Proof of Evidence of Professor Alastair Fitter CBE FRS

for the Yorkshire Wildlife Trust

14 October 2019

Outline planning permission (with all matters reserved except for means of access) for up to 516 residential units (Class C3) with local centre (Use Classes A1-A4, B1a, C3, D1) public open space with pavilion and associated infrastructure and full application for demolition of existing buildings and structures and creation of ecological protection and enhancement zone. | OS Fields 5475 7267 aAnd 8384 Moor Lane Acomb York

Appeal Reference: APP/C2741/W/19/3233973

Local Authority Reference: 18/02687/OUTM

Personal information

Alastair Fitter, Emeritus Professor of Ecology at the University of York

Synopsis

I am an ecologist with 50 years professional training and experience. My research focussed on plant-soil interactions and the biological impacts of climate change, and I have taught a wide range of ecological topics at degree level. I have supervised 26 PhD students and 18 postdoctoral fellows.

I was elected a Fellow of the Royal Society in 2005 and appointed CBE in 2010 for my contributions to the science of ecology: the Royal Society is the national academy of science for the UK and the Commonwealth.

I am an Honorary Member of several of the leading learned societies in my field, and have sat on advisory and governing bodies for a range of scientific and conservation bodies. I am currently a trustee of the Yorkshire Wildlife Trust (YWT) and Professor Emeritus of Ecology at the University of York.

I have been involved with the ecology and management of Askham Bog SSSI since 1972 and, jointly with Clifford Smith, one of the founders of the YWT, wrote a book on its history and ecology in 1979. I have published numerous scientific papers reporting research undertaken at Askham Bog (see Appendix 1). I have also written a number of identification guides and other natural history books which are widely used by both amateur and professional naturalists.

Education

BA Oxford, Botany,1969, Class 1; PhD Liverpool, 1973

Career (University of York, 1972-2013)

- Pro-Vice-Chancellor for Research, 2004-2010.
- Formerly Head of Biology Department, 1997-2004; Professor of Ecology (Personal Chair), 1992-2013; lecturer and senior lecturer 1972-1992.

Professional distinctions

- CBE, 2010
- Fellow of the Royal Society, 2005
- *Honorary Memberships*: British Ecological Society, 2013; Botanical Society of the British Isles, 2007; British Mycological Society, 2007
- *Honorary Fellowship*: British Naturalists' Association, 2006
- Director, UK Population Biology Network (UKPopNet), 2004-2007
- President, British Ecological Society, 2003-2005
- President's Medal, British Ecological Society, 1997

Relevant external activity (since 2000)

- *New Phytologist Trust*: Trustee 2001-2016
- *DEFRA Central Science Laboratory*: Advisory Board 2002-2008
- *National Biodiversity Network*: Trustee 2004-2009
- *Natural Environment Research Council***:** Terrestrial Sciences Peer Review Committee, Member 2001-2003, Chair 2004-2006; Science and Innovation Strategy Board, 2001-2005; Council 2005-2010
- *Royal Society*: Sectional Committee 9 2005-2007, 2015-2017; Chair, International Awards Committee 2007-2010; Chair, Leverhulme Awards Committee 2010-2013; Chair, European Academies Science Advisory Council (EASAC) - '*Biodiversity and*

Ecosystem Services' 2006-2007
- *Natural England*: Science Advisory Committee 2007-2012
- *International Association of Ecology*: Vice-President 2010-2013, Board member 2013-2015; Chair International Scientific and Organising Committees for International Congress of Ecology, London, 2013
- *Yorkshire Wildlife Trust*: Trustee 1984-1985, 2010-2014 , 2016-
- *York Archaeological Trust*: Chair, General Advisory Council, 1997-2002
- *River Foss Society*: President 2005-
- *Yorkshire Arboretum*: Chair of Trustees 2011-

Editorships

- *New Phytologist,* 1988- 2013
- *Advances in Ecological Research,* 1987-1999
- *Journal of Ecology,* 1992-1996
- British Ecological Society *Bulletin,* 1979-1984

Editorial Boards

- *Tree Physiology,* 1990-1993, 1997-1998
- *Environmental Reviews,* 1991-1994
- *Plant and Soil,* 1993-2003

Publications

- 170 scientific papers, 85 other publications
- 1 textbook (3 editions, 2 translations)
- 10 identification guides, numerous editions, translations into 7 languages

Contents

1. Summary of evidence

1.1. Askham Bog SSSI is a species-rich valley mire with a number of nationally and internationally significant species and plant communities (Section 2).

1.2. The site was historically even richer and most of the species that have become locally extinct were those of wetter habitats and the plant communities associated with these, especially those influenced by groundwater. These losses are in large part the result of a historical deterioration in the hydrology of the site by agricultural and other transformation of the surrounding catchment and consequent lowering of the water table (Section 3).

