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Habitats Regulations Assessment for the City of Bradford District Core Strategy

Appropriate Assessment Report for the Further Engagement Draft Document (October 2011)

May 2013

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List of Tables and Figures

Abbreviations

BBS	Breeding Bird Survey
BoCC	Bird of Conservation Concern
CRoW Act	Countryside and Rights of Way Act 2001
Dpa	Dwelling per hectare
DPD	Development Plan Document
FCT	Favourable Condition Tables
HRA	Habitats Regulations Assessment
LDF	Local Development Framework
Ml	Megalitres
Ml/d	Megalitres per day
NO_X	Oxides of nitrogen
RSS	Regional Spatial Strategy
SAC	Special Area of Conservation
SPA	Special Protection Area
Sqm	Square metres
SSSI	Site of Special Scientific Interest
WRMP	Water Resource Management Plan
WWTW	Waste Water Treatment Works

Executive Summary

E1 Introduction

E1.1 The City of Bradford Metropolitan District Council is preparing the Core Strategy Development Plan Document as part of the district's Local Development Framework. As an integral part of this process, the Council is undertaking a Habitats Regulations Assessment to ensure that the Core Strategy does not lead to adverse effects on the ecological integrity of internationally important habitats or species assemblages within or close to the district.

E1.2 Habitats Regulations Assessment (HRA) is a requirement of the Conservation of Habitats and Species Regulations 2010 (commonly referred to as 'the Habitats Regulations'), and must be applied to any plan or project in England and Wales with the potential to adversely affect the ecological integrity of any sites designated for their nature conservation importance as part of a system known collectively as the Natura 2000 network of European sites.

E1.3 The Council previously undertook a joint HRA screening assessment for the Draft Core Strategy and Draft Waste Management DPD (Environ, 2012) which found that the Core Strategy was considered likely to lead to significant effects on European sites in and around the district. This document updates the HRA and contains a more detailed assessment (known as 'Appropriate Assessment') of issues affecting the European sites.

E1.4 However, the Appropriate Assessment applies retrospectively to the Core Strategy (Further Engagement Draft, October 2011). It is intended to inform Officers and Councillors of the potential scale of impacts to European sites, based on currently available information, while setting out preliminary recommendations for avoiding adverse effects on the integrity of European sites. A further iteration of the Appropriate Assessment will add greater detail to the avoidance strategy, while also updating the assessment in relation to the Core Strategy Proposed Submission Document.

E1.5 Chapters 1and 2 introduce the Core Strategy, its HRA and the methods used in the assessment.

E2 Scope of the Assessment

E2.1 European sites considered within the scope of this assessment include all those identified during the earlier screening assessment as likely to be significantly affected by Core Strategy developments:

- South Pennine Moors SAC;
- South Pennine Moors SPA;
- North Pennine Moors SAC; and
- North Pennine Moors SPA.

E2.2 These four European sites have been designated to conserve similar groups of upland habitats, wading birds and raptors, although there are some significant differences between them; see Chapters 3 and 4 for a review of qualifying habitats and species, and their conservation objectives.

E3 Impact Pathways

E3.1 The HRA screening assessment identified a range of likely significant effects on the North and South Pennine Moorlands that could result from the Core Strategy for Bradford district. This list has been reviewed and rationalised, with new impact categories added as part of the Appropriate Assessment procedure. Impact pathways now considered likely to significantly affect the European sites are:

- Loss of supporting feeding sites to development;
- Increased emissions to air from road traffic;
- Collision mortality risk and displacement due to wind turbine developments;
- Recreational impacts, including walkers, dogs, trampling and erosion; and
- A range of urban edge effects, including fly-tipping, invasive species, off-road vehicle use, wildfire and increased predation.

E3.2 Chapter 5 describes the available evidence about these impact pathways in relation to the North and South Pennine Moors.

E4 Impact Assessment

E4.1 Based on the information currently available, the assessment has not been able to demonstrate that the Core Strategy is capable of avoiding or mitigating the impacts of development. As a result, and in accordance with the precautionary principle, the HRA currently concludes that adverse effects on ecological integrity are likely to occur for all four European sites included within the scope of the assessment. However, adverse effects resulting from increased water demand or impacts on water quality are not considered likely.

E4.2 The distribution and magnitude of impacts differs between the four designated areas. For example, impacts are likely to be of a greater magnitude within the South Pennine Moors sites due to their relative proximity and accessibility to development projects within the district. Chapters 6 and 7 describe how the impacts are likely to affect each site, and determine whether there would be adverse effects on ecological integrity.

E5 Recommendations and Conclusions

E5.1 A variety of recommendations are made, focusing on the need for additional studies and changes to the development strategy and policy content. These are grouped into the following themes:

- Understanding carrying capacity (further evidence gathering);
- Adjusting the rate, scale and spatial distribution of development;
- Decreasing the overall impact;
- Identifying strategic avoidance measures;
- Designing site-specific mitigation measures; and
- Small scale policy recommendations.

E5.2 A further iteration of the Appropriate Assessment will add greater detail to the avoidance and mitigation strategy, while also updating the assessment in relation to the Core Strategy Proposed Submission Document.

E6 Next Steps

E6.1 The Council is currently working to update the evidence base underpinning a number of aspects of the Core Strategy, notably demographic forecasts, assessments of housing need and the infrastructure delivery plan. Further studies are also scheduled for 2013 to address some of the data gaps highlighted by this Appropriate Assessment, including breeding bird surveys, habitat surveys and visitor activity surveys.

E6.2 It is anticipated that, once these are complete, amendments will be made to the overall level and distribution of development across the district. This provides the opportunity to consider the findings of the HRA, and to adjust the development strategy to reduce the magnitude of impacts to European sites.

E6.3 The Council will be seeking the views of Natural England and other interested stakeholders in relation to the HRA conclusions before embarking on additional studies as recommended by this assessment.

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1 Introduction

1.1 Background

1.1.1 The City of Bradford Metropolitan District Council is preparing the Core Strategy Development Plan Document (DPD) as part of the district's Local Development Framework (LDF). As an integral part of this process, the Council is undertaking a Habitats Regulations Assessment to ensure that the Core Strategy does not lead to adverse effects on the ecological integrity of internationally important habitats or species assemblages within or close to the district.

1.2 Requirement for Habitats Regulations Assessment

1.2.1 Habitats Regulations Assessment (HRA) is a requirement of the Conservation of Habitats and Species Regulations 2010 (commonly referred to as 'the Habitats Regulations'), the UK's transposition of European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('the Habitats Directive').

1.2.2 Under Regulation 102, HRA must be applied to any plan or project in England and Wales with the potential to adversely affect the ecological integrity of any sites designated for their nature conservation importance as part of a system known collectively as the Natura 2000 network of European sites.

1.2.3 European sites provide ecological infrastructure for the protection of rare, endangered or vulnerable natural habitats and species of exceptional importance within the European Union. These sites consist of Special Areas of Conservation (SAC, designated under the Habitats Directive) and Special Protection Areas (SPA, designated under European Council Directive 2009/147/EC on the conservation of wild birds ('the Birds Directive')). Meanwhile, the National Planning Policy Framework (DCLG, 2012) and Circular 06/05 (ODPM, 2005) require that Ramsar sites (UNESCO, 1971) are treated as if they are fully designated European sites for the purposes of considering development proposals that may affect them.

1.2.4 An HRA must determine whether or not a plan or project will adversely affect the integrity of the European site(s) concerned, in view of the site's conservation objectives.

1.3 Bradford District Core Strategy – Further Engagement Draft (October 2011)

1.3.1 The Core Strategy (Further Engagement Draft) is the culmination of several years' work and forms the central strategic planning document for the district. It will govern the way in which development is planned and managed for the period through to 2028.

1.3.2 The preferred spatial development option for the plan identifies the following development aims for the district over the plan period and provides for:

- A total of 44,500 new dwellings and 146ha of new employment land;
- Directing development-led regeneration towards the Regional City of Bradford as the main priority, together with strategic development aims for the Principal Towns (Keighley, Bingley and Ilkley) and Local Growth Centres (Burley in Wharfedale, Menston, Queensbury, Silsden, Steeton with Eastburn and Thornton);
- Development to meet projected housing need in the Local Service Centres;
- Growth areas, an urban extension (at Holme Wood), local green belt deletions and a focus on previously developed land; and
- A wide variety of infrastructure, ancillary and supporting development to achieve regeneration and build sustainable communities.

1.3.3 The Key Diagram for the Core Strategy (Further Engagement Draft, October 2011) is shown at Figure 1.1, while the distribution of residential development (which is the primary focus of the HRA) is listed in Table 1.1. The relative scale of residential development is illustrated at Figure 1.2.

Table 1.1: Preferred spatial distribution of residential development

Preferred spatial distribution of residential development			
Regional City of Bradford			
Bradford City Centre	3500	**Canal Road**	3000
Shipley	2000	**SE Bradford**	6000
NE Bradford	5000	**SW Bradford**	4500
NW Bradford	4000	**-**	-
Principal Towns			
Keighley	5000	**Bingley**	1600
Ilkley	1300	**-**	-
Local Growth Centres			
Burley in Wharfedale	500	**Menston**	900
Queensbury	1500	**Silsden**	1700
Steeton w/ Eastburn	800	**Thornton**	700
Local Service Centres			
Addingham	400	**Baildon**	550
Cottingley	300	**Cullingworth**	200
Denholme	450	**East Morton**	150
Harden	150	**Haworth**	600
Oakworth	250	**Oxenhope**	150
Wilsden	300	**-**	-

1.4 Purpose and Structure of this Document

1.4.1 The Council previously undertook a joint HRA screening assessment for the Draft Core Strategy and Draft Waste Management DPD (Environ, 2012) which found that the Core Strategy was considered likely to lead to significant effects on European sites in and around the district. This document updates the HRA and contains a more detailed assessment (known as 'Appropriate Assessment') of issues affecting the European sites.

1.4.2 However, the Appropriate Assessment applies retrospectively to the Core Strategy (Further Engagement Draft, October 2011). It is intended to inform Officers and Councillors of the potential scale of impacts to European sites, based on currently available information, while setting out preliminary recommendations for avoiding adverse effects on the integrity of European sites. A further iteration of the Appropriate Assessment will add greater detail to the avoidance strategy, while also updating the assessment in relation to the Core Strategy Proposed Submission Document.

1.4.3 The findings of the report include information in relation to:

- **Chapter Two:** HRA methodology;
- **Chapter Three:** European site features and conservation objectives;
- **Chapter Four:** Baseline information about the European sites;
- **Chapter Five:** Identifying impact pathways;
- **Chapter Six:** Assessment of impacts;
- **Chapter Seven:** Determining whether there will be adverse effects on integrity;
- **Chapter Eight:** Interim recommendations on avoidance and mitigation; and
- **Chapter Nine:** Summary and conclusions.

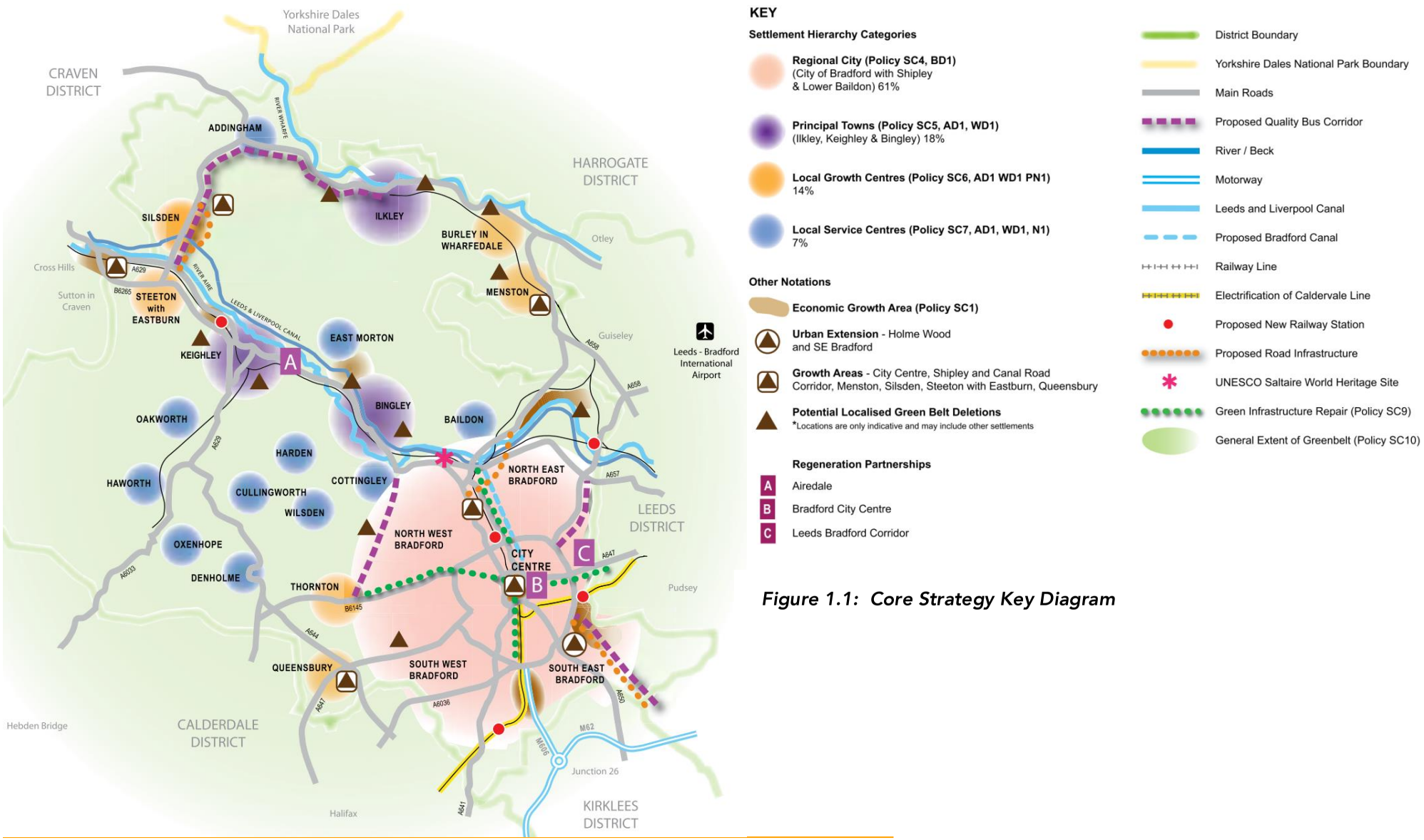

Figure 1.1: Core Strategy Key Diagram

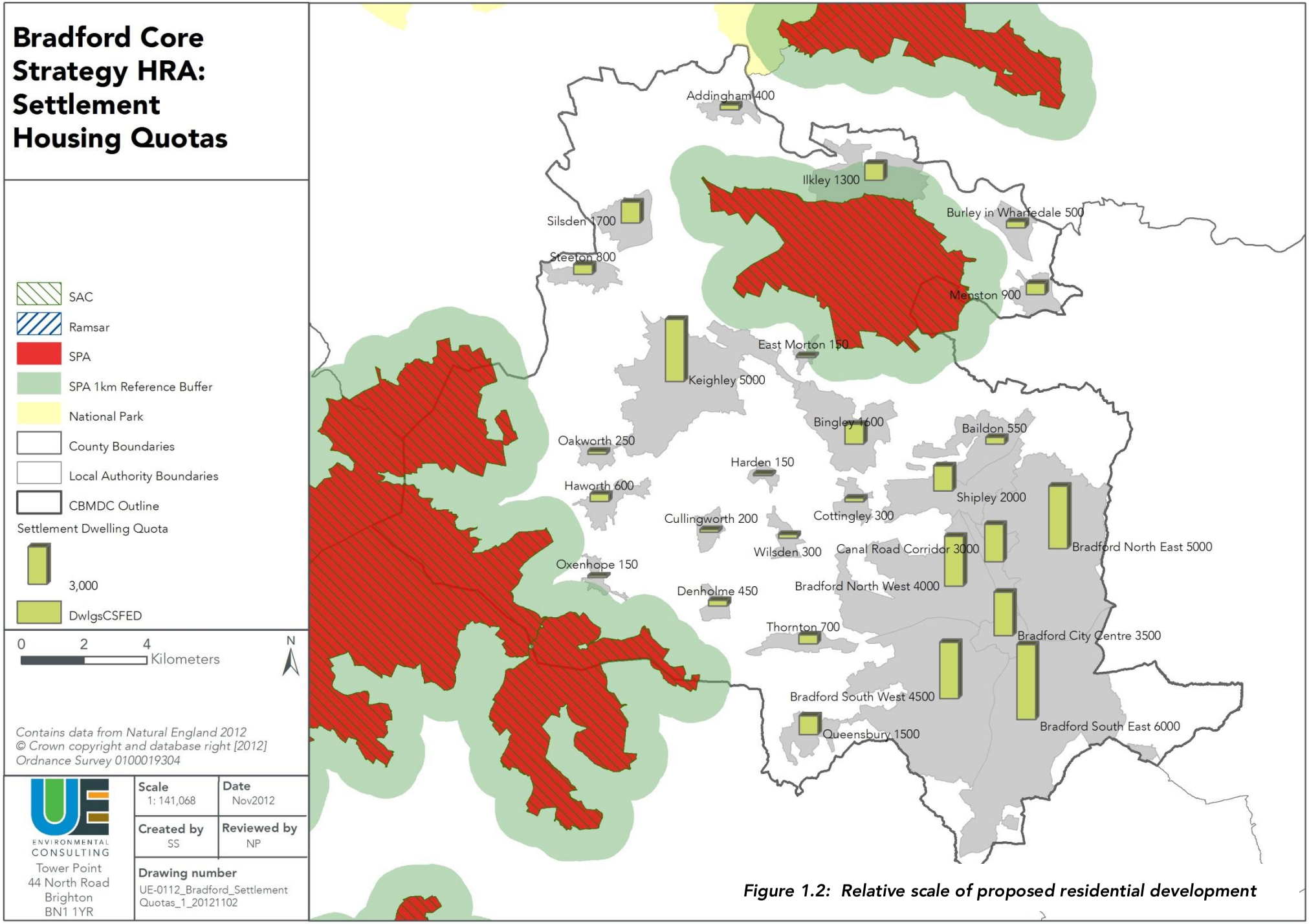

Figure 1.2: Relative scale of proposed residential development

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2 Methodology

2.1 Guidance and Best Practice

2.1.1 Draft guidance on HRA has been defined by DCLG (2006) with more detailed draft guidance from Natural England (Tyldesley, 2009) and a range of other bodies[1]. The guidance recognises that there is no statutory method for undertaking Habitats Regulations Assessment and that the adopted method must be appropriate to its purpose under the Habitats Directive and Regulations. DCLG guidance identifies three main stages to the HRA process:

- Screening: Analysing draft options for likely significant effects on internationally designated sites;
- Appropriate Assessment: Ascertaining the effects on site integrity; and
- Alternative Solutions: Devising alternatives to the plan options, avoidance or mitigation measures.

2.1.2 An HRA must determine whether or not a plan or project will adversely affect the integrity of the European site(s) concerned, in view of the site's conservation objectives. Where adverse effects are anticipated changes must be made to the plan or project. The process is characterised by the precautionary principle. The European Commission (2000a) describes the principle as follows:

> *"If a preliminary scientific evaluation shows that there are reasonable grounds for concern that a particular activity might lead to damaging effects on the environment, or on human, animal or plant health, which would be inconsistent with the protection normally afforded to these within the European Community, the Precautionary Principle is triggered.*
>
> *"Decision-makers then have to determine what action to take. They should take account of the potential consequences of taking no action, the uncertainties inherent in the scientific evaluation, and they should consult interested parties on the possible ways of managing the risk. Measures should be proportionate to the level of risk, and to the desired level of protection. They should be provisional in nature pending the availability of more reliable scientific data.*
>
> *"Action is then undertaken to obtain further information enabling a more objective assessment of the risk. The measures taken to manage the risk should be maintained so long as the scientific information remains inconclusive and the risk unacceptable."*

2.1.3 The hierarchy of intervention is important: where significant effects are likely or uncertain, decision-makers must firstly seek to avoid the effect through for example, a change of policy. If

[1] For example European Commission (2001) and RSPB (Dodd *et al*, 2007)

this is not possible, mitigation measures should be explored to remove or reduce significant effects.

2.1.4 If neither avoidance, nor subsequent mitigation is possible, alternatives to the plan or project should be considered. Such alternatives should explore ways of achieving the objectives that avoid significant effects entirely. If there are no alternatives suitable for removing an adverse effect, decision-makers must demonstrate that there are Imperative Reasons of Overriding Public Interest to continue with the proposal. This is widely perceived as an undesirable position and should be avoided if at all possible.

2.2 Methodology

2.2.1 The guidance from DCLG and Natural England was written for use in assessing strategic plans. Where individual projects come into play, as may be the case for any individual site allocation requiring Appropriate Assessment for instance, it may prove to be more suitable to use previous guidance from Natural England's forerunner, English Nature (1997a&b, 1999 and 2001) in conjunction with guidance European Commission (2001) and Countryside Council for Wales (Tyldesley, 2011).

2.2.2 The overall objective of an Appropriate Assessment will be to ascertain whether any part of the plan will lead to an adverse effect on the ecological integrity of nearby European sites and, if so, make recommendations on how such effects can be avoided or mitigated. It will be carried out in accordance with the draft Natural England guidance (Tyldesley, 2009) as summarised in Table 2.1.

2.3 Screening

2.3.1 All proposed policies were screened for likely significant effects on the European sites. Such effects can be sorted into one of 17 categories which are derived from the draft HRA guidance document produced for Natural England (Tyldesley, 2009). They help to determine which, if any, elements of the plan would be likely to have a significant effect on any interest feature of any European site, alone or in combination with other projects and plans, directly or indirectly. The 17 categories fall into four broader sections which are described as:

Category A	Elements of the plan / options that would have no negative effect on a European site at all
Category B	Elements of the plan / options that could have an effect, but the likelihood is there would be no significant negative effect on a European site either alone or in combination with other elements of the same plan, or other plans or projects
Category C	Elements of the plan / options that could or would be likely to have a significant effect alone and will require the plan to be subject to an appropriate assessment before the it may be adopted
Category D	Elements of the plan / options that would be likely to have a significant effect in combination with other elements of the same plan, or other plans or projects and will require the plan to be subject to an appropriate assessment before the plan may be adopted

Table 2.1: Stages in the HRA process drawing on guidance from DCLG and Natural England

DCLG Stage	Natural England (Tyldesley) Steps		
AA1: Likely significant effects	1. Gather the evidence base about international sites.		
	2. Consult Natural England and other stakeholders on the method for HRA and sites to be included.		
	3. Screen elements of the plans for likelihood of significant effects.		
	4. Eliminate likely significant effects by amending the plan / option.		
	5. Consult Natural England and other stakeholders on the findings of the screening stage, and scope of the Appropriate Assessment if required.		
AA2: Appropriate Assessment and ascertaining the effect on integrity	6. Appropriate Assessment of elements of the plan likely to have significant effects on a European site.	8. Assess additions and changes to the plan and prepare draft HRA record.	ITERATIVE
AA3: Mitigation measures and alternative solutions	7. Amend the plan / option or take other action to avoid any adverse effect on integrity of European site(s).	9. Complete the draft Appropriate Assessment and draft HRA record.	
Reporting and recording	10. Submit draft HRA and supporting documents to Natural England.		
	11. Consult Natural England, other stakeholders and the public (if suitable).		
	12. Publish final HRA record and submit with Natural England letter to Inspector for Examination.		
	13. Respond to any representations relating to the HRA and to Inspector's questions.		
	14. Check changes to the plan, complete HRA record and establish any monitoring required.		

2.3.2 Categories A, C and D are subdivided so that the specific reason why the assessor has allocated the policy or proposal to that category is more transparent, and more directly related to the ways in which the plan may affect a European site. These subdivisions are detailed in Appendix I together with the findings of a revised screening exercise. The categories, and traffic light colour-coded sub-categories, provide the means of recording the results of the assessment in such a way that important issues are identified whilst policies that have no effect are screened out.

2.3.3 The ways in which each site might be significantly affected by proposed Core Strategy policies are described in Chapter 5.

2.4 The Appropriate Assessment Stage

2.4.1 The purpose of the Appropriate Assessment (HRA Stage AA2) is to further analyse likely significant effects identified during the screening stage, as well as those effects which were uncertain or not well understood and taken forward for assessment in accordance with the precautionary principle. The impact assessment (Chapter 6) seeks to establish whether or not the plan's effects, either alone or in combination with other plans or projects, will lead to adverse effects on site integrity, in view of the site's conservation objectives (see Chapter 3).

2.4.2 Site integrity can be described as follows (ODPM, 2005) and a summary description of effects on integrity for each site is given at Chapter 7:

> *"The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified."*

2.4.3 The assessment first focuses on the effects generated by the proposed policies of the Core Strategy and considers ways in which they can be avoided altogether. Where adverse effects cannot be avoided by changes to the plan, mitigation measures are introduced to remove or reduce the effects to the level of non-significance (Chapter 8). Any residual (non-significant) effects can then be taken forward for further analysis to establish whether they might be expected to become significant in combination with the effects of other plans or projects.

3 European Site Features and Conservation Objectives

3.1 Scope of the Assessment

3.1.1 Each European site has its own intrinsic qualities, besides the habitats or species for which it has been designated, that enable the site to support the ecosystems that it does. For example, an intrinsic quality of any European site is its functionality at the landscape ecology scale; in other words, how the site interacts with the zone of influence of its immediate surroundings, as well as the wider area.

3.1.2 Hence the ecological integrity of a site is influenced by natural and human-induced activities in the surrounding environment. This is particularly the case where there is potential for development to take land, generate water- or air-borne pollutants, use water resources or otherwise affect water levels, or involve an extractive or noise emitting use. Adverse effects may also occur via impacts to mobile species occurring outside of a designated site but which are qualifying features of the site. For example, there may be effects on protected birds that use land outside the designated site for foraging or roosting.

3.1.3 European sites considered within the scope of this assessment include all those identified during the earlier screening assessment (Environ, 2012) as likely to be significantly affected by Core Strategy developments, as shown on Figure 3.1 and listed below:

- South Pennine Moors SAC;
- South Pennine Moors SPA;
- North Pennine Moors SAC; and
- North Pennine Moors SPA.

3.1.4 These four European sites have been designated to conserve similar groups of upland habitats, wading birds and raptors, although there are some significant differences between them. Table 3.1 identifies the qualifying features of each site.

3.1.5 The following sections provide a description of the features for which each European site has been classified or designated. Chapter 4 goes on to provide more detailed information regarding the disposition of these features in the vicinity of Bradford.

Bradford Core Strategy HRA: European Sites

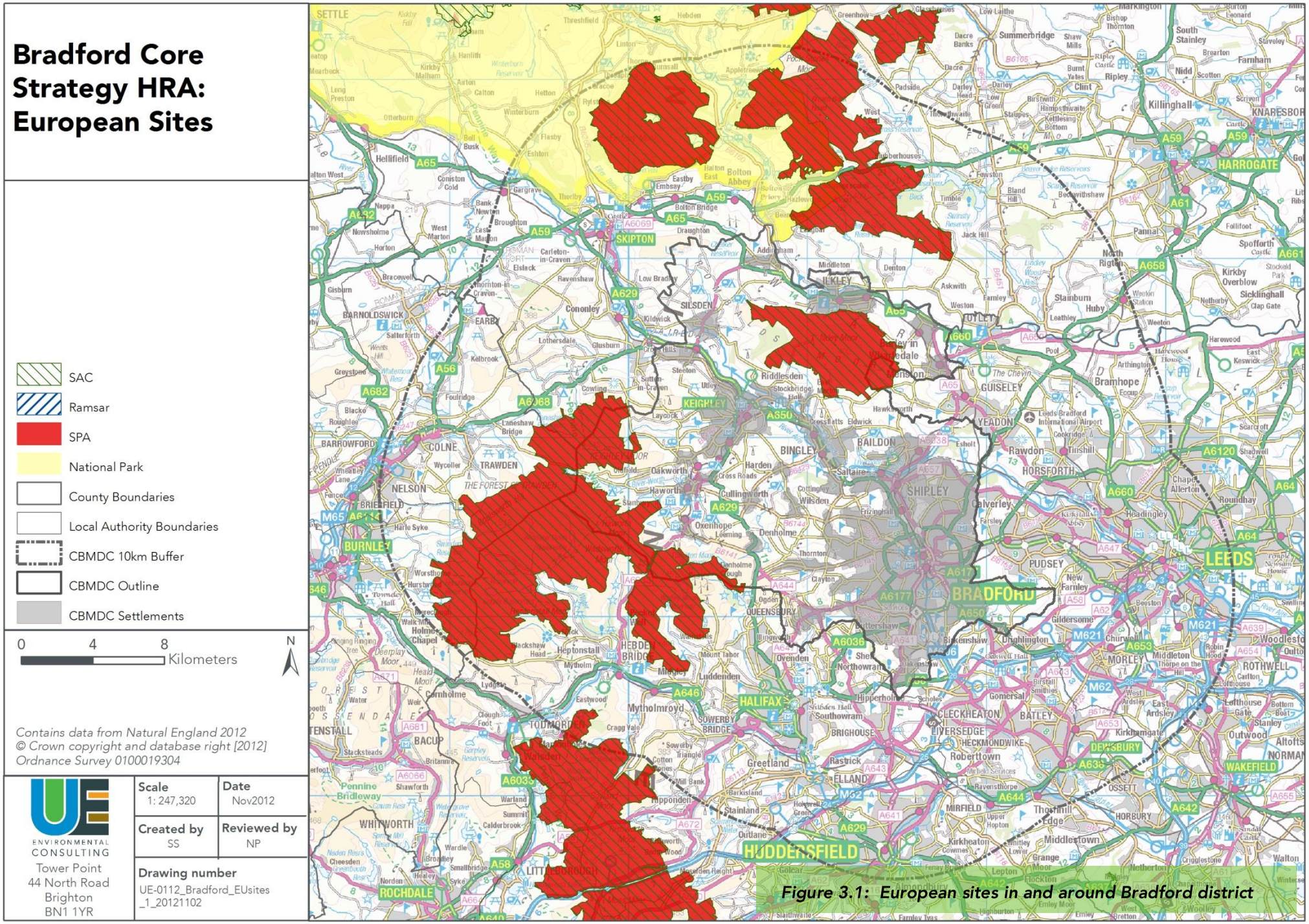


Figure 3.1: European sites in and around Bradford district

Table 3.1: European site qualifying features

South Pennine Moors SAC	South Pennine Moors SPA	North Pennine Moors SAC	North Pennine Moors SPA
Annex I Habitats (primary) ▪ 4030 - European dry heaths ▪ 7130 - Blanket bogs * Priority feature ▪ 91A0 - Old sessile oak woods with Ilex and *Blechnum* in the British Isles Annex I Habitats (not primary) ** ▪ 4010 - Northern Atlantic wet heaths with *Erica tetralix* ▪ 7140 - Transition mires and quaking bogs	Annex I Birds (breeding) ▪ A098 – Merlin *Falco columbarius* ▪ A140 - Golden Plover *Pluvialis apricaria* ▪ A149 - Dunlin *Calidris alpina schinzii* ▪ A103 - Peregrine Falcon *Falco peregrinus* ▪ A222 - Short-eared Owl *Asio flammeus*	Annex I Habitats (primary) ▪ 4030 - European dry heaths ▪ 5130 - *Juniperus communis* formations on heaths or calcareous grasslands ▪ 7130 - Blanket bogs * Priority feature ▪ 7220 - Petrifying springs with tufa formation (*Cratoneurion*) * Priority feature ▪ 8220 - Siliceous rocky slopes with chasmophytic vegetation ▪ 91A0 - Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I Habitats (not primary) ** ▪ 4010 - Northern Atlantic wet heaths with *Erica tetralix* ▪ 6130 - Calaminarian grasslands of the *Violetalia calaminariae* ▪ 6150 - Siliceous alpine and boreal grasslands ▪ 6210 - Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*) ▪ 7230 - Alkaline fens ▪ 8110 - Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) ▪ 8210 - Calcareous rocky slopes with chasmophytic vegetation Annex II Species * ▪ 1528 - Marsh saxifrage *Saxifraga hirculus*	Annex I Birds (breeding) ▪ A082 -Hen Harrier *Circus cyaneus* ▪ A098 – Merlin *Falco columbarius* ▪ A103 - Peregrine Falcon *Falco peregrinus* ▪ A140 - Golden Plover *Pluvialis apricaria* ▪ A149 - Dunlin *Calidris alpina schinzii* ▪ A160 - Eurasian Curlew *Numenius arquata*

* Denotes priority feature ** Present as a qualifying feature but not a primary reason for site selection

3.2 South Pennine Moors SPA

3.2.1 The South Pennine Moors SPA was designated in two phases in 1996 and 1997, extending to an area of some 66,207 hectares and spanning 13 local authorities. It incorporates four component Sites of Special Scientific Interest (SSSI), including the Eastern Peak District Moors SSSI which was included within the extended SPA in 2000. It includes the major moorland areas of the South Pennines from Ilkley in the north to Leek and Matlock in the south. It covers extensive expanses of semi-natural moorland habitat including upland heath and blanket mire.

3.2.2 The SPA is of European importance for several upland breeding bird species, including birds of prey and waders. Both Merlin *Falco columbarius* and Golden Plover *Pluvialis apricaria* feed upon farmland or in-bye land on the edge of the moors that is outside of the SPA boundary; this is considered important to the long term conservation of the SPA population of these birds. The northern end of the South Pennine Moors SPA is within 10 km of the North Pennine Moors SPA which supports a similar assemblage of upland breeding species.

3.2.3 The South Pennine Moors SPA qualifies under Article 4.1[2] of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following species listed on Annex 1 of the Directive. Population numbers and significance are at time of designation unless otherwise stated:

- Golden Plover: 752 pairs representing at least 3.3% of the breeding population of Great Britain (count as at 1990);
- Merlin: 77 pairs representing at least 5.9% of the breeding population of Great Britain;
- Peregrine *Falco peregrinus:* 16 pairs representing at least 1.4% of the breeding population of Great Britain; and
- Short-eared Owl *Asio flammeus*: 25 pairs representing at least 2.5% of the breeding population of Great Britain.

