to the abstraction. Snipe Marsh and Cromes Broad area were raised as being of concern by the Broads Authority in a letter to Environment Agency in response to the AMEC report (March 2012). Both sites are either managed or managed and owned by the Broads Authority. This omission in the groundwater report for both sites, and in the case of Snipe Marsh the Appendix 12, is concerning. This concern is relevant as Broads Authority site managers have noted that the site has a problem with water levels and is often too dry to maintain the S24 vegetation community on much of the site.

4.2 Snipe Marsh supports mainly S24(d) the unique and characteristic Broadland community (*Phragmites australis-Peucedanum palustre reed fen,Typical sub-community)* and M22(d) a base rich fen meadow *(Juncus subnodulosus-Cirsium palustre fen meadow, Iris pseudacorus sub-community)*, with small areas of S5 *(Glyceria maxima swamp, no assigned sub-community)* and MG10(b) (*Holcus lanatus-Juncus effusus rush pasture, Juncus inflexus sub-community*). We advise that hydrological and ecological assessment is required or if this has already been completed that this is made available to the Broads Authority.

4.3 The AMEC report refers to 7cm drawdown at Snipe Marsh, although subsequent assessments showed that this was not always to do with abstraction it is not clear what is the cause of the drawdowns.

4.4 Transmissivity of the crag was shown to be greater to the north, towards Catfield. If this is the case we are unclear why Sharpe Street, which is also to the south and west of the abstractions, has been considered in such detail in the Environment Agency ground water report, yet Snipe Marsh has no mention.

4.5 There is no reference to the long-term water level data provided by the RSPB, this evidence should be considered and clearly referenced within the hydrological report as a key piece of data, particularly considering the lack of field data for this area.

4.6 It is essential that the latest data is used and referred to in the hydrological report. The hydro-chemical data used in the report is dated and Broads Authority supports the Natural England recommendation that the Environment Agency considers whether this evidence is likely to have changed. Dr Barendregt's report (June 5 2013) to Mr Harris includes some hydro-chemical information.

4.7 To date there has not been consideration of the Broads Authority and RSPB submitted evidence of Ellenberg value change, and there is scant information within the Appropriate Assessment.

5. Use of 1986 as date for defining acceptable abstraction

5.1 The Broads Authority agrees with Natural England in being unable to support a statement that says that the hydrological regime was acceptable in 1986. We consider the grounds on which former conditions are judged to be ecologically acceptable both scant and flawed.

5.2 The change in vegetation composition to a less valued/drier community and in some places a more acidic community (shown by some areas of Sphagnum growth) and assuming that this occurred at a measurable point in time that would coincide with

the hydrology: i.e. the vegetation composition in relation to the hydrology and response lag times. Given this, comparison of the licenced scenarios to the naturalised model scenario are essential.

6. Levels of certainty

6.1 Broads Authority is concerned about the use of words such as just, slight and minor. While these may give a feel for relative impact they are not meaningful. There is no quantification of either the range of variation from the thresholds that might be deemed acceptable or the error within the model, so it is simply not possible to assess the risk of departure from the species requirements. It would be more meaningful to provide quantitative measures.

6.2 Relating to 'Uncertainty and error' is the following text from the Environment Agency's own Ecohydrological guidelines document which needs to be considered in detail:

"Only with these two components (Hydrological Impact and Ecological effect) together can a predicted hydrological impact be translated into a direct ecohydrological effect. It is at this link stage that extreme care is needed. It is vital that hydrologists and ecologists communicate at the same scale (Hunt and Wilcox, 2003). For example, it is of little use having models which cannot be linked to the same scale at which ecological impact may be occurring (i.e. the surface zone of the wetland itself). A groundwater model may be considered accurate if predicted water table levels are within 10 cms of observed values, whereas a 10 cm difference in water levels may mark a difference between the condition required by quite different vegetation communities.

We must ask the real question; whether hydrological modelling can be undertaken with sufficient resolution as to provide valuable information to link with ecological thresholds. The value of the groundwater model in this case is likely to be in predicting the size of changes in water levels rather than absolute levels. This is a particularly crucial issue when the hydrological cause and ecological response are at different scales. For example, to model the impact of abstraction on water table level in a large aquifer requires a broad scale groundwater model. The wetland may be very small in comparison, and local changes in water level within the wetland may be influenced by local conditions, such as soil structure that cannot be modelled to a sufficient degree of accuracy with a regional model. Temporal variability is a key issue in modelling. Many factors influencing the hydrological regime of a wetland, including rainfall, river flow, groundwater levels and evaporation are continually changing; on a minute by minute to a year to year basis. Indeed, it is widely accepted that this variability maintains diversity with the ecosystem. It also suggests that the vegetation may not necessarily be in equilibrium with hydrological regime,

but may be recovering from a recent drought or flood. Temporal variability also makes it difficult to identify a "representative period" over which to assess the hydrological regime. Even data collected over several years may not capture frequently experienced conditions."

7. Decision tables

7.1 The decision risk tables are qualitative and designed to compare risk across a large number of sites investigated under RoC. However the Habitats Regulation Assessment method should be robust and stand alone for each site and provide quantitative data and certainty given the sensitivity of the sites.