FOOTPRINT ECOLOGY

The Wash and North Norfolk Coast Limits of Acceptable Change Study

Durwyn Liley, Chris Panter, Phil Saunders, Zoe Caals, Sophie Lake & Emma Bishop

FOOTPRINT ECOLOGY, FOREST OFFICE, BERE ROAD,
WAREHAM, DORSET BH20 7PA
WWW.FOOTPRINT-ECOLOGY.CO.UK
01929 552444

Project leads:

Project funders:

Habitats Monitoring & Mitigation fund

Championing Coastal Coordination (3Cs) fund

This study was co-financed as part of PROWAD-LINK, an Interreg project supported by the North Sea Programme of the European Regional Development Fund of the European Union.

Footprint Contract Reference: 682
Date: 6th December 2022
Version: Final
Recommended Citation: Liley, D., Panter, C., Saunders, P., Caals, Z., Lake, S.& Bishop E. (2022). The Wash and North Norfolk Coast Limits of Acceptable Change Study. Report by Footprint Ecology.

Summary

This report has been commissioned by The Wash & North Norfolk Marine Partnership (WNNMP), Norfolk Coast Partnership (NCP) and PROWAD LINK. It revolves around how to achieve the balance between nature conservation and access around The Wash and North Norfolk Coast; access to the coast brings a wide range of benefits but can also damage the nature conservation interest.

The study focusses on the nature conservation impacts arising from recreational use and the area consists of the North Norfolk and Lincolnshire coast, from Gibraltar Point in Lincolnshire, around The Wash, and along the North Norfolk Coast east to Weybourne. We followed the Limits of Acceptable Change (LAC) process, which provides a framework for managing recreation impacts. The process has been used widely around the world since the 1980s, but it has hardly been applied in the UK before, and not for an area as large and complex as the North Norfolk and The Wash coastline.

We initially worked with stakeholders to identify the main issues of concern, focussing upon key themes that are relevant across much of the study area coastline. These comprised: beach nesting birds, non-breeding waterbirds, seals, and coastal habitats (foredune, vegetated shingle and saltmarsh, in particular).

We defined zone types ("opportunity classes" in the LAC) to reflect the different resource (i.e. wildlife interest), management, and social conditions (i.e. what they are like to visit) around the coast. The classification involved 6 zone types:

- **Town and Village**: with hard sea defences, sea fronts and a range of infrastructure, comprising urban, developed, and busy destinations.
- **Local Greenspace**: local countryside providing for a range of local access, encompassing public rights of way and the wider countryside through to sites such as Country Parks.
- **Destination Sites**: attractive sites with expansive open beaches and other habitats; well-known with a wide draw and appeal, drawing tourists as well as local people.
- **Wildlife Tourism**: nature reserves where management and infrastructure are focussed around people and wildlife. They exhibit high visitor volumes, but are focussed around nature viewing, with hides and other viewing facilities, trails, etc.
- **Wild Places**: remote areas incorporating expansive open beaches, saltmarsh and other coastal habitats, with low visitor numbers and wilder areas with few people.
- **Wildlife Only**: large areas with sensitive wildlife or habitats present where access to the general public is restricted. Access is limited to monitoring, navigation and permitted activities.

We then set out a range of measurable standards that applied to each zone and related to the issues of concern. These included factors such as the number of people on intertidal habitats, the number of dogs, and the number of boats present, in addition to metrics reflecting key biological indicators for our themes. The latter included distribution measures and numbers

of birds or seals. The standards in part were drawn from actual visitor data collected as part of this study, including counts of parked vehicles around the entire study area coastline and counts of people, dogs, boats, etc, at a selection of vantage points distributed along its' length.

A face-to-face workshop was held with stakeholders in July 2022 during which the zone types were reviewed. Workshop participants were then split into groups reflecting their different geographic expertise/affiliations and were asked to apply the zone types to maps of the study area. These were then combined, with the resulting map comprising an aspiration of how participants felt the coast should look, whilst also considering how achievable such zoning would be in practice. Most of the overall map (60%) was zoned as Wildlife Only, with 18% as Wild Places. No other zone type accounted for more than 10% of the total area mapped.

Using this zone map allowed us to identify areas where changes in access management are necessary to meet the relevant zone type standards. We then set out a list of management actions that could be applied to different zone types and issues, essentially providing a toolkit from which interventions could be selected.

The LAC process is continuous, and this report therefore comprises only an initial step rather than any kind of end point. The process could also be extended to include social issues (for example, local traffic and parking impacting residents) and impacts to the historic environment. The zone types and standards can be revised and refined over time and more data (particularly biological) are necessary to ground truth the standards. Continued monitoring will be necessary to identify any changes and the relative success of management interventions, with the process ultimately evolving into a continued feedback loop of monitoring and adaptive management.