3.2.4 The site also qualifies under Article 4.2[3] of the Birds Directive by supporting populations of the following regularly occurring migratory species[4]:

- Dunlin *Calidris alpina schinzii*: 140 pairs representing at least 1.3% of the breeding Baltic/UK/Ireland population.

[2] Article 4.1 relates to populations of birds listed on Annex I of the Birds Directive.

[3] Article 4.2 relates to regularly occurring migratory species not listed on Annex I.

[4] This information is based on the 2001 UK SPA Review carried out by JNCC. The original citation for South Pennine Moors SPA also lists the following species as part of the Article 4.2 breeding bird assemblage qualification, however, it is assumed that this was superseded by the 2001 UK SPA Review: Common Sandpiper *Actitis hypoleucos*, Twite *Carduelis flavirostris*, Snipe *Gallinago gallinago* , Curlew *Numenius arquata* ,Wheatear *Oenanthe oenanthe*, Whinchat *Saxicola rubetra*, Redshank *Tringa totanus* , Ring Ouzel *Turdus torquatus*, and Lapwing *Vanellus vanellus*.

3.3 North Pennine Moors SPA

3.3.1 The North Pennine Moors SPA extends north from the Ribble-Aire corridor (Skipton) to the Tyne Gap (Hexham) incorporating the Pennine moorland massif within the local authorities of North Yorkshire, Cumbria, Durham and Northumberland. It extends to a total of 147,246 hectares and encompasses extensive tracts of moorland habitat. It is important for several upland breeding bird species including waders and birds of prey.

3.3.2 The North Pennine Moors SPA qualifies under Article 4.1 of the Birds Directive by supporting breeding populations of the following species listed on Annex I of the Directive:

- Golden Plover: 1,400 pairs representing at least 6.2% of the breeding population in Great Britain;
- Hen Harrier *Circus cyaneus:* 11 pairs representing at least 2.2% of the breeding population of Great Britain;
- Merlin: 136 pairs representing at least 10.5% of the breeding population of Great Britain; and
- Peregrine: 15 pairs representing at least 1.3% of the breeding population of Great Britain.

3.3.3 The North Pennine Moors SPA also qualifies under Article 4.2 of the Directive by supporting breeding populations of European importance of the following regularly occurring migratory species:

- Curlew *Nemenius arquata:* 3,930 pairs representing at least 3.3% of the European breeding population; and
- Dunlin: 330 pairs representing at least 3.0% of the breeding Baltic/UK/Ireland population (based on 92-94 counts).

3.4 South Pennine Moors SAC

3.4.1 The South Pennine Moors SAC was selected for its representation of three Annex 1 habitat types (European dry heaths, Blanket bogs, and Old sessile oak woodlands) while a further two were subsequently identified as being present as qualifying features within the SAC (Northern Atlantic wet heaths, and Transition mires and quaking bogs). These vegetation communities are described in detail in Chapter 4.

3.5 North Pennine Moors SAC

3.5.1 The North Pennine Moors SAC was selected for a total of six Annex 1 habitat types. A further seven habitat types were subsequently identified as being present as qualifying features. Four of the Annex 1 habitat types are the same as those within the South Pennine Moors SAC; Blanket bog, Dry heath, Northern Atlantic wet heath and Old sessile oak woodland. In addition to these extensive habitat types, the North Pennine Moors SAC also contains examples of a number of more localised Annex 1 habitat types:

- *Juniperus communis* formations on heaths or calcareous grasslands;
- Petrifying springs with tufa formation (*Cratoneurion*) * Priority feature*;
- Siliceous rocky slopes with chasmophytic vegetation;
- Calaminarian grasslands of the *Violetalia calaminariae;*
- Siliceous alpine and boreal grasslands;
- Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*);
- Alkaline fens;
- Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*); and
- Calcareous rocky slopes with chasmophytic vegetation.

3.5.2 The distribution of many of these upland habitats is associated with calcareous and other rocky outcrops and heavy metal contaminated soils found further north in the Pennines and are not considered likely to be affected by proposals within the Bradford Core Strategy.

3.6 Conservation Objectives

3.6.1 The Habitats Directive requires that Member States maintain or where appropriate restore habitats and species populations of European importance to favourable conservation status. Guidance from the EC (2000b; p.19) states: *"The conservation status of natural habitat types and species present on a site is assessed according to a number of criteria established by Article 1 of the Directive. This assessment is done both at site and network level".* In the UK, the term favourable condition has been used to differentiate the status of habitats and species populations on a given site, as compared to that of the wider network of European sites.

3.6.2 Regulation 102[5] requires that an Appropriate Assessment is made of the implications for each site in view of the site's conservation objectives. To make such an assessment, it is necessary to understand in more detail the features of the sites that contribute to their favourable condition or conservation status. Natural England has published detailed Favourable Condition Tables (FCT) in which various attributes of the habitat and species populations are defined for assessing site condition. These have been developed from the definition of Favourable Conservation Status provided in Article 1 of the Habitats Directive (**Box 1** overleaf).

3.6.3 The above descriptions of qualifying Annex 1 habitat types within the two SAC identifies a number of habitats, particularly within the North Pennine Moors SAC, that are not likely to be affected by policies within the Bradford Core Strategy. Conservation Objectives for the two SAC are therefore confined to the following four habitat types:

- European dry heaths;
- Blanket bogs;

[5] Conservation of Habitats and Species Regulations 2010.

- Northern Atlantic wet heaths with *Erica tetralix*; and
- Transition mires and quaking bogs.

3.6.4 In addition to those habitats that are not likely to be affected by the Bradford Core Strategy, the location of the Annex II species marsh saxifrage *Saxifraga hirculus* is within the Yorkshire Dales National Park and is not likely to be affected.

Box 1: Extract from Managing Natura 2000 Sites (EC, 2000)

Conservation status is defined in Article 1 of the Habitats Directive. For a **natural habitat**, Article 1(e) specifies that it is: *'the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species …'.*

For a species, Article 1(i) specifies that it is: *'the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its population …'*

The Member State has therefore to take into account all the influences of the environment (air, water, soil, territory) which act on the habitats and species present on the site.

Favourable conservation status is also defined by Article 1(e) for natural habitats and Article 1(i) for species.

For a **natural habitat**, it occurs when:

- *'its natural range and areas it covers within that range are stable or increasing;*
- *the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and*
- *the conservation status of its typical species is favourable'.*

For a **species**, it occurs when:

- *'the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis'.*

The favourable conservation status of a natural habitat or species has to be considered across its natural range, according to Articles 1(e) and 1(i), i.e. at biogeographical and, hence, Natura 2000 network level. Since, however, the ecological coherence of the network will depend on the contribution of each individual site to it and, hence, on the conservation status of the habitat types and species it hosts, the assessment of the favourable conservation status at site level will always be necessary.

The conservation status of natural habitat types and species present on a site is assessed according to a number of criteria established by Article 1 of the Directive. This assessment is done both at site and network level.

Conservation objectives of the South Pennine Moors SPA and North Pennine Moors SPA

3.6.5 For the South Pennine Moors SPA and North Pennine Moors SPA an over-riding conservation objective has been defined by Natural England as:

"Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive."

3.6.6 For the populations of birds within the two SPA, favourable conservation status can be defined by reference to article 1(i) (Box 1). Conservation objectives for the South Pennine Moors SPA and North Pennine Moors SPA would therefore be, subject to natural change, to maintain or restore the:

- **Objective 1:** Extent and distribution of the habitats of the qualifying features;
- **Objective 2:** Structure and function of the habitats of the qualifying features;
- **Objective 3:** Supporting processes on which the habitats of the qualifying features rely;
- **Objective 4:** Populations of the qualifying features; and
- **Objective 5:** Distribution of the qualifying features within the site.

Conservation objectives of the South Pennine Moors SAC and North Pennine Moors SAC

3.6.7 For the South Pennine Moors SAC and North Pennine Moors SAC, the over-riding conservation objective for each of the qualifying habitats has been defined by Natural England as:

"Avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving Favourable Conservation Status of each of the qualifying features."

3.6.8 For the SAC habitats that might be affected by policies within the Bradford Core Strategy (listed in section 3.6.3), favourable conservation status can be defined by reference to article 1(e) (Box 1). Conservation objectives for the South Pennine Moors SAC and North Pennine Moors SAC would therefore be, subject to natural change, to maintain or restore the:

- **Objective 6:** Extent and distribution of qualifying natural habitats and habitats of qualifying species;
- **Objective 7:** Structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species. A list of some of the typical species associated with the habitat types is given in Table 3.2;
- **Objective 8:** supporting processes on which qualifying natural habitats and habitats of qualifying species rely;
- **Objective 9:** populations of qualifying species; and
- **Objective 10:** distribution of qualifying species within the site.

3.6.9 From consideration of the distribution of qualifying habitats and species within the North Pennine Moors SAC (sections 3.5 and 4.3), it has been concluded that only those habitats that also occur within the South Pennine Moors SAC should be considered within the context of Objectives 6 - 10.

3.7 Typical Species

3.7.1 In order to assess the impacts of Core Strategy policy on the Annex 1 habitats within the SAC it is necessary to define a group of species that might be considered 'typical' of these habitat types. Guidance on the identification of typical species is limited, however, the EC (2000) *Managing Natura 2000 Sites* states:

> *"Habitat deterioration occurs in a site when the area covered by the habitat in the site is reduced or the specific structure and functions necessary for the long-term maintenance or the* ***good conservation status of the typical species which are associated with the habitat*** *are reduced in comparison to their initial status. This assessment is made according to the contribution of the site to the coherence of the network."*

3.7.2 However, there is no guidance as to how to define typical species. One method is to refer to the species listed as being associated with the habitat type within the Interpretation Manual of European Habitats (EU, 2007). Other sources of species information are available from the JNCC SAC selection criteria for Annex 1 habitat types[6]. The list of species used in this assessment is not exhaustive but should be considered as indicator species of good condition. In this respect they have a similar role as species identified by Natural England in its Common Standards Monitoring approach to monitoring habitat condition[7]. For bird species typically present within SAC habitats reference has been made to the *South Pennine Moors Integrated Management Strategy and Conservation Action Plan* (SCOSPA, 1998).

[6] http://jncc.defra.gov.uk/ProtectedSites/SACselection/SAC_habitats.asp

[7] http://jncc.defra.gov.uk/pdf/CSM_Upland_Oct_06.pdf

Table 3.2: Some of the typical species of Annex 1 habitat types present with SAC

Annex I Habitat Type	SAC in which it occurs	Typical species
4030 European dry heaths	South Pennine Moors SAC North Pennine Moors SAC	Birds Merlin *Falco columbarius*, Short-eared Owl *Asio flammeus*, Golden Plover *Pluvialis apricaria*, Twite *Carduelis flavirostris*, Red Grouse *Lagopus lagopus scoticus*, Skylark *Alauda arvensis*, Meadow Pipit *Anthus pratensis* Invertebrates Bilberry bumblebee *Bombus monticol* Plants Bilberry *Vaccinum myrtillus*, Crowberry *Empetrum nigrum ssp. nigrum*, Cowberry *Empetrum vitus-idea*, Heather *Calluna vulgaris*, Bell heather *Erica cinera*
4010 Northern Atlantic wet heath with *Erica tetralix*	South Pennine Moors SAC North Pennine Moors SAC	Plants Heather, Cross-leaved heath *Erica tetralix*, Deer grass *Trichophorum cespitosum*
7130 Blanket bogs *Priority feature*	South Pennine Moors SAC North Pennine Moors SAC	Birds Golden Plover, Dunlin *Calidris alpina schinzi*, Curlew *Numenius arquata*, Meadow Pipit Plants Heather, Crowberry, Common cotton-grass *Eriophorum angustifolium*, Hare's tail cotton-grass *Eriophorum vaginatum*, Bog mosses *Sphagnum spp.*
7140 Transition mires and quaking bogs	South Pennine Moors SAC	Plants Bottle sedge *Carex rostrata*, Bog mosses, *Sphagnum spp.*

4 European Site Characterisation

4.1 SPA Bird Populations and Ecology

4.1.1 The following summaries have been adapted from the UK SPA Review, published by the Joint Nature Conservancy Committee (JNCC; 2001), together with a review of other available literature on the behaviour and ecology of these species.

Golden Plover

4.1.2 Golden Plovers are ground nesting birds, breeding on heather moorland, blanket bog, acidic grasslands and montane summits, where they prefer to nest on high, flat or gently sloping plateaux, away from the moorland edge. Adjacent pastures with abundant earthworms and cranefly larvae are important for feeding adults, and chicks may be moved up to 2 km or more to feed in marshy areas rich in invertebrate food (Byrkjedal & Thompson, 1998)[8]. Breeding densities generally vary from 2–7 pairs/km^2, but exceptionally have been recorded at 16 pairs/km^2 (Ratcliffe, 1976)[9]. Densities in Great Britain are some of the highest within the range (Byrkjedal & Thompson, 1998).

4.1.3 In Europe, breeding occurs through Iceland, Scandinavia, and the Baltic States, northern Russia and in northern/upland parts of Britain and Ireland. In Britain, the species is distributed widely throughout upland areas, with concentrations in northern and western Scotland and the north and south Pennines, and smaller outlying groups breeding in Wales and south-west England (Ratcliffe, 1976; Gibbons *et al.*, 1993[10]). In Ireland, the species breeds mainly in the northern and western uplands. Two-thirds of the British and Irish breeding population occur in Scotland. The English and Welsh populations breed at the southern edge of the species' global range (Gibbons *et al.*, 1993; Byrkjedal & Thompson, 1998).

4.1.4 The South Pennine Moors SPA is one of seven SPA in the UK that have been selected for their populations of breeding Golden Plover. Other sites and their populations are shown in Table 4.1.

4.1.5 Breeding Golden Plover populations have been adversely affected by loss of habitat from agricultural improvement and forestry development. A decline in Grouse moor management and associated keepering has also been implicated in declines in some upland areas. Numbers in Britain during the 1980s were estimated at 22,600 pairs, compared with 29,400 during 1968–1972 (Gibbons *et al.*, 1993).

[8] Byrkjedal, I. & Thompson, D.B.A. 1998. *Tundra Plovers. The Eurasian, Pacific and American Golden Plovers and Grey Plover*. London, T. & A.D. Poyser. 422 pp.

[9] Ratcliffe, D.A. 1976. Observations on the breeding of the Golden Plover in Great Britain. *Bird Study* **23**: 63-116.

[10] Gibbons, D.W., Reid, J.B. & Chapman, R.A. 1993 *The New Atlas of Breeding Birds in Britain and Ireland: 1988–1991*. London, T. & A.D. Poyser. 520 pp.

4.1.6 The 2005 South Pennine Moors SPA breeding bird survey identified a total of 132 Golden Plover registrations within 5km of settlement boundaries within Bradford. Fourteen of these registrations were from Rombalds/Ilkley Moor with the majority being located on the moors to the south and west of Haworth and Oxenhope; see Figure 4.1 and Figure 4.2. Data on the proximity of breeding Golden Plover to settlement boundaries within the North Pennine Moors SPA boundary is not available.

Table 4.1: SPA selected for their populations of breeding Golden Plover and proportion of the national and biogeographic population they support

Site name	Site total	% biogeographic pop.[11]	% of national pop.
Caithness and Sutherland Peatlands	1,064	0.2	4.7
Lewis Peatlands	1,978	0.4	8.8
Muirkirk and North Lowther Uplands	175	<0.1	0.8
North Pennine Moors	1,400	0.3	6.2
North York Moors	526	0.1	2.3
Pettigoe Plateau (NI)	12	<0.1	3.0 (Ire)
South Pennine Moors	752	0.2	3.3
TOTAL	**5,907**	**1.2%**	**26.1%** **3.0% (Ire)**

4.1.7 A study undertaken by Whitfield and Thomas for Scottish Natural Heritage in 2006[12] centred on the use of moorland fringe fields by golden plover in east Sutherland around the Caithness and Sutherland Peatlands SPA, Scotland. They found golden plover moving up to 6km from the SPA boundary to feed (range 1–5,994m, mean 1,922 ± 1,387m). In the pre-breeding period and during incubation, adult birds flew an average of 2.7km to feed on fields (range 0.4–10.7km) with strong fidelity within and across years to the same field and parts of a field.

4.1.8 The use of moorland fringe habitats in other locations is also reviewed by Whitfield and Thomas (2006). They refer to two studies in northern England, (Whittingham *et al.*, 2000[13]; Pearce-Higgins & Yalden, 2003[14]).

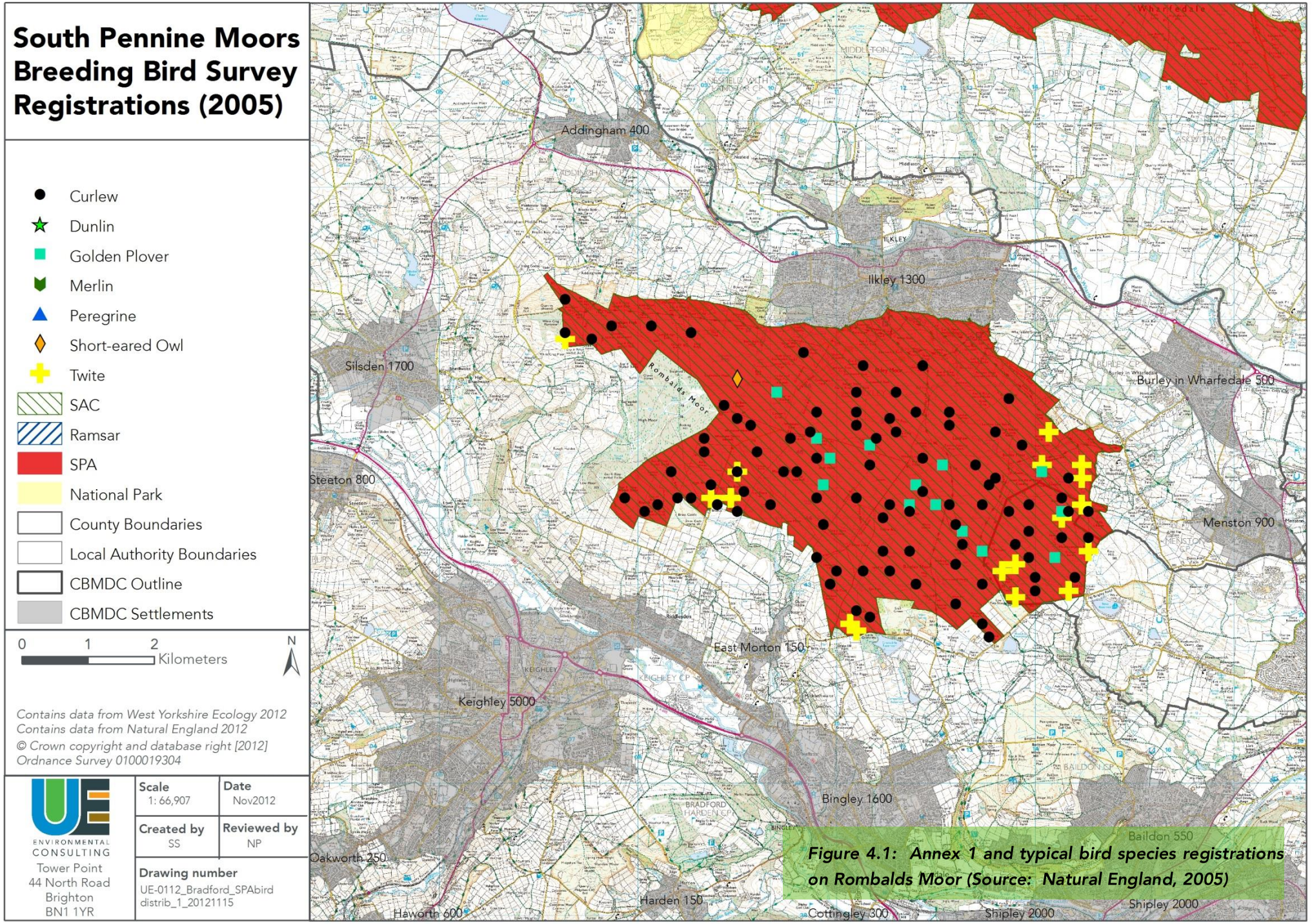
[11] Numbers breeding in Europe (Iceland, Scandinavia, and the Baltic States, northern Russia and northern/upland parts of Britain and Ireland).

[12] Whitfield, D. P. & Thomas, C. J. (2006). *Analysis of a survey of golden plover around the Caithness and Sutherland Peatlands Special Protection Area*. Scottish Natural Heritage Commissioned Report No. 181 (ROAME No. F01LB205/5.

[13] Whittingham, M.J., Percival, S.M. & Brown, A.F. (2000). Time budgets and foraging of breeding goldenplover *Pluvialis apricaria*. *Journal of Applied Ecology*, **37**, 632–646.

[14] Pearce-Higgins, J.W. & Yalden, D.W. (2003). Variation in the use of pasture by breeding European golden plovers *Pluvialis apricaria* in relation to prey availability. *Ibis*, **145**, 365–381.

South Pennine Moors Breeding Bird Survey Registrations (2005)



Contains data from West Yorkshire Ecology 2012
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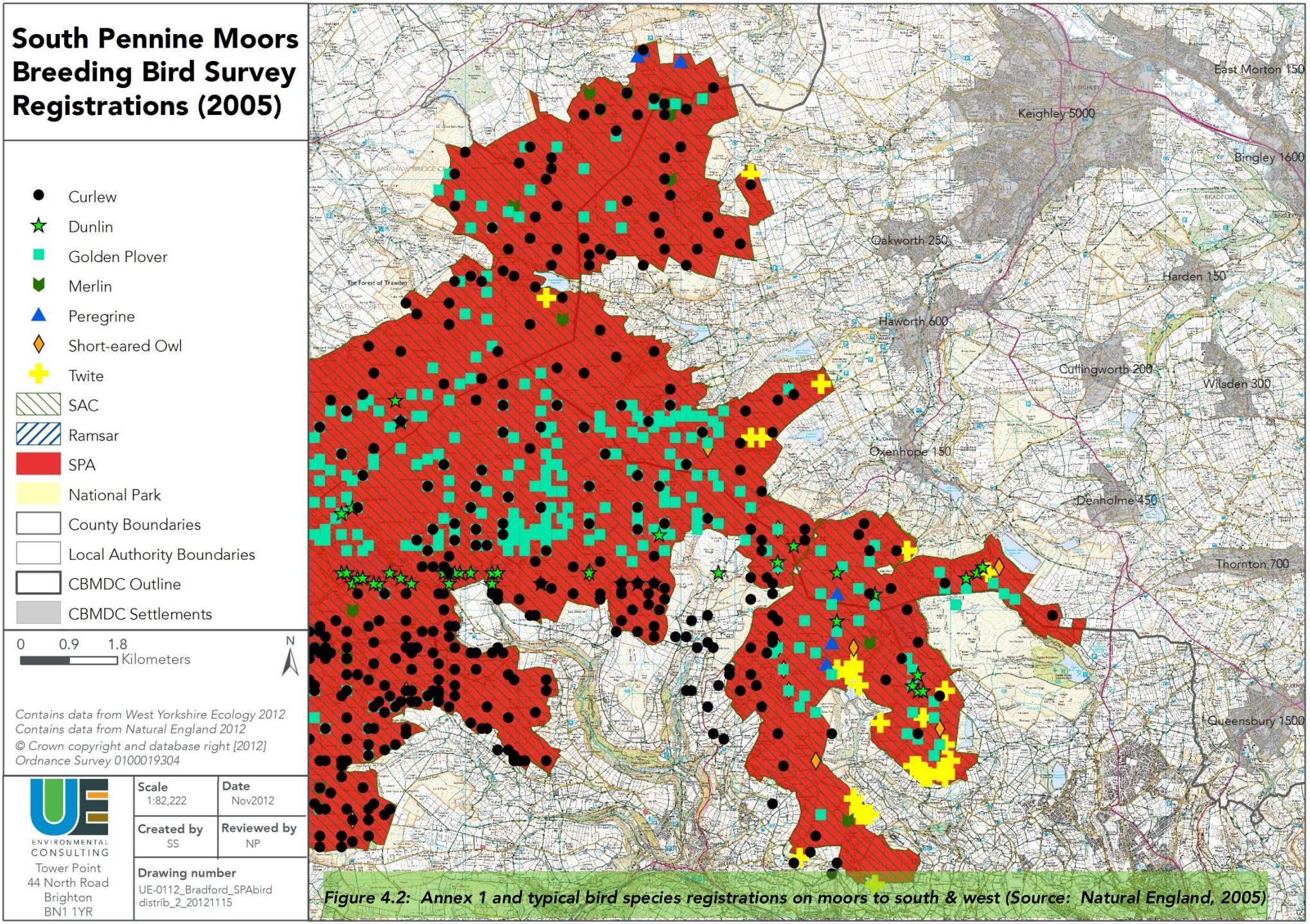
44 North Road
Brighton
BN1 1YR

Scale	Date
1: 66,907	Nov2012
Created by	**Reviewed by**
SS	NP

Drawing number
UE-0112_Bradford_SPAbird distrib_1_20121115

Figure 4.1: Annex 1 and typical bird species registrations on Rombalds Moor (Source: Natural England, 2005)

South Pennine Moors Breeding Bird Survey Registrations (2005)



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Brighton
BN1 1YR

Scale	Date
1:82,222	Nov2012
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SS	NP

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UE-0112_Bradford_SPAbird distrib_2_20121115

Figure 4.2: Annex 1 and typical bird species registrations on moors to south & west (Source: Natural England, 2005)

4.1.9 Both studies found females used fields during the day, and males at night, but it was apparent that field choice could differ between males and females, notably in the South Pennines study when males used fields closer to breeding sites than their mates (Pearce-Higgins & Yalden, 2003). Distances travelled to fields from nests was similar to east Sutherland, with mean distances of 2.1–2.7km in North Pennines (range 1.2–3.7km: Whittingham *et al.*, 2000) and 6.6–7.2km (max. 8.2km: females) or 2.4–2.7km (max. 4.2km: males) in South Pennines (Pearce-Higgins & Yalden, 2003).

4.1.10 Both studies also indicated that use of fields for feeding was greater than in east Sutherland. For example, whereas field use virtually stopped when chicks hatched in Sutherland, parents continued to feed in fields to some degree in northern England during this phase of the breeding cycle, especially in the South Pennines. Field size was an influential factor in north Pennines (larger fields selected) but not in south Pennines, and sward height was important in south Pennines (shorter swards selected) but not in north Pennines. Evidence suggested that earthworms (north Pennines) and tipulid larvae (south Pennines) were influential in determining plovers' choice of fields.

Merlin

4.1.11 The Merlin is a small dashing Falcon that feeds mostly on small birds such as Meadow Pipit *Anthus pratensis* and Skylark *Alauda arvensis*. Merlin breed on heather moorland across the uplands of Britain. They traditionally build their nest on the ground in the cover of heather but are now more frequently using tree nest sites. Ground nesting is a peculiar feature of British nesting Merlin and may only be possible where mammalian predators are controlled on moors managed for Grouse shooting (Gibbons *et al.*, 1993).

4.1.12 In Europe there are an estimated 10,166–16,612 pairs, with the largest numbers occurring in Sweden, Norway and Finland – each of which holds more than 2,000 pairs. The Great Britain population was estimated at 1,128 pairs in 2008[15]. In the breeding season, the UK's SPA suite for Merlin supports, on average, 426 pairs. This amounts to about a third of the British breeding population.

4.1.13 The British breeding population was thought to have declined from the 1950s until the early 1990s, initially as a result of organochlorine and other pesticide contamination, and more recently through habitat loss (Gibbons *et al.*, 1993). The first national Merlin survey in 1983–84 returned a population estimate of 550–650 breeding pairs for Britain (Bibby & Natrass, 1986). A second national Merlin survey in 1993–94 estimated the British population as 1,291 breeding pairs (95% CI: 1108–1500; Rebecca & Bainbridge, 1998), providing evidence that the population had increased since 1983–84. This increase may be partly due to increased tree nesting and use of woodland edge nest sites[16]. As a result the Merlin has moved from being Red listed in 2001 to Amber listed in Birds of Conservation Concern 3 (2009)[17].

[15] Ewing, S.R., Rebecca, G.W., Heavisides, A., Court, I., Lindley, P., Ruddock, M., CoHen, S. & Eaton, M.A. (2011) Breeding status of the Merlin *Falco columbarius* in the UK in 2008. *Bird Study* **58**: 379–389

[16] Little, B., Davison, M. & Jardine, D. (1995) Merlins *Falco columbarius* in Kielder Forest: influences of habitat on breeding performance. *Forest Ecology and Management* **79**: 147–152.

4.1.14 Information on the population of Merlin in England, and the South Pennine Moors in particular, has been extracted from Ewing *et al.* (2008). This suggests significant regional declines in the three main upland areas of England between the 1993-94 survey and 2008, with a 47% decline in the South Pennine Moors and North York Moors and a 67% decline in Northumbria. The figures extracted are reproduced in Table 4.2. These declines may be due to equivalent declines in the main prey species of Merlin in these uplands with declines in the numbers of Meadow Pipit, Skylark and Wheatear *Oenanthe oenanthe* all recorded over this same time period. Ewing *et al.* (2008) suggest that changes in Grouse moor management with increased levels of moor burning may also be significant.

4.1.15 The 2005 South Pennine Moors breeding bird survey recorded 11 registrations for Merlin within 5km of settlement boundaries within the Bradford area. These were concentrated in two areas, one south west Steeton and a second (single registration) south of Oxenhope.

Table 4.2: Changes in Merlin population within northern England from Ewing et al. (2008)

Site name	Breeding pairs 1993-94	Breeding pairs 2008	% change
South Pennine Moors	55	29	-47
North York Moors	36	19	-47
Northumbria	39	12	-67

4.1.16 Information on use of supporting habitat by merlin is very limited and, while they will hunt several kilometres from the nest, they are generally thought to confine their activity to the moorland within the SPA, or to a tight buffer around its margins, where its primary prey species (meadow pipit) is abundant (Murison, unpubl.). More information is available on effects of recreational disturbance although even this is rather inconclusive. The following extracts from Newton *et al.* (1981)[18] are of interest.

> *"Of the 16 sites which were used after 1970, 14 are remote from footpaths, and therefore relatively undisturbed. This may indicate that, as the Merlin has become scarcer, it has avoided the most disturbed areas. Newton et al (1978) noted that two of their five 'lost' sites had suffered from disturbance.*
>
> *"The negotiation of access agreements between moorland owners and the Peak Park Planning Board has not produced a negative correlation between access areas and Merlins. However, there was a negative correlation between latter-day Merlin sites and nearby footpaths, which might suggest a sensitivity to disturbance. Since the enormous increase in outdoor recreation in the Peak District occurred mainly during the 1970s, it is unlikely to have accounted for the sharp decline in Merlins during the 1950s. It could, perhaps, delay or prevent recolonisation in future, but given the tendencies of walkers to follow well-known footpaths and to walk (where possible) along ridges rather than in*

Rebecca, G.W. (2011) Spatial and habitat-related influences on the breeding performance of Merlins in Britain. *British Birds* **104**: 202–216.

[17] http://www.rspb.org.uk/Images/BoCC_tcm9-217852.pdf

[18] Dr I. Newton , J. E. Robinson & Dr D. W. Yalden (1981): Decline of the Merlin in the Peak District, *Bird Study*, **28**:3, 225-234.

cloughs, there should be sufficient undisturbed sites for numbers of Merlins to breed successfully."

4.1.17 References to feeding stress the importance of small passerines (meadow pipit and skylark) which suggests that they will hunt in any habitat near to the open moorland that supports high densities of these birds. This could include in-bye land within close proximity to the moorland fringe.

4.1.18 During winter, merlin move to the coast or lower altitude habitat where there are concentrations of wintering passerines. There is no clear geographical relationship with the upland breeding habitats and no obvious link between the Pennine moorland fringe and wintering merlin habitat.

Peregrine Falcon

4.1.19 Since the well documented declines in Peregrine populations caused by organochlorine pesticide poisoning in the 1950s and 60s, the population has recovered strongly throughout Britain. This has involved both increases in breeding density and occupation of new or long deserted breeding haunts. This increase has resulted in a greater range of nest sites being used; in addition the traditional rocky cliff or crag nest sites, birds have exploited 'walk–in' nest sites on tiny crags as well as genuine ground nest sites and widespread exploitation of ledges on tall buildings in urban areas.

4.1.20 Peregrines occur widely throughout Europe, although they are generally highly dispersed and nest at low densities. As elsewhere in the species' global range, breeding distribution is determined by the availability of suitable nest sites (usually cliffs, or other habitats to which the Peregrine has adapted locally). The European population is estimated at 5,633–6,075 pairs. This represents approximately one-fifth of the world population (Hagemeijer & Blair, 1997).

4.1.21 The number of UK breeding pairs has been censused every ten years since 1961 by BTO/JNCC/RSPB/Raptor Study Groups, and has been estimated as follows: 1961 - 385 pairs; 1971 - 489 pairs; 1981 - 728 pairs; 1991 - 1,283 pairs (Ratcliffe 1993[19]). The National Peregrine Survey 2002[20] found 1,437 breeding pairs in the UK and Isle of Man, a further 12% increase overall since 1991 but with declines in north and west Scotland, North Wales and Northern Ireland (Banks et al. 2003[21]).

4.1.22 The Rare Breeding Birds Panel[22] report for 2009 recorded 833–1,046 pairs, with 34 occupied territories in Yorkshire, 9 in Greater Manchester and 29 in Lancashire and North Merseyside. This conceals increases in all regions of England (by 11%) and in Wales (19%), which are offset by a decline in the reporting rate in Scotland and Northern Ireland. Low site occupation and productivity was reported from study areas where much of the land is managed as grouse moor.