1.3. Management activity by the Yorkshire Wildlife Trust aimed at retaining water on site and reducing evapotranspiration has resulted in the recolonisation of the site by several species and the recovery of populations of others, as well as the recovery of nationally and internationally threatened communities. The hydrogeological evidence shows that the proposed development would likely lead to a lowering of the water table on the Bog, reversing the positive trends that the site has experienced and leading to the loss of species and communities (Section 4).

1.4. The plant communities are dependent on a complex hydrology involving a balance between precipitation, groundwater and surface water, and the claim by the appellant that the SSSI is dependent solely on precipitation is in my view misleading and a misinterpretation of the data (Section 4). It may well be true that precipitation is the main source of water: what is at issue is how a high water table is maintained, not where the water comes from, and many of the plant communities at Askham Bog are indubitably dependent on both a high water table and base-rich water (i.e. not rainfall which is always base-poor). The analysis in this Proof demonstrates that the critical issue is losses rather than sources of water and confirms the key role of the geological deposits underlying the peat (Section 5). An analogy would be with a sink: the rate and source of flow into the sink is less important in keeping it full than the effectiveness and the location of the plug.

1.5. The rarity and irreplaceable nature of the habitats at Askham Bog mean that there is a requirement to both protect and further restore them. The proposed development would not only undermine the current recovery of the site, but would prevent future enhancement of the environmental status of Askham Bog SSSI by building on the adjacent land and thus effectively severing the link between the bog and its hydrological catchment. Such an action would irreversibly prevent the restoration of the lagg zone, the area of wetland around the bog which sustains and supports it and is an essential part of a healthy peatland system. Restoring the lagg must be part of any long-term restoration plan (Section 6).

1.6. Proceeding with the application would run counter to key elements of the National Policy Planning Framework (Section 7).

1.7. My analysis supports the decision (reason 2) by City of York Council to refuse planning permission (Section 7).

2. The Importance of Askham Bog SSSI

2.1. Askham Bog is a valley mire occupying a narrow basin between two arms of the York moraine. The history of the site is well documented[1]: a postglacial lake developed into a mineral-rich mire system which in turn developed so as to support a rain-fed (raised) and therefore mineral-poor bog, with a groundwater-fed lagg zone. This site was exceptionally rich in species through the presence of acidic, base-rich and transitional habitats. Much of the upper layer of this peat bog (i.e. the rain-fed part) has disappeared, probably because it was cut and burnt as fuel, possibly from as early as Roman times and continuing up to the eighteenth century.

2.2. In the nineteenth century the site is considered to have been one of the premier natural history locations in the country, notably for plants and insects, with detailed records spanning 150 years. Askham Bog was identified by Rothschild in 1915 as a potential national nature reserve in the first such national assessment of the country's biodiversity.

2.3. The site was eventually bought by Francis Terry and Arnold Rowntree and given to the Yorkshire Naturalists' Trust (now Yorkshire Wildlife Trust, YWT), which was created in 1946 to receive Askham Bog as its first reserve. The YWT now owns the entire site.

2.4. Askham Bog occupies an important place in the heritage of York, due to (i) the long period of human interaction with the site; its rich biodiversity and the unusually good and long-standing documentation of that; (ii) its place in the history of nature conservation in Yorkshire; and (iii) the particular affection in which it is held by the citizens of York, as evidenced by the high visitor numbers (20000 visits per year) and the strong public response when this application was proposed in 2018.

2.5. Askham Bog has also been the focus of a substantial scientific research effort and the subject of a book on its history and ecology (see Bibliography, Appendix 1).

2.6. The YWT holds data on species recorded at the site. Recent records show that there are at least 2925 non-microbial species recorded from Askham Bog, a figure that represents over 5% of the total UK species list[2]. Askham Bog is therefore unusually rich in biodiversity, and these figures are certainly under-estimates, since some taxonomic groups such as Orthoptera and Pisces have never been surveyed at the site, and others have received insufficient attention: for example, additional recording during 2019 has increased the site list for moths (Lepidoptera) from 267 species to 424, an increase of nearly 60%, representing nearly 20% of UK species.

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[1] Fitter AH, Smith CJ (1979). *A Wood in Ascam: a study in wetland conservation. Askham Bog 1879-1979.* Ebor Press, York, Chapter 2; Ove Arup & Partners Ltd (March 2003) Yorkshire Wildlife Trust - Askham Bog Restoration Project - Technical Report, Chapter 5 **AF App1**

[2] Raper., C (2019).UK Species inventory project. Angela Marmont Centre for UK Biodiversity. Natural history Museum, London. The NHM gives the total UK species as 70000. The analysis above is for non-microbial species (i.e. excluding fungi – 15000 species - as well as bacteria and archaea) giving a total of 55000. **AF App2**

3. Losses of species

3.1. Historical records show that Askham Bog was once even more rich in species. The most complete data are for plants: a total of 414 plant species have been recorded from the site over the last 200 years[3], but there has been a steady loss of species over the last 100 years (Fig. 1).