Contents

Acknowledgements

This report has been commissioned by The Wash & North Norfolk Marine Partnership (WNNMP), Norfolk Coast Partnership (NCP) and PROWAD LINK, with our thanks to Adele Powell (WNNMP) and Melanie Gillings (Norfolk County Council) for overseeing the work. We are also grateful to a wide range of people for their input, support and provision of data and information, including: Charlie Barnes (Greater Lincolnshire Nature Partnership), Ed Foss (Norfolk County Council), Sydney Jacus (Norfolk County Council), Sarah Mitchell (RSPB), Jan Shelley (Norfolk County Council), Tammy Smalley (Lincolnshire Wildlife Trust), and Helen Timson (Norfolk County Council).

We'd also like to thank the following workshop participants: Trevor Amos (Gedney Wildfowlers), Helen Baczkowska (Norfolk Wildlife Trust), Sarah Baker (East Lindsey District Council), Sophie Barker (Norfolk Ornithologists Association), Hannah Barnes (Natural England), Cathy Batchelar (North Norfolk District Council), Ian Benn (Environment Agency - *speaking in a personal capacity*), Chris Bielby (National Trust), Lizzie Bruce (RSPB - Titchwell), Cllr Martin Crown (Holme Parish Council), Cllr Ian Devereux (Borough Council of King's Lynn & West Norfolk), Clive Doarks (Natural England), Phillip Eke (Visit West Norfolk), Diane Fairchild Fenton (South Holland District Council), Cllr Angie Fitch-Tillett (North Norfolk District Council), Beth Fox (Lincolnshire Wildlife Trust), John Harlow (Holbeach Wildfowlers), Cllr Victoria Holliday (North Norfolk District Council), Nicola McGarry (Visit Lincolnshire Coast), Sarah Mitchell (RSPB), Kate Percival (Lincolnshire County Council), Jonathan Preston (Norfolk Wildlife Trust), Nathan Reed (King's Lynn Wildfowlers), Laura Steuart (Natural England), Helen Timson (Norfolk Coast Partnership), Peter Udy (Boston Borough Council), Kay Went (Natural England), Kevin Wilson (Lincolnshire Wildlife Trust), Iain Withington (North Norfolk District Council), and Kerys Witton (Natural England).

Our thanks to the following for their helpful comments on a draft version of this report: Cathy Batchelar, Clive Doarks, Adrian Gardiner, John Harlow, Adele Powell, Sarah Mitchell, Phil Pearson (RSPB), Graham Wall, Kerys Witton and Kevin Wilson.

Survey work (vehicle counts and vantage point counts) were coordinated by James Lowen and undertaken by Robin Chittenden, James Lowen, Jack Morris, Philip Precey, Chris Sharpe and Will Soar,

1. Introduction

1.1 The coast of North Norfolk and The Wash is of exceptional importance for nature conservation, encompassing a suite of coastal habitats and hosting a range of rare and notable species. The area is also a popular destination for recreation and attracts high numbers of visitors through the year.

1.2 This report, commissioned by The Wash & North Norfolk Marine Partnership (WNNMP), Norfolk Coast Partnership (NCP) and PROWAD LINK, is about how to achieve the balance between nature conservation and access, recognising that access to the coast brings a wide range of benefits but can also damage the nature conservation interest. It follows the Limits of Acceptable Change (LAC) process, which provides a framework for managing recreation impacts.

Limits of Acceptable Change (LAC)

1.3 The LAC approach was first used in the U.S. in the 1980s and was initially devised to address impacts associated with perceived overcrowding and restore qualities of naturalness and solitude in areas defined as wilderness (Stankey et al., 1985). It is a framework that is 'indicator' or 'standards-based' and focusses on managers setting out the different characteristics or types of zone they want to achieve (referred to as opportunity classes) and within each type of zone setting management actions to achieve or maintain particular conditions, linked to monitoring data. Managers have to identify where, and to what extent, varying degrees of change are appropriate and acceptable.

1.4 The process involves 9 steps (summarised in Figure 1 and Table 1) and is described in detail by Stankey *et al.* (1985). The approach stems from the premise that defining a precise carrying capacity in terms of visitor numbers is not necessarily appropriate or achievable. This is because there are a wide range of different impacts associated with recreation and for each type of impact, different levels of use will have different scales of impact. Furthermore, the relationship between impact and visitor numbers will vary, such that in some habitats and types of impact the impact might be in direct proportion to the number of visitors (i.e. linear) while in others it may be curvi-linear (Cole, 1995; Coombes, 2007; Monz et al., 2013). In very few cases will there be a clearly defined point at which impact occurs.