[19] Ratcliffe, D.A. (1993) *The Peregrine Falcon*. Second Edition. T. & A.D. Poyser, London

[20] Banks, A.N., Crick, H.Q.P., Coombes, R., Benn, S., Ratcliffe, D.A. & Humphreys, E.M. (2010) The breeding status of Peregrine Falcons *Falco peregrinus* in the UK and Isle of Man in 2002. *Bird Study* **57**: 421–436

[21] Banks, A.N., Coombes, R.H. & Crick, H.Q.P. (2003) *The Peregrine Falcon breeding population of the UK & Isle of Mann in 2002.* Research Report 330. BTO, Thetford.

[22] Holling, M. & the Rare Breeding Birds Panel (2011) Rare breeding birds in the United Kingdom in 2009. *British Birds* **104**: 476–537

4.1.23 The 2005 South Pennine Moors breeding bird survey recorded six registrations for Peregrine Falcon within 5km of settlement boundaries within the Bradford area. These were concentrated in two areas, one south-west of Oxenhope and a second south west of Steeton.

Short-eared Owl

4.1.24 David Glue describes the habitat requirements for breeding Short-eared Owls in Gibbons (1993) as follows; "*The primary requirements for successful nesting by Short-eared Owls are an extensive tract of open ground, a substantial population of small mammal prey, and freedom from persistent disturbance by ground predators including man.*" Apart from a few isolated populations in the south east, the English distribution of Short-eared Owl is centred on the upland moors, from north Staffordshire northwards to the Scottish border.

4.1.25 The nest is normally concealed in tall heather and coarse grass and, following hatching, is normally only visited by adults after dark. In addition, populations can change dramatically following good field vole years when prey abundance is high. Populations can also be temporarily enhanced following the creation of forestry plantations which provide high numbers of voles in the early stages of tree establishment, but this declines as the canopy closes. These factors make census of numbers particularly difficult and the last national population estimate of 1988-91 gives a wide range of between 1,000-3,500 pairs. There is concern that the population is declining in the UK, and the 2009 report of Rare Breeding Birds in the UK (Holling *et al*., 2010) added this species to its list as it had estimated that numbers had dropped below 1,500 pairs. Despite this, it is still included on the Amber list of the Birds of Conservation Concern (BoCC 3).

4.1.26 During the breeding season, the UK's SPA suite for Short-eared Owls supports, on average about 131 pairs. This amounts to about 13% of the British breeding population and about 1% of the international population; see Table 4.3.

Table 4.3: Distribution of Short-eared Owls within SPA in Britain (JNCC, 2001)

Site name	Site total	% of biogeographic pop.	% of national pop.
Caithness and Sutherland Peatlands	30	0.2	3.00
Forest of Clunie	20	0.1	2.00
Muirkirk and North Lowther Uplands	30	0.2	3.00
Orkney Mainland Moors	20	0.1	2.00
Skomer and Skokholm	6	<0.1	0.60
South Pennine Moors	25	0.2	2.50
TOTAL	**131**	**1.0%**	**13.1%**

4.1.27 The 2005 South Pennine Moors breeding bird survey recorded 11 registrations for Short-eared Owl within 5km of settlement boundaries within the Bradford area. One registration was from

the west of Rombalds Moor with the remaining 10 registrations to the south and west of Oxenhope and Haworth.

4.1.28 There are no reliable references to short-eared owls using supporting habitat associated with upland moorland habitats. Lawton Roberts & Bowman (1986)[23] provide evidence of prey preferences which in moorland tends to be dominated by pigmy shrews reflecting the relative abundance of these small mammals in this habitat. They also state;

> *"Borrero (1962) stated that Short-eared Owls normally hunt within a few hundred metres of the nest. In contrast, we rarely saw one hunting closer than 500 m to a nest and— though our observations were casual and scattered— we felt that the birds were wandering widely in search of food. None was seen to hunt over the adjacent agricultural land.*
>
> *"In our Calluna dominated study area the Pigmy Shrew, probably the most numerous small mammal, is also the most frequent prey of the breeding Short-eared Owls."*

4.1.29 Murison (unpubl.) discusses an average foraging distance of 1.5-4.5km from the nest. However, this may be restricted to within moorland habitats and the number of observations was too low to draw conclusions regarding foraging habitat preferences.

Hen Harrier

4.1.30 Like other moorland raptors, the Hen Harrier is a ground nesting bird, constructing its nest in areas of mature heather and tall grass. Although a few birds remain in the vicinity of the moors during the winter most birds migrate to the coastal marshes especially within the East Anglia estuaries, the Dee estuary, Greater Thames estuary and Solent area. In these regions, Hen Harriers hunt especially over salt-marshes taking small passerines, small mammals and waders.

4.1.31 The national population of breeding Hen Harriers was estimated by Sim *et al.* in 1998 at 570 pairs (500-640) rising to 806 (732-889) territorial pairs in 2004 (Sim *et al.*, 2007). The Rare Breeding Bird Panel (Holling & RBBP, 2011) recorded 646 territorial pairs in 2010.

4.1.32 Hen Harriers have been included on the Red list of Birds of Conservation Concern 3. This reflects the substantial declines over the last two centuries. The UK population was unchanged between surveys in 1988-89 and 1998, with declines in Orkney and England but increases in Northern Ireland and the Isle of Man. A 41% increase was recorded in the UK and Isle of Man during 1998-2004, possibly due to increased use of non-moorland habitats, but with decreases in the Southern Uplands, east Highlands and England, all being areas with many managed Grouse moors. The latest survey, in 2010, reveals a decline of almost 20% since the 2004 survey in these areas (Holling & RBBP, 2011)[24]. Hen Harriers are now almost extinct as a breeding bird in England with only four pairs successfully raising young within the Forest of Bowland, Lancashire in 2011.

[23] John Lawton Roberts & Neil Bowman (1986): Diet and ecology of Short-eared Owls Asio flammeus breeding on heather moor, *Bird Study*, **33**:1, 12-17.

[24] http://blx1.bto.org/birdtrends/species.jsp?&s=Henha

4.1.33 Hen harrier are a species for which the North Pennine Moors SPA has been classified, however, there are currently no breeding birds in this part of England. Efforts to restore this species to the SPA and potentially the South Pennine Moors SPA should not be compromised by policies in the Bradford Core Strategy.

4.1.34 Hen harriers, like merlin, are known to feed extensively on small passerine birds such as meadow pipit and skylark. In winter, they migrate from the uplands to lowland coastal and farmland habitats where these and other prey species congregate. The recently published Conservation Framework (Fielding *et al.* 2011) for hen harrier in the UK provides further information on hen harrier prey. This re-enforces the conclusions of other studies that there is a need to conserve habitats supporting the moorland nest sites at a landscape scale.

4.1.35 Hen harrier have not bred within the vicinity of Bradford for many years but are a feature of the North Pennine Moors SPA. In bye land could provide important hunting habitat for hen harrier (as well as merlin) but limited information is available on the distribution of potential prey species within these habitats associated with the Pennine Moors SPAs.

Dunlin

4.1.36 Breeding Dunlin are characteristic of moorland and upland habitats and this is reflected in the species' breeding distribution in the UK. Concentrations are found in the Flow Country of Caithness and Sutherland, and peat moors in the Orkneys, Shetland, Grampians, Pennines and Outer Hebrides (Gibbons *et al.*, 1993).

4.1.37 Dunlin breeding in Britain and Ireland are of the temperate population of *C. a. schinzii* which also occurs in the Baltic region. The UK breeding population of Dunlin is estimated to be 9,150 pairs (Stone *et al.* 1997, based on Reed 1985), which represents 83% of the biogeographic population. No information is available concerning population change at a national level, although there have been documented declines in some regions of Britain where forestry has been implicated in displacing breeding Dunlin from peatlands. The population of Dunlin that breed in Britain *C. a. schinzii* are migratory and winter on the coast of west Africa.

4.1.38 In the breeding season, the UK's SPA suite for Dunlin supports, on average, 6,812 pairs. This amounts to about 74% of the British breeding population. The suite contains about 62% of the international population. The latest estimate of the Dunlin population within the South Pennine Moors SPA is 62 pairs representing a significant decline from that within the SPA at time of designation.

4.1.39 The 2005 South Pennine Moors breeding bird survey recorded 15 registrations for Dunlin within 5km of settlement boundaries within the Bradford area. These were concentrated in an area to the west and south-west of Oxenhope. Figures for Dunlin populations currently nesting in the North Pennine Moors SPA are not available.

Curlew

4.1.40 Breeding Curlew populations within the North Pennine Moors SPA meet selection criteria for this species but numbers in the South Pennine Moors are insufficient to cross the selection threshold of 1% of the international (biogeographic) population.

4.1.41 In Europe, Curlew have an essentially northern temperate distribution, occurring in greatest numbers in Scandinavia, the Low Countries (especially The Netherlands) and in Britain and Ireland (Hagemeijer & Blair, 1997). Their distribution becomes thinner and more localised in the south of Europe (France, southern Germany and Hungary). The Curlew is a widespread breeding species throughout much of Britain, but is absent from most parts of south-east England, and is sporadic in south-west England, north-west Scotland and parts of Ireland. It is most common in the North Pennines, the Southern Uplands of Scotland, parts of the east Highlands, Caithness, Orkney and Shetland.

4.1.42 Despite its recent expansion into lowland agricultural habitats, the species is still more abundant in uplands and northern regions where there are extensive areas of moorland and rough grazing. Variation in breeding densities show that nesting Curlews prefer low intensity agricultural habitats (Gibbons *et al.*, 1993).

4.1.43 In the UK, there has been no further expansion of the breeding range in the last 20 years and the distribution has not altered since 1968-72 (Sharrock, 1976). Population declines have been recorded in Northern Ireland and the North Staffordshire Moors (Grant, 1998) but not in recent extensive re-surveys of farmland habitats in Scotland and northern England (O'Brien, unpubl. data). Declines are likely to be associated with recent agricultural improvements, such as land drainage and re-seeding of moorlands, though increases in nest and chick predation rates are also implicated in causing declines (Grant *et al.*, 1999).

4.1.44 The Breeding Bird Survey (BBS) organised by the British Trust for Ornithology (BTO) records regional changes or trends in the population of selected breeding bird species. For Curlew it shows no significant change in population within Yorkshire and Humberside between 1994 and 2011, being present within a total of 83 1km sample squares, a reduction of 6 squares since the start of the survey in 1994.

4.1.45 The North Pennine Moors SPA is reported to support 3,930 pairs of nesting Curlew or 3.3% of the international (biogeographic) population and 11.9% of the national population[25].

Typical bird species

Twite

4.1.46 A comprehensive study of breeding ecology of twite was commissioned by English Nature in 1994[26] focusing on twite nesting on the South Pennines in West Yorkshire. The Pennine population of twite is migratory, leaving in October and returning between the end of March and beginning of April. Evidence from ringed birds suggests that in winter they move to the saltmarshes of the Wash and some to the coast of the Netherlands, France and Belgium.

4.1.47 Observations for the 1994 study were made within three study areas near Halifax; with nests found on Rishworth Moor, Midgley Moor and Withens Clough. Nests were located in areas of bracken and heather moorland. Birds that nested near to each other tended to use the same

[25] http://jncc.defra.gov.uk/pdf/UKSPA/UKSPA-A6-73A.pdf

[26] McGhie, H.A., Brown, A.F., Reed, S. and Bates, S.M. (1994). *Aspects of the Breeding Ecology of Twite in the South Pennines*. English Nature Research Reports No. 118.

fields for feeding. Many fields were only used once or twice. The distances between nests and feeding grounds ranged from 0.10 km – circa 2.6km, but most nests were more than 0.5km from the main feeding grounds.

4.1.48 Birds fed almost exclusively on unripened dandelion seed until this disappeared in mid-June. After that they fed almost exclusively on sorrel. There was a strong selection for fields with high densities of these plants, and the birds abandoned fields with high dandelion density for fields with high sorrel density after the dandelions lost their seeds. Densities of these preferred food species were found to be highest in unimproved meadows and lowest in improved pastures and reseeded grasslands.

Skylark

4.1.49 The previous chapter identified skylark as a typical species of the European Dry Heaths habitat of the SAC. They are also a key prey species of several of the raptors for which the SPA is classified (merlin and hen harrier). Skylark breed on both the open moorland and suitable in-bye meadows in the moorland fringe. In winter, skylark tend to migrate from moorland to coastal areas and lowland farmland. This may also include in-bye meadows.

4.1.50 Research into habitat type and management for skylark has been published in the Journal of Applied Ecology (Chamberlain et al, 1999)[27]. The following extracts from this paper give some indication of upland habitat use by skylark, but most importantly, states that '*skylarks in the uplands remain little studied and relatively little is known about associations within upland landscapes*'.

> *"Although skylark populations on farmland appear to have undergone the steepest declines, there is also evidence that upland populations are declining (Hancock & Avery 1998). The pattern of decline in this habitat is different from that in farmland and appears to have happened somewhat later (Chamberlain & Crick 1999), implying a different cause. There have been a number of changes in upland habitats that may have affected skylark populations adversely, including increasing grazing pressure (Fuller & Gough 1999), changes in moorland management and afforestation (Hancock & Avery 1998). As upland birds tend to move to lowlands in the winter, there is a possibility that agricultural changes are having consequences for upland populations as well. However, skylarks in uplands remain little studied and relatively little is known about habitat associations within upland landscapes.*
>
> *"However, when considering habitat associations within upland landscapes, no significant differences between habitats were detected, implying that differences at the national level are merely reflecting a more general upland–lowland contrast. The results here are in contrast to those found by Brown & Stillman (1993) in upland habitats, who found positive associations between skylark abundance and grass and bracken and negative associations with heather moorland. Clearly, there is a need for more detailed*

[27] D.E. Chamberlain, A.M. Wilson, S.J. Browne, J.A. Vickery (1999) Effects of habitat type and management on the abundance of skylarks in the breeding season. *Journal of Applied Ecology*, **36** Issue 6, pages 856-870.

understanding of the factors affecting skylark abundance in uplands and what causes the wide variation within semi-natural habitats in general used by skylarks."

Meadow Pipit

4.1.51 Like the skylark, the meadow pipit is identified as a typical species of the European Dry Heaths habitat type and also provides an important prey species for merlin and hen harrier. The Cheshire and Wirral Bird Atlas also provides some useful information on movements and habitat use by upland breeding meadow pipit. Extracts are reproduced below:

"With their substantial southward autumn movement, Meadow Pipit is one of the most obvious species for those watching visible migration, and the northern half of Britain – where most Meadow Pipits breed – is only sparsely occupied in winter (BTO Winter Atlas). The species' traditional wintering grounds lie as far south as the Mediterranean but the destination of Cheshire and Wirral breeders is not known in our changing climate: as a partial migrant, the proportion staying in Britain is likely to have increased with the milder weather of the last two decades.

"The winter habitat codes were scattered thinly across a wide range, but the vast majority (83%) were of farmland, with 7% semi-natural grassland and marsh. Cheshire farmland may be inhospitable for them in the breeding season, but in winter it is able to support Meadow Pipits. 41% of the total were improved grassland and 12% unimproved grassland, with 9% stubble. This is the small passerine with the highest number of records in unimproved grassland."

Other wading birds

4.1.52 There are a number of wet grassland nesting wading birds that are excluded from the assessment process – notably redshank, lapwing and snipe. It was concluded that these birds do not contribute to the SPA selection criteria nor are they 'typical' species of any of the Annex 1 habitat types of which the SAC have been selected. However, their distribution within in-bye land could be used as a surrogate for identifying the more important grassland sites for biodiversity and hence value in supporting the SPA and SAC features. This may be in the form of providing food (small mammals and birds) for hunting raptors (merlin, hen harrier, short-eared owl), food for seed eating birds such as twite, nectar for species such as the bilberry bumble bee or feeding habitat for golden plover chicks and curlew in the form of soil invertebrates.

4.2 Habitats of South Pennine Moors SAC

4.2.1 The following paragraphs are adapted from the JNCC site characterisation of the South Pennine Moors SAC[28].

[28] http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030280

European dry heaths

4.2.2 The site is representative of upland dry heath at the southern end of the Pennine range, the habitat's most south-easterly upland location in the UK. Dry heath covers extensive areas, occupies the lower slopes of the moors on mineral soils or where peat is thin, and occurs in transitions to acid grassland, wet heath and blanket bogs.

4.2.3 The upland heath of the South Pennines is strongly dominated by heather *Calluna vulgaris*. Its main NVC types are H9 *Calluna vulgaris – Deschampsia flexuosa* heath and H12 *Calluna vulgaris – Vaccinium myrtillus* heath. More rarely H8 *Calluna vulgaris – Ulex gallii* heath and H10 *Calluna vulgaris – Erica cinerea* heath are found. On the higher, more exposed ground H18 *Vaccinium myrtillus – Deschampsia flexuosa* heath becomes more prominent. In the cloughs, or valleys, which extend into the heather moorlands, a greater mix of dwarf shrubs can be found together with more lichens and mosses. The moors support a rich invertebrate fauna, especially moths, and important bird assemblages.

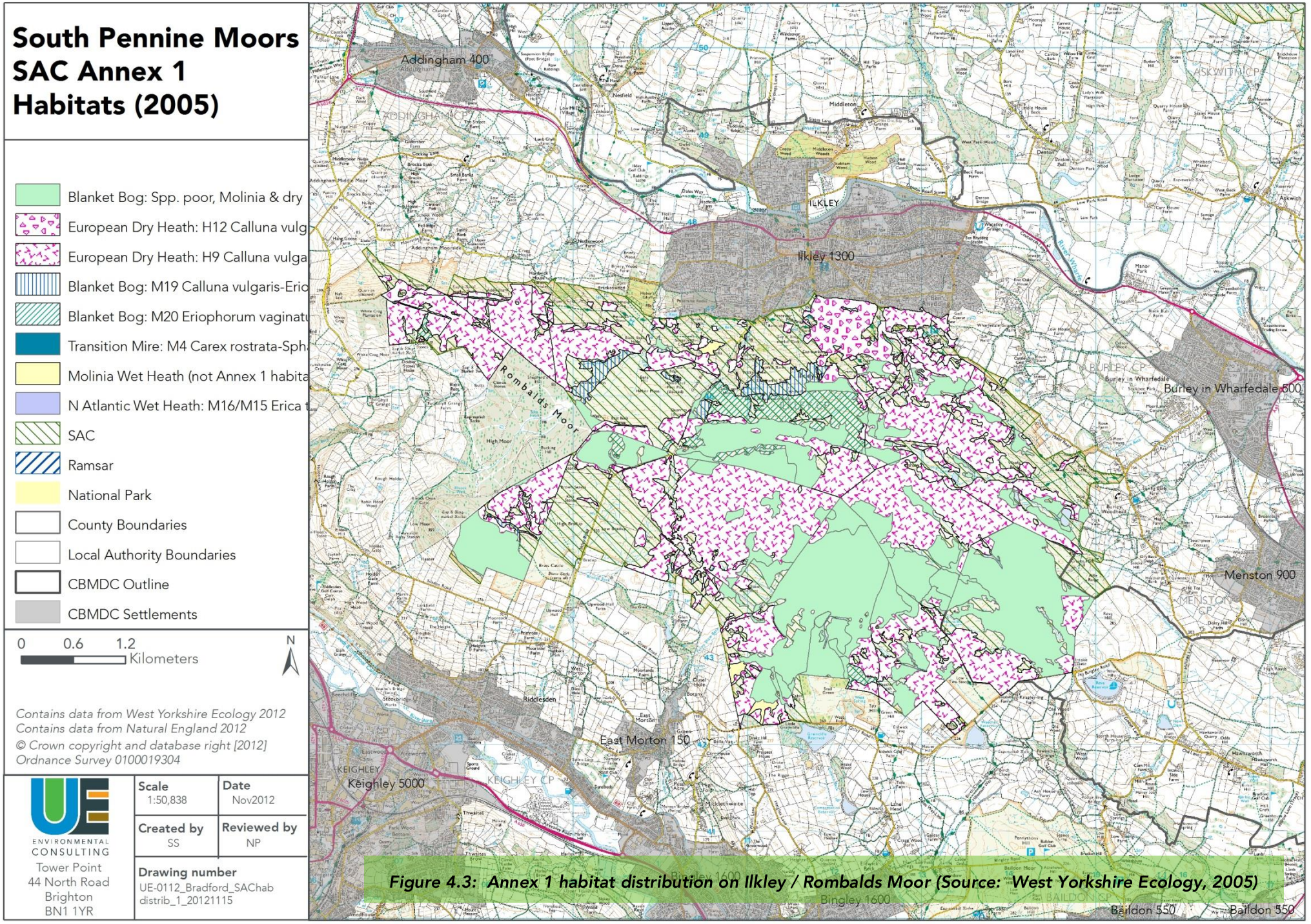
Blanket bogs (*priority feature*)

4.2.4 This site represents blanket bog in the south Pennines, the most south-easterly occurrence of the habitat in Europe. The bog vegetation communities are botanically poor. Hare's-tail cottongrass *Eriophorum vaginatum* is often overwhelmingly dominant and the usual bog-building *Sphagnum* mosses are scarce. Where the blanket peats are slightly drier, heather *Calluna vulgaris*, crowberry *Empetrum nigrum* and bilberry *Vaccinium myrtillus* become more prominent. The uncommon cloudberry *Rubus chamaemorus* is locally abundant in bog vegetation. Bog pools provide diversity and are often characterised by common cottongrass *E. angustifolium*. Substantial areas of the bog surface are eroding, and there are extensive areas of bare peat. In some areas erosion may be a natural process reflecting the great age (9000 years) of the south Pennine peats.

4.2.5 Blanket bog and dry heath often form intimate mosaics of vegetation in the South Pennine Moors and have been mapped as mosaics within the most recently produced vegetation survey of the SAC (West Yorkshire Ecology, 2009). This makes it difficult to calculate the area of each of these two Annex 1 habitats in the vicinity of Bradford, however, an estimation is given in Table 4.4.

4.2.6 An area of 1,783 hectares of blanket bog has been identified from the South Pennines SAC that falls within 5km of the settlements in the Bradford area. A total of 1,361 hectares of H9 dry heath and 149 hectares of H12 dry heath were also mapped within this area; see Figure 4.3 and Figure 4.4.

South Pennine Moors SAC Annex 1 Habitats (2005)



Contains data from West Yorkshire Ecology 2012
Contains data from Natural England 2012
© Crown copyright and database right [2012]
Ordnance Survey 0100019304

ENVIRONMENTAL CONSULTING
Tower Point
44 North Road
Brighton
BN1 1YR

Scale	Date
1:50,838	Nov2012
Created by	**Reviewed by**
SS	NP

Drawing number
UE-0112_Bradford_SAChab distrib_1_20121115

Figure 4.3: Annex 1 habitat distribution on Ilkley / Rombalds Moor (Source: West Yorkshire Ecology, 2005)

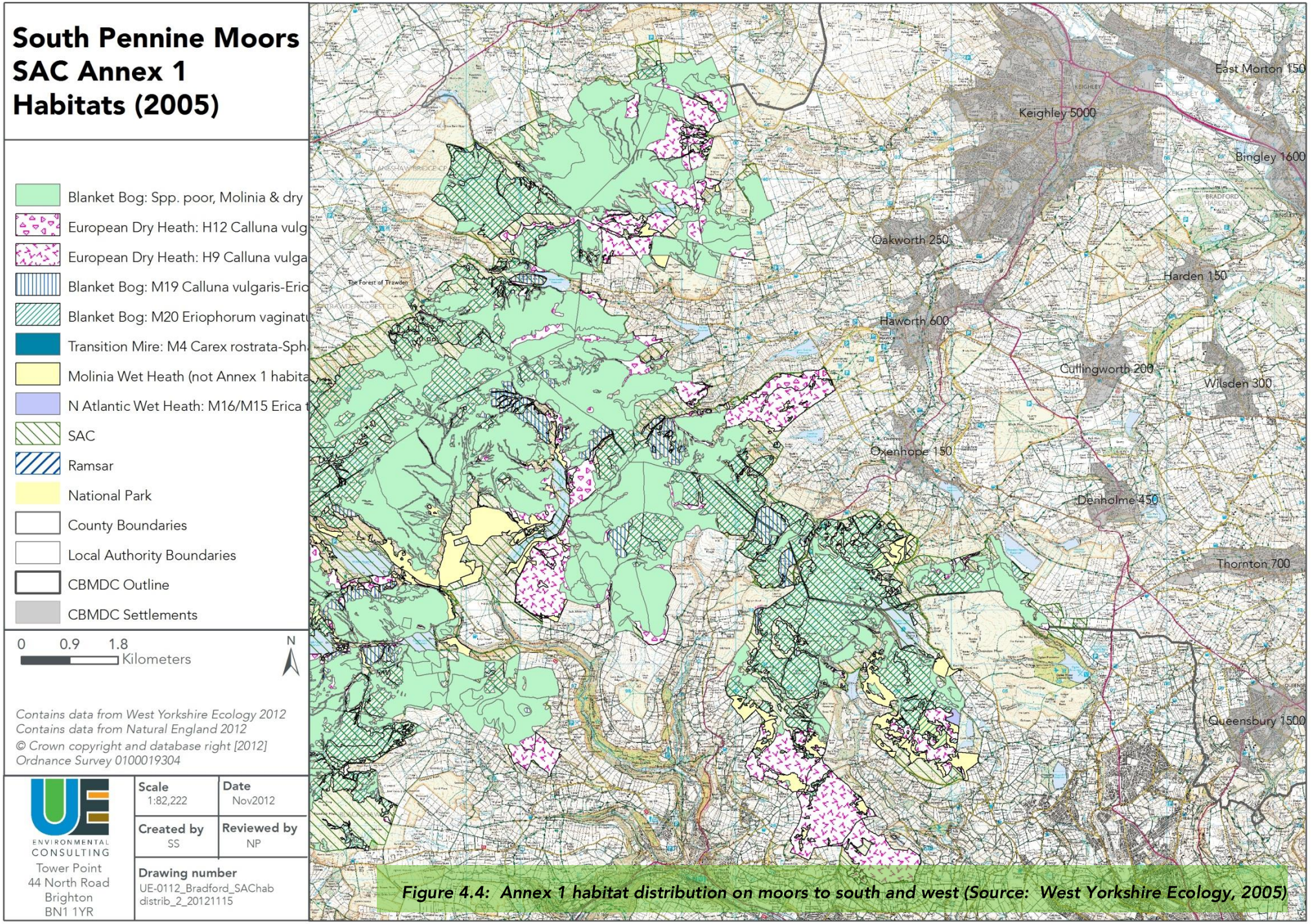


Figure 4.4: Annex 1 habitat distribution on moors to south and west (Source: West Yorkshire Ecology, 2005)

Table 4.4: Area of Annex I habitats within the South Pennine Moors SAC (West Yorkshire Ecology, 2009)

Habitat	Area (ha)
H9 Dry heath	2,161
H12 Dry heath	418
Undefined Blanket bog	6,855
M19 Blanket bog	299
M20 Blanket bog	4,758

Old sessile oak woods with* Ilex *and* Blechnum *in the British Isles

4.2.7 Around the fringes of the upland heath and bog of the south Pennines are blocks of old sessile oak woods, usually on slopes. These tend to be dryer than those further north and west, such that the bryophyte communities are less developed (although this lowered diversity may in some instances have been exaggerated by the effects of 19th century air pollution). Other components of the ground flora such as grasses, dwarf shrubs and ferns are common. Small areas of alder woodland along stream-sides add to the overall richness of the woods.

4.2.8 The extent and location of this woodland habitat type in the vicinity of the Bradford area was not included in the 2009 vegetation survey of the South Pennine Moors. However, reference to the Ancient Woodland Inventory shows that the nearest area of ancient woodland within either of the two SAC is Guisecliff Wood (North Pennine Moors SAC) near Glasshouses, over 15km to the north of the Bradford district boundary, and is not likely to be affected by policies within the Core Strategy.

4.2.9 In addition to the Annex 1 habitats for which this SAC was originally selected, it also supports two additional habitats that are present as qualifying features. These are Northern Atlantic wet heath and Transition mires and quaking bogs.

***Northern Atlantic wet heaths with* Erica tetralix**

4.2.10 Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses.

4.2.11 The Pennine Moors contains small areas of typical M16 *Erica tetralix – Sphagnum compactum* wet heath. This is characteristic of drier climates in the south and east, and is usually dominated by mixtures of *E. tetralix*, *Calluna* and *Molinia*. The bog-moss *Sphagnum compactum* is typically abundant, while on Orkney and at high altitude in the eastern Scottish Highlands, *Cladonia* lichens are abundant. In the south, species with a mainly southern distribution in Britain, such as marsh gentian *Gentiana pneumonanthe*, brown beak-sedge *Rhynchospora fusca* and meadow thistle *Cirsium dissectum*, enrich wet heaths. At high altitude in northern Scotland, forms of the community rich in northern and montane species occur and often also have an abundance of *Cladonia* lichens.

4.2.12 Only 5.04 hectares of true wet heath (M15/M16) were mapped as occurring within the South Pennines SAC during the 2009 South Pennine Moors vegetation survey. However, a much larger area of 2,915 hectares was mapped as purple moor-grass (*Molinia caerulea*) dominated blanket bog and wet heath. This degraded moorland vegetation does not conform to the Habitats Directive Annex I definition of Northern Atlantic Wet Heath. A note relating to these areas of purple moor-grass dominated vegetation states:

> *"Many examples of Molinia blanket bog have probably been placed in the M25 community solely on the basis of dominance by Molinia, and it is possible that a large proportion of these could be better described as wet heath that has been degraded by grazing and / or burning in the past."*

Transition mires and quaking bogs

4.2.13 The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and Alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich. The vegetation normally has intimate mixtures of species considered to be acidophile and others thought of as calciphile or basophile. In some cases the mire occupies a physically transitional location between bog and fen vegetation, as for example on the marginal lagg of raised bog or associated with certain valley and basin mires. In other cases these intermediate properties may reflect the actual process of succession, as peat accumulates in groundwater-fed fen or open water to produce rainwater-fed bog isolated from groundwater influence. Many of these systems are very unstable underfoot and can therefore also be described as 'quaking bogs'.

4.2.14 Transition mires and quaking bogs can occur in a variety of situations, related to different geomorphological processes: in flood plain mires, valley bogs, basin mires and the lagg zone of raised bogs, and as regeneration surfaces within mires that have been cut-over for peat or areas of mineral soil influence within Blanket bogs (e.g. ladder fens).

4.2.15 In the South Pennine Moors SAC, Transition mire habitat occurs as examples of M4 *Carex rostrata – Sphagnum recurvum* mire. The SAC was not originally selected for this habitat type but its presence was subsequently identified as a qualifying feature. A total of 5.75 hectares of M4 Transition mire has been recorded from the South Pennines SAC. The nearest examples of this habitat occur some distance from the proposed development within Bradford occurring over 8km to the west of Haworth.

4.3 North Pennine Moors SAC

4.3.1 This SAC was selected for its representation of a total of six Annex 1 habitat types. A further seven habitat types were subsequently identified as being present as qualifying features within the SAC (see Chapter 3), many of which are upland habitats associated with calcareous and other rocky outcrops and heavy metal contaminated soils found further north in the Pennines. These are not considered likely to be affected by proposals within the Bradford Core Strategy.

4.3.2 Four of the Annex 1 habitat types are the same as those within the South Pennine Moors SAC; Blanket bog, Dry heath, Northern Atlantic wet heath and Old sessile oak woodland. It has not

been possible to obtain detailed information on the distribution of these Annex 1 habitats within the North Pennine Moors SAC. Their distribution in the vicinity of Bradford district has instead been obtained by reference to the NBN Gateway; see Figure 4.5.

4.3.3 Information on the distribution of Old sessile oak woodland has been inferred the Natural England ancient woodland inventory. The extent and location of this woodland habitat type shows that the nearest area of ancient woodland within either of the two SAC is Guisecliff Wood (North Pennine Moors SAC) near Glasshouses, over 15km to the north of the Bradford district boundary, and is not likely to be affected by policies within the Core Strategy.

4.4 Condition (Conservation) Status

4.4.1 Assessing the impact of a plan or project on a European site requires an understanding of the current condition of that site. Sites that are already under environmental stress are less likely to be able to withstand increased pressure than those that are less stressed. Such stressed sites may therefore be closer to a tipping point where additional pressure changes them from favourable to unfavourable condition and consequent adverse effect on site integrity.

4.4.2 It is very difficult to predict the capacity of sites to absorb additional pressure without pushing them beyond this theoretical tipping point. As a consequence, it is important to take a precautionary approach to such assessment and only countenance a conclusion of no adverse effect where there is strong evidence to show that the condition (conservation status) of a site will not be reduced.

4.4.3 Natural England undertakes periodic condition monitoring of SSSIs which is published on the Natural England website. Figure 4.6 shows a summary of the condition of SSSI units in the South Pennines. It shows that most of the area is either in unfavourable but recovering condition (i.e. under suitable management) or in unfavourable condition with no change.