3.2. The genus *Carex* (sedges) is especially well represented at Askham Bog, which supports 30 of the 66 species found in England[4] . Most of the species of *Carex* found at Askham Bog are characteristic of fens and bogs and this genus shows the same pattern of losses as the flora overall (Fig. 2).

3.3. These patterns of species loss (which could be replicated for a range of other groups, notably water beetles) are demonstrably linked to habitat change. Detail of the species losses (Table 1) shows that many characteristic species -of mineral-rich (as opposed to rain-fed) mires were lost from the site between 1879 (when the first major survey was published) and 1940, with very few losses since, showing that the species most vulnerable to habitat change were lost early. Other evidence, from naturalists' memoirs and old photographs, confirms that the extent of these habitats decreased markedly over that time period.

3.4. The preponderance of species losses that are from groups characteristic of wet habitats is clear evidence that Askham Bog was wetter until relatively recent times. Most of the wetland species that have been lost are particularly associated with plant communities wholly or partially dependent on groundwater, such as might be found in soligenous flushes (i.e. where water seeps out of sloping ground) or the lagg zone of a raised bog, which is the set of waterlogged marginal communities that surrounds and supports a peat bog in its natural state.

3.5. Arup (2003)[5] state that National Vegetation Classification (NVC) communities M5 (*Carex rostrata – Sphagnum squarrosum* mire) and M9 (*Carex rostrata – Calliergon cuspidatum/giganteum* mire[6]) were formerly present at Askham Bog but have been lost. Excluding bryophytes, for which historical data are less good, this seems feasible since all the species which are 'constants' for this community were historically present, viz. *Carex nigra, C. rostrata, Eriophorum angustifolium, Comarum palustre* (formerly *Potentilla palustris*) and *Succisa pratensis* for M5; and *Carex rostrata, E. angustifolium, Galium palustre, Menyanthes trifoliata* and *Comarum palustre* for M9.

3.6. Table 1 suggests that NVC community M10 (*Carex dioica – Pinguicula vulgaris* mire) may also have been an important component of the original site: its constant species *Carex dioica, C. hostiana, C. lepidocarpa, C. panicea, C. pulicaris, E. angustifolium,*

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[3] Fitter & Smith 1979, *op. cit.*, Appendix 3; modern data held by Yorkshire Wildlife Trust **AF App3**

[4] Stace C (2019). *New Flora of the British Isles*, 4th edition. C&M Floristics, Suffolk, pp. 998-1022 **AF App4**

[5] Arup (2003), *op. cit.*, Section 5.2.1 **AF App5**

[6] National Vegetation Classification (NVC) **AF App6** communities are the standard method of classifying plant communities, as described by Rodwell, J (1991, 1995). *British Plant Communities, vol. 2* **AF App7 AF App8** *: Mires and Heaths; vol. 4 Aquatic Communities, swamps and tall-herb fens.* University Press, Cambridge. **AF App9** Volumes cited are the ones used in this Proof.

Juncus articulatus and *Pinguicula vulgaris* were all recorded from Askham Bog in the 19th century. If this identification is correct, it suggests that formerly there were soligenous M10 communities (i.e. dependent on seepage of base-rich groundwater, probably from the York moraine). This mire community is now almost confined to upland areas in Scotland and northern England but would once have been more widespread.

3.7. The drying of the site has been associated in part with the development of tree cover on the site. However, early maps[7] show clearly that much of the site was wooded at a time when these mire communities persisted at Askham Bog. Land drainage over a long period of time linked with urban and infrastructure development in the vicinity of the bog has certainly also played a major role. This process of desiccation has been stabilised in recent years through the work carried out by YWT, and plans to restore these and similar plant communities on the site depend upon now reversing the negative trend.