1.5 Furthermore, the scale of impact is likely to vary with a range of factors. For example, environmental factors that increase or lessen plant sensitivities to trampling include soil moisture, canopy density, aspect, micro-climate and drainage (Kuss, 1986). Therefore, a given level of access has a different impact at different times of year or weather conditions. Visitor behaviour and the types of access will also have a marked effect. For example impacts to vegetation and soils from trampling will vary between people on foot, on bikes or riding a horse (Liddle, 1997; Pickering et al., 2010).

1.6 The LAC process therefore moves away from relying on carrying capacity as a basis for management, and instead focuses on management objectives, associated indicators and their standards. It determines what environmental impacts are acceptable from 'desirable' social activities and then determines management actions to ensure activities remain constrained within the acceptable limits.

1.7 The approach is well established in the US and globally (Leung et al., 2018). Examples of its application include the Wadden Sea (New Insights for Tourism, 2019), Australia (Autralian Government, 2012) and New Zealand (McKay, 2006). The approach has however rarely been applied in the UK, with the sole (and limited) exception (that we are aware of) relating to the management of visitor impacts at a ski resort in the Scottish Highlands[1].

[1] See https://www.northecol.co.uk/managing-visitor-impacts-at-the-ski-resort-on-aonach-mor/

Figure 1: Summary of the LAC process. Taken from Stankey et al. 1985.

Table 1: Summary of the LAC process. Taken from Stankey et al. 1985.

	Step	Description
1	Identify issues and concerns	The purpose of this step is to identify features of particular concern to be maintained or achieved; identify specific locations of concern; provide a basis for establishing management objectives; guide allocation of the protected landscape to different opportunity classes.
2	Develop and describe opportunity classes	The purpose of this step is to devise a range of different opportunity classes, where an opportunity class provides "…a qualitative description of the kinds of resource and social conditions acceptable for that class and the type of management activity considered appropriate". This will facilitate the provision and maintenance of inter and intra area diversity within the protected landscape.
3	Select indicators for resource and social conditions	This step identifies specific variables which require inventorying and monitoring (for example, vegetation damage, soil erosion, amount of infrastructure, crowding) and to provide the basis for identifying what management actions are required where.
4	Inventory existing resource and social conditions	During this step data is collected on the range of resources and social conditions that will help establish meaningful standards and help decisions on allocation to different opportunity classes.
5	Develop standards required for each opportunity class	This step involves the specification of standards that describe acceptable and appropriate conditions for each defined opportunity class.
6	Identify alternative opportunity classes	This step involved examining options to help define what conditions are acceptable in terms of the resource and social conditions.
7	Identify management actions for each alternative	Identify management actions for each alternative. During this step the range of management strategies that would be required for each alternative opportunity class are examined, which will help determine which are viable.
8	Evaluate alternatives and select preferred alternative	This step involves finalising opportunity class allocations and the preferred management programme.
9	Implement actions and monitor conditions	During this step, the management programme is implemented to achieve the objectives set in step eight (above). Monitoring ensures periodic, systematic feedback on how the management action is working. It also identifies trends or variances that may require the introduction of new actions.

Aims and objectives

1.8 The study has been commissioned to apply the LAC process to provide recommendations for future sustainable development and tourism. The study encompasses three geographically distinct areas:

- South East Lincolnshire;
- West Norfolk; and,
- North Norfolk.

1.9 The brief for the work stated that the following were required:

- Establish acceptable levels of visitor presence for nature sites, green-spaces, and other nature-based attractions around The Wash & North Norfolk coast;
- Develop sector-specific recommendations (including mitigation measures) for relevant stakeholders, providing clear guidance on how best to protect local sites and to reduce pressure on nature 'hotspots' and/or support the promotion/creation of alternative sites;
- Support promotion of less pressurised sites (including inland/urban parks) – working in partnership/collaboration with relevant stakeholders;
- Support development (and subsequent promotion) of alternative access points – working in partnership/collaboration with relevant stakeholders; and,
- Develop a range of communication methods to assist in the support provided.

2. Our approach

Study area

2.1 The study area focusses upon the coast, and stretches south from Gibraltar Point in Lincolnshire, around The Wash, and along the North Norfolk Coast east to Weybourne (see Map 1). Nevertheless, it is recognised that sites set back from the coast will also be relevant to the study, as some may be linked in terms of their ecology (e.g. use by birds) or recreation use (e.g. some inland sites may also have the potential to attract people away from the coast). The study area therefore has a fuzzy inland boundary and to allow GIS data to be extracted and maps etc' generated we have used the area within 5km of the coast (see Map 1). It is important to note that not all the area within 5km is however relevant to the study and equally there may be locations further than 5km that are relevant.