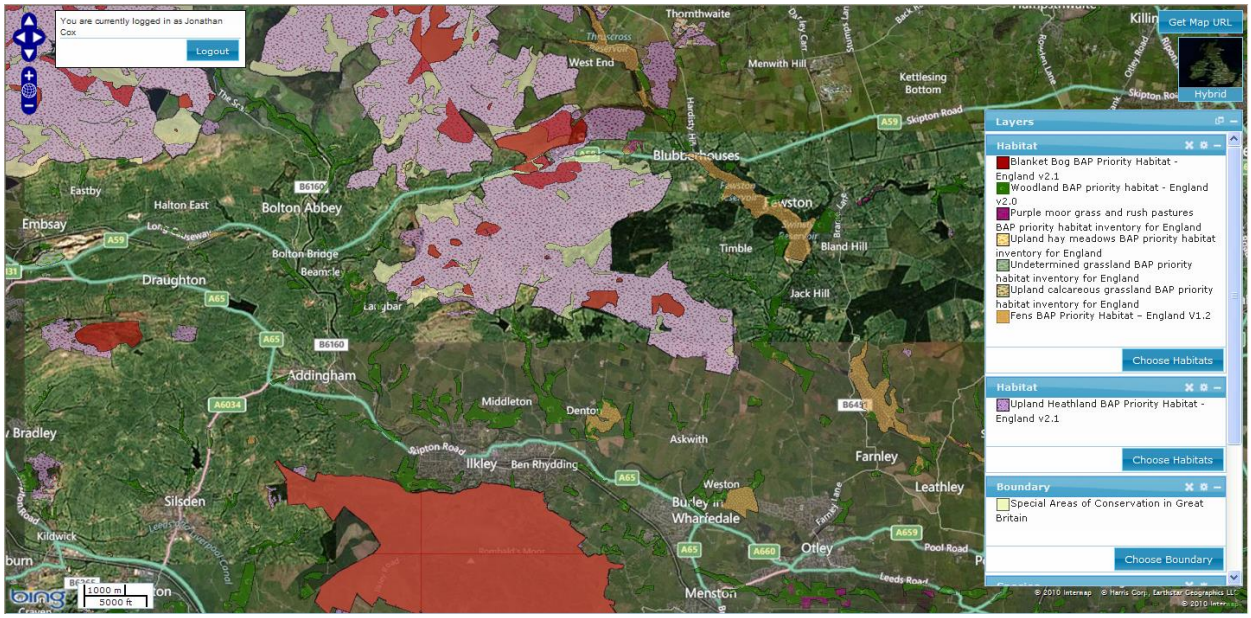


Figure 4.5: Habitat extents in North Pennine Moors SAC (Source: NBN Gateway)

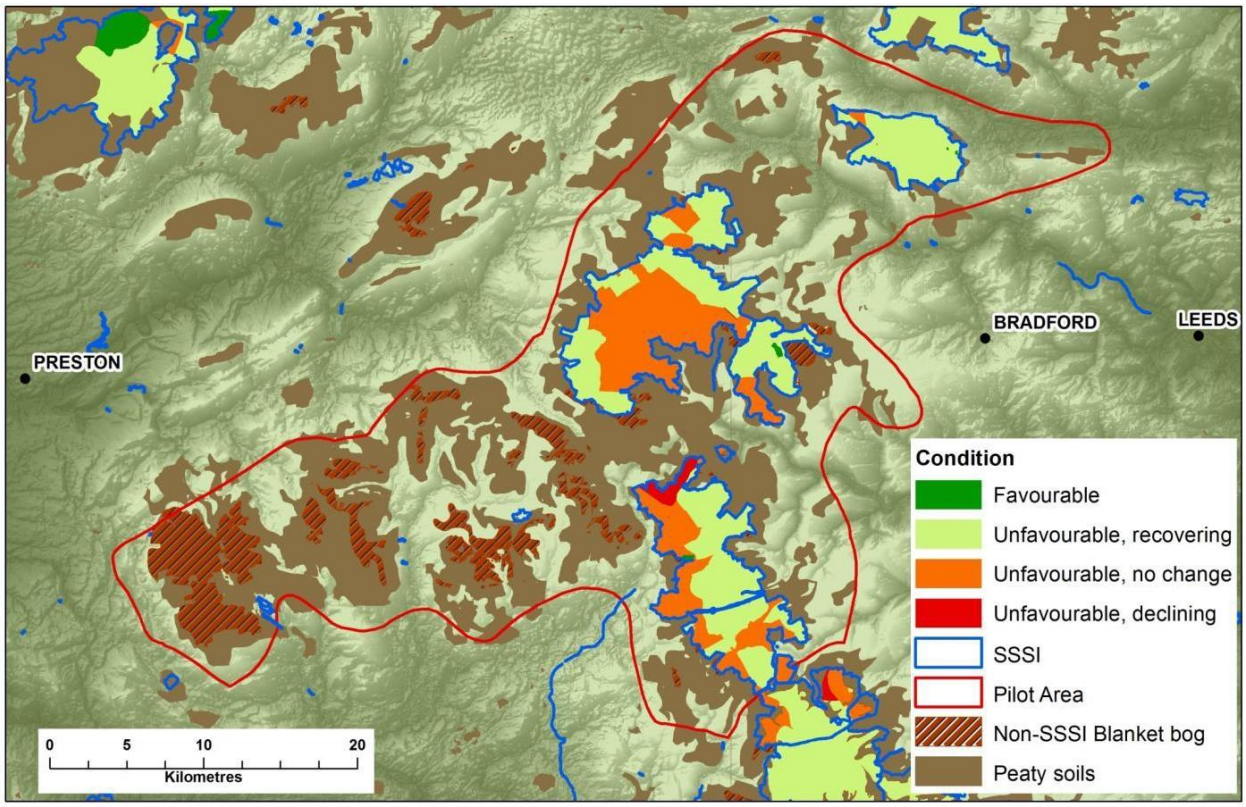


Figure 4.6: SSSI condition status in the South Pennines Moors SAC close to Bradford[29]

[29] Source: http://www.naturalengland.org.uk/Images/delivering-natures-services2_tcm6-17171.pdf

5 Identifying Impact Pathways

5.1 Introduction

5.1.1 The HRA screening assessment (Environ, 2012) identified a range of likely significant effects on the North and South Pennine Moorlands that could result from the Core Strategy for Bradford district. This list has been reviewed and rationalised, with new impact categories added as part of the Appropriate Assessment procedure. A revised screening matrix is presented in Appendix I, while the following sections provide information on how the identified impact pathways could affect the moors.

5.2 Loss of Supporting Feeding Sites

The revised screening assessment identifies a risk of significant effects resulting from the following proposed policies:

- **BD1: City of Bradford including Shipley and Lower Baildon Sub Area**
- **AD1: Airedale Sub Area**
- **WD1: Wharfedale Sub Area**
- **PN1: South Pennine Towns and Villages Sub Area**
- **HO3: Distribution of Housing Requirement**

5.2.1 The populations of birds for which the two SPA were classified breed within the SPA boundary but often feed on habitats outside of the SPA. These off-site habitats are vital to the conservation of the SPA bird populations and their conservation is of paramount importance to the maintenance of favourable conservation status (condition) of the SPA. Off-site habitats are particularly important for Golden Plover during the breeding season as young birds are often taken from their moorland nest sites to feed on meadows adjacent to the moorland. These meadows, sometimes referred to as in-bye land are rich in invertebrate food, in particular cranefly larvae and earthworms. Chicks may be moved up to 2km or more to feed in such meadows (Byrkjedal & Thompson, 1998).

5.2.2 Curlew also frequently utilise wet meadows to feed both during the breeding season and in periods of migration when flocks of birds congregate in in-bye fields. Curlew are a species for which the North Pennine Moors SPA has been selected (but not the South Pennine Moors SPA). However Curlew are also considered a typical species of the Annex 1 habitat type Blanket bogs. This is a habitat for which both the North and South Pennine Moors SAC have been selected and hence the conservation of these off-site in-bye meadows is important to the maintenance of favourable condition (conservation status) of the North Pennine Moors SPA and both the North and South Pennine Moors SAC.

5.2.3 The in-bye meadows are also important for nesting Twite. These small finches have undergone significant national declines in recent years and are red list species (Birds of Conservation Concern 3). They are a bird of the moorland- farmland interface, nesting under rocky crags or in

patches of bracken, heather or bilberry in areas of mature heathland within the dry heaths habitat. However, the Twite only eats seeds, even when it is feeding its young. Without a good supply of seed sources close to its moorland nest, it will not survive. It searches for seeds on roadside verges, patches of waste ground and particularly hay meadows, within 2.5km of its nesting site[30].

5.2.4 Another typical species of the dry heaths habitat is the bilberry bumblebee. This is also a declining species in Britain and, like the Twite, it is a species of dry heaths. There are clear flower-visiting preferences for this species, with bilberries *Vaccinium* spp. and sallow *Salix* spp. being much used in spring; bird's-foot trefoil *Lotus corniculatus*, clovers *Trifolium* spp. and raspberry *Rubus idaeus* and bramble *Rubus fruticosus* agg. in early to mid-summer; and bell heather and bilberries in mid- to late-summer[31]. It is in the mid-summer period when these bees are feeding on a wider range of species that they will forage away from the moorland on areas of in-bye land away from the SAC. As with the Twite, the conservation of this typical species of the dry heath habitat is dependent upon the conservation of off-site species rich meadows (in-bye).

5.2.5 In-bye land of importance for the conservation of typical species of Annex 1 habitats on the Pennine Moors has been surveyed for birds by West Yorkshire Ecology (WYE, 2003) and for habitats by the Bradford Wildlife Areas Survey (2011-12). Figure 5.1 and Figure 5.2 have been produced to provide an indication of the areas used by these birds – together with the other SPA species, typical species and key prey species – in the vicinity of the SPA and SAC. Bird records are from all sources and all dates provided by WYE.

5.2.6 It is therefore important to look at clusters of records for several species that may indicate important supporting habitat concentrations that should be protected by policies in the Core Strategy. Skylark and meadow pipit, for example, tend to occur in fields used by a number of other key bird species including twite, lapwing and curlew. It is anticipated that additional and more specific detail will become available once the South Pennine Moorland Fringe Bird Survey of 2012 is complete.

South Pennine Moorland Fringe Bird Survey (2012)

5.2.7 Additionally, during 2012 West Yorkshire Ecology has been carrying out further surveys of the South Pennine Moorland fringe to examine the relative importance of areas of in-bye land to a group of 14 birds associated with the moors. When complete, it is likely that the work will provide a vital insight to which areas are of particular importance and need to be safeguarded from development or changes of use in order to protect the integrity of the SPA. The results of this survey are currently being analysed and a full report of the survey has not been published. However, some early draft results were made available by the project lead (pers. comm., 2012a) to help with the preparation of this assessment.

[30] http://www.watershedlandscape.co.uk/care/the-pennine-Twite/

[31] http://www.bwars.com/index.php?q=bee/apidae/bombus-monticola

Use of Supporting Habitats by Key Bird Species (all records)

Meadow pipit & skylark within 2km of SPA_font_point

- Meadow Pipit
- Skylark

Target 14 bird species SPA +2km_font_point

- Common Sandpiper
- Curlew
- Dunlin
- Eurasian Curlew
- Golden Plover
- Lapwing
- Merlin
- Peregrine
- Redshank
- Ring Ouzel
- Short-Eared Owl
- Snipe
- Twite
- Wheatear
- Whinchat
- SAC
- SPA
- Grassland habitats
- CBMDC Outline
- CBMDC Settlements

0 1 2 Kilometers

N

ENVIRONMENTAL CONSULTING
Tower Point
44 North Road
Brighton
BN1 1YR

Scale	Date
1: 79,443	Apr2013
Created by	**Reviewed by**
JC	NP

Drawing number
UE-0112_Bradford_Supporting_Habitats_1_20130426

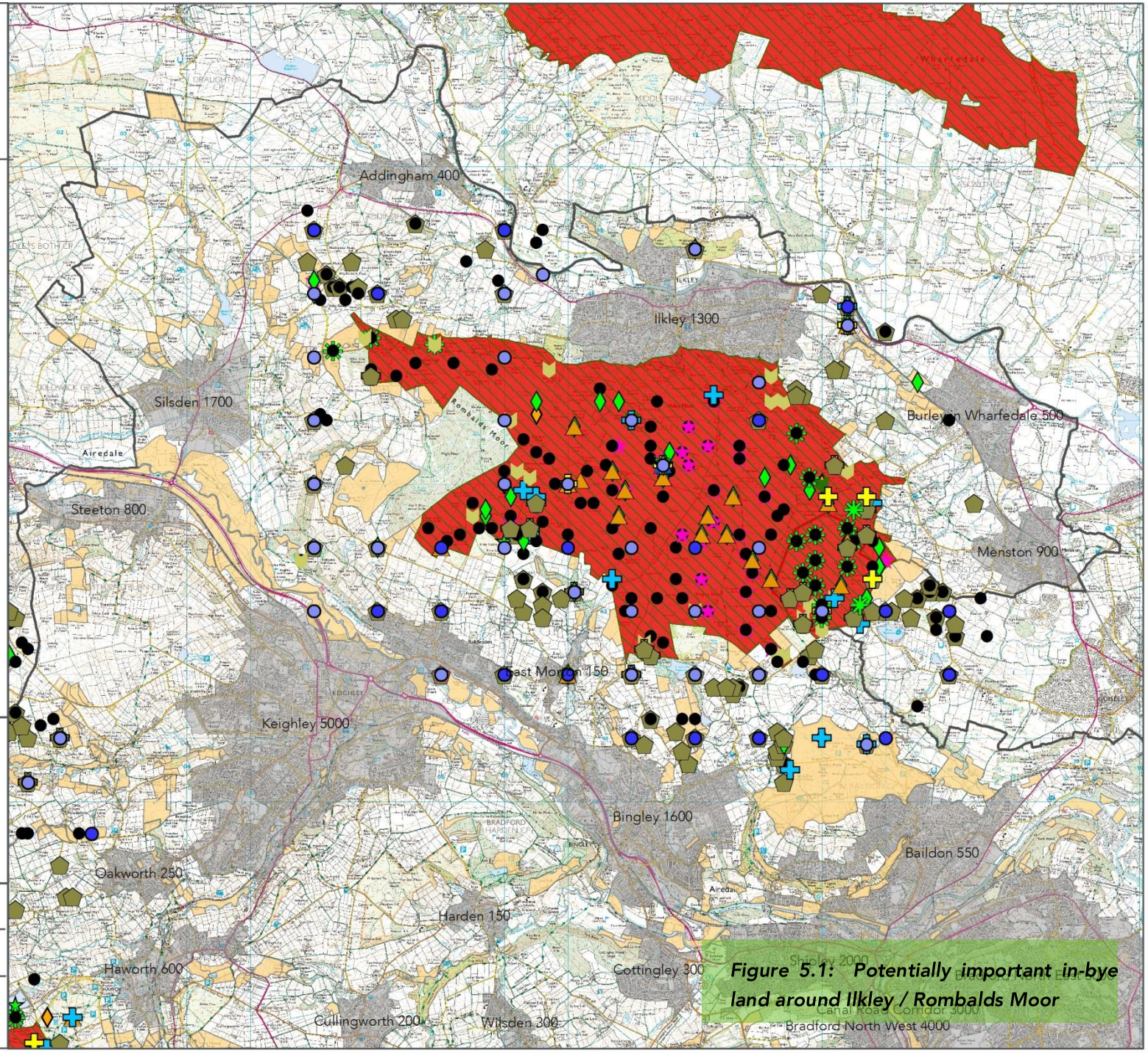


Figure 5.1: Potentially important in-bye land around Ilkley / Rombalds Moor

Use of Supporting Habitats by Key Bird Species (all records)

Meadow pipit & skylark within 2km of SPA_font_point

- Meadow Pipit
- Skylark

Target 14 bird species SPA +2km_font_point

- Common Sandpiper
- Curlew
- Dunlin
- Eurasian Curlew
- Golden Plover
- Lapwing
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- Grassland habitats
- CBMDC Outline
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0 1 2 Kilometers

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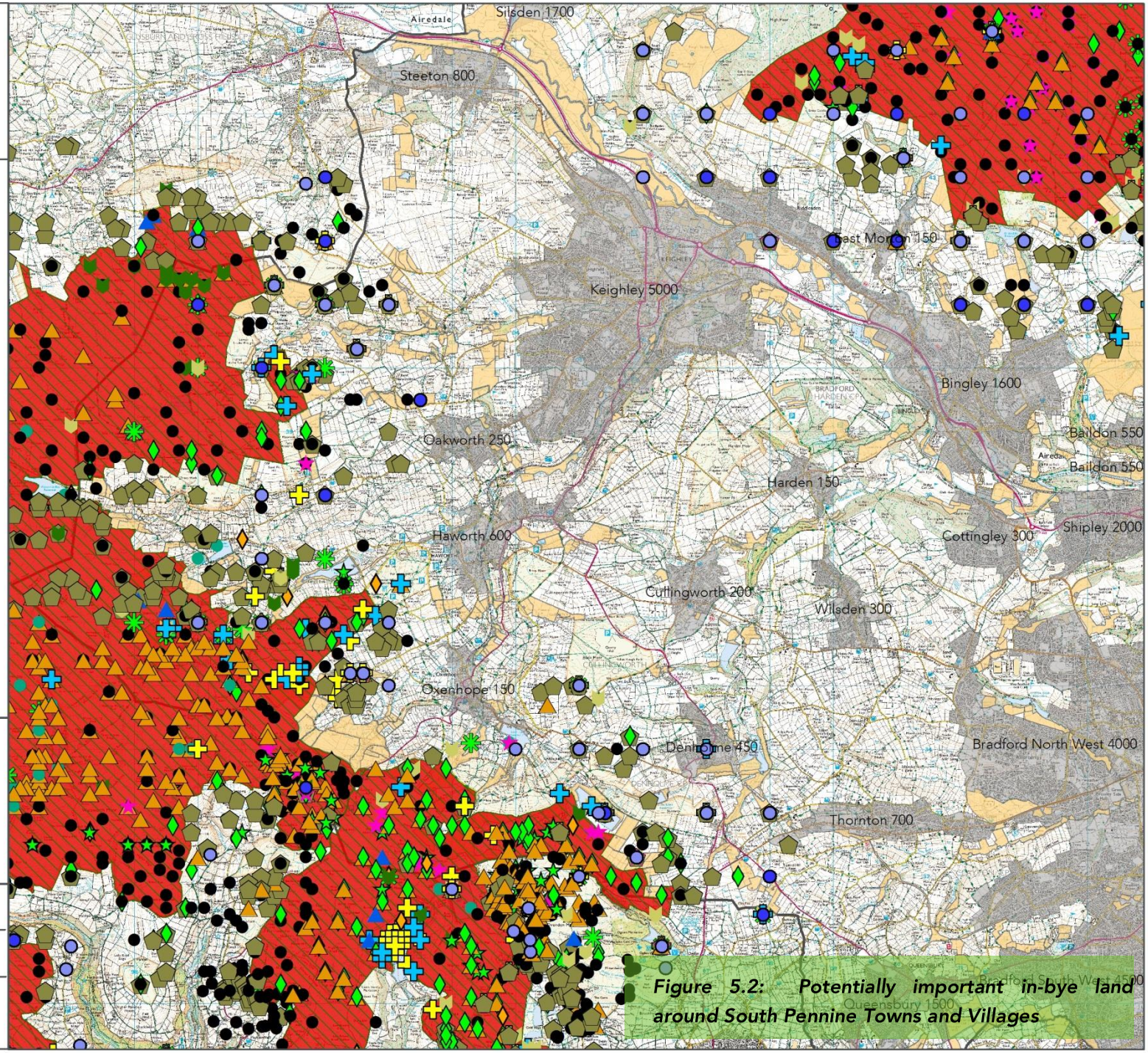


Figure 5.2: Potentially important in-bye land around South Pennine Towns and Villages

ENVIRONMENTAL CONSULTING
Tower Point
44 North Road
Brighton
BN1 1YR

Scale	Date
1: 79,443	Apr2013
Created by	**Reviewed by**
JC	NP

Drawing number
UE-0112_Bradford_Supporting_Habitats_2_20130426

Table 5.1: South Pennine Moors SPA Annex I and migratory species recorded at sites near priority settlements in Bradford – draft results of the South Pennine Moorland Fringe Bird Survey 2012 (Source: adapted from West Yorkshire Ecology (pers. comm., 2012a)

Site	Settlement	Key species	Activity *	Abundance (approx.)
2	Addingham	Curlew	Breeding, Foraging	15 +
3	Addingham	Curlew	Breeding, Foraging	5 +
4	Addingham	Curlew	Breeding, Foraging	20 +
17	Baildon (Shipley)	Curlew	Breeding, Foraging	15 +
20	Baildon (Shipley)	Curlew	Breeding, Foraging,	5 +
16	Bingley	Curlew	Breeding, Foraging	10 +
18	Bingley	Curlew	Foraging, in flight	10 +
41	Denholme	Curlew	Breeding, Foraging	20 +
42	Denholme	Curlew	Foraging	10 +
43	Denholme	Curlew	Breeding, Foraging	20 + (min 1 breeding pair on site)
44	Denholme	Curlew	Breeding, Foraging	15 + (including small post-breeding flocks)
11	East Morton	Curlew	Breeding, Foraging	10 + (min 1 pair breeding on site)
12	East Morton	Curlew	Breeding, Foraging	5 +
34	Haworth	Curlew	Breeding, Foraging	5 +
23	Keighley	Curlew	Breeding, Foraging	10 +
24	Keighley	Curlew	Breeding, Foraging,	10 +
25	Keighley	Curlew	Breeding, Foraging	15 +
26	Keighley	Curlew	Breeding, Foraging	7 + (including 2 pairs)
27	Keighley	Curlew	Breeding, Foraging	10 +
28	Oakworth	Curlew	Breeding, Foraging	15 +
31	Oakworth	Curlew	Foraging, In flight	5 +
32	Oakworth	Curlew	Foraging	3 +
33	Oakworth	Curlew	Breeding, Foraging	15 +

Site	Settlement	Key species	Activity *	Abundance (approx.)
36	Oxenhope	Curlew	Foraging, In flight	2 +
37	Oxenhope	Curlew	Breeding, Foraging	10 +
39	Oxenhope	Curlew	Breeding, Foraging	5 +
5	Silsden	Curlew	Breeding, Foraging	7 +
6	Silsden	Curlew	Foraging	5 +
7	Silsden	Curlew	Breeding, Foraging	10 +
27	Keighley	Dunlin	Foraging	1
17	Baildon (Shipley)	Golden Plover	Foraging, Roosting	30 + (pre-breeding migration flock)
44	Denholme	Golden Plover	Breeding, Foraging	25 + (including pre-breeding migration flock)
26	Keighley	Golden Plover	Breeding, Foraging	5 +
11	East Morton	Golden Plover*	Foraging, In flight, Calling	1 + (* 30 + pre-breeding roost to north of site – on moor)
11	East Morton	Merlin	Hunting	1 +
34	Haworth	Merlin	Hunting	1
26	Keighley	Merlin	Hunting	1 (female)
27	Keighley	Merlin	Hunting	1 (juvenile)
11	East Morton	Short-eared Owl	Breeding, Hunting	1 pair (breeding to north of site)
26	Keighley	Short-eared Owl	Breeding	1 pair (as for Site 27)
27	Keighley	Short-eared Owl	Breeding	1 pair
33	Oakworth	Short-eared Owl	Hunting	1 + (to SW of site)
36	Oxenhope	Short-eared Owl	Hunting	1 +
37	Oxenhope	Short-eared Owl	Hunting	1 +
41	Denholme	Short-eared Owl*	Hunting	Site 40 – on Oxenhope Moor
41	Denholme	Twite	Foraging	2 +
44	Denholme	Twite	Foraging	1 +
37	Oxenhope	Twite	Foraging	1

NB:

'Breeding' does not necessarily mean breeding on site (particularly for Curlew), just that these birds have been recorded as exhibiting 'confirmed', 'probable' or 'possible' breeding behaviour (i.e. the behaviours have been grouped in this summary table). Numbers are approximate – included simply to give an indication of relative abundance.

Surveys concentrated on the in-bye, not the SPA, so where a survey square includes areas of the SPA, this does not mean they were covered by the survey transects.

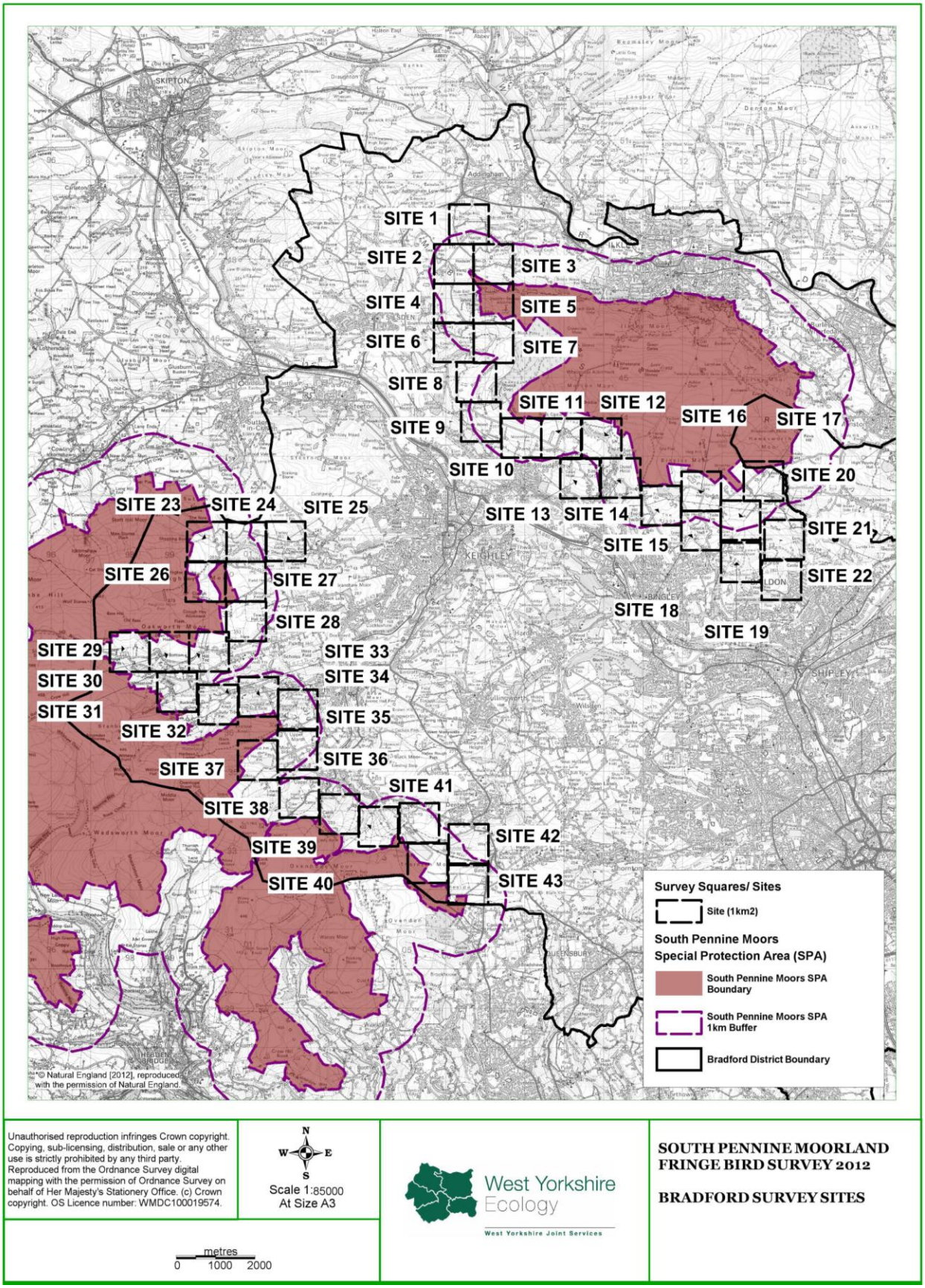


Figure 5.3: Extent and location of South Pennine Moorland Fringe Bird Survey sites 2012

5.2.8 Survey sites were identified as 1km squares or sample plots located around the fringes of the South Pennine Moors SPA within Bradford district. These covered the majority of the moorland fringe apart from the area within Wharfedale to the north of Ilkley Moor. Initial data from this survey has been sorted to give the locations of Annex 1 and migratory species for which the SPA has been classified (see section 3.2) and those species identified as being typical of the Annex 1 habitat types within the SAC (Table 3.2). These are reported in Table 5.1 (note the limitations to this data at the foot of the table) and should be read with reference to Figure 5.3. Only records of birds noted as "breeding" or "foraging" have been included in this analysis.

5.2.9 The most frequent and widespread species recorded was Curlew with records of breeding or foraging from 29 of the 1km squares and association with 10 settlements. Most of these were found in the area between Keighley and the SPA/SAC boundary although there were also concentrations around Oakworth and Denholme. Additional concentrations were found to the north west of Ilkely Moor around Addingham and to the south east of the Moor to the north of Baildon and Bingley.

5.2.10 Golden Plover were recorded breeding or foraging in four 1km squares at Baildon (Shipley), Denholme, west of Keighley and East Morton. There was only one record of one Dunlin foraging in an area on the edge of the SPA/SAC west of Keighley. Merlin were recorded hunting in four 1km squares on moorland fringes to the west of East Morton, Haworth and Keighley. Short-eared Owls were recorded breeding and/or hunting from seven 1km squares, all of them on the fringes of the SPA/SAC to the west of East Morton, Keighley, Oakworth, Oxenhope and Denholme.

5.2.11 Twite, a typical species of dry heathland habitat within the SAC, was recorded from only three 1km squares two of these to the west of Denholme and one west of Oxenhope.

5.3 Increased Water Demand

5.3.1 In relation to water demand, the earlier screening assessment stated the following (Environ, 2012):

> *"Changes in groundwater levels and water quality from new housing and economic development: The risk of a likely significant effect (LSE) is uncertain. On the basis of the precautionary principle, an LSE is identified because the Core Strategy directs development close to the boundaries of the SPA, particularly at Rombalds Moor, and it is not known whether there are any issues relating to water supply and the delivery of the Core Strategy. Measures to manage flood risk associated with development in the District and whether they could affect the hydrology of the site are also unknown."*

5.3.2 The Water Resource Management Plan 2010-35 (WRMP) prepared by Yorkshire Water (2009) shows that Bradford district falls entirely within its 'Grid Surface Water Zone'. Urban areas in the west and south are principally supplied from reservoirs in the Pennines. The Pennines and the valleys of the Rivers Don, Aire, Wharfe, Calder, Nidd and Colne are the largest upland source of water in the region. Yorkshire Water operates over 100 impounding reservoirs of which two are

major pumped storage reservoirs. The total storage capacity of all the supply reservoirs is 160,431 megalitres (Ml).

5.3.3 The WRMP assesses the supply-demand balance on the basis of household and population forecasts for the period 2010-35. In the first instance the plan took the Yorkshire and Humber Regional Spatial Strategy (RSS) residential development target of 22,620 dwellings per annum (dpa) for 2008-26, and extended this forward to the end of its planning period (2035). It then revised this forecast on the basis that (i) Yorkshire Water's area is slightly smaller than the Yorkshire and Humber Regional Spatial Strategy area, and (ii) to take account of the slowdown in residential development as a result of the recession. Its final household growth projection across its area amounted to 550,214 dwellings (2010-35), an average of 20,378dpa, slightly less than the RSS annual target. The residential development target within the Core Strategy (Further Engagement Draft) is 45,500, slightly less than the original RSS allocation for Bradford district of 50,000.

5.3.4 In its analysis of the water resource supply-demand balance, the WRMP finds that there is no deficit in supply for any year in the planning period, and that no new water resources need to be developed in order to meet demand; see Figure 5.4.

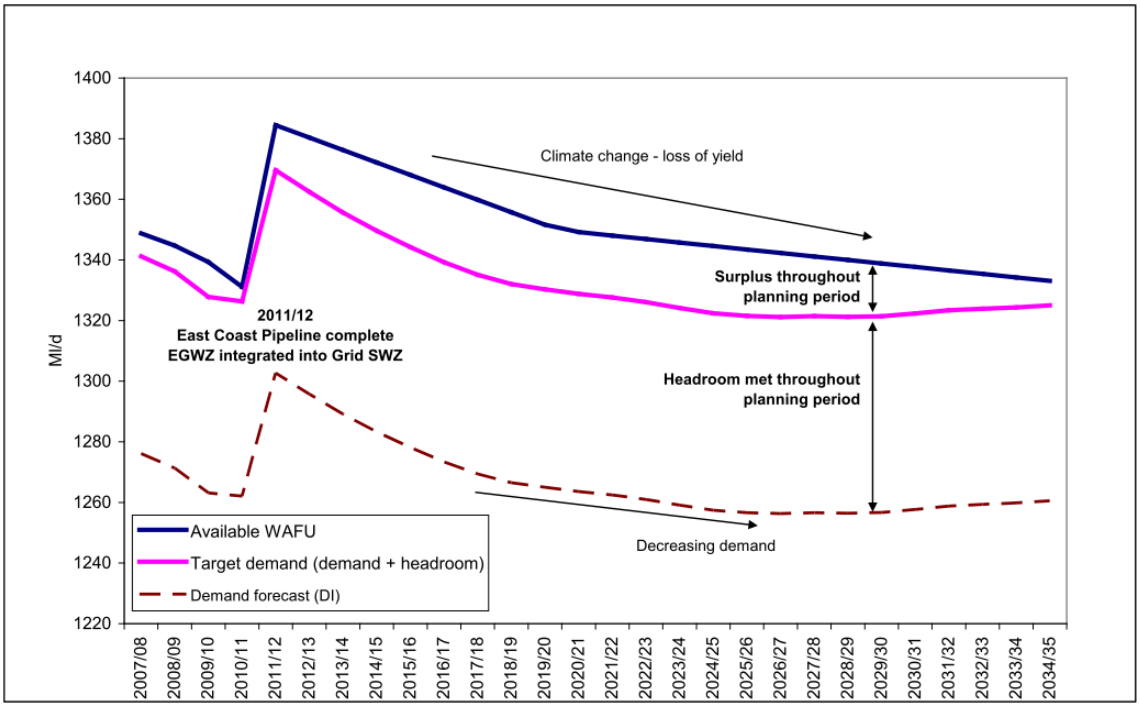


Figure 5.4: Final Water Resources Management Plan Baseline Dry Year Annual Average Grid SWZ supply-demand balance (Source: Yorkshire Water, 2009, p.131)

5.3.5 Furthermore, the company states that its "*abstractions have been assessed as part of the Habitats Directive investigations and are considered to have no detrimental impact on the environment*" (Yorkshire Water, 2009, p.14); by which we take it to mean that the Environment Agency has assessed its abstractions as part of the Review of Consent process under the Habitats Regulations and found that no Sustainability Reductions are necessary in order to preserve ecological integrity within European sites.