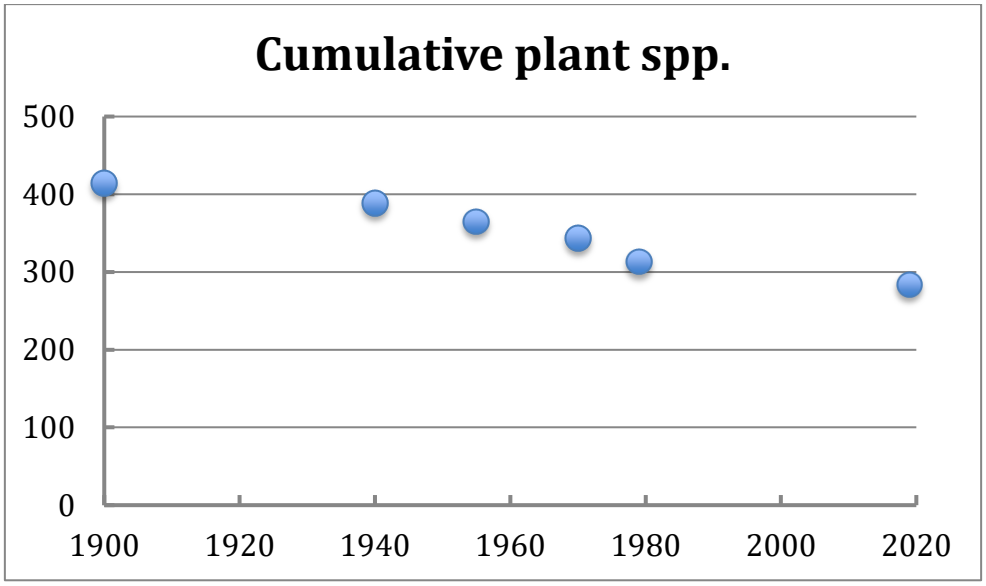

Figure 1. The total number of plant species recorded from Askham Bog has declined progressively over the last 100 years.

[7] e.g. Robert Cooper (1832) AF **App10** ~~available in Fitter and Smith~~), Ordnance Survey (1849~~7~~) AF **App11** ~~available in Ove Arup~~; see Fitter and Smith (1979), *op. cit.*, p. 18; Arup (2003), Fig. 3.2 for details.

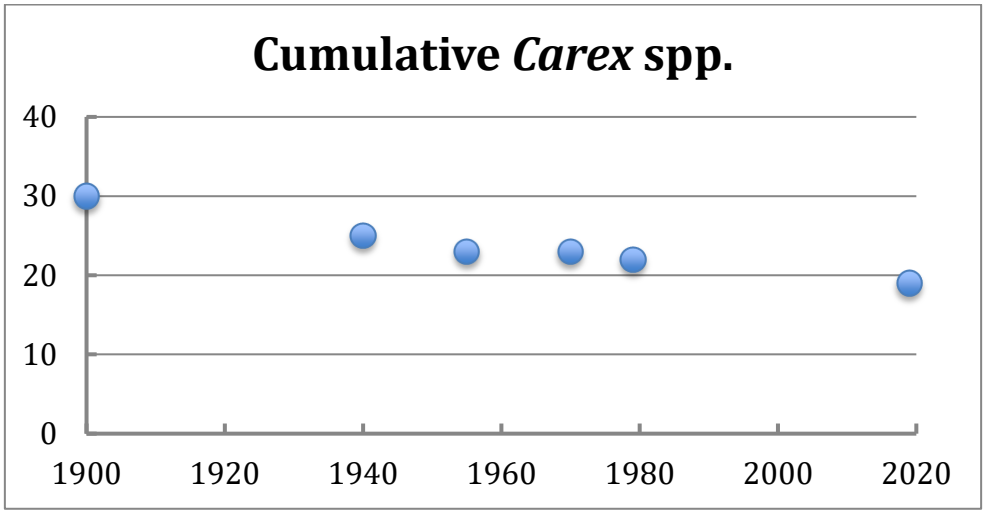

Fig. 2. The total number of species of sedge Carex*, many of which are indicator species of wet ground, has declined progressively, but the rate of decline was slightly more rapid in the early part of the period.*

	Date of last record	
Habitat	**pre 1900**	**1900-1940**
Open water	*Berula erecta*	*Apium inundatum*
	Eleogiton fluitans	*Baldellia ranunculoides*
	Hydrocharis morsus-ranae	*Butomus umbellatus*
	Myosotis secunda	*Ranunculus peltatus*
	Ranunculus circinatus	*Utricularia vulgaris*
	Sparganium natans	
Mire	*Carex dioica (M9,* ***M10****)*	*Anagallis tenella*
	Hypericum elodes	*Carex lasiocarpa (M5, M9)*
	Pedicularis sylvatica (M10)	*Carex limosa (M9)*
	Pinguicula vulgaris (M10)	*Lycopodiella inundata*
	Samolus valerandi	*Narthecium ossifragum (M9, M10)*
	Trichophorum germanicum (M10)	
Fen	*Dryopteris cristata*	
	Lathyrus palustris	
Grassland & heath	*Carex binervis*	
	Carex pallescens	
	Carex pilulifera	
	Coeloglossum viride	

Table 1. Plant species characteristic of open water and mire habitats were mainly lost in the late nineteenth and early twentieth centuries (Data from Fitter & Smith 1979; nomenclature following Stace 2019). Species found in NVC communities M5, M9, and M10, which seem likely to have been present formerly on the site, are noted in parenthesis, in bold where the species is a constant (Rodwell 1991). Only one mire species was lost after 1940: Pedicularis palustris *(M9, M10).*

4. Management and recovery

4.1. The YWT has taken extensive action to protect the Bog, with control of water loss being early recognised as critical. The ancient cross-ditches were dammed at their northern ends and, from the 1970s onwards, the tree cover in Near Wood[8] was largely cleared, reducing the rate of evapotranspiration and further conserving water. In addition, large areas of fen have been either grazed or mown on a regular basis, to prevent recolonisation by trees.