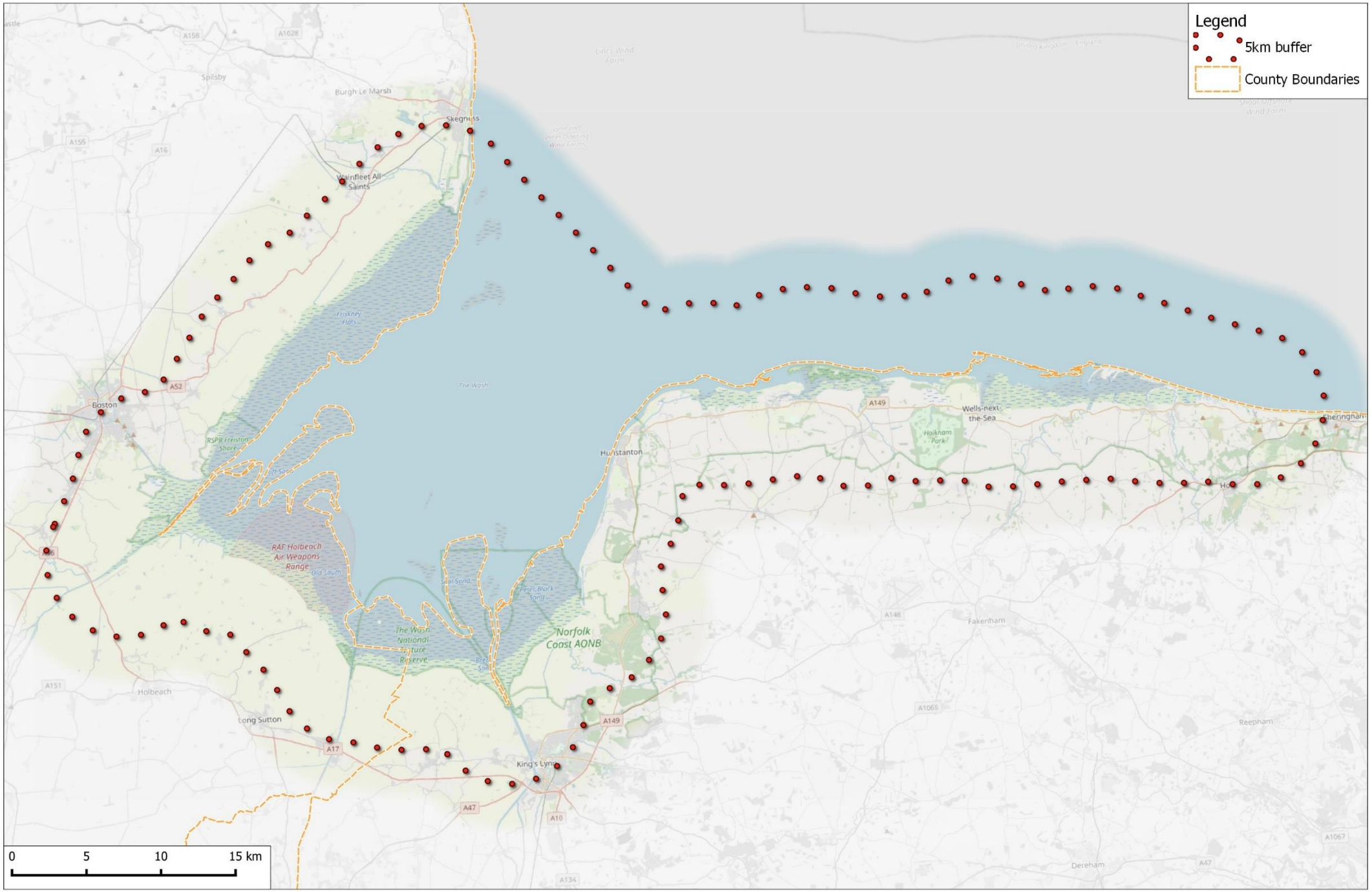
Scope

2.2 We have focussed solely upon the nature conservation impacts of recreation. In terms of recreation use, our focus is on terrestrial access and access to the water from the shore, extending to water sports in inshore waters. Aerial disturbance (for example from civil or military aviation, drones etc) are beyond the scope (but are the subject of other work conducted by the WNNMP).

2.3 High levels of recreation use can have a wider range of other impacts that are also beyond the scope of this report, for example social and cultural impacts to local communities (see Leung et al., 2018 for review), and impacts upon other visitors in terms of tranquillity and visitor experience (Manning, 2013; Shelby et al., 1989; Vaske and Shelby, 2008).

2.4 The study involves collaborative work with stakeholders, who will be representatives of key organisations who undertake visitor management, nature conservation or have statutory responsibilities for the coastal strip. The study has not therefore involved the general public or user groups, but it's remit could be extended to include wider stakeholder engagement in the future.

Map 1: The study area with 5km buffer



Methods

2.5 Our methods are summarised in Figure 2. The approach broadly conforms with the relevant steps in the LAC method as detailed in Stankey et al (1985), although the terminology and exact approach have been adapted.

