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THE SIZEWELL C PROJECT
NNB Generation Co (SZC) Ltd

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SUMMARY OF WRITTEN REPRESENTATION and
EXPERT REPORT

A critical review of SZC Co's site characterisation, impact assessment, and proposals for impact mitigation, in relation to the risks posed to the ecohydrological integrity of Sizewell Marshes SSSI

Dr Rob Low, Dr David Mould, Jonathan Graham

s.coastalfoe@yahoo.co.uk

SUMMARY. A critical review of SZC Co.'s site characterisation, impact assessment, and proposals for impact mitigation, in relation to the risks posed to the ecohydrological integrity of Sizewell Marshes SSSI by the development of Sizewell C Nuclear Power Station, as proposed.

Authored by Dr. Rob Low (lead), Dr. David Mould and Mr. Jonathan Graham.

This document is a summary, as required, of a Written Representation to the Sizewell C hearing which concerns the serious risks to the viability of wetland plant communities and species of interest within Sizewell Marshes Site of Special Scientific Interest (SSSI), leading from the proposals to develop the Sizewell C Nuclear Power Station, brought forward by NNB Generation Company (SZC) Ltd (SZC Co. hereafter). It has been written on behalf of Friends of the Earth and Suffolk Wildlife Trust by the following:

- Dr. Rob Low (BSc [Hons], MSc, PhD, FGS, CGeol) is the Managing Director of Rigare Ltd (Abergavenny), a company which provides expert services and advice on the subjects of wetland ecohydrology and hydrogeology. He has 24 years' of experience as an environmental consultant, providing expert services and advice in both wetland ecohydrology and hydrogeology
- Dr. David J. Mould (BSc [Hons], PhD, CEnv) is a surface water hydrologist who has provided expert technical advice on surface water systems over 18 years. He has worked for the Hydro-Ecology and Wetlands research group at the Centre for Ecology and Hydrology (now UKCEH), instrumenting wetland systems for research projects and Wallingford HydroSolutions Ltd. He works as Principal Hydrologist for the Canal & River Trust (previously British Waterways), and also for his private company, Milestone Environmental Ltd.
- Jonathan J. Graham (BSc [Hons]) is a botanical and ecological specialist. He has worked for the Countryside Council for Wales (now Natural Resources Wales) and English Nature (now Natural England), and since 2007 has been an independent consultant. A large proportion of Jon's work has related to aquatic and wetland habitats such as assessments of rivers and drainage channels, vegetation surveys of fen, swamp and washlands, hydro-ecological assessment of base-rich flushes (including tufa sites) and their restoration, and he has published research in relation to bryophytes of springs and water chemistry.

Our full Written Representation can be summarised as follows:

- As noted in its citation, Sizewell Marshes SSSI is a '*large area of lowland, unimproved meadows which supports outstanding assemblages of invertebrates and breeding birds*' with '*an extensive network of ditches across the site*'. A number of key species, which have been recorded through SZC Co. and other surveys, are considered sensitive to changes in the water supply mechanism or water chemistry and/or are listed as Red Data species. The vegetation of Sizewell Marshes is of exceptional importance especially in the context of East England and it is this vegetation that supports the equally exceptional invertebrate and bird interests.
- There are a number of serious shortcomings in the analysis and interpretation of vegetation surveys within the SZC Co. submissions.
- Environment Agency (2010) contains collated ecohydrological information relating specifically to the M22 *Juncus subnodulosus* – *Cirsium palustre* fen meadow community in question here. Importantly, over 70% of recorded stands were irrigated by groundwater, and optimal summer water tables are very high (0.05-0.18 mbGL), which is consistent with groundwater support.

Most stands of M22 are associated with permanent or intermittent seepages or where the water table is shallowly subsurface all year, sometimes peripheral to permanent seepages; this indicates a strong preference for soligenous wetness, where wet conditions are maintained by continuous incoming flow, rather than downstream (topographic or artificial) impoundment.

M22 is typically found in base-rich conditions over a wide range, but usually with a moderate level of fertility. Some of the least fertile sites are the most species-rich.