4.2. These management practices have resulted in the re-appearance of a number of formerly locally extinct species on the site, notably several sedges. These include indicator species of wet mire conditions such as Star sedge *Carex echinata*, Bladder sedge *C. vesicaria* and Cotton grass *Eriophorum angustifolium*. Other sedges typical of wet woodland and fen, including Remote sedge *C. remota* and Hop sedge *C. pseudocyperus* have also re-colonised.

4.3. The most remarkable recovery has been by the wetland sedge *Carex elongata*. Until the 1990s this plant was restricted to a small area of Far Wood, and when the colony there was surveyed in about 1990 it comprised around 250 plants. Even so, it was then the largest colony in England, where its current status is 'Near Threatened'. A resurvey in 2019 has revealed that it has increased markedly in numbers – there are now around 6000 plants – and expanded greatly in range, occurring over a much larger area of Far Wood and into Middle Wood, having crossed the raised causeway that traverses Middle Wood. This sedge is dependent on a fluctuating water table, including winter flooding[9]. It is hard to see how this species would have been able to cross the causeway into Middle Wood other than by water-borne seeds at times of flood.

4.4. In the early 1970s, another species of conservation significance, Greater fen sedge or Saw sedge *Cladium mariscus*, once abundant at the site, persisted as two small, non-flowering colonies. Following careful management and improvement of the water balance, *C. mariscus* is now thriving at Askham Bog, flowering and setting seed. It occurs in large, vigorous patches in both Near and Middle Woods, although it is otherwise rare in the region, as it always has been: in 1879 H. Ibbotson stated: "it has not been recorded for any other locality within at least 30 miles"[10]. This is a species found in calcareous fens with a strong groundwater influence and its presence here demonstrates clearly the influence of groundwater on the communities at Askham Bog. It follows that the simplistic view of the hydrogeology of the site being entirely determined by precipitation cannot be sustained.

4.5. Another major range expansion has occurred with the scarce Marsh fern *Thelypteris palustris*, another species dependent on groundwater influence. This formerly occurred in small quantities in the south-east corner of Far Wood. It is now found in abundance in most of the wetter, low-lying areas of Far Wood, but also in grazed

[8] Askham Bog is divided by ancient cross-dykes into four compartments, referred (going east to west) as Near Wwood, Middle Wood, Far Wood and Gilson's Bog

[9] *Online Atlas of the British and Irish Flora,* (https://www.brc.ac.uk/plantatlas/). **AF App 12**

[10] quoted by Le Tall, BB (1879) Flowers and Ferns of Askham Bog in *The Societies in Friends Schools. The Natural History Journal* **AF App13**

fen in Middle Wood and carr woodland in Near Wood. The spread into a diversity of habitats in this case argues strongly for a general improvement in conditions, most probably wetter ground conditions, rather than a specific management intervention, as it now occurs in wooded and open areas, and in grazed and ungrazed areas.

4.6. It is notable that these species include those that are dependent on the influence of groundwater (e.g. those in paras 4.2, 4.4 and 4.5) and also those that need winter flooding to survive (para 4.3). This variety of ecological niche reflects the complex hydrology of the site. The typical hydrological year includes periods of flooding, usually in winter, which may only cover the very margins of the Bog, but may on occasion be more extensive, exceptionally covering the entire surface including the raised centre. These exceptional events have occurred at least twice in the last 50 years.

4.7. Even when the site is not flooded, the water table in winter is at or within a few cm of the peat surface, except in the highest (i.e. raised) central portions (see Plate 11 of Mr Jones' proof of evidence (JBA 2019). In a typical year, the water table begins to decline in May, driven both by losses of water to the north boundary drain and by evapotranspiration. In a dry summer, the water table can fall to 50-70 cm below the peat surface, at which point many of the wetland species discussed are at a competitive disadvantage to species with a broader ecological tolerance, such as nettles *Urtica dioica* and the invasive alien Himalayan Balsam *Impatiens glandulifera.* A critical period is late spring/early summer; a low water table at that time leads to notably strong growth of nettles later in the year.

4.8. The critical management need therefore is both to allow flooding in winter and, most importantly, to minimise the losses of water in summer.

4.9. All the species discussed in this section are important elements of the threatened wetland communities at the site and all are associated with the influence of groundwater. There is therefore good evidence that it is possible to further restore the communities at Askham Bog by appropriate management and hydrological interventions, the latter being dependent upon the surrounding land not being further developed.