5.3.6 Earlier drafts of the WRMP included an assessment of options for developing new water resources in the event that any would be required during the planning period. These were reviewed to establish whether, if developed, they would be likely to affect the North or South Pennine Moors SAC/SPA, to cover off the risk forecast errors in the final WRMP. Three new water resource developments were considered to offer best value (in terms of economic viability, environmental and carbon costs):

- A leakage reduction programme yielding 22Ml/d;
- An increase in groundwater abstractions in the Swale area yielding 2Ml/d; and
- An extension to an existing water treatment works on the River Ouse yielding 22Ml/d.

5.3.7 None of these are needed to maintain the supply-demand balance over the plan period, and none is considered likely to significantly affect the North or South Pennine Moors SAC/SPA. It can be concluded that the residential development target of the Bradford district Core Strategy (Further Engagement Draft) is not likely to affect the North or South Pennine Moors SAC/SPA.

5.4 Impacts on Water Quality

5.4.1 In relation to water demand, the earlier screening assessment stated the following (Environ, 2012):

> *"Changes in groundwater levels and water quality from new housing and economic development: The risk of a likely significant effect (LSE) is uncertain. On the basis of the precautionary principle, an LSE is identified because the Core Strategy directs development close to the boundaries of the SPA, particularly at Rombalds Moor, and it is not known whether there are any issues relating to water supply and the delivery of the Core Strategy. Measures to manage flood risk associated with development in the District and whether they could affect the hydrology of the site are also unknown"*

5.4.2 There is no further elaboration on how water quality on the moorlands could be significantly affected as a result of new housing and economic development in Bradford district. However, waste water from new developments must be collected, conveyed and treated prior to discharge to the environment, and can result in impacts to water quality and ecological receptors. The following information regarding waste water treatment infrastructure and discharge flows relevant to Bradford district was gathered from conversations with Environment Agency (pers. comm., 2012b). The main waste water treatment works (WWTW) serving settlements in the district are listed in Table 5.2.

5.4.3 All of these WWTWs discharge to the Rivers Aire, Wharfe or Calder, either directly or via tributaries. The River Clader joins the Aire at Castleford, with the Aire flowing on to meet the Riiver Ouse at Goole, while the Wharfe joins the Ouse at Cawood; the Ouse eventually joins the Humber Estuary.

5.4.4 The Humber Estuary, which drains over a fifth of the area of England, is an SAC, SPA and Ramsar site and all discharges to it were assessed as part of the Environment Agency's Review of Consents under the Habitats Directive. It was assumed for the purposes of the RoC that all

discharges were operating to their licensed limit. The assessment could not conclude with certainty that there would be no adverse effect on the integrity of the site's features as a result of dissolved oxygen sag due to organic loading (from sewage discharges as well as other sources)[32]. Low dissolved oxygen can impact on a number of estuary features; effects can include changes to the types and numbers of plant, animal and fish species present.

5.4.5 The Environment Agency modelled all regulated consents that affect oxygen sag and concluded that they are responsible for approximately 40% of the total impact. In response it made changes to two discharge permits, including significant improvements in the Selby area to reduce major surcharges to the River Ouse.

5.4.6 It is concluded that development under the Bradford district Core Strategy is unlikely to affect any European site as a result of impacts on water quality.

Table 5.2: Main waste water treatment works serving settlements in Bradford district

WWTW	Settlement	Discharges to
Esholt	Bradford City Centre	R. Aire
Dowley Gap	Bingley	R. Aire
Marley	Keighley	R. Aire
Oxenhope	Oxenhope	Bridgehouse Beck > R. Worth > R. Aire
Ben Rhydding	Ilkley	R. Wharfe
Ash Holme	Burley in Wharefdale	R. Wharfe
Denholme	Denholme	Denholme Beck > Harden Beck > R. Aire
Mitchell Laithes (Dewsbury)	South east Bradford	R. Calder

5.5 Increased Emissions to Air

The revised screening assessment identifies a risk of significant effects resulting from the following proposed policies:

- **BD1: City of Bradford including Shipley and Lower Baildon Sub Area**
- **AD1: Airedale Sub Area**
- **WD1: Wharfedale Sub Area**
- **PN1: South Pennine Towns and Villages Sub Area**
- **EC3: Employment Land Requirement**
- **HO3: Distribution of Housing Requirement**

5.5.1 Atmospheric pollution is a widespread issue, with background air quality heavily influenced by large point-source emitters including transboundary sources. During the 1800s the industrial

[32] Other types of impact were considered, including entrainment and impingement of Lamprey, toxic contamination from current and past industry, and freshwater flows over mud flats, but none of these in linked to Core Strategy development in Bradford.

revolution led to extensive use of steam-powered machines, and an increase in the number of factories in northern Britain including around Manchester, the Peak District and South Pennines. Nitrous and sulphurous oxides released from chimney stacks in South and West Yorkshire and Greater Manchester were deposited on the moors. Deposition of sulphurous oxides degraded or destroyed large areas of peat-forming *Sphagnum* moss, while nitrous oxide emissions (which remain high today) result in nutrient enrichment, benefitting, nitrophilous grasses so that they out-compete the mosses and other moorland vegetation.

5.5.2 Local pollutant sources can affect designated sites, particularly in relation to protected habitats within SAC, and especially from road traffic emissions. The Core Strategy cannot feasibly influence causes of background pollution such as large point sources but, through its spatial distribution of development and sustainable transport measures, will affect the way in which locally emitted pollutants reach each site. The main pollutant effects of interest are acid deposition and eutrophication by nitrogen deposition. The following brief descriptions draw on information presented through the Air Pollution Information System[33] (APIS).

5.5.3 Acid deposition: caused by oxides of nitrogen (NO_X) (or sulphur dioxide) reacting with rain/ cloudwater to form nitric (or sulphuric) acid, and is caused primarily by energy generation, as well as road traffic and industrial combustion. Both wet and dry acid deposition have been implicated in the damage and destruction of vegetation (heather, mosses, liverworts and lichens are particularly susceptible to cell membrane damage due to excessive pollutant levels) and in the degradation of soils and watercourses (including acidification and reduced microbial activity).

5.5.4 Eutrophication by nitrogen deposition: consists of the input of nitrogen from NO_X (and sometimes ammonia) emissions by deposition, and is caused primarily by road traffic, as well as energy generation, industrial combustion and agricultural practices. Nitrogen deposition can cause direct damage to heather, mosses, liverworts and lichens, as well as other plant species, because of their sensitivity to additional atmospheric nitrogen inputs, whilst deposition can also lead to long term compositional changes in vegetation and reduced diversity. For example a marked decline in heather and an increased dominance of grasses have been observed throughout the Netherlands and also in the East Anglian Brecklands (see for example Bobbink et al (1993) and Pitcairn et al (1991)). Furthermore, while plants are able to detoxify and assimilate low exposure to atmospheric concentrations of NO_X, high levels of uptake can lead to detrimental impacts including:

- Inhibition of pigment biosynthesis, leading to reduced rates of photosynthesis;
- Water soaking as NO_2 molecules attach to lipids in membranes, causing plasmolysis (removal of water) and eventually necrosis;
- Inhibition of lipid biosynthesis, leading to reduced rates of regeneration and growth;
- Injury to mitochondria and plastids, essential to internal processing of energy & proteins;
- Decrease in stomatal conductance of air and water vapour; and
- Inhibition of carbon fixation (at least under low light levels).

[33] Online at: http://www.apis.ac.uk/index.html [Accessed 17/10/12]

5.5.5 Critical loads and levels can be used both as a benchmark for air quality management, and assessing the impacts of actions that lead to new pollutant emissions. Nilsson and Grennfelt (1988) define the concept of critical loads and levels as "*a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*". Critical loads concern the quantity of pollutants deposited from the air to the ground (for example nitrogen deposition and acid deposition), whilst critical levels concern the gaseous concentration of a pollutant in the air (for example nitrogen oxides).

5.5.6 Appendix II presents data available through APIS on background critical load/level exceedances for these key pollutants types. A selection of grid references within European sites on or close to the road network connecting to Bradford district were chosen to interrogate APIS (Figure 5.5) because beyond 200m effects from road sources diminish to the equivalent of background levels (Laxen & Wilson (2002), DfT (2005)).

5.5.7 For each grid reference, the actual and critical load/level was obtained for acid deposition, nutrient deposition and NOx in relation to a representative qualifying habitat type, or closest available match thereto, within European sites of interest (North and South Pennine Moors SAC). Cells shaded in red indicate an exceedance, whereas those shaded in amber indicate that the background load/level is more than 70% the critical load/level i.e. it is approaching exceedance.

5.5.8 As can be seen, for every location queried, the nitrogen deposition load is already exceeded, often by a high margin; Wadsworth Moor (GR3) and Thornton Moor (GR4), which are dissected by the A6033 Hebden Bridge Road currently have a modelled nitrogen loading of 552% of the critical load for bog habitats. All locations except Round Hill (Grid Reference 1 and Embsay Moor (GR2) are also currently exceeded for acid deposition (from a combination of sulphur and nitrogen inputs). None of the locations are exceeded for atmospheric concentrations of nitrogen, although Rishworth/Moss Moor (GR6) is approaching exceedance; this site is sandwiched between the A672 Oldham Road and M62 (J23-J22).

5.5.9 Environment Agency H1 guidance (2010) explains that, regardless of the baseline environmental conditions, a process' contribution to atmospheric pollution (i.e. the Core Strategy's contribution) can be considered insignificant if: the long-term (annual mean) process contribution is <1% of the long-term environmental standard (critical load/level). This criterion is also used in guidance issued by the Agency and JNCC on applying the Habitats Regulations in relation to air quality impacts (Environment Agency, 2005) which states that:

> *"Where the concentration within the emission footprint in any part of the European site is less than 1% of the relevant benchmark, the emission is unlikely to have a significant effect irrespective of the background levels."*

5.5.10 The guidance further states that if the process contribution is >1% of the critical load/level and, when added to background pollution levels, the total predicted environmental concentration of a pollutant is >70% of the critical load/level, detailed assessment of atmospheric pollution effects would be required.

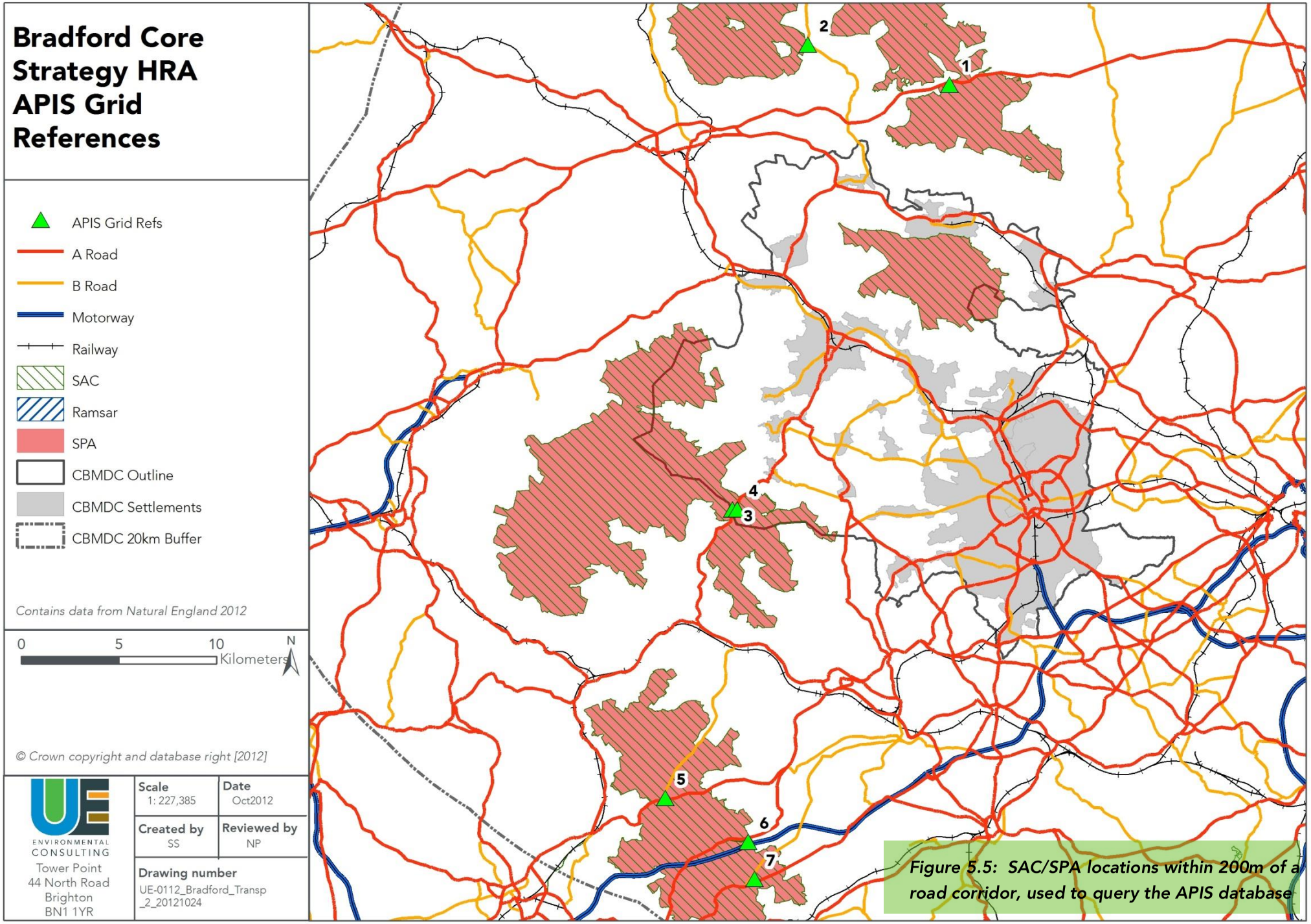


Figure 5.5: SAC/SPA locations within 200m of a road corridor, used to query the APIS database

5.5.11 In selecting its preferred spatial development option for the Core Strategy, the Council commissioned an extensive transport study to examine impacts to all modes of travel (Steer Davies Gleave, 2010), based on a multi-modal model of the district's transport network. For all options considered (including a preferred option not dissimilar to the Further Engagement Draft preferred option) the model produces trip rate forecasts by origin and destination, across all modes, according to 15 sectors of the district. The study identifies ten key transport corridors in the district that can be expected to carry increased transport demand, as listed below and shown in Figure 5.6:

- 1: M606/M62;
- 2: A629/A644 (Keighley to Queensbury);
- 3: A6036/Little Horton Lane (route between Calderdale and Bradford – through Northowram/Shelf);
- 4: B6145 (Thornton Road);
- 5: A650 (Airedale corridor between Keighley and Bradford);
- 6: A629 (route between Craven and Bradford – through Silsden/Steeton area);
- 7: A65/A6038 (Wharfedale corridor between Addingham and Bradford);
- 8: A647 (route between Leeds and Bradford ring-roads);
- 9: A641 (route between Calderdale (Brighouse) and Bradford); and
- 10: A650 (Tong Street).

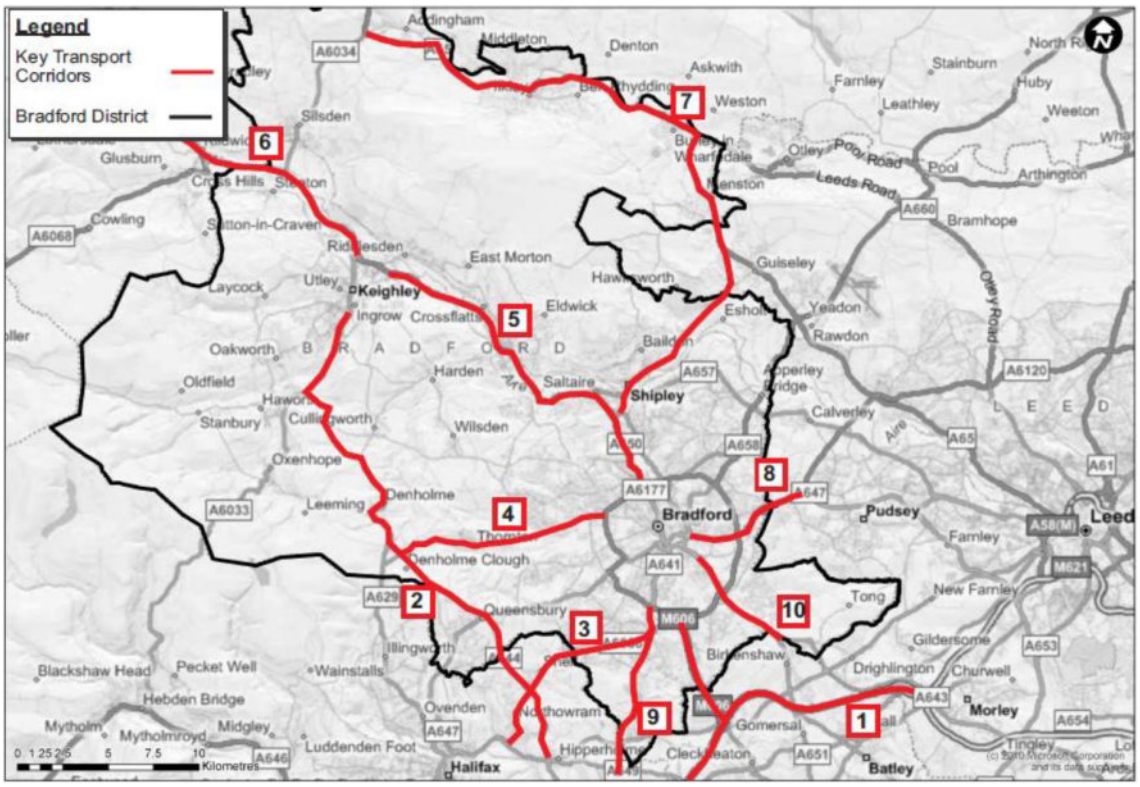


Figure 5.6: Transport corridors with increased demand in the preferred option (Source: Steer Davies Gleave, 2010)

5.5.12 Comparing Figure 5.6 with Figure 5.5, it can be seen that none of the study's "key transport corridors" coincides with any of the locations on the road network falling within 200m of the North or South Pennine Moors SAC/SPA, although several of them are heading in the direction of trans-Pennine routes in the Rishworth and Moss Moor areas. This makes it very difficult to draw any conclusions regarding the potential impact of development-related traffic growth on the SAC/SPA.

5.5.13 On the other hand, the Core Strategy refers to 2001 census data which suggests that 77% of the working age population in Bradford district both live and work within the district; the majority of those who do commute in/out of the district for work travel in the direction to/from Leeds. These figures indicate relatively high levels of internalisation, and a large number of trips being made on routes that do not pass nearby SAC/SPA habitats. But the figures are not sufficiently robust to be the bases for substantive conclusions.

5.6 Wind Turbines (Collision Mortality Risk and Displacement)

The revised screening assessment identifies a risk of significant effects resulting from the following proposed policies:

- PN1: South **Pennine Towns and Villages Sub Area**
- **EN6: Energy**

5.6.1 Proposed policy EN6 encourages the development of energy efficiency, and low carbon and renewable sources of energy, which is to be welcomed in the context of climate change. The supporting text to EN6 acknowledges that the presence of the South Pennine Moors SAC/SPA places a 'strategic constraint' on potential new wind generation capacity. Conversely, policy PN1 (South Pennine Towns and Villages) identifies the settlements of Denholme, Thornton and Queensbury as having the greatest potential for wind turbines, and these are in relatively close proximity (approximately 1.4km, 1.6km and 3km respectively) to the SAC/SPA.

5.6.2 The risk of impacts to bird populations from wind turbine development is well-documented in scientific literature. For example, wind turbines can negatively affect birds through the risk of collision mortality, habitat loss, displacement from otherwise supporting habitats, and disorientation from flight paths (see for example Langston and Pullan, 2003). Displacement leads to the reduction in birds' use of an area for feeding or roosting, or absence in entirety, effectively rendering the loss of habitats to birds. Research shows that such negative effects, as associated with wind turbines, have been observed at a distance of up to 800m (including zero); 600m is the maximum reliably recorded distance at which such effects would take place (Drewitt and Langston, 2006) However, there is inconclusive evidence in relation to the precise mechanisms of impacts, the general applicability of findings between species or sites, and the relative importance of disturbance, displacement and collision mortality risk in effects on bird populations and distribution.

5.6.3 Pearce-Higgins *et al.* (2009) compared twelve operational wind farms in unenclosed upland locations (moorland, rough grassland or blanket bog) to investigate whether there is reduced occurrence of breeding birds close to wind farm infrastructure including turbines, access tracks and overhead transmission cables. Seven of the twelve species (Buzzard *Buteo buteo*, Hen

Harrier, Golden Plover, Snipe, Curlew, Wheatear and Meadow Pipit) studied had significantly lower occurrence close to the turbines, after accounting for habitat variation. They also found sound evidence of reduced flight activity in raptors close to turbines. They concluded that there could be a reduction in breeding bird densities of up to c.50% within up to 500m of wind farms. But in a later study, Douglas, Bellamy & Pearce-Higgins (2011) found that Golden Plover showed an increase in numbers from 0.8 pairs per km^2 to 1.4 pairs per km^2 over two years close to an operational 17-turbine wind farm site. Of note was an increase from 4 to 9 plover territories within 500m of turbines, with even greater increases in numbers noted on the control site. These findings potentially underline the importance of prey abundance and habitat suitability in population numbers.

5.6.4 Furthermore, recent studies have suggested that impacts during construction may have greater detrimental impacts than those during wind farm operation (Pearce-Higgins *et al.*, 2012). Another multi-site, multi-species investigation, this study found that Red Grouse, Snipe and Curlew densities all declined on wind farms during construction, whereas Skylark and Stonechat population densities increased. Red Grouse populations recovered post-construction but, although Snipe and Curlew densities did not, there was little evidence for consistent post-construction decline in any of the species studied. They considered that high levels of activity and disturbance are likely to cause birds to vacate territories close to turbines during construction and that, depending on their subsequent breeding success, they may not return to breed in subsequent years.

5.6.5 Additional studies in a South Pennine moorland setting are just getting underway; a PhD student at Manchester Metropolitan University investigating anthropogenic influences on moorland birds within the South Pennines, including recreational pressures and small-scale wind turbine developments (pers. comm. 2012c). Data collected as part of this research should help to provide some clarity to the mechanisms and magnitude of impacts in a local context.

5.7 Recreational Impacts

The revised screening assessment identifies a risk of significant effects resulting from the following proposed policies:

- **BD1: City of Bradford including Shipley and Lower Baildon Sub Area**
- **AD1: Airedale Sub Area**
- **WD1: Wharfedale Sub Area**
- **TR4: Transport and tourism**
- **HO3: Distribution of Housing Requirement**

Visitor activity

Introducing the effects of visitor activity

5.7.1 Research into the effects of urban development on southern lowland heathlands has identified a number of pressures that threaten their habitat condition, arising from a range of factors that have been reviewed by a number of studies. Visitors surveys have revealed how much the open, remote and natural features of these lowland heathland are appreciated by the local population and make them attractive for a range of recreational uses, particularly walking and dog walking although horse riding, cycling, jogging, picnicking and bird watching are also

identified as regular activities (see for example Clarke *et al.*, 2006, Liley *et al.*, 2006, Pincombe & Smallbone, 2009a&b). Although comparable visitor survey information is not currently available for the Pennine Moors, it seems likely that their character is also attractive to local populations for this range of recreational uses.

5.7.2 These recreational uses place the habitats and the breeding birds they support under pressure. This can arise from: disturbance to nesting birds leading to chilling or predation of eggs or young; displacement of birds from areas with high levels of disturbance; trampling and erosion of moorland vegetation and soils; increased risk of accidental or intentional fire; and nutrient enrichment and eutrophication of heathland soils from dog fouling (see for example Langston *et al.*, 2007, Liley & Clarke, 2003, Murison, 2002, Murison*et al.*, 2007, and Underhill-Day, 2005).

5.7.3 The Pennine Moors are subject to a wide range of recreational effects. These are reviewed in the *South Pennine Moors Integrated Management Strategy and Conservation Action Programme* and include; walking (with & without dogs), horse-riding, cycling/mountain biking, hang gliding, rock climbing, model aircraft flying, orienteering, fell running, off-road driving (including 4x4 & scrambling), Grouse shooting and angling. The Strategy goes on to state:

> *"Research and evidence to date is inconclusive as to whether or not recreation and access at current levels are having a major impact on bird conservation in the South Pennine Moors. However, these activities may have significant localised impacts, and have the potential to have wider conservation implications. Plans to extend or develop recreational activities in the area must be accompanied by appropriate assessment and monitoring.*
>
> *"A large proportion of recreational activity takes place on already well-developed access networks and facilities, with honeypots absorbing a proportion of this. The general level of negative impact upon birds and habitats is, therefore, probably relatively limited. Research literature to date does not prove that access to open moorland in itself has a significant long-term impact upon breeding bird populations. There are, however, real short-term, localised effects from, for example:*
>
> - *uncontrolled dogs;*
> - *orienteering;*
> - *large walking events (eg. sponsored);*
> - *model aircraft;*
> - *hang gliders particularly at breeding sites or seasons; and*
> - *uncontrolled fires."*

5.7.4 Although the 1998 Strategy identified some concerns from short term, localised effects of recreation on the SPA it recognised the need for more detailed research and monitoring. Information on current visitor numbers to the South Pennine Moors has been sought in the course of undertaking this assessment. Natural England (2011) undertook an assessment of ecosystem services provided by four pilot areas including the South Pennines, and states:

"There are measurements of visitor numbers to the national parks (visitor survey data) which covers three of the four areas. However, we have been unable to find any information on visitor numbers for the South Pennines as this character area is not within a national park."

5.7.5 However, a PhD student at Manchester Metropolitan University is in the early stages of investigating anthropogenic influences on moorland birds within the South Pennines, including recreational pressures and small-scale wind turbine developments (pers. comm. 2012c). The resulting dataset should help to build a picture of how the moors are used as a local recreational resource, and whether changes in management could be explored to reduce the impact of visitor activity. For the time being, the assessment can only draw on pre-existing data which is not sufficiently comprehensive to fully inform an avoidance and mitigation strategy; it is recommended that additional visitor surveys are carried out as a priority in order to help plug this data gap.

Review of available visitor data

5.7.6 Data was provided by the Countryside and Rights and Way division of Bradford Council from a survey of four sites carried out in late spring / early summer 2000. Three of the sites give access onto moorland which is part of the South Pennines SPA: Cow and Calf (Ilkley Moor), Shipley Glen (Rombalds Moor) and Penistone Hill (Haworth Moor). The following paragraphs summarise the data, while the full dataset is included at Appendix III. The majority (62%) of visitors to all three sites travelled less than 10 miles, with 41% travelling less than 5 miles, and an overwhelming majority of visits were made by car (75%). The proportion walking to their chosen site was 13%, with 5% arriving by bus and 4% travelling by train.

5.7.7 Over three-quarters of visitors (87%) had been to their site previously, with over a quarter (29%) making frequent visits, 12% visiting regularly, 46% occasionally, and 13% not having visited in the previous twelve months. The sites are generally most popular with older people, with those over 50yrs making up 38% of respondents. People aged 31-50yrs formed 37% of respondents, 19-30yr olds made up 22% of the sample, with children (<18yrs) representing 3%.

5.7.8 Reasons for making the visit varied widely, but the list is comparable to the activities mentioned in paragraph 5.7.1. Walking (34%) was the most popular activity, following by dog walking (20%), visiting the moor (12%) and making a day trip (11%). Other popular activities included getting some fresh air and exercise (3% combined), picnicking (1%) and taking in the scenery (2%). 'General' recreation and visiting while on holiday were frequent (7% combined) while a number of location-specific activities were also popular, such as climbing at the Cow and Calf Rocks, visiting Bracken Hall (Shipley Glen) and the Bronte Connection (Haworth).

5.7.9 Interviewees were asked to describe the good and bad points about their chosen site. Again there were differences between sites (see Appendix III), particularly regarding local features, but some common messages prevail. A third (33%) of all respondents valued the scenery most highly, while associated characteristics were also favoured such as 'peace and quiet' (11%) and 'openness' (8%). The wildlife interest (3%), walking (8%), fresh air (7%) the ability to take the dog for a walk (4%), accessibility (4%), parking (2%), good path network (3%), facilities (e.g. café; 2%) and child-friendliness (3%) were important to several of those taking part.

5.7.10 Notably, 37% of people could not identify a bad point to the site they visited. Chief among the problems identified by others was litter or fly-tipping (23%), followed by lack of or substandard facilities (e.g. toilet 9%, litter bins 4%, or picnic tables 1%), dog fouling (7%), poor signage (4%), poor paths (2%), insufficient parking (3%), overcrowding (2%), and the weather (2%).

5.7.11 This visitor data, whilst not sufficiently comprehensive to fully inform the Appropriate Assessment, already points to some interesting patterns which are distinct from those affecting the southern heathland SPAs. For example, the distances travelled to reach the sites appear to be greater, but with less frequent visits being made by each respondent. The range of activities undertaken is more diverse, with proportionately fewer people visiting specifically to walk the dog. On the other hand, as in the southern heaths, open aspect, valued landscapes and views and peace and quiet are important features, whilst accessibility and well planned and maintained facilities and visitor infrastructure all have a role in making the sites successful.

5.7.12 The assessment that follows identifies known relationships between recreational visitors and effects on wildlife sites, but cannot identify specific housing number thresholds or quantify the scale and type of mitigation measures that might be required, without a more detailed understanding of visitor activity.

Impacts on wading birds

5.7.13 Research into the effects of walkers on nesting Golden Plover has been of particular interest (Finney *et al*, 2005). They investigated effects of recreational disturbance on Golden Plovers in the Peak District National Park. A population of birds was studied at Snake Summit on the route of the Pennine Way. Surveys of breeding Golden Plovers were carried out during the years 1986–1988 and 1996–1998. The Pennine Way was resurfaced with flagstones between these two survey periods. The study found that recreational disturbance along the Pennine Way footpath resulted in Golden Plovers avoiding a zone 200m wide either side of the unsurfaced path, and that this was likely to result in a reduction in breeding density within the study site as a whole. However, following surfacing of the path, the effect of disturbance was significantly reduced. They concluded that:

> *"In the 1980s, before the Pennine Way was resurfaced, the Snake Summit study site received approximately 60 visitors per day at weekends and 20 visitors per day during the week; areas of moorland adjacent to the Pennine Way footpath were disturbed for up to 33% of the day (0900–1800, Yalden and Yalden, 1988). Additionally, 32% of walkers strayed from the footpath in an effort to avoid the most severely eroded sections (Yalden and Yalden, 1988). Movement of people across the study site was therefore widespread and unpredictable. This study demonstrates that this level of recreational disturbance had a significant effect on Golden Plover distribution during the breeding season. Golden Plovers tended to avoid areas within 200m of the footpath during the chick-rearing period. At weekends, when disturbance levels were highest, Golden Plovers were 54% less likely to occupy areas within 200m of the footpath and 62% less likely to occupy areas within 50m of the footpath. Furthermore, Golden Plovers did not appear to move closer to the footpath on weekdays, when levels of disturbance were lower.*

"The area around the Pennine Way that was avoided by breeding Golden Plovers fell from 200m before the footpath was resurfaced to just 50m following the resurfacing work. Golden Plovers were 24% less likely to occupy areas within 50m of the footpath at weekends, but did not appear to avoid areas close to the footpath on weekdays. These changes occurred despite a twofold increase in the number of people visiting the Snake Summit study site over the same period (Pearce-Higgins & Yalden, 1997).

"The results from this study suggest that an increase in recreational activity could have an adverse impact on breeding Golden Plovers, and potentially other upland waders, by reducing the availability of suitable chick-rearing habitat, but that this is most likely to occur in extreme situations, where there is very high visitor pressure. Given the mean home-range size of broods at Snake Summit of 41ha (Pearce-Higgins & Yalden, 2004), it is likely that the 54% drop in occupancy within 400m of the Pennine Way (an area equivalent to 29% of the study site), was sufficient to reduce breeding density at Snake Summit during the 1980s."

5.7.14 It can be concluded from this study that on well-used unsurfaced access routes across the Pennine Moors there is likely to be an avoidance by breeding Golden Plover and potentially other waders. The width of this disturbance zone can be as much as 400m (200m either side of the path). However, where walkers are provided with a well-surfaced route the disturbance levels are significantly reduced. This effect was studied in relation to Golden Plover, the most numerous species for which the South Pennine Moors SPA has been selected. However, it is also likely to affect other ground nesting birds, such as Dunlin and Curlew, in similar ways.

Impacts on raptors

5.7.15 The impacts of recreational access on birds of prey are more difficult to assess. These birds exist at low densities and will select nest sites in secluded locations away from public disturbance. There is likely to be a critical threshold level of disturbance above which they will be unable to utilise an area of moorland for nesting, but identifying such a threshold is fraught. Ground nesting birds of prey such as Merlin and Short-eared Owl are likely to be particularly vulnerable to such disturbance.

Interpreting the available evidence in relation to the South Pennine Moors

5.7.16 Although there is strong evidence that recreational disturbance has adverse effects on breeding bird numbers, distribution and success, in the absence of detailed information on current and predicted changes in levels of recreational access it not possible to predict the effects of increased housing development and consequent changes in recreational use of the SPA on the breeding bird populations.

5.7.17 Although it is not possible to predict impacts of recreation on bird distribution and populations in the absence of visitor survey data, an analysis has been undertaken on access provision on Rombalds Moor to illustrate the potential avoidance response of Annex 1 birds. Access routes on Rombalds Moor have been mapped into three classes based on information supplied by Bradford Council (pers. comm., 2012d):

1. Re-surfaced footpaths and tracks;
2. Unsurfaced public rights of way (footpaths and bridleways); and

3. Other unsurfaced paths and tracks.

5.7.18 This third class of routes has been made available for public access under the provisions of the Countryside and Rights of Way Act (CRoW; 2000). Each of these routes was buffered with a 200m and 50m wide zone based on the conclusions of Finney *et al.* (2005). These buffers occupy an area of 1,718 hectares of Rombalds Moor (68% of the total area of 2,527 hectares) as shown in Figure 5.7.