- Many of the species recorded within the SSSI are highly characteristic of groundwater dependence and low nutrient conditions, to the extent that they can be used as surrogate hydrological indicators. As such, our analysis indicates a hydrologically very complex, low fertility site where some groundwater seepage occurs involving both calcareous and mildly acidic water chemistries, with much variation at a microtopographic level.
- The environmental monitoring and analysis undertaken by SZC Co. has failed to identify the controlling variables and mechanisms which directly control the variables defining the hydrological supporting conditions for the M22 community within the SSSI; this is a fundamental failing of the SZC Co. work. It is our view that the hydro(geo)logical functioning of the shallow zone within Sizewell Marshes SSSI should have been monitored, analysed and characterised in much more detail, using a contemporary ecohydrological approach.

For example, it is highly instructive and of very significant concern that water table elevation in the Peat is never plotted in relation to the ground surface within the SZC Co. submissions. This variable is very widely recognised as the most important in relation to defining hydrological supporting conditions for M22. Its use also allows more effective analysis of near-surface hydro-dynamics, which in turn can inform identification of key water supply mechanisms; this appears to be absent from the SZC Co. submissions.

From the available evidence we conclude that direct, upwards groundwater flow and discharge, in response to the upwards hydraulic gradient from the Crag to the Peat, is almost certainly a critical source of water to some of the stands of M22. It is critical because it allows favourable hydrological supporting conditions to be maintained, in terms of water table elevation regime and water quality, for these stands.

- Prediction of the ecohydrological impacts of the proposed development must be informed by the best-possible ecohydrological conceptual model; as noted above, our view is that SZC Co.'s conceptual model is significantly flawed, and therefore that the prediction of impacts (including the design and use of the numerical model) has not been informed to the best possible degree.
- Regarding prediction of impacts through use of the numerical model:
 - For the base-case model, the magnitude of the projected drawdown is c. 50% of the range in optimal summer water table depth observed in stands of M22 (Environment Agency, 2010); this indicates that the projected drawdown could easily take the water table elevation outside of the optimal range for the summer water table, and therefore shows that the M22 community is significantly more vulnerable to the projected drawdowns than is acknowledged within the SZC Co. submissions.
 - The design of the model sensitivity analyses is overly optimistic; the effects of a three- to five-fold increase in the hydraulic conductivity of the cut-off wall should have been tested, and some (not unlikely) combinations of single sensitivity analysis scenarios should have been tested. If this had been done, it would have shown that there is a reasonable chance that projected drawdowns will be significantly larger than the base-case model, and in turn that the M22 community is potentially significantly more vulnerable to the proposed development.
- Development and agreement of a detailed monitoring and mitigation plan, since it forms a part of the ecohydrological viability of the proposed development, should be addressed at the earliest stage in the planning process. The required contents of the plan, such as the scope of monitoring, data quality-checking procedures and reporting, detailed actions and timescales in relation to the loss of a monitoring point, periodic reporting requirements, and the requirements of the stakeholders which review the reports, all have long-term cost and logistical implications for the developer, and should be agreed before determination.
- The primary measure for mitigation of ecohydrological impacts from the development appears to be that, if drawdown of the water table in the Peat within Sizewell Marshes is larger than predicted, water levels in the SSSI drainage ditch network will be raised, such that water migrates from the ditches into the Peat layers to maintain in-field water table elevations. This measure is fundamentally inappropriate, and would actually cause further damage to the M22 within the SSSI as follows:

- The historical recorded nutrient concentrations within the ditch network indicate that the threshold value for potential damage of mesotrophic and fen-meadow fens within a GWDTE would frequently be exceeded. This is unsurprising as a significant percentage of incoming flow comes from the Leiston STW.
- It appears to promote topogenous wet conditions, with associated hydro-chemical and hydro-physical implications, rather than the soligenous wet conditions usually favoured by M22.

And in final summary, our view is that SZC Co.'s understanding of the environmental processes which support M22 and associated communities within Sizewell Marshes SSSI is flawed, because up-to-date ecohydrological knowledge and techniques have not been applied. This has led to ill-informed impact prediction, which has resulted in the likelihood, magnitude and significance of potential impacts being significantly underestimated. These problems have been compounded by SZC Co.'s proposal of a mitigation technique which would actually cause further damage to the SSSI, rather than mitigating any unexpectedly large impacts.