5. Extant plant communities

5.1. The most recent NVC survey of Askham Bog[11] identified 4 mire, 5 swamp/tall-herb fen and 5 woodland communities, viz. M22, M23, M25, M27, S4, S5, S24, S26, S27, W2, W4, W5, W6, W10). Almost all of these are characteristic of a variety of topogenous habitat conditions: in other words, they do not typically occur on ombrogenous peat where rainfall is the sole determinant of hydrology[12].

5.2. NVC community S24 (*Phragmites australis – Peucedanum palustre* tall-herb fen) is described[13] as 'generally restricted to fen peats with a moderate to high summer water-table and some winter flooding with base-rich, calcareous and often oligotrophic waters' and as 'a community of topogenous mires, occurring where [there has been] long and complex histories of exploitation for peat". Similarly S25 (*Phragmites australis – Eupatorium cannabinum* tall-herb fen) is "most characteristic of moderately eutrophic situations where mineral or organic soils are irrigated and frequently waterlogged by usually calcareous and base-rich waters", while S27 occurs on 'peaty soils kept moist by mesotrophic to oligotrophic, neutral to moderately base-rich and calcareous waters". S27 (*Carex rostrata – Potentilla palustris* tall-herb fen) has a summer water table no more than 40 cm below the surface[12].

5.3. NVC community S24 equates to the European-level habitat classification of 'Calcareous fens with *Cladium mariscus* and *Caricion davallianae* species (CFC)'[14], alternatively known as chalk-rich fen dominated by saw sedge[15], which is an Annex 1 habitat type[16] (7210). In addition, S27 at Askham Bog can be ascribed to the 'Transition mire and Quaking Bog' Annex 1 habitat type (7140).

5.4. Both of these two plant communities are of both national and European conservation importance. The 'calcareous fens' habitat type is a European 'Priority' habitat; i.e. it is considered of greater importance still than other European habitats listed in Annex I. The great majority of this habitat in England is in East Anglia; in the rest of England only ~40 ha survives, such that the 2.70 ha identified by the 2011 NVC survey at Askham Bog (Table 2) is of substantial importance. The overall conservation status of habitat type 7210 in England is classified as 'Bad', due

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[11] Prosser M and Wallace H (2011). National Vegetation Classification Survey. Askham Bog 2011. Ecological Surveys, Bangor **AF App6**

[12] Topogenous peat refers to peat developed where there is a strong influence of groundwater; ombrogenous peat is rain-fed and occurs where the peat surface grows above the influence of groundwater. Raised bogs are ombrogenous; fens are typically topogenous.

[13] Rodwell J 1995. *British Plant Communities,* vol. 4. Cambridge University Press, p. 224 **AF App9**

[14] JNCC Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* https://sac.jncc.gov.uk/habitat/H7210/ **AF App 14**

[15] Wheeler, B.D., Shaw, S., & Tanner, K. 2009 A wetland framework for impact assessment at statutory sites in England and Wales Integrated Catchment Science Programme Science Report.**AF App 15**

[16] Annex 1 habitats are those recognized by the European Directive as requiring conservation intervention, and correspond to the priority habitats of the UK Biodiversity Action Plan

to both habitat area and habitat structure and function being insufficient for viable conservation[17].

S24		**Phragmites australis-Peucedanum palustre tall-herb fen**	Extent (ha)
	d	**Typical subcommunity**	2.24
	g	**Myrica gale subcommunity**	0.46
S26		**Phragmites australis-Urtica dioica tall herb fen**	
	a	**Filipendula ulmaria subcommunity**	0.58
	b	**Arrhenatherum elatius subcommunity**	1.49
S27		**Carex rostrata-Potentilla palustris tall-herb fen**	
	b	**Lysimachia vulgaris subcommunity**	0.23

Table 2. Areal extents of tall-herb fen communities at Askham Bog (Prosser and Wallace 2011)

5.5. The Third Report by the United Kingdom under Article 17 for H7210 - Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (2013) [18] notes that a Favourable Reference Area (FRA) for this community cannot be determined due to inadequate information, but it is considered that the FRA would be more than 10% above the current area range, which means that at present the designated area of this habitat is insufficient to ensure its long term viability. In particular the Report indicates (p.7; 2.4.12.d): '*… the general opinion of experts now is that because this habitat has been greatly reduced in extent, and in many cases occurs in relatively small isolated sites that are frequently adjoined by intensive land uses, it is particularly vulnerable to pollution and other degradation, and the FRA is more than 10% above the current area.*'

5.6. It is also notable that '*Tall-sedge base-rich fens*' (which cover these communities) are regarded as '**Endangered**', the second highest threat level, in the recently published *European Red List of Habitats* (2016)[19]. There is therefore an urgent need to ensure that environmental and particularly hydrological conditions at Askham Bog are not only maintained but enhanced in order to promote recovery of these communities. This objective will be substantially undermined by the proposed development because it is expected to lead to disruption to the hydrology of the site, as demonstrated by the Proof of Evidence submitted by Mr Alex Jones (JBA).