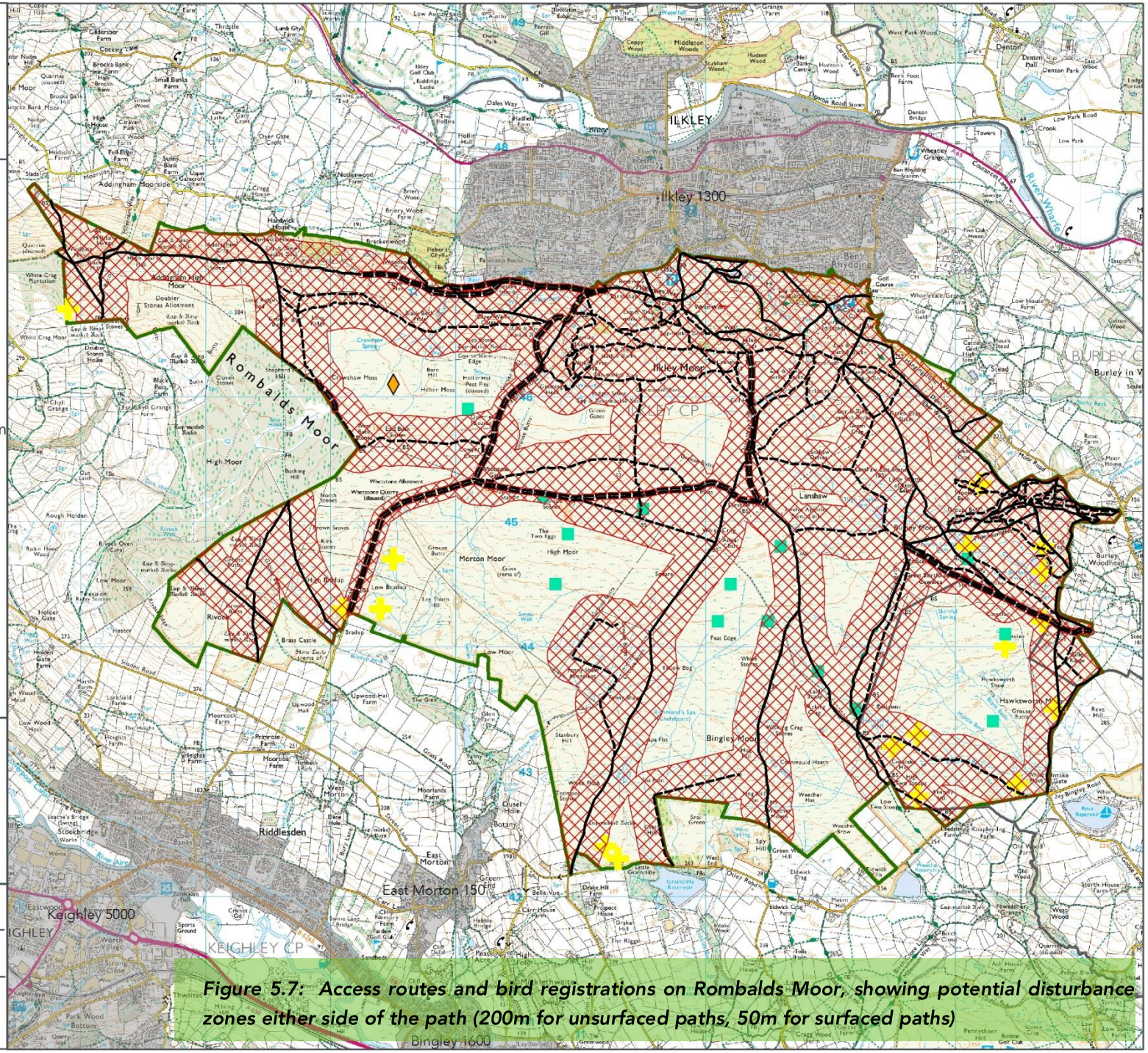
5.7.19 The distribution of Golden Plover registrations from the 2005 South Pennine Moors breeding bird survey is overlain on the buffered access route map. Further analysis is required to take into account habitat types present on the Moor, but it appears from this initial analysis that Golden Plover registrations are proportionately more abundant in areas of the Moor outside of the disturbance zones associated with access routes i.e. 50% of registrations occur outside of the disturbance zones whereas these occupy 68% of the Moor.

5.7.20 An alternative approach to assessing potential impact of recreational access is to consider the distance that walkers and dog walkers penetrate into a site from an access point. Access points are often car parks but in sub-urban locations may be the start of a footpath or bridleway. Visitor survey is required to establish how far visitors penetrate South Pennine sites, and to clarify the total number and diversity of access points. Visitor surveys of this type have been undertaken at a number of lowland heathland sites in Dorset, the Thames Basin, Wealden Heaths and Ashdown Forest.

5.7.21 Figure 5.9 shows a combined cumulative distance curve for Dorset and Thames Basin Heaths. It shows that 50% of visitors penetrate into a site by up to about 700m. Other surveys show penetration distances for walkers and dog-walkers on Ashdown Forest of 867m and 872m respectively, and Wealden Heaths of 920m and 784m respectively (mean of the latter four distances = 860m). The greater penetration distances recorded for Ashdown Forest and Wealden Heaths may be explained by the generally larger size of each heathland patch in comparison to those in Dorset and the Thames Basin.

5.7.22 To represent these penetration distances spatially, Figure 5.8 provides an analysis for Rombalds Moor showing 860m buffers around access points to the Moor in relation to Annex 1 bird registrations from the 2005 breeding bird survey. As may be expected it shows greater areas of likely disturbance around the edges of the Moor where access points are located, occupying an area of 1,292 hectares or 51% of the Moor. It also shows that Annex 1 bird registrations (mostly Golden Plover) tend to be found outside of the 860m buffer zone (79% of registrations).

Rombalds Moor Recreational Access



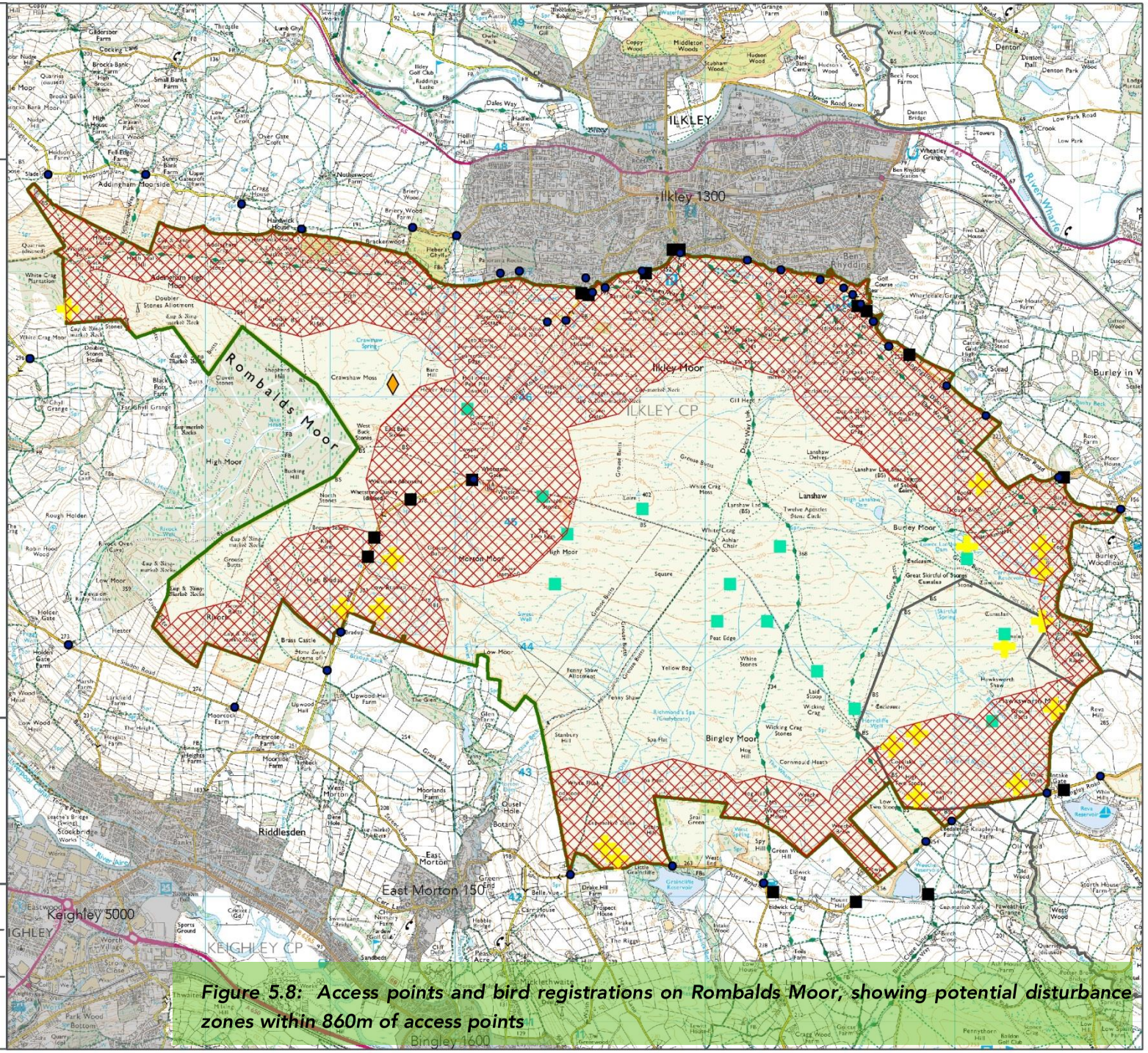
ENVIRONMENTAL CONSULTING
Tower Point
44 North Road
Brighton
BN1 1YR

Scale	Date
1:40,405	Nov2012
Created by	**Reviewed by**
SS	NP

Drawing number
UE-0112_Bradford_Rombalds access_1_20121115

Figure 5.7: Access routes and bird registrations on Rombalds Moor, showing potential disturbance zones either side of the path (200m for unsurfaced paths, 50m for surfaced paths)

Rombalds Moor Recreational Access



Contains data from West Yorkshire Ecology 2012
Contains data from Natural England 2012
© Crown copyright and database right [2012]
Ordnance Survey 0100019304

ENVIRONMENTAL CONSULTING
Tower Point
44 North Road
Brighton
BN1 1YR

Scale	Date
1:40,405	Nov2012
Created by	**Reviewed by**
SS	NP

Drawing number
UE-0112_Bradford_Rombalds access_2_20121115

Figure 5.8: Access points and bird registrations on Rombalds Moor, showing potential disturbance zones within 860m of access points

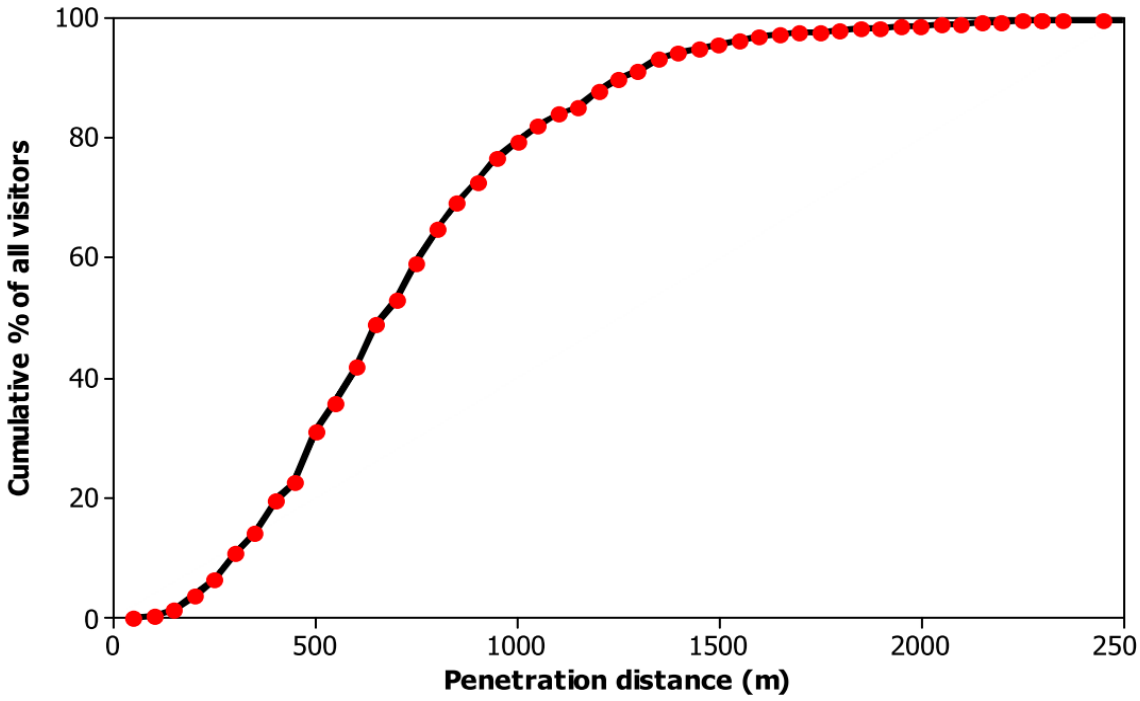


Figure 5.9: Cumulative frequency distribution of the penetration distance onto Dorset and Thames Basin heaths by all visitors combined (Source: Liley at al, 2006)

Effects of dogs

5.7.23 An important impact of urban development is that arising from the increased use of accessible land by walkers with dogs. These are generally included within the wider mix of recreational and urban pressures considered above, but a more detailed understanding of the mechanisms by which they impact on lowland heathland wildlife is helpful in predicting potential impacts on the moorland habitats and bird populations in the vicinity of Bradford.

5.7.24 Dogs have been recorded preying on ground nesting birds and studies have shown a variety of bird species being flushed from their nest by dogs. Studies have also shown birds to be warier of dogs and people with dogs than people alone, with birds flushing (flying away) more readily, more frequently and at greater distances, and staying longer off the nest when disturbed (Murison, 2002).

5.7.25 Other studies have shown dog fouling to cause changes in heathland vegetation with a reduction in heather and increase in grass abundance due to the effects of nutrient enrichment (eutrophication). Dogs also chase and worry livestock. As a consequence, conservation grazing schemes can be affected due to graziers not being prepared to graze sites with open access to dog walkers (Underhill-Day, 2005).

Trampling and erosion

5.7.26 A comprehensive review of the effects of trampling and erosion on moorland heath and blanket bog was undertaken as part of the implementation of the CRoW Act (Anderson ed., 2001). The following review has been extracted from this report, the main findings of which were:

- Off-path use can be as high as 30% where adjacent vegetation is amenable to walking;

- Paths can have very substantial trampling widths in popular areas;
- Path networks and density can increase significantly with increasing use;
- People walk extensively in the uplands;
- Lichen-rich and *Sphagna*-rich communities are destroyed after c.50-80 passages;
- Wet vegetation on peat is very sensitive;
- Acid grassland and young heather less vulnerable;
- Heather in montane situations more sensitive than at lower altitudes;
- Crowberry and *Vaccinium* species are sensitive to trampling; and
- Vegetation recovery may not be to pre-existing communities.

5.7.27 Where the adjacent ground is rough, the vegetation tall and woody (heather in its mature and senescent states), or where very wet areas are present, visitors to mountain and moorland tend to keep to paths. However, the work by Anderson (1990), which involved counting visitors on and off paths in large areas of open access (or *de facto* access) moorland in the Peak District, showed that across all the vegetation types, on average, 23.4% of people were off the path. This was accentuated beside small rivers and on blanket bog. In the Peak District this habitat is mostly M19 *Eriophorum vaginatum* mire with minimal *Sphagnum* cover, or eroding, dissected blanket mire with cottongrass, crowberry and bilberry, in this respect it is similar to much of the vegetation within the two SAC adjacent to the Bradford area.

5.7.28 There is a long tradition of fell or hill walking involving direction finding and off-path use, especially in the South Pennines. Even where there are primary footpath routes like the Pennine Way, the intensity of use has resulted in eroding, boggy ground which pedestrians avoid as far as possible, resulting in an extension of the path widths.

5.7.29 In addition to extensive off-path use, path networks have increased in extent and density, and have deteriorated in condition, with a proliferation of routes developing (Bayfield & Aitken, 1992). Research has also shown how, if the path surface becomes difficult to walk on due to erosion, a new path forms alongside, thus increasing the impact width. Bayfield (1985) notes that path width can continue increasing for some time: at least 12 years on Stac Polly, 14 years on the Cairngorms, and longer on the Pennine Way in the Peak District.

5.7.30 In many upland areas, unlike some lowland sites, a *s*ignificant proportion of visitors typically walk more than two miles probably in areas where repeat visits and a general familiarity is greater, as in the South Pennines near the large conurbations where weekend rather than holiday visitors predominate. For example, the Peak Park Joint Planning Board Recreation Survey (1988) found that on average 22% of 18.5 million visitors walked more than two miles (more in winter, and fewer in summer).

5.7.31 A review of the relative sensitivity of plant species to trampling was undertaken by Anderson (1990) in the Peak District moorlands. The relative sensitivity of species and their associated Annex 1 habitat types within the South and North Pennines SAC are shown in Table 5.3. The Review concludes with a summary table of impacts of public access to moorland habitats, including direct as well as indirect impacts; see Table 5.4 (from Anderson, 2001).

Table 5.3: Relative sensitivity of moorland plants to trampling pressure (Anderson, 1990)

Less sensitive	Species name	Notes	SAC/SPA Presence
	Common bent/crested dog's-tail grasses	As in some in-bye land	Not major component of SAC Annex 1 habitats
	Wavy hair-grass/sheep's fescue	On mineral soils	Often minor component of SAC dry heath habitat
	Heather	Young	Major component of Annex 1 dry heath and blanket bog habitats
	Mat-grass	Usually on drier, thin peats or peaty mineral soils	Often component of heavily grazed dry heath habitat
	Purple moor-grass	Usually on wetter flushed peaty soils.	Major component of wetter heath and blanket bog habitats
	Bracken	Young plants	Can be invasive on drier heath and acid grassland habitats
	Heather	Old – old plants are brittle and easily broken.	Major component of Annex 1 dry heath and blanket bog habitats. Important for nesting SPA birds
	Crowberry/bilberry	On peat	Major component of Annex 1 dry heath and blanket bog habitats
	Cotton-grass spp.	Cotton-grass mire on peat	Major component of Annex 1 blanket bog habitats
More sensitive	*Sphagna*	Flushes, mire on peat.	Major component of blanket bogs and transition mire habitats

Table 5.4: Summary of potential significance of access impacts on mountain and moor

Habitats	Direct Impacts		Indirect Impacts	
	Trampling	Disturbance	Fire	Management
Dry dwarf-shrub heath	XX		XXX	
Wet dwarf-shrub heath	XXX		XX	
Blanket mire	XXX		XXX	
Mountain	XXX		X	
Acid grassland	XX		XX	
Calcareous grassland	XX			XX
Flushes/springs	XXX			
Rock ledges	XX			
Screes	XX			
Breeding birds		XXX	XXX	XX
Wintering birds (Raptor roosts)		X		
Invertebrates	XX		XX	X
Deer		XX		
Earth heritage	X?			

Key (degree of negative effects): Least X XX XXX Most

The assessment assumes a moderate to high level of use to have the above impacts.

5.8 Urban Edge Effects

The revised screening assessment identifies a risk of significant effects resulting from the following proposed policies:

- **BD1: City of Bradford including Shipley and Lower Baildon Sub Area**
- **AD1: Airedale Sub Area**
- **WD1: Wharfedale Sub Area**
- **TR4: Transport and tourism**
- **HO3: Distribution of Housing Requirement**

Introducing urban edge effects

5.8.1 In addition to recreational pressure, urban edge moorlands are also subject to a number of additional pressures from people's use and abuse of these areas of land. This includes: fly tipping; dumping of garden waste and resultant introduction of invasive/alien plants; traffic causing air pollution and rat running along minor roads and tracks; off-road vehicles leading to track erosion; disturbance to (conservation) grazing livestock; increased incidence of wildfire; and predation from domestic pets and urban scavengers.

Evidence of edge effects in general

5.8.2 A review of the existing pressures on the lowland heathlands around Whitehill and Bordon in East Hampshire was undertaken using data gathered from a focus group workshop and from meetings with the major landowners (Cox & Pincombe, 2011). The results of this review are summarised in Table 5.5. Note that the data, although collected in 2011, do not relate to a defined period.

5.8.3 The results of the focus group workshop fit closely with the findings of other studies undertaken by Liley *et al.*, (2006) and Underhill-Day (2005). The range of effects that people and the proximity of urban development have on the conservation of lowland heathland sites have become known as 'urban pressures' and present the greatest single impact of development on the conservation of these often fragmented and vulnerable areas of habitat.

5.8.4 It can be predicted that a similar range of impacts is likely to arise from urban development near to the upland moorland habitats found in the vicinity of the Bradford, particularly those moorland blocks that are isolated and fragmented. Indeed, analysis of 2012 incident reports collected by the South Pennines Moorwatch website[34] (run by Pennine Prospects) reveals a range of reported activities, which aligns closely with those reported elsewhere; see Table 5.5.

Fire

5.8.5 The effects of fire on lowland heathland have been reviewed by Underhill-Day (2005), who highlights a study for the UK Government by Kirby & Tantrum (1999) following an adverse report on the condition of the Dorset Heaths by The Council of Europe's Bern Secretariat.

[34] http://www.moorwatch.com/view-reports&report_start=0

Table 5.5: Urban and recreational pressures on lowland heathlands near Whitehill and Bordon, Hampshire (2011), and South Pennine Moors (2012)

Impact type	Incidence	
	Whitehill-Bordon	South Pennines
Camping	9	-
Disturbance of wildlife	28	1
Disturbance to livestock	5	-
Dog fouling	21	-
Impact caused by animal (e.g. horse, dog)	10	-
Fly-tipping	72	3
Garden waste / invasive species	10	2
Litter	5	-
Mixed impacts	11	-
Off-road vehicles	32	21
Pollution	10	-
Rat-running / illegal parking	4	3
Theft or poaching	11	2
Unlawful digging / building	2	-
Vandalism (e.g. of visitor mgt infrastructure)	1	-
Wildfire or arson	83	2
TOTAL	314	35

5.8.6 Kirby & Tantram concluded that fires occurred at higher densities on the fringes of larger conurbations and in sites within developed urban areas, where fire events present a serious risk to ecological integrity. They considered that the statistical data, in combination with visual assessment and their fire event density map, suggested that the incidence of fires on heaths in urbanised areas was higher than those in more rural locations, and that this was likely to be due to easier access to these heaths, as the data suggested that most fires were deliberately set. The evidence suggested that fire setting by children of school age may be a significant factor in the pattern.

5.8.7 Heather burning is a traditional management tool on Grouse moors. But uncontrolled wildfire, particularly during spring and summer, destroys moorland vegetation which can then take many years to re-establish, depending on substrates and the characteristics of the fire. In various studies it took between 4 and 20 years for heathland vegetation to recover, and in some cases the fire triggered a change from heathland to woodland on the better soils. In most studies, burnt areas go through a successional phase of grassland before dwarf ericaceous shrubs re-establish.

5.8.8 Fire has a number of effects on the ecology of moorland habitats and bird populations. The most obvious effect is where spring and summer fires result in destruction of birds' nests and other typical species of Annex 1 habitat types. Fire also has a significant effect on the habitat structure even if there is no long term effect on species composition. This can have a major

effect on the use of upland heathland by ground nesting birds such as Merlin, Short-eared Owl and Twite that select areas of taller heather in which to nest. More severe fire or repeated fires can have fundamental effects of the moorland soils and vegetation especially in areas of dry and drying heathland and blanket bog where fire can burn into the peat substrate. In these instances habitats can take many years to recover.

5.8.9 Although it is not possible to equate numbers of residents to numbers of fires it is clear that there is a relationship between urban development and fire incidents on moorlands. This was investigated by the Moors for the Future Partnership which commissioned research into moorland fire risk mapping on the South Pennine Moors (Walker *et al.*, 2009). This study identified c.400 fires occurring on the moorlands of the South Pennines in the nine year period between 2000 and 2008 (excluding North Yorkshire). This is a similar number to those recorded over the last 32 years on the moorlands of the Peak District National Park. Based on a 2x2km grid of wildfire occurrence, they identified three areas of high wildfire density and four areas of medium wildfire density as listed in Table 5.6 and shown in Figure 5.10.

Table 5.6: High and medium fire density areas in West Yorkshire, Lancashire and Greater Manchester

Moorland block(s)	County
High fire density	
Rishworth, Soyland & Blackstone Edge Moors	Greater Manchester, West Yorkshire
Crompton Moor	Greater Manchester
Illingworth *	West Yorkshire
Medium fire density	
Ilkley Moor	West Yorkshire
Baildon Moor *	West Yorkshire
Anglezarke and Rivington Moor	Greater Manchester, Lancashire
Ashworth Moor (Knowl Moor)	Greater Manchester

* Illingworth, although within the Natural England 'moorland line' is actually two narrow wedges of scrub between two densely populated urban areas on the outskirts of Halifax, while Baildon Moor suffers high levels of recreational pressure from a number of sources, including a golf course (which extends across c.50% of its area) and caravan park.

5.8.10 Overall, the study found that wildfire incidents were more likely to occur in areas close to centres of population, or where access to the moor was readily available. This compares well to a similar study within the Peak District National Park (McMorrow & Lindley, 2006). Here wildfires are more common in the west of the Park, especially in the Dark Peak on blanket peat, and where the long-distance footpath, the Pennine Way, is located. Few wildfires are found on managed heather moor in the east of the Peak District which is likely to be because prescribed burning successfully manages fuel load. In the Dark Peak, it appears to be the combination of peat, especially exposed peat, and major footpaths which favour high fire risk.

5.8.11 Of the four Medium fire density areas it is interesting to note that they include Ilkley Moor and Baildon Moor. Both of these sites are located in the Bradford area. Ilkley Moor is within the SPA and SAC whereas Baildon Moor has been degraded by urban edge pressures such that it does not meet European site selection criteria. As Walker *et al.* (2009) point out, Baildon Moor is *"heavily modified, with three paved roads running directly over the top of the moor, as well as a golf… course… covering the entire northern half of the moor, as well as a sizable caravan park in the south western corner of the region. The only area on the moor which could be described as "true moorland" is criss-crossed by a tightly interconnected network of footpaths – indicating the moors proximity to the town, and some of its likely uses by the residents – dog walking and small scale recreation."*

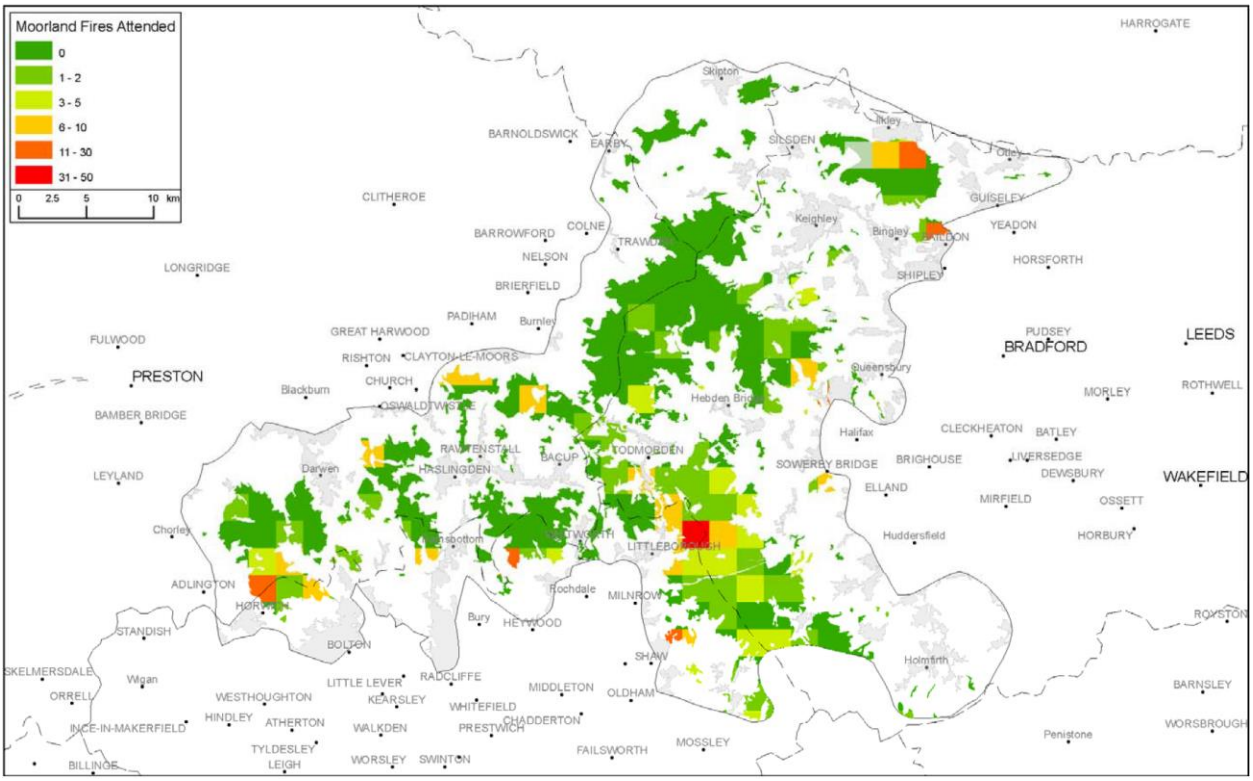


Figure 5.10: Moorland fire density map of incidents attended between 2000-2008 at 2x2km cell resolution. Green indicates few to no fire occurrences, whilst red indicates fire hot spots (Source: Walker et al., 2009)

5.8.12 Examining the extent of wildfires on Ilkley Moor Walker *et al.* (2009) determine that, although it is a good example of 'true' moorland habitat, it is strongly influenced by the town of Ilkley some of whose houses back directly onto the moor. Their analysis shows that 20 out of 26 of the recorded wildfires between 2000-08 occurred within 1km of the urban boundary.

5.8.13 This study refers to work undertaken on lowland heathlands which face similar problems of fire damage to important urban edge wildlife sites. The Dorset Urban Heaths Partnership was awarded £1.2 million by the European Union's LIFE fund between 2001-2005 to help combat the urban pressures on these internationally important lowland heathlands. The funds were matched by the Partnership to finance the Urban Heaths LIFE Project, which provided:

- Extra wardening for the heaths;

- New fire fighting equipment for the Dorset Fire & Rescue Service;
- A Heathland & Wildlife Officer in Dorset Police; and
- An education programme to help gain understanding and respect for the heaths and their importance.

5.8.14 One of the key outputs from the project was the publication of Fighting Fire with LIFE; A Best Practice guide for Fire Risk Assessment and Management[35].

Pet predation (cats)

5.8.15 Studies of the impacts of urban development on lowland heaths within southern England have identified the potential impact of predation by domestic cats on birds, reptiles and mammals. These can be European protected species, Annex 1 birds for which SPA have been classified or typical species of qualifying habitats within SAC. A significant amount of research has been undertaken to understand the relationship between domestic cats and their effects on European wildlife sites.

5.8.16 The effects of cat predation on lowland heathlands are reviewed in detail by Underhill-Day (2005). Prey items taken by hunting cats have been collated from a number of studies and show that small mammals make up the greatest proportion of prey items (49-91%). Birds are the next most commonly predated group making up between 5% and 30% of prey items. Amphibians, reptiles and fish make up the next most frequently preyed upon group with between 0.4% and 9.4% of prey items. Using this data, Underhill-Day (2005) estimates total numbers of prey caught by cats per 1000 households per annum as reproduced in Table 5.7.

Table 5.7: Total prey caught by cats per 1000 households per annum (Source: Underhill-Day (2005) estimated from Woods et al, 2003, and Howes, 2002)

Species group	Estimated numbers	Estimated percentage
Mammals	6,735	72.7
Birds	2,075	22.4
Herpetofauna and fish	251	2.7
Invertebrates	140	1.5
Unidentified	6	0.7
TOTAL	9,261	100.0

5.8.17 The impact of cat predation on species populations is more difficult to assess. Mead (1982) could find no evidence of cats affecting the population of the eighteen bird species most commonly reported as having been taken by cats. However, cat predation was a significant cause of death for most of the species examined and accounted for 25% of all recoveries (ringed birds found dead) in six species. However, such levels of predation may be sustainable for common and widespread species but may not apply to small populations found on localised or specialist habitat.

[35] http://www.dorsetforyou.com/media.jsp?mediaid=89279&filetype=pdf

5.8.18 Cats can range widely from their home. Again, a number of studies have assessed this ranging distance. In all studies, male cats range more widely than females. The distances they range vary considerably, from 80-400m for Cornish farm cats to 1107m (± 589m) for male feral cats in Avonmouth Docks. Radio tracking studies have also looked at the size of cat home ranges and again show larger home ranges for male cats ranging in size from 615ha for cats in Australia to 134ha for cats in New Zealand. Using an average home range size for male cats from all studies of 365ha, and assuming a circular home range, gives a mean ranging radius of 1,078 m or just over 1km.

5.8.19 The potential impact of cat predation on the moorland habitats and birds has not previously been estimated. There are no quantifiable records of moorland birds being taken by cats; although cats have been recorded taking some species including Linnet *Carduelis cannabina* and Yellow Hammer *Emberiza citrinella* it is not recorded if these were killed on moorland or other habitats. Despite the inconclusive data of the potential impact of cats on moorland wildlife the evidence shows that cats kill a large number of animals including birds and mammals, and that cats range widely from their homes with male cats ranging up to 1,107 m.

5.8.20 Although the data remains inconclusive, as with lowland heaths, there is a potential threat from cat predation to birds and small mammals within 1km of urban areas. For most species, the level of predation may be sustainable but for species dependent upon localised micro-habitats, such as seed rich meadows used by feeding Twite, this could be significant. The in-bye bird survey (West Yorkshire Ecology, 2003) did not identify any sites for Twite within the Bradford area, the nearest being between Thornton and Ovenden Moor, 2.5km south west of the village of Denholme.