5.7. The evidence above demonstrates that Askham Bog is a site of national conservation significance, both for the diversity of its habitats and the rare species they support, and importantly for its calcareous fen communities which are influenced by groundwater. That groundwater is important at Askham Bog is evident not only from the presence of particular plant communities but also from

[17] Hydrological Functioning Theme Plan Natural England, 2015, Annex 4, p.46. publications.naturalengland.org.uk/file/5406384017375232 **AF App16**

[18] European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora(92/43/EEC). Third Report by the United Kingdom under Article 17, p. 7, 2.4.12d: http://jncc.defra.gov.uk/pdf/Article17Consult_20131010/H7210_UK.pdf **AF App 17**

[19] European Red List of Habitats (2016). Part 2 Terrestrial and Freshwater Habitats. Box 3.2, p. 14 https://ec.europa.eu/environment/nature/knowledge/pdf/terrestrial_EU_red_list_report.pdf **AF App18**

the pronounced concentric pattern of peat pH[20]. The very low peat pH values in the raised central area (12.00 -12.25 m AOD) is evidence of ombrotrophic (rain-fed) conditions. The marginal areas have a much higher pH, showing the influence of base-rich water.

5.8. The evidence presented demonstrates that the assertions by the Appellant that Askham Bog is dependent on rainfall[21] represent a misunderstanding of the hydrology of the Bog. It is likely that rainfall is the main input of water to the Bog, but what determines the plant communities on the site is the level of the water table at different times of year (see section 4, above), which is determined by losses of water from the Bog. An analogy would be with a sink: although the tap is essential for filling the sink, the rate of flow and the source of the water are not the critical determinants of the level of water in it. That is determined by the effectiveness of the plug and the position of the overflow.

5.9. There are 4 possible sources of the basic minerals – probably principally Calcium - that give rise to the patterns of peat chemistry on the site:

1. water seeping from the moraine: this is true on the south side but does not concern this analysis
2. residual minerals left from an earlier time when there was a functioning lagg: unlikely still to be having such a large influence
3. surface flow from the north boundary drain at times of high water table: known to occur and to be important for some of the plant communities
4. direct absorption by plants rooting through thin peat into the Alne formation: on the northern margins of the Bog, the peat layer is in places very thin and lies directly on Alne formation deposits. Plant roots will therefore have direct access to base-rich water in the formation and will raise the bases to the surface.

5.10. The active management of the site, including hydrological restoration by YWT, is progressively enhancing the quality and diversity of the habitat, but it is absolutely dependent on maintaining and raising the water levels in the Alne formation that support the surface water layers in the peat. Importantly, several of the current habitat types and characteristic plant species at Askham Bog are strongly influenced by groundwater, probably involving mechanisms 3 and 4 in para. 5.6 (above). This is particularly the case for the following NVC communities[22], all of which are represented at Askham Bog:

- M22 *Juncus subnodulosus - Cirsium palustre* fen meadow

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[20] see Mr A Jones Proof of Evidence Plate 11 **AF App19**

[21] e.g. Environmental Statement Addendum Appendix 3 (WWT Consulting), para 4.2: 'It is the opinion of the authors, following review of the information provided and familiarity with the site, that precipitation is the primary hydrological input to Askham Bog SSSI." **AF App 24**

[22] UK Technical Advisory Group on the Water Framework Directive: Risk assessment of groundwater dependent terrestrial ecosystems, Annex 1. https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf **AF App20**

- M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture
- S2 *Cladium mariscus* swamp and sedge beds
- S24 *Phragmites australis – Peucedanum palustre* tall-herb fen
- S25 *Phragmites australis – Eupatorium cannabinum* tall-herb fen
- and almost all the woodland communities (W2, W4, W5, W10)

5.11. There is reasonable expectation that with time, and assuming there are no further threats to its hydrological status, and especially if actions can be taken to enhance that status, the site will not only retain these existing wetland communities, but will again host substantial areas of wetland habitats that are threatened both nationally and at a European level, and are rare in the region.

6. Restoration

6.1. Despite the recovery that has already taken place in the state of the SSSI, large parts of Askham Bog are in unfavourable condition[23]. This is the condition of the fen communities in Near Wood which are close to the northern boundary ditch and therefore especially vulnerable to changes in water level. It is Government policy, and a clear obligation under the 25-year Environment Plan, to undertake actions to bring SSSIs back into favourable condition

6.2. In the case of a peat bog, the single most important action to be taken is the restoration of the hydrological regime that allowed the bog to form in the first instance. A natural peat bog will typically have an ombrotrophic centre, as at Askham Bog, and it will be surrounded by a lagg, a zone of usually shallow peat or mineral soils, whose hydrology supports the water table in the main part of the bog.

6.3. A JNCC (Joint Nature Conservation Committee) report in 2005[24] states this relationship very clearly: "There is a specific relationship between the level of water around a bog and that at its centre. Take away the water from around its edge, and the centre suffers. Important bog margin habitats such as lagg fen and wet woodland are also lost, creating artificially sharp boundaries between what remains of the bog and its hinterland. The corollary is that if bog restoration is to be successful, we must return water to the edge of the bog."

6.4. Recovery of Askham Bog to favourable condition therefore depends on improving the hydrological conditions. The site has been isolated from its catchment by the northern boundary ditch, which was certainly dug before the 19th century, by the conversion of the lagg wetlands to agricultural and related use, and by drainage of the catchment leading to a lowered local water table. An effective recovery programme would involve restoring the lagg, whose original dimensions are suggested clearly by the LIDAR contour map[25], following the 12.25 m contour.

6.5. The proposed development would permanently render such a restoration programme impossible, both by development of part of the catchment and importantly by the construction of the bund in the buffer zone, which follows closely the outer boundary of the Bog and therefore sits in the original lagg fen. The construction of the earth bund would have this additional damaging effect on the Bog, in addition to the ecological isolation and aesthetic impacts referred to elsewhere (see Proof of Evidence by Professor Sir John Lawton).

6.6. This analysis shows that the plant communities at Askham Bog depend on a complex of water sources (rainwater, surface water and groundwater), and not as stated by the appellant solely on rainwater. The groundwater supply at Askham Bog, which has been shown to be critical to the ecological and hydrological integrity of the site, depends on the water body in the Alne Formation, as shown by the

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[23] Natural England designated sites https://designatedsites.naturalengland.org.uk/SiteUnitList.aspx?SiteCode=S1000196&SiteName=&countyCode=30&responsiblePerson=&unitId=&SeaArea=&IFCAArea= **AF App 21**

[24] Morgan-Jones, W. Poole, J.S, Goodall, R, (2005), Characterisation of Hydrological Protection Zones at the Margins of Designated Lowland Raised Peat Bog Sites, JNCC Report 365, ISSN 0963-8091. Foreword. AF **App22**

[25] Map 2, Proof of Evidence by Mr A. Jones 2019 **AF App23**

proof of evidence to this inquiry by Mr Alex Jones (JBA), and the proposed surface water attenuation features proposed by the Appellant cut into this formation, creating the risk of severance or drawdown of the groundwater and consequent damage to these nationally significant communities.

7. Conclusions

7.1 This Proof of Evidence demonstrates that the plant communities and rare species of Askham Bog SSSI are dependent on a complex hydrogeology in which precipitation, surface flow and groundwater are all important. The evidence from Mr Alex Jones (see Proof of Evidence) shows that the proposed development risks damaging the hydrology of the site because the Appellant has failed to develop a proper conceptual model. There is therefore a real risk that the development, if it were to proceed, would lead to further losses of endangered habitats and their associated species from the SSSI.

7.2 The national and European importance of the habitats at the site is such that there is a legal requirement under the Habitats Directive and UK Government policies to ensure that they are not only sustained but enhanced. To achieve enhancement and recovery to a favourable state will require improvements in the hydrological status of Askham Bog, which would almost certainly involve more sympathetic management of the wider catchment. The proposed development would render that impossible in perpetuity.

7.3 In these respects the proposed development runs counter to paragraphs 170 and 175 of the National Planning Policy Framework, which refer to "*"protecting and enhancing valued landscapes, sites of biodiversity"* and state that *"Development of land within or outside a SSSI and which is likely to have an adverse effect on it (either individually or in combination with other developments) should not normally be permitted ".* The NPPF also requires that *"Development resulting in the loss or deterioration of irreplaceable habitats…[….] should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists….".* The habitats at Askham Bog SSSI are indeed irreplaceable, as this Proof of Evidence has demonstrated, and will deteriorate if the development were to proceed.

7.4 These conclusions therefore support Reason for refusal 2 (RR2) in the City of York Council's decision to refuse planning permission:

> *The proposed drainage scheme and Environmental Protection and Enhancement Zone associated with the residential development are considered to have an adverse impact on Askham Bog Site of Special Scientific Interest as a result of changes likely to occur to the hydrological/ hydro-geological interaction between the development site and the Bog. The proposals are considered contrary to paragraph 175 of the National Planning Policy Framework and policies DP2 Sustainable Development, DP3 Sustainable Communities, GI2 Biodiversity and access to nature and GI3 Green Infrastructure Network of the emerging Local Plan.*

Appendix 1

Bibliography of scientific papers

This Bibliography lists only published material. In addition, a large number of undergraduate research projects have been carried out at Askham Bog, principally from the University of York but also from the University of Leeds, York St John University and other Universities.

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