5.8.21 For feeding waders such as Curlew and Golden Plover it seems unlikely that cats would present a significant threat due to the natural avoidance by these birds of tall grass, hedges, scrub and woodland cover and the propensity for cats to hunt in the vicinity of these habitats.

Urbanised avifauna

5.8.22 Several species of birds are associated with urban and sub-urban areas including crows *Corvus corone* and magpies *Pica pica* (collectively known by their generic name of Corvids). The following review of the impact of these birds, and other urban predators, has been taken from Underhill-Day's literature review of urban effects on lowland heaths and their wildlife (2005). It has been found that corvid numbers are higher on sites visited by more people (Taylor, 2002), and other predators have been recorded at higher densities in urban than rural environments including magpies and foxes.

5.8.23 Taylor (2002) investigated the predation risk to woodlarks on lowland heathland and analysed the degree of disturbance and the presence of predators, and found that as human activity increases, the presence and activity of corvids also increases. Hence the risk of predation is higher on sites with higher corvid activity.

5.8.24 The link between corvids and disturbance is much stronger early in the season; in late season it is no longer significant. Taylor considered that the link between human presence and greater number of corvids was not solely due to increased scavenging opportunities as litter was not

common on the study sites and most disturbance was due to dog walkers. She suggested that corvids have greater opportunities to find food when sites are more heavily disturbed because the disturbance is associated with greater urban development around sites, which probably offers better scavenging opportunities.

6 Impact Assessment

6.1 Introduction

6.1.1 The following assessment uses the conservation objectives defined in Chapter 3 and considers these against the range of impact pathways described in Chapter 5 for each of the European sites considered likely to be significantly affected.

6.2 South Pennine Moors SPA

Conservation Objectives – subject to natural change, to maintain or restore the:

- **Objective 1: Extent and distribution of the habitats of the qualifying features;**
- **Objective 2: Structure and function of the habitats of the qualifying features;**
- **Objective 3: Supporting processes on which the habitats of the qualifying features rely;**
- **Objective 4: Populations of the qualifying features; and**
- **Objective 5: Distribution of the qualifying features within the site.**

Supporting habitat

6.2.1 The 2003 survey of breeding birds on in-bye land found no evidence of Annex 1 or regularly occurring migratory birds for which the South Pennine Moors SPA has been selected using land associated with the settlements within the Bradford Core Strategy. However, more recent surveys undertaken by West Yorkshire Ecology this year (2012) have shown a number of locations used by Annex 1 and migratory birds (section 5.2) including Golden Plover, Merlin and Short-eared Owl. These are concentrated along the moorland fringe to the west of Keighley, Oxenhope and Denholme; an area to the north west of Ilkley Moor south of Addingham and another important area to the south east of Rombalds / Ilkley Moor north of the settlements of Bingley and Baildon.

6.2.2 Development that impinges upon these areas of supporting habitat, either directly or indirectly, may result in a loss of habitat and consequent decline in the population and range of these species within the SPA.

Increased emissions to air

6.2.3 There is evidence of degradation to the bog habitats of the qualifying bird species of the SPA (particularly Golden Plover and Dunlin) as a result of atmospheric pollution, both from industrial sources (past and present) and road traffic emissions. The nitrogen and acid deposition loading at all locations investigated was found to significantly exceed the critical load.

6.2.4 However, linking pollution loads to development proposed through the Core Strategy is not straight forward and at present there is insufficient data to enable the nature of impacts, where and when they might manifest themselves, to be properly explored. Rombalds / Ilkley Moor is

unlikely to be affected (because there are no major roads passing within 200m of the SPA boundary), but Haworth and Oxenhope Moors could be affected, particularly in the vicinity of A6033 Hebden Bridge Road. The most substantial impacts are likely to continue to occur around Rishworth and Moss Moors where a number of road corridors cross the Pennines towards Greater Manchester, although impacts here are likely to be from a combination of sources.

Wind turbines – collision mortality risk and displacement

6.2.5 Although recent scientific studies have led to mixed conclusions, there is some evidence to suggest that negative impacts from wind turbine development can occur, including through suppressed breeding densities and displacement, and locally reduced population size. Such impacts have been demonstrated (though not consistently) in relation to upland raptors and wading birds, including Golden Plover, a qualifying feature of the SPA. Adverse effects on birds using supporting habitats off the SPA are also possible.

Recreation (including dog walkers)

6.2.6 There is significant potential for additional recreational pressure having adverse effects on the populations of Annex 1 (Merlin, Peregrine Falcon and Short-eared Owl) and regularly occurring migratory birds (Golden Plover) within the South Pennine Moors SPA. Populations at particular risk are the Golden Plover on Rombalds / Ilkely Moor, the single possible breeding Short-eared Owl on Rombalds / Ilkley Moor, and the Merlin, Peregrine Falcon, Short-eared Owl, Golden Plover and Dunlin breeding on the Moors to the south and west of the South Pennine Towns and Villages.

6.2.7 Declines in breeding numbers of SPA birds are also likely to result in a reduction in the range of these birds within the SPA, particularly birds are displaced from isolated moorland blocks such as Rombalds and Ilkely Moors.

Trampling and erosion (including pedestrian and off-road vehicles)

6.2.8 Urban development threatens increased erosion of paths causing damage to habitats used by SPA bird populations, particularly on Rombalds / Ilkley Moor and the moors to the south and west of the South Pennine Town and Villages.

Fire

6.2.9 Rombalds / Ilkley Moor has been identified as one of seven high and medium fire density areas within the South Pennine Moors (section 5.8.10). Additional housing development in the vicinity of this urban edge moorland is liable to further exacerbate the risk of fire on the moor, leading to potential loss of nest sites and habitats used by SPA birds, particularly Golden Plover and potentially Short-eared Owl. The moors to the south and west of the South Pennine Towns and Villages have been identified as currently having lower levels of fire density although it is evident from Figure 5.10 that moors closest to Queensbury have a raised incidence of fire. Although difficult to quantify, it seems that increased urban development near to the SPA is liable to result in an increase in threat from fire to SPA bird populations, their range and the habitats they use.

Fly-tipping and garden waste / invasive species

6.2.10 It is unlikely that these impacts will have an adverse effect on the SPA bird population, their range or the habitats they use.

Dog fouling

6.2.11 It is unlikely that dog fouling will have an adverse effect on the SPA bird population, their range or the habitats they use.

Urbanised avifauna

6.2.12 The effects of increased crow and magpie predation on SPA bird species is likely to operate where housing development is in close proximity to SPA birds' nest sites. Current evidence from the 2005 SPA breeding bird survey shows that the nearest breeding Golden Plover are 1km from settlement boundary of Ilkley. It is unlikely that these urban edge effects will impact on these nesting birds. However, it may be that such effects are already operating and causing a displacement of birds away from the urban edge.

Cat predation

6.2.13 There is a risk of wide ranging cats reaching Rombalds / Ilkley Moor if green field development within Wharfedale or Airedale is permitted within 1km of the SPA boundary. This could have localised impacts on the population and range of SPA birds, although currently these are all well within the core of this area of moorland and are not likely to be affected by even the most adventurous cats.

6.2.14 The South Pennine Towns and Villages are located slightly further from the SPA boundary and development here is unlikely to result in threats of cat predation to the SPA bird species.

6.3 Overall Assessment against the Conservation Objective of South Pennine Moors SPA

6.3.1 Recreational impacts and urban edge effects from housing proposed in the Bradford Core Strategy risks reducing Annex 1 and migratory bird populations, habitat viability and range within the South Pennine Moors SPA. We do not currently have sufficient data to conclude that the proposed development will not result in loss of supporting habitat for SPA birds.

6.3.2 Increased risks of fire could reduce extent and viability of Annex 1 and migratory bird habitat. There is a slight risk of cat predation affecting bird populations and range within Rombalds / Ilkley Moor. Wind turbine developments could displace birds from otherwise viable territory, possibly reducing population numbers.

6.3.3 Traffic-related atmospheric pollution could affect the extent, structure and composition of the habitats of Annex 1 and migratory bird species, although Rombalds / Ilkley Moor is unlikely to be affected. There is currently insufficient data to make a fuller assessment.

6.3.4 It cannot be concluded that development proposed in the Bradford Core Strategy will not have an adverse effect on the South Pennine Moors SPA.

6.4 South Pennine Moors SAC

Conservation Objectives – subject to natural change, to maintain or restore the:

- **Objective 6: Extent and distribution of qualifying natural habitats and habitats of qualifying species;**
- **Objective 7: Structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;**
- **Objective 8: supporting processes on which qualifying natural habitats and habitats of qualifying species rely;**
- **Objective 9: populations of qualifying species; and**
- **Objective 10: distribution of qualifying species within the site.**

Supporting habitat

6.4.1 Development that significantly impinges, either directly or indirectly, on in-bye fields used by typical species of the Annex 1 habitats of the SAC could have an adverse effect on the conservation status of these species, and hence the habitat for which the SAC has been selected. Twite are known to forage in seed rich grassland up to 2.5km from their nest sites whilst other species such as Curlew may also feed on in-bye fields within this distance from the SAC boundary.

6.4.2 Records of in-bye land used by Curlew have been obtained from the 2003 survey as shown in Figure 5.1. Initial records from the 2012 moorland fringe bird survey provide further information on the distribution of land used as supporting habitat by typical bird species of the Annex 1 SAC habitats (section 5.2).

6.4.3 In addition, areas of species rich agriculturally unimproved grassland need to be identified especially if these have the potential to support birds such as the Twite, Meadow Pipit, Skylark or insects such as the Bilberry Bumble-bee that are typical species of the upland dry heathland and blanket bog habitats. Figure 5.2 identifies potential supporting grassland habitats within 2.5km of the SAC boundary. This includes a range of grassland types including agriculturally semi-improved and improved grasslands. Their value for wildlife and typical species will be dependent upon how these are managed, their vegetation structure and location in the landscape, and the presence of micro-habitats such as springs and flushes.

Increased emissions to air

6.4.4 There is evidence of changes to the structure and composition of Blanket bog and Transition mire habitats of the SAC as a result of atmospheric pollution, and this may also be affecting the habitats' typical bird species including Golden Plover, Dunlin and Meadow Pipit.. Dry and wet heathland habitats are also vulnerable to inputs of nitrogen, with typical plant species being out-competed by nitrophilous species. The nitrogen and acid deposition loading at all locations investigated was found to significantly exceed the critical load.

6.4.5 However, linking pollution loads to development proposed through the Core Strategy is not straight forward and at present there is insufficient data to fully assess the nature of impacts. Rombalds / Ilkley Moor is unlikely to be affected (because there are no major roads passing

within 200m of the SPA boundary), but Haworth and Oxenhope Moors could be affected, particularly in the vicinity of A6033 Hebden Bridge Road. The most substantial impacts are likely to continue to occur around Rishworth and Moss Moors where a number of road corridors cross the Pennines towards Greater Manchester, although impacts here are likely to be from a combination of sources.

Wind turbines – collision mortality risk and displacement

6.4.6 There is some evidence to suggest that negative impacts from wind turbine development can occur, including through suppressed breeding densities and displacement, and locally reduced population size. Such impacts have been demonstrated (though not consistently) in relation to upland raptors and wading birds, including Golden Plover and Curlew, typical species of the SAC habitats. Adverse effects on birds using supporting habitats off the SAC are also possible.

Recreation (including dog walkers)

6.4.7 Recreational use of the SAC has the potential to cause disturbance to typical moorland birds of the SAC habitats, in particular breeding Curlew. This could result in reduction in breeding population and range and a consequent impact on the dry heathland and blanket bog habitats with which these species are typically associated.

6.4.8 Recreational use of important supporting habitats used by typical species of the SAC habitats could also have an indirect impact upon the conservation status of SAC habitats.

Trampling and erosion (including pedestrian and off-road vehicles)

6.4.9 Erosion from increased recreational use of tracks and paths in the SAC has significant potential to cause damage to both heathland and blanket bog habitats. In the absence of visitor survey data, it is not possible to determine current or predicted levels of path use and consequent damage to these habitats.

Fire

6.4.10 The increased risk of fire to the SAC from greater urbanisation of the moorland edge poses a potentially significant impact upon heathland and blanket bog habitats. Fire mapping data has shown the current relatively high levels of fire associated with the most urban moors such as Ilkley Moor. Further housing in this location has the potential to exacerbate this impact.

Fly-tipping and garden waste / invasive species

6.4.11 Urban development near to the SAC with easy access to car parks on the moorland fringe has the potential to result in damage to SAC habitats from introduced invasive species and from fly-tipping. The effects tend to be localised and are unlikely to have an adverse effect on the integrity of the SAC.

Dog fouling

6.4.12 Linked to the impacts of trampling and increased public access is the potential for dog fouling to change soil nutrient levels and have an adverse effect on heathland and blanket bog habitats. This can occur along paths and tracks leading from heavily used car parks but the effect tends to be localised and it is unlikely to have an adverse effect on the SAC integrity.

Urbanised avifauna

6.4.13 The impact of urban associated avian predators has the potential to impact in-bye land used by typical SAC species, for example, Curlew and Twite. However, these birds are likely to be nesting within the SAC boundary and using this in-bye land for feeding. It is unlikely that the presence of greater numbers of avian predators such as crows and magpies will have significant effects on these feeding birds. It is acknowledged that Curlew may also nest on in-bye land along with other waders of wet grassland. However, these birds are not linked with the SAC Annex 1 habitats and are not considered in this assessment.

Cat predation

6.4.14 Cat predation of typical bird species could have an impact upon SAC habitats, for example, if domestic cats prey upon Twite feeding on in-bye meadows or nesting in mature heathland near to urban development. However, most of the potential housing would be in excess of 1km from the SAC boundary and is beyond the distance likely to be visited by domestic cats. The exception to this is around Rombalds / Ilkley Moor where new development could potentially come very close to the SAC; land for development has yet to be released or allocated and so it is not yet possible to be specific.

6.5 Overall Assessment against the Conservation Objective of South Pennine Moors SAC

6.5.1 Urban edge effects and increased recreational use of the SAC threatens the population, range and habitat of typical species of the SAC. Wind turbine developments could displace typical bird species from otherwise viable territory, possibly reducing population numbers.

6.5.2 There is a risk of loss of Annex 1 habitat extent and structure and function due to increased recreational use and consequent erosion and trampling, as well as an increased threat of fire and changes induced by deposition of atmospheric pollutants.

6.5.3 It cannot be concluded that there will be no adverse effect on the South Pennine Moors SAC as a consequence of the proposals within the Bradford Core Strategy.

6.6 North Pennine Moors SPA

Conservation Objectives – subject to natural change, to maintain or restore the:

- **Objective 1: Extent and distribution of the habitats of the qualifying features;**
- **Objective 2: Structure and function of the habitats of the qualifying features;**
- **Objective 3: Supporting processes on which the habitats of the qualifying features rely;**

- **Objective 4: Populations of the qualifying features; and**
- **Objective 5: Distribution of the qualifying features within the site.**

Supporting habitat

6.6.1 The North Pennine Moors SPA boundary is only 2.5km north of Ilkely, but most of the land between the two sites lies outside of the Bradford district. Any housing allocations brought forward through the Bradford Core Strategy are therefore unlikely to have direct effects on SPA supporting habitats within this area. However, it is important that consideration is given to planning policies within the neighbouring planning authority to ensure this buffer between the SPA and the settlements within Wharfedale are conserved.

Increased emissions to air

6.6.2 There is evidence of degradation to the bog habitats of the qualifying bird species of the SPA (particularly Golden Plover, Dunlin and Curlew) as a result of atmospheric pollution, both from industrial sources (past and present) and road traffic emissions. The nitrogen (but not acid) deposition loading at both locations investigated was found to significantly exceed the critical load.

6.6.3 However, linking pollution loads to development proposed through the Core Strategy is not straight forward and at present there is insufficient data to enable the nature of impacts to be properly explored. Examining the layout of the road network emanating northwards from Bradford district, impacts could be expected at Round Hill close to the A59 Kex Gill Road, and at Embsay Moor on the B6160 (nr Barden Tower).

Wind turbines – collision mortality risk and displacement

6.6.4 Although recent scientific studies have led to mixed conclusions, there is some evidence to suggest that negative impacts from wind turbine development can occur, including through suppressed breeding densities and displacement, and locally reduced population size. Such impacts have been demonstrated (though not consistently) in relation to upland raptors and wading birds, including Hen Harrier, Golden Plover and Curlew, qualifying features of the SPA. However, small-scale development within Bradford district is less likely to affect the SPA, which lies just over 2km to the north of its boundary.

Recreation (including dog walkers)

6.6.5 There is potential for additional recreational pressure having adverse effects on the populations of Annex 1 (Merlin and Peregrine Falcon) and regularly occurring migratory birds (Golden Plover, Curlew) within the North Pennine Moors SPA. However, this is likely to be of a lesser scale than the potential recreational pressure on the South Pennine Moors SPA, due in part to the limited number of car parks and access points onto the SPA in the vicinity of settlements within the Bradford area. Further visitor survey is needed to determine patterns of recreational use of the North Pennine Moors SPA by residents of Bradford district. In the absence of this further information it cannot be concluded that the proposed development within the Core Strategy will not have an adverse effect on the population, range and habitat of important bird species within the North Pennine Moors SPA.

Trampling and erosion (including pedestrian and off-road vehicles)

6.6.6 It seems improbable that there would be a significant increase in path erosion and loss of habitat from proposed development in the Core Strategy on the North Pennine Moors SPA. This is due to the limited availability of access to the SPA from settlements within the Bradford area, the distance between the SPA and the Bradford settlements and the presence of alternative more accessible moorlands within the South Pennines SPA/SAC. However, until data on visitor access patterns to the North Pennine Moors has been obtained, it cannot be concluded that there will not be an adverse effect on this SPA as a consequence of the proposed development in the Core Strategy.

Fire

6.6.7 It has been shown from studies on both lowland heathlands and the Pennine moors that fire risk is significantly increased where these sites are close to urban areas, where young people are concentrated and at times of day and periods of the year when young people are likely to have access to these heaths and moors. In all these respects the North Pennine Moors are unlikely to be used by new residents within the Bradford district and it is concluded that there is no significant risk of fire to the North Pennine Moors SPA as a consequence of the proposed development in the Core Strategy.

Fly-tipping and garden waste / invasive species

6.6.8 It is unlikely that these impacts will have an adverse effect on the SPA bird populations, their range or the habitats they use.

Dog fouling

6.6.9 It is unlikely that dog fouling will have an adverse effect on the SPA bird populations, their range or the habitats they use.

Urbanised avifauna

6.6.10 It is unlikely that there will be an adverse effect on bird populations from an urbanisation of the bird fauna associated with the proposed new development as this will all be at least 2km from the SPA boundary.

Cat predation

6.6.11 It is unlikely that cat predation will have an adverse effect on the SPA bird populations, their range or the habitats they use.

6.7 Overall Assessment against the Conservation Objective of North Pennine Moors SPA

6.7.1 It is not possible to conclude that housing allocations within the Bradford Core Strategy will not have adverse effects on the North Pennine Moors SPA. However, with further visitor survey information it may be possible to conclude that there will be no significant increase in recreational use and consequent trampling and disturbance to birds within this SPA.

6.7.2 Without additional information on the use of the land between the SPA and Bradford district by birds from the SPA it is not possible to determine if this land provides supporting habitat for the SPA or if this is threatened by the housing proposals in the Core Strategy. Small-scale wind turbine developments within Bradford district are unlikely to affect the SPA.

6.7.3 Traffic-related atmospheric pollution could affect the extent, structure and composition of the habitats of Annex 1 and migratory bird species, especially around Round Hill and Embsay Moor. There is currently insufficient data to make a fuller assessment.

6.8 North Pennine Moors SAC

Conservation Objectives – subject to natural change, to maintain or restore the:

- **Objective 6: Extent and distribution of qualifying natural habitats and habitats of qualifying species;**
- **Objective 7: Structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;**
- **Objective 8: supporting processes on which qualifying natural habitats and habitats of qualifying species rely;**
- **Objective 9: populations of qualifying species; and**
- **Objective 10: distribution of qualifying species within the site.**

Supporting habitat

6.8.1 The North Pennine Moors SPA boundary is only 2.5km north of the Ilkely settlement boundary but most of this land lies outside of the Bradford area. Any housing allocations brought forward through the Bradford Core Strategy are therefore unlikely to have direct effects on habitats supporting typical SAC species. However, it is important that consideration is given to planning policies within the neighbouring planning authority to ensure that buffer habitats between the SAC and the settlements within Wharfedale can continue to be used by typical species of the SAC habitats.

Increased emissions to air

6.8.2 There is evidence of changes to the structure and composition of Blanket bog and Transition mire habitats of the SAC as a result of atmospheric pollution, and this may also be affecting the habitats' typical bird species including Golden Plover, Dunlin, Curlew and Meadow Pipit.. Dry and wet heathland habitats are also vulnerable to inputs of nitrogen, with typical plant species being out-competed by nitrophilous species. The nitrogen (but not acid) deposition loading at both locations investigated was found to significantly exceed the critical load.

6.8.3 However, linking pollution loads to development proposed through the Core Strategy is not straight forward and at present there is insufficient data to fully assess the nature of impacts. Impacts could be expected at Round Hill close to the A59 Kex Gill Road, and at Embsay Moor on the B6160 (nr Barden Tower).

Wind turbines – collision mortality risk and displacement

6.8.4 There is some evidence to suggest that negative impacts from wind turbine development can occur, including through suppressed breeding densities and displacement, and locally reduced population size. Such impacts have been demonstrated (though not consistently) in relation to upland raptors and wading birds, including Golden Plover and Curlew, typical species of the SAC habitats. However, small-scale development within Bradford district is less likely to affect the SAC, which lies just over 2km to the north of its boundary.

Recreation (including dog walkers)

6.8.5 Recreational use of the SAC has the potential to cause disturbance to typical moorland birds of the SAC habitats, in particular breeding Curlew, Twite, Golden Plover and birds of prey listed as typical species in Table 3.2. This could result in reduction in breeding population and range and a consequent impact on the blanket bog and dry heathland habitats with which they are associated.

6.8.6 Recreational use of important supporting habitat used by typical species of the SAC habitats could also have an indirect impact upon the conservation status of SAC habitats.

Trampling and erosion (including pedestrian and off-road vehicles)

6.8.7 It seems unlikely that there would be a significant increase in path erosion and loss of habitat from the proposed development in the Core Strategy on the North Pennine Moors SAC. This is due to the limited availability of access to the SAC from settlements within the Bradford District area, the distance between the SAC and the Bradford settlements and the presence of alternative more accessible moorlands within the South Pennines SPA/SAC. However, until data on visitor access patterns to the North Pennine Moors has been obtained, it cannot be concluded that there will not be an adverse effect on this SAC as a consequence of the proposed development in the Core Strategy.

Fire

6.8.8 It has been shown from studies on both lowland heathlands and the Pennines moors that fire risk is significantly increased where these sites are close to urban areas, where young people are concentrated and at times of day and periods of the year when young people are likely to have access to heaths and moors. In all these respects the North Pennine Moors are unlikely to be used by new residents within the Bradford District and it is concluded that there is no significant risk of fire to the North Pennine Moors SAC as a consequence of the proposed development in the Core Strategy.

Fly-tipping and garden waste / invasive species

6.8.9 It is unlikely that these impacts will have an adverse effect on the extent, structure and function or typical species of the Annex 1 habitats of the North Pennine Moors SAC.

Dog fouling

6.8.10 It is unlikely that dog fouling will have an adverse effect on the extent, structure and function or typical species of the Annex 1 habitats of the North Pennine Moors SAC.

Urbanised avifauna

6.8.11 It is unlikely that changes to the local bird fauna from urban development with Bradford district will have an adverse effect on the extent, structure and function or typical species of the Annex 1 habitats of the North Pennine Moors SAC.

Cat predation

6.8.12 It is unlikely that cat predation will have an adverse effect on the extent, structure and function or typical species of the Annex 1 habitats of the North Pennine Moors SAC.

6.9 Overall Assessment against the Conservation Objective of North Pennine Moors SAC

6.9.1 It is not possible to conclude that housing allocations within the Bradford Core Strategy will not have adverse effects on the North Pennine Moors SAC. However, with further visitor survey information it may be possible to conclude that there will be no significant increase in recreational use and consequent trampling and disturbance to the habitats and their typical species within this SAC.

6.9.2 Without additional information on the use of the land between the SAC and Bradford District by typical species of the SAC habitats it is not possible to determine supporting areas are threatened by the housing proposals in the Core Strategy. Small-scale wind turbine developments within Bradford district are unlikely to affect the SAC.

6.9.3 Traffic-related atmospheric pollution could affect the extent, structure and composition of the Annex 1 habitats of the SAC, especially around Round Hill and Embsay Moor. There is currently insufficient data to make a fuller assessment.

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7 Determining Effects on Site Integrity

7.1 Introduction

7.1.1 Using the information presented in Chapters 5 and 6, the following sections consider whether there will be adverse effects on the integrity of the North or South Pennine Moors SAC or SPA.

7.1.2 English Nature (2004; now Natural England) has produced guidance on determining site integrity which includes a 'simple, pragmatic checklist' for assessing likely effects on integrity. This requires the assessor to pose a series of five questions to consider whether the Appropriate Assessment has shown:

- That the area of Annex 1 habitats (or composite features) will not be reduced?
- That there will be no direct effect on the population of the species for which the site was designated or classified?
- That there will be no indirect effects on the populations of species for which the site was designated due to loss or degradation of their habitat (quantity/quality)?
- That there will be no changes to the composition of the habitats for which the site was designated (e.g. reduction in species structure, abundance or diversity that comprises the habitat over time)?
- That there will be no interruption or degradation of the physical, chemical or biological processes that support habitats and species for which the site was designated or classified?

7.1.3 The guidance suggests that if the answer to all of these questions is 'Yes' then it is reasonable to conclude that there is not an adverse effect on integrity. If the answer is 'No' to one or more of the questions then further site-specific factors need to be considered in order to reach a decision. Such factors include:

- Scale of impact;
- Long term effects and sustainability;
- Duration of impact and recovery/reversibility;
- Dynamic systems;
- Conflicting feature requirements;
- Off-site impacts; and
- Uncertainty in cause and effect relationships and a precautionary approach.

7.1.4 This two-step process is applied to determine whether there will be adverse effects on the North or South Pennine Moors SAC or SPA as a result of the Bradford district Core Strategy (Further Engagement Draft, October 2011).

7.2 South Pennine Moors SPA

Step-one tests

Has the Appropriate Assessment shown:	Y/N
That the area of annex I habitats (or habitats of qualifying features) will not be reduced?	**No**
That there will be no direct effect on the population of the species for which the site was designated or classified?	**No**
That there will be no indirect effects on the populations of species for which the site was designated or classified due to loss or degradation of their habitat (quantity/quality)?	**No**
That there will be no changes to the composition of the habitats for which the site was designated (eg reduction in species structure, abundance or diversity that comprises the habitat over time)?	**No**
That there will be no interruption or degradation of the physical, chemical or biological processes that support habitats and species for which the site was designated or classified?	**No**

Step-two tests

Site specific factors	Comment
Scale of impact	Impacts are likely to be of a particularly high magnitude on Rombalds / Ilkley Moor due to its close proximity to a number of existing urban areas which could be allocated substantial numbers of new houses. Impacts may be of a lesser, though still significant, magnitude on the moors to the south and west of the South Pennine Towns and Villages.
Long-term effects and sustainability	Effects are likely to be long-lasting and threaten the viability of habitats and species over a sustained period.
Duration of impact and recovery/reversibility	Impacts are likely to be most acute during the summer months. They are potentially reversible although this is less likely.
Dynamic systems	The natural ecological dynamics of the site are threatened due to the range of impacts which could occur.
Conflicting feature requirements	There are no relevant conflicting feature requirements.
Off-site impacts	There is great potential for impacts to bird species foraging offsite, particularly within around 2km of the site.
Uncertainty in cause and effect relationships and a precautionary approach	There is extensive uncertainty in how impacts could actually operate due to a lack of suitable data for use in the assessment. A precautionary approach has been taken.

7.2.1 At the present time, it cannot be concluded that there will not be adverse effects on the ecological integrity of the South Pennine Moors SPA.

7.3 South Pennine Moors SAC

Step-one tests

Has the Appropriate Assessment shown:	Y/N
That the area of annex I habitats (or composite features) will not be reduced?	No
That there will be no direct effect on the population of the species for which the site was designated or classified?	N/A*
That there will be no indirect effects on the populations of species for which the site was designated or classified due to loss or degradation of their habitat (quantity/quality)?	No**
That there will be no changes to the composition of the habitats for which the site was designated (eg reduction in species structure, abundance or diversity that comprises the habitat over time)?	No
That there will be no interruption or degradation of the physical, chemical or biological processes that support habitats and species for which the site was designated or classified?	No

* SAC not designated for any Annex 2 species.
** Considered as typical species for the purposes of the assessment

Step-two tests

Site specific factors	Comment
Scale of impact	Impacts are likely to be of a particularly high magnitude on Rombalds / Ilkley Moor due to its close proximity to a number of existing urban areas which could be allocated substantial numbers of new houses. Impacts may be of a lesser, though still significant, magnitude on the moors to the south and west of the South Pennine Towns and Villages.
Long-term effects and sustainability	Effects are likely to be long-lasting and threaten the viability of habitats and species over a sustained period.
Duration of impact and recovery/reversibility	Impacts are likely to be most acute during the summer months. They are potentially reversible although this is less likely.
Dynamic systems	The natural ecological dynamics of the site are threatened due to the range of impacts which could occur.
Conflicting feature requirements	There are no relevant conflicting feature requirements.
Off-site impacts	There is potential for impacts to typical bird species foraging offsite, particularly within around 2.5km of the site.
Uncertainty in cause and effect relationships and a precautionary approach	There is extensive uncertainty in how impacts could actually operate due to a lack of suitable data for use in the assessment. A precautionary approach has been taken.

7.3.1 At the present time, it cannot be concluded that there will not be adverse effects on the ecological integrity of the South Pennine Moors SAC.

7.4 North Pennine Moors SPA

Step-one tests

Has the Appropriate Assessment shown:	Y/N
That the area of annex I habitats (or habitats of qualifying features) will not be reduced?	No
That there will be no direct effect on the population of the species for which the site was designated or classified?	No
That there will be no indirect effects on the populations of species for which the site was designated or classified due to loss or degradation of their habitat (quantity/quality)?	No
That there will be no changes to the composition of the habitats for which the site was designated (eg reduction in species structure, abundance or diversity that comprises the habitat over time)?	No
That there will be no interruption or degradation of the physical, chemical or biological processes that support habitats and species for which the site was designated or classified?	No

Step-two tests

Site specific factors	Comment
Scale of impact	Impacts are likely to be of a lesser magnitude than on the Southern Pennines due to the comparative inaccessibility of the North Pennine Moors. However, impacts could still be significant.
Long-term effects and sustainability	Effects are likely to be long-lasting and threaten the viability of habitats and species over a sustained period.
Duration of impact and recovery/reversibility	Impacts are likely to be most acute during the summer months. They are potentially reversible although this is less likely.
Dynamic systems	The natural ecological dynamics of the site are threatened due to the range of impacts which could occur.
Conflicting feature requirements	There are no relevant conflicting feature requirements.
Off-site impacts	There is a degree of potential for impacts to bird species foraging offsite, particularly within the Wharfedale valley where inter-authority planning will need to be carefully implemented.
Uncertainty in cause and effect relationships and a precautionary approach	There is extensive uncertainty in how impacts could actually operate due to a lack of suitable data for use in the assessment. A precautionary approach has been taken.

7.4.1 At the present time, it cannot be concluded that there will not be adverse effects on the ecological integrity of the North Pennine Moors SPA.

7.5 North Pennine Moors SAC

Step-one tests

Has the Appropriate Assessment shown:	Y/N
That the area of annex I habitats (or composite features) will not be reduced?	No
That there will be no direct effect on the population of the species for which the site was designated or classified?	N/A*
That there will be no indirect effects on the populations of species for which the site was designated or classified due to loss or degradation of their habitat (quantity/quality)?	No**
That there will be no changes to the composition of the habitats for which the site was designated (eg reduction in species structure, abundance or diversity that comprises the habitat over time)?	No
That there will be no interruption or degradation of the physical, chemical or biological processes that support habitats and species for which the site was designated or classified?	No

* SAC not designated for Annex 2 species. Marsh Saxifrage is present but not as a primary reason for site selection, and is not present close to Bradford district boundary.
** Considered as typical species for the purposes of the assessment

Step-two tests

Site specific factors	Comment
Scale of impact	Impacts are likely to be of a lesser magnitude than on the Southern Pennines due to the comparative inaccessibility of the North Pennine Moors. However, impacts could still be significant.
Long-term effects and sustainability	Effects are likely to be long-lasting and threaten the viability of habitats and species over a sustained period.
Duration of impact and recovery/reversibility	Impacts are likely to be most acute during the summer months. They are potentially reversible although this is less likely.
Dynamic systems	The natural ecological dynamics of the site are threatened due to the range of impacts which could occur.
Conflicting feature requirements	There are no relevant conflicting feature requirements.
Off-site impacts	There is a degree of potential for impacts to typical bird species foraging offsite, particularly within the Wharfedale valley where inter-authority planning will need to be carefully implemented.
Uncertainty in cause and effect relationships and a precautionary approach	There is extensive uncertainty in how impacts could actually operate due to a lack of suitable data for use in the assessment. A precautionary approach has been taken.

7.5.1 At the present time, it cannot be concluded that there will not be adverse effects on the ecological integrity of the North Pennine Moors SAC.

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8 Interim Recommendations for Avoiding and/or Mitigating Impacts

8.1 Introduction

8.1.1 At the outset of the project we identified a broad typology of actions that could help to avoid or mitigate the adverse effects of the Core Strategy. These were grouped into the following themes:

- Understanding carrying capacity (further evidence gathering);
- Adjusting the rate, scale and spatial distribution of development;
- Decreasing the overall impact;
- Identifying strategic avoidance measures;
- Designing site-specific mitigation measures; and
- Small scale policy recommendations.

8.1.2 Each of these is discussed in turn.

8.2 Understanding Carrying Capacity (Evidence Gathering)

8.2.1 In order to improve our understanding of how the impacts assessed in this report could manifest themselves on the ground, a number of additional studies are required.

8.2.2 Visitor surveys are needed to fulfil a number of data gaps including: the proportion of residents living around the moors that visit on a regular basis; how frequently they visit; from where and by what mode do they travel; what activities they undertake while visiting; and how far they penetrate into the designated sites. These data and related information are needed to enable impacts to be predicted more precisely, and to establish whether impacts can be reduced by changing the overall spatial development strategy. They will also be essential to inform detailed design of site-specific mitigation measures (see below), including alternative recreational spaces and amendments to designated site management.

8.2.3 Additionally, while the results of the 2012 South Pennine Moorland Fringe Bird Survey is expected to provide a timely insight to how the SPA birds use areas of land within 1km of the SPA, the review of literature presented in Chapter 4 of this report suggests that many SPA/typical species travel as far as 2.5km from the SPA boundary to forage (and in some cases further). Hence there is a need during spring/summer 2013 to carry out additional bird surveys to establish how the SPA/typical species may utilise suitable land within around 2.5km, in order that regularly used areas can be protected from development and its associated impacts. It would be appropriate to focus the scope of survey on land that is both reasonably likely to be

allocated[36] (in the broadest sense) and within 2.5km of the SPA, in order to make the best use of available resources.

8.2.4 Similarly, it is important to gain an understanding of which areas of land provide suitable, high quality foraging habitat for SPA/typical species, or could be encouraged to do so under an appropriate management regime. Such areas should also protected from development and its associated impacts and, where management improvements can be made, could be used to target funds collected through development as a form of mitigation. Habitat surveys should therefore be undertaken, focusing on areas of potentially suitable land (for instance meadow, pasture, semi-/un- improved or rough grassland, and rush pasture) within around 2.5km[37] of the SPA/SAC. The survey should also aim to identify wildflower and seed rich habitats which would have a particularly important supporting role for typical species of the SAC.

8.2.5 Further ecological data is required on the distribution of Annex 1 habitat types and SPA bird species within the North Pennine Moors SPA and SAC. The identification of supporting habitat between the Bradford district boundary and the North Pennine Moors should also be identified, particularly if this is close to the district boundary and hence liable to disturbance from housing allocations within the district.

8.2.6 Further work is needed to prepare more detailed projections of traffic flow increases on roads passing within 200m of the SAC/SPA, and to relate these to development scenarios within Bradford district. Depending on the findings of this work, it may be necessary to undertake atmospheric dispersion modelling to establish the overall increase on pollutant deposition that could result from increased demand for travel associated with the Core Strategy. It is acknowledged, however, that proposed polies TR1 and TR2 already pursue an array of measures designed to reduce the traffic-generating impacts of the Core Strategy, and there may be limited opportunities for recommending further measures to address this impact.

8.2.7 Research into the effects of small-scale wind turbine developments on breeding bird populations on the SPA, being carried out as part of a Manchester Metropolitan University research project, should be used to inform specific policy requirements in relation to renewable energy generation. Ideally it would be helpful if the Core Strategy, or a later planning document such as the Site Allocations DPD, could give a clear indication of where and of what magnitude wind turbine developments would normally be permitted, and of the monitoring arrangements that might be required both pre- and post-construction. In order to secure a precautionary approach in advance of the research becoming available, it may be appropriate to require development proposals to be constructed away from the SPA boundary and outside of the breeding season, following production of the necessary survey and ecological assessment.

[36] For example, this could include land that has previously been allocated but not yet consented or implemented, land identified as potentially deliverable for residential development in the Council's latest Strategic Housing Land Availability Assessment, or greenfield land close to existing settlements which may be subject to urban extension.

[37] The most immediate need is for an understanding of which areas of high quality habitats should potentially be excluded from the development strategy, and surveys could therefore focus in the first instance on the same land as described in footnote 36. In the longer term, and to inform the overall package of avoidance and mitigation measures, additional land within 2.5km of the SAC/SPA should also be surveyed, so that potentially high quality habitats can be targeted for improvement.

8.2.8 It will also be necessary to develop a better understanding of future population growth within the Bradford district area and, to help in achieving this, the Council will be commissioning consultants to re-assess housing need.

8.3 Adjusting the Rate, Scale and Spatial Distribution of Development

8.3.1 We are concerned that the overall level of housing being proposed within Bradford district is such that adverse effects on SAC and SPA may not be capable of being avoided and mitigated. To use Rombalds and Ilkley Moors as a case in point, the settlements falling within approximately 2.5km of this moorland block (Addingham, Ilkley, Burley in Wharfedale, Menston, Bingley, East Morton, Keighley (outskirts) and Silsden) would receive a combined total of 11,550 new dwellings over the plan period under the Further Engagement Draft Core Strategy. It seems apparent from the distribution of bird registrations described earlier in this report that the moorland may already be suffering reduced productive capacity due to a combination of factors, of which housing may be one. Reducing the scale of housing allocations, particularly for settlements wholly or substantively within 2.5km of the SAC/SPA, is therefore likely to be necessary to satisfy the requirements of the Habitats Regulations.

8.3.2 From the data that is available to date, it is clear that residential allocations should ideally be located more than 2.5km from the SAC/SPA boundary. This is the zone most frequently utilised by several of the SAC/SPA species. Within this zone new housing must avoid direct (e.g. land take) or indirect (e.g. increased disturbance) impacts on supporting habitats. It is anticipated that the extent of this zone should be guided by the results of the 2012 South Pennine Moorland Fringe Bird Survey, and additional bird and habitat surveys described above.

8.3.3 In addition to this, the review of available evidence presented in Chapter 5 indicates that a precautionary spatial strategy would in the first instance seek to restrict residential development within 400m of the SAC/SPA boundary, in order to avoid the risk of urban edge effects such as fly-tipping, introduction of invasive species, cat/scavenger predation and increasing fire risk. There is also a case for considering a 600m zone for restricting the development of wind energy proposals, at least until further research and monitoring evidence becomes available. Finally, a further zone around the SPA could be established, within which contributions would be collected from residential development to (a) establish a network of alternative recreational spaces, and (b) adjust the management of visitors within the SAC/SPA. Such an approach has been used around many of the southern heathlands, and 5km has often delimited the extent of the zone, but it should be informed by the results of visitor surveys as described above.

8.3.4 The extent of each of these zones is shown on Figure 8.1 to give an impression of the provisional spatial avoidance strategy that could be deployed for Bradford district's Core Strategy.

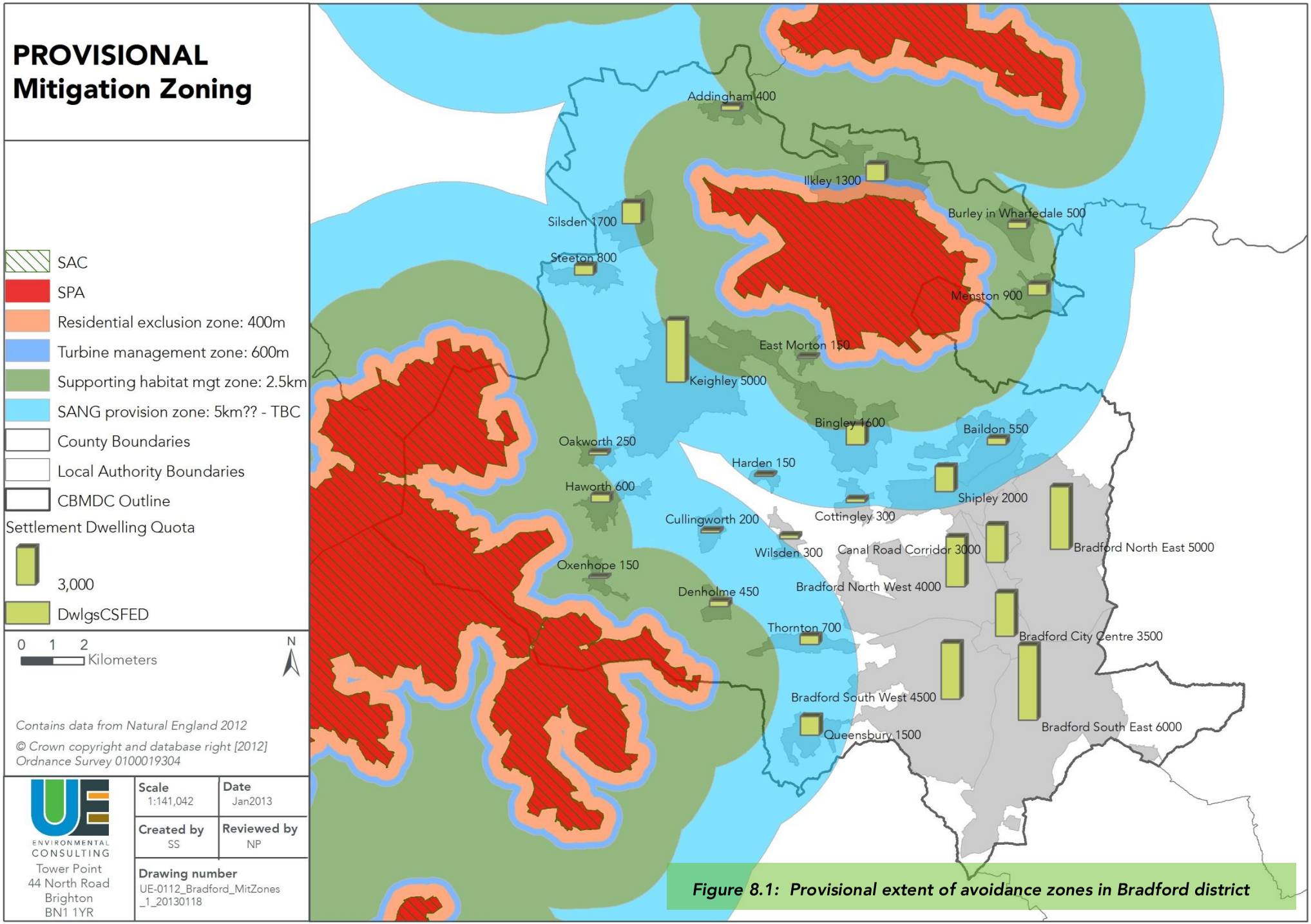

Figure 8.1: Provisional extent of avoidance zones in Bradford district

8.3.5 Once the scale and distribution of housing has been re-examined in response to the recommendations presented in this report, and if there is still considered to be a risk of adverse effects on the integrity of the SAC/SPA, a suitably precautionary policy response will be required. The policy should focus on the zone(s) of influence around the SAC/SPA and seek to restrict or manage the amount of development coming forward by setting out the required actions for avoiding and mitigation impacts. Precedents of policy which aims to deal with such risks in a precautionary way, and which have successfully undergone Examination in Public, are characterised by the following:

- The policy acknowledges the risk of impact, its likely causes and potential scale;
- The impact is addressed within policy and spatial strategy;
- Flexibility and early review are built into the development plan;
- A commitment is made to gathering further evidence to better understand the impact;
- A broad approach to avoidance and mitigation is outlined; and
- A delivery mechanism for avoidance and mitigation measures is described.

8.4 Decreasing the Overall Impact

8.4.1 It may be possible to reduce the overall level of impacts to the moorlands by introducing measures aimed at deflecting current pressure away from the moors. Examples are readily available in relation to some of southern England's lowland heaths where alternative recreational sites known as Suitable Alternative Natural Greenspaces (SANG) have been put forward as a means of drawing current or future recreational pressure away from sensitive habitats. However, their suitability and effectiveness in an upland context, and the design requirements they should exhibit, needs to be explored in greater detail via surveys of visitor activity on the SAC/SPA itself. Given the general character of the district is one of moorland, steep-sided valleys under agricultural usage, and developed valley bottoms, some locally important opportunities present themselves. These include the development of multifunctional river valley corridors (with roles including recreation, biodiversity and flood storage), and promotion of undesignated uplands such as Norr Hill and Harden Moor.

8.4.2 Another and more fundamental way in which the overall impact could be reduced would be to re-assess the scale of housing need and reduce the housing requirement from its current proposed level of 45,500. The Council has indicated that it will be commissioning consultants to re-assess housing need and this will include analysis of a range of factors including the most up to date population and household projections, economic and employment projections and regeneration objectives. This may have implications for the total amount of SANG that would be required to offset visitor impacts on the SAC/SPA.

8.4.3 The plantation woodland at High Moor on the south-west edge of Rombalds Moor could offer an alternative approach. There is scope to consider felling, thinning or reducing the area of the woodland to provide space for expanding and restoring upland habitats and species, thereby improving the overall condition of Rombalds Moor. There are a number of potential difficulties with this proposition, not least landowner assent, making the most of the woodland resource

(i.e. waiting for maturation), loss of woodland biodiversity and other ecosystem services, and possible impacts on landscape value. It has also been noted that merlin and short-eared owl recorded during recent bird surveys appear to have an association with this area of woodland, which would require careful consideration in planning any future woodland management.

8.5 Designing Site Specific Management Measures

8.5.1 The visitor surveys discussed at section 8.2.2 will provide data essential to enable a rationalisation of access management on moorland areas. An integrated access management plan is needed to assess the relative benefits that could be gained a suitable mix of the following interventions:

- Selected paving of main paths/routes across the moors;
- Closing or otherwise restricting access along other routes;
- Reducing or relocating car parking facilities;
- Zoned (both spatial and temporal) control of certain activities such as dog walking;
- Signage, interpretation and educational materials;
- Increased wardening; and
- Habitat management and manipulation.

8.5.2 Such measure can be effective in redistributing or reducing visitor activity, particularly when coupled with pre-visit information (for example through the Watershed Landscape Project[38] or Paws on the Moors[39]).

8.6 Small Scale Policy Recommendations

8.6.1 A number of minor policy amendments could be made to the Core Strategy to improve its integration with the HRA process. These include:

- Including a section within TR4 Transport and Tourism that aligns with recommendations above regarding access management planning, to ensure that policy interventions improve rather than worsen the baseline situation;
- Including a section within PN1 and EN6 Energy to draw attention to future work seeking to establish areas where wind turbine development could be suitable, and areas where it should be avoided; and
- Including a section within ID3 Developer Contributions to establish a funding mechanism for the HRA avoidance and mitigation package once it has been worked up in detail.

[38] http://www.watershedlandscape.co.uk/

[39] http://www.pawsonthemoors.org/

9 Conclusions

9.1 Summary

9.1.1 This report presents an Appropriate Assessment under the Habitats Regulations for the Bradford District Core Strategy. It adds further detail to a previous screening assessment carried out for the Council in March 2010. The Appropriate Assessment applies retrospectively to the Core Strategy (Further Engagement Draft, October 2011) and is intended to inform Officers and Councillors of the potential scale of impacts to European sites, based on currently available information.

9.2 Findings

9.2.1 Four nature conservation sites of European importance are addressed by the assessment, the North and South Pennine Moors SAC and SPA. Based on currently available evidence, it cannot be concluded that development proposed by the Core Strategy will not lead to adverse effects on any of the sites via the following impact pathways:

- Loss of supporting habitats;
- Increased emissions to air from road traffic;
- Collision mortality risk and/or displacement from wind turbine developments;
- Recreational impacts; and
- Urban edge effects.

9.2.2 Adverse effects resulting from increased water demand or impacts on water quality are not considered likely.

9.3 Conclusions

9.3.1 A number of additional studies are needed to allow more precise assessment conclusions to be drawn, some of which are already underway. The report makes a range of recommendations setting out preliminary ideas for avoiding adverse effects on the integrity of European sites. A further iteration of the Appropriate Assessment will add greater detail to the avoidance and mitigation strategy, while also updating the assessment in relation to the Core Strategy Proposed Submission Document.

9.4 Next Steps

9.4.1 The Council is currently working to update the evidence base underpinning a number of aspects of the Core Strategy, notably demographic forecasts, assessments of housing need and the infrastructure delivery plan. Further studies are also scheduled for 2013 to address some of the data gaps highlighted by this Appropriate Assessment, including breeding bird surveys, habitat surveys and visitor activity surveys.

9.4.2 It is anticipated that, once these are complete, amendments will be made to the overall level and distribution of development across the district. This provides the opportunity to consider the findings of the HRA, to adjust the development strategy to reduce the magnitude of impacts to European sites, and to create the necessary policy platform for successfully avoiding and mitigating adverse effects.

9.4.3 The Council will be seeking the views of Natural England and other interested stakeholders in relation to the HRA conclusions before embarking on additional studies as recommended by this assessment.

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Appendix I: Screening Matrix

Please see insert.

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			SAC		SPA	
			South Pennine Moors	North Pennine Moors	South Pennine Moors	North Pennine Moors
City of Bradford District Core Strategy						
ID	**Strategic Core Policies**	**Likely Significant Effect(s)**				
SC1	Overall Approach and Key Spatial Priorities	-	A1	A1	A1	A1
SC2	Climate Change and Resource Use	-	A2	A2	A2	A2
SC3	Working together to make Great Places	-	A1	A1	A1	A1
SC4	Hierarchy of Settlements	-	A5	A5	A5	A5
SC5	Location of Development	-	A1	A1	A1	A1
SC6	Green Infrastructure	-	A3	A3	A3	A3
SC7	Green Belt	-	A5	A5	A5	A5
ID	**Sub Area Policies**	**Likely Significant Effect(s)**				
BD1	City of Bradford including Shipley and Lower Baildon Sub Area (inc. 28,000 dwellings + 105ha employment)	Loss of supporting feeding sites, atmospheric pollution, recreational impacts and urban edge effects	D1/2	D1/2	D1/2	D1/2
AD1	Airedale Sub Area (inc. 10,100 dwellings + 31ha employment)	Loss of supporting feeding sites, atmospheric pollution, recreational impacts and urban edge effects	C2	D1/2	C2	D1/2
AD2	Investment Priorities for the Airedale Sub Area	-	A4	A4	A4	A4
WD1	Wharfedale Sub Area (inc. 3,100 dwellings + 10ha employment)	Loss of supporting feeding sites, atmospheric pollution, recreational impacts and urban edge effects	C1	D1/2	C1	D1/2
WD2	Investment Priorities for the Wharfedale Sub Area	-	A4	A4	A4	A4
PN1	South Pennine Towns and Villages Sub Area (inc. 4,300 dwellings)	Loss of supporting feeding sites, atmospheric pollution, recreational impacts and urban edge effects, collision risk mortality / displacement	C2	D1/2	C2	D1/2
PN2	Investment Priorities for the South Pennine Towns and Villages Sub Area	-	A4	A4	A4	A4
ID	**Economic Policies**	**Likely Significant Effect(s)**				
EC1	Creating a successful and competitive Bradford District economy within the Leeds City Region	-	A1	A1	A1	A1
EC2	Supporting Business and Creating Jobs	-	A5	A5	A5	A5
EC3	Employment Land Requirement	Principally atmospheric pollution	D1/2	D1/2	D1/2	D1/2
EC4	Sustainable Economic Growth	-	A1	A1	A1	A1
EC5	City, Town, District and Local Centres	-	A1	A1	A1	A1
ID	**Transport Policies**	**Likely Significant Effect(s)**				
TR1	Travel Reduction and Modal Shift	-	A1	A1	A1	A1
TR2	Parking Policy	-	A1	A1	A1	A1
TR3	Public Transport, Cycling and Walking	-	A4	A4	A4	A4
TR4	Transport and Tourism	Recreational impacts and urban edge effects	C1	A4	C1	A4

			SAC		SPA	
	City of Bradford District Core Strategy		South Pennine Moors	North Pennine Moors	South Pennine Moors	North Pennine Moors
TR5	Rural Transport	-	A1	A1	A1	A1
TR6	Freight	-	A1	A1	A1	A1
TR7	Transport Investment and Management Priorities	-	A1	A1	A1	A1
TR8	Aircraft Safety	-	A1	A1	A1	A1
ID	**Housing Policies**	**Likely Significant Effect(s)**				
HO1	Scale of Housing Required	-	A5	A5	A5	A5
HO2	Strategic Sources of Supply	-	A5	A5	A5	A5
HO3	Distribution of Housing Requirement	Loss of supporting feeding sites, atmospheric pollution, recreational impacts and urban edge effects	C2	D1/2	C2	D1/2
HO4	Phasing and Release of Housing Sites	-	A1	A1	A1	A1
HO5	Density of Housing Schemes	-	A1	A1	A1	A1
HO6	Maximising use of Previously Developed Land	-	A1	A1	A1	A1
HO7	Housing Site Allocation Principles	-	A1	A1	A1	A1
HO8	Housing Mix	-	A1	A1	A1	A1
HO9	Housing Quality	-	A1	A1	A1	A1
HO10	Overcrowding and Vacant Homes	-	A1	A1	A1	A1
HO11	Affordable Housing	-	A1	A1	A1	A1
HO12	Provision of Sites for Gypsies, Travellers and Travelling Showpeople	-	A1	A1	A1	A1
		Likely Significant Effect(s)				
EN1	Open Space, Sports and Recreational	-	A1	A1	A1	A1
EN2	Biodiversity and Geodiversity	-	A2	A2	A2	A2
EN3	Historic Environment	-	A3	A3	A3	A3
EN4	Landscape	-	A2	A2	A2	A2
EN5	Trees and woodlands	-	A2	A2	A2	A2
EN6	Energy	Collision risk mortality / displacement	D1/2/3	A4	D1/2/3	A4
EN7	Development and Flood Risk	-	A1	A1	A1	A1
EN8	Environmental Protection Policy	-	A2	A2	A2	A2

			SAC		SPA	
			South Pennine Moors	North Pennine Moors	South Pennine Moors	North Pennine Moors
City of Bradford District Core Strategy						
EN9	New Minerals Extraction Sites	-	A2	A2	A2	A2
EN10	Sand Stone Supply	-	A1	A1	A1	A1
EN11	Sand, Gravel, Fireclay and Coal Supply	-	A1	A1	A1	A1
EN12	Minerals Safeguarding	-	A1	A1	A1	A1
EN13	Waste Management	-	A1	A1	A1	A1
EN14	Identifying Waste Management Sites	-	A4	A4	A4	A4
		Likely Significant Effect(s)				
ID1	Development Plan Documents and Authority Monitoring Report	-	A1	A1	A1	A1
ID2	Development Management	-	A1	A1	A1	A1
ID3	Developer Contributions	-	A1	A1	A1	A1
ID4	Working with Partners	-	A1	A1	A1	A1
ID5	Facilitating Delivery	-	A1	A1	A1	A1
ID6	Simplification of Planning Guidance to Encourage Sustainable Development	-	A1	A1	A1	A1
ID7	Community Involvement	-	A1	A1	A1	A1
ID8	Regeneration Funding and Delivery	-	A1	A1	A1	A1

		SAC		SPA	
		South Pennine Moors	North Pennine Moors	South Pennine Moors	North Pennine Moors
City of Bradford District Core Strategy					
Assessment Key					
Category A: No negative effect					
A1	Options / policies that will not themselves lead to development e.g. because they relate to design or other qualitative criteria for development, or they are not a land use planning policy.				
A2	Options / policies intended to protect the natural environment, including biodiversity.				
A3	Options / policies intended to conserve or enhance the natural, built or historic environment, where enhancement measures will not be likely to have any negative effect on a European Site.				
A4	Options / policies that positively steer development away from European sites and associated sensitive areas.				
A5	Options / policies that would have no effect because development is implemented through later policies in the same plan, which are more specific and therefore more appropriate to assess for their effects on European Sites.				
Category B: No significant effect					
B	Options / policies that could have an effect, but the likelihood is there would be no significant negative effect on a European site either alone or in combination with other elements of the same plan, or other plans or projects.				
Category C: Likely significant effect alone					
C1	The option, policy or proposal could directly affect a European site because it provides for, or steers, a quantity or type of development onto a European site, or adjacent to it.				
C2	The option / policy could indirectly affect a European site e.g. because it provides for, or steers, a quantity or type of development that may be ecologically, hydrologically or physically connected to it or increase disturbance.				
C3	Proposals for a magnitude of development that, no matter where it was located, the development would be likely to have a significant effect on a European site.				
C4	An option / policy that makes provision for a quantity / type of development but the effects are uncertain because its detailed location is to be selected following consideration of options in a later, more specific plan.				
C5	Options / policies for developments or infrastructure projects that could block alternatives for the provision of other development in the future, that may lead to adverse effects on European sites, which would otherwise be avoided.				
C6	Options, policies or proposals which are to be implemented in due course - if implemented in one or more particular ways, the proposal could possibly have a significant effect on a European site.				
C7	Any other options, policies or proposals that would be vulnerable to failure under the Habitats Regulations at project assessment stage; to include them in the plan would be regarded by the EC as 'faulty planning'.				
C8	Any other proposal that may have an adverse effect on a European site, which might try to pass the tests of HRA at project level by arguing that the plan provides IROPI to justify its consent despite a negative assessment.				
Category D: Likely significant effects in combination					
D1	The option, policy or proposal alone would not be likely to have significant effects but if its effects are combined with the effects of other policies within the same plan the cumulative effects would be likely to be significant.				
D2	Options, policies or proposals that alone would not be likely to have significant effects but if their effects are combined with the effects of other plans or projects, the combined effects would be likely to be significant.				
D3	Options or proposals that are, or could be, part of a programme or sequence of development delivered over a period, where the implementation of the later stages could have a significant effect on European sites.				
?	Uncertain effects because the issue/option currently lacks detail. The screening assessment will be re-visited as more detail becomes available.				

Appendix II: APIS Grid Reference Data

The following tables show the latest data held by APIS (at 30/10/12) for exceedances of critical loads/levels for atmospheric pollutant types relevant to the HRA, at a range of grid references on the strategic road network connecting to Bradford district. All locations are both within a European site, and within 200m of a road corridor. Cells highlighted in red are already exceed; those highlighted in yellow have a background load/level >70% of the critical load/level. The following abbreviations apply:

CL = Critical load or level for target habitat at this location

Dep. / conc. = Current rates of deposition or concentration

Exceed. = The amount by which CL is exceeded

EU site name: North Pennine Moors SAC/SPA (Round Hill)

Queried habitat(s): Fen, Marsh and Swamp

Grid ref(s): 412280,454781

Map ref: 1

Road corridor(s): A59 Kex Gill Road

	412280,454781		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	This habitat is not sensitive to acidity	2.18 (N: 1.7 | S: 0.48)	n/a
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Rich fens: 15 - 30	23.8	Valley mires, poor fens and transition mires: 13.8 (238%) Rich fens: 8.8 (159%)
NOx (μgm^{-3})	30	10.39	-19.61

EU site name: North Pennine Moors SAC/SPA (Embsay Moor)

Queried habitat(s): Fen, Marsh and Swamp

Grid ref(s): 405015,456825

Map ref: 2

Road corridor(s): B6160 (nr Barden Tower)

	405015,456825		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	This habitat is not sensitive to acidity	2.04 (N: 1.59 | S: 0.45)	n/a
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Rich fens: 15 - 30	22.26	Valley mires, poor fens and transition mires: 12.26 (226%) Rich fens: 7.26 (151%)
NOx (µgm^{-3})	30	9.07	-20.93

EU site name: South Pennine Moors SAC/SPA (Wadsworth Moor)

Queried habitat(s): Bogs

Grid ref(s): 401140,433000

Map ref: 3

Road corridor(s): A6033 Hebden Bridge Road

	401140,433000		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	CLmaxS: 0.47 CLminN: 0.32 CLmaxN: 0.8	2.58 (N: 1.97 | S: 0.61)	Yes
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Raised and blanket bogs: 5 - 10	27.58	Valley mires, poor fens and transition mires: 17.58 (276%) Raised and blanket bogs: 22.58 (552%)
NOx (µgm^{-3})	30	12.13	-17.87

EU site name: South Pennine Moors SAC/SPA (Thornton Moor)

Queried habitat(s): Bogs

Grid ref(s): 401400,432985

Map ref: 4

Road corridor(s): A6033 Hebden Bridge Road

	401400,432985		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	CLmaxS: 0.47 CLminN: 0.32 CLmaxN: 0.79	2.58 (N: 1.97 | S: 0.61)	Yes
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Raised and blanket bogs: 5 - 10	27.58	Valley mires, poor fens and transition mires: 17.58 (276%) Raised and blanket bogs: 22.58 (552%)
NOx (µgm^{-3})	30	12.13	-17.87

EU site name: South Pennine Moors SAC/SPA (Soyland Moor)

Queried habitat(s): Bogs

Grid ref(s): 397697,418193

Map ref: 5

Road corridor(s): B6138 Turvin Road & A58 Rochdale Road

	397697,418193		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	CLmaxS: 0.44 CLminN: 0.32 CLmaxN: 0.76	2.16 (N: 1.66 | S: 0.5)	Yes
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Raised and blanket bogs: 5 - 10	23.24	Valley mires, poor fens and transition mires: 13.24 (232%) Raised and blanket bogs: 18.24 (465%)
NOx (µgm^{-3})	30	18.38	-11.62

EU site name: South Pennine Moors SAC/SPA (Rishworth/Moss Moor)

Queried habitat(s): Dwarf Shrub Heath

Grid ref(s): 401955,415950

Map ref: 6

Road corridor(s): A672 Oldham Road & M62(J23-J22)

	401955,415950		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	CLmaxS: 0.57 CLminN: 0.64 CLmaxN: 1.21	2.49 (N: 1.95 | S: 0.54)	Yes
N dep. (kgN/ha/yr)	10-20	27.3	17.3 (273%)
NOx (µgm^{-3})	30	21.95	-8.05

EU site name: South Pennine Moors SAC/SPA (Moss Moor)

Queried habitat(s): Bogs

Grid ref(s): 402280,414043

Map ref: 7

Road corridor(s): B6114 & A640 New Hey Road

	402280,414043		
Pollutant:	**CL**	**Dep. / conc.**	**Exceed.**
Acid dep. (keq/ha/yr)	CLmaxS: 0.52 CLminN: 0.32 CLmaxN: 0.84	2.44 (N: 1.89 | S: 0.55)	Yes
N dep. (kgN/ha/yr)	Valley mires, poor fens and transition mires: 10 – 15 Raised and blanket bogs: 5 - 10	26.46	Valley mires, poor fens and transition mires: 16.46 (265%) Raised and blanket bogs: 21.46 (529%)
NOx (µgm^{-3})	30	17.53	-12.47

Appendix III: Visitor survey data from 2000

Please see over.

Site Surveys - Comparison

Distance travelled

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
<5 miles	30	32	61	41.0
6-10 miles	23	17	22	20.7
11-15 miles	18	5	7	10.0
16-20 miles	10	7	6	7.7
20+ miles	19	39	4	20.7

Means of transport

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
Car	90	72	64	75.3
Bus	-	7	7	4.7
Train	1	8	3	4.0
Walk	3	13	24	13.3
Cycle	-	-	-	0.0
Horse	-	-	-	
Other	6	-	2	

Reason for visit

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
Walk dog	12	15	32	19.7
Walking	29	39	33	33.7
Visit the Moor	37	-	-	12.3
Day trip	-	18	14	10.7
Rock Climbing	1	-	-	0.3
Cow and Calf Rocks	8	-	-	2.7
Picnic	2	2	-	1.3
Holiday	7	7	-	4.7
Educational visit	2	-	-	0.7
Fresh air	-	3	3	2.0
Bronte connection	-	11	-	3.7
Scenery	-	3	2	1.7
General recreation	-	-	8	2.7
Exercise	-	-	2	0.7
Bracken Hall visit	-	-	1	0.3
Horse riding	-	-	1	0.3
Saltaire link	-	-	1	0.3
Fun fair/tramway	-	-	1	0.3
Shortcut	-	-	1	0.3
Cycling	-	-	1	0.3

Age

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
<18	3	0	5	2.7
19-30	22	25	18	21.7
31-50	39	41	31	37.0
50+	35	34	45	38.0

Visited before

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
Yes	84	80	96	86.7
No	16	20	4	13.3

Frequency

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
Very Often	15	25	46	28.7
Regularly	18	7	12	12.3
Occasionally	49	47	41	45.7
Not in 12 months	18	20	1	13.0

Good points

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
Scenery	34	42	23	33.0
Peace and quiet	6	22	6	11.3
Open space	-	4	19	7.7
Walking	12	4	8	8.0
Nature interest	3	5	1	3.0
Fresh air	7	8	7	7.3
Dog walking area	3	6	4	4.3
Accessibility	3	-	9	4.0
Educational/historic value	3	-	-	1.0
Good for kids	4	-	5	3.0
Climbing	10	-	-	3.3
Free	2	-	1	1.0
Café	1	-	4	1.7
Parking	2	2	1	1.7
Good paths	4	4	-	2.7
Cow and Calf rocks	7	-	-	2.3
Bronte connection	-	2	-	0.7
Bracken Hall	-	-	4	1.3
Tramway / fair ground	-	-	4	1.3

Bad points

Variable	Cow & Calf	Penistone Hill %	Shipley Glen	Ave
No bad points	33	52	27	37.3
Litter/tipping	20	16	33	23.0
No/poor toilets	16	6	6	9.3
Dog fouling	3	4	13	6.7
Poor paths	-	6	1	2.3
Poor signing on moor	3	9	-	4.0
Weather	6	-	-	2.0
Not enough parking	8	-	-	2.7
Too crowded	3	-	2	1.7
Rocks dangerous	1	-	-	0.3
No dog bins	-	-	2	0.7
No litter bins	3	3	5	3.7
Café too expensive	2	-	-	0.7
Lack of picnic facilities	1	-	2	1.0
Poor public transport	1	-	1	0.7
No camping	-	3	-	1.0
Poor disabled facilities	-	-	1	0.3
Other facilities poor/closed	-	-	4	1.3
Cars too fast	-	-	2	0.7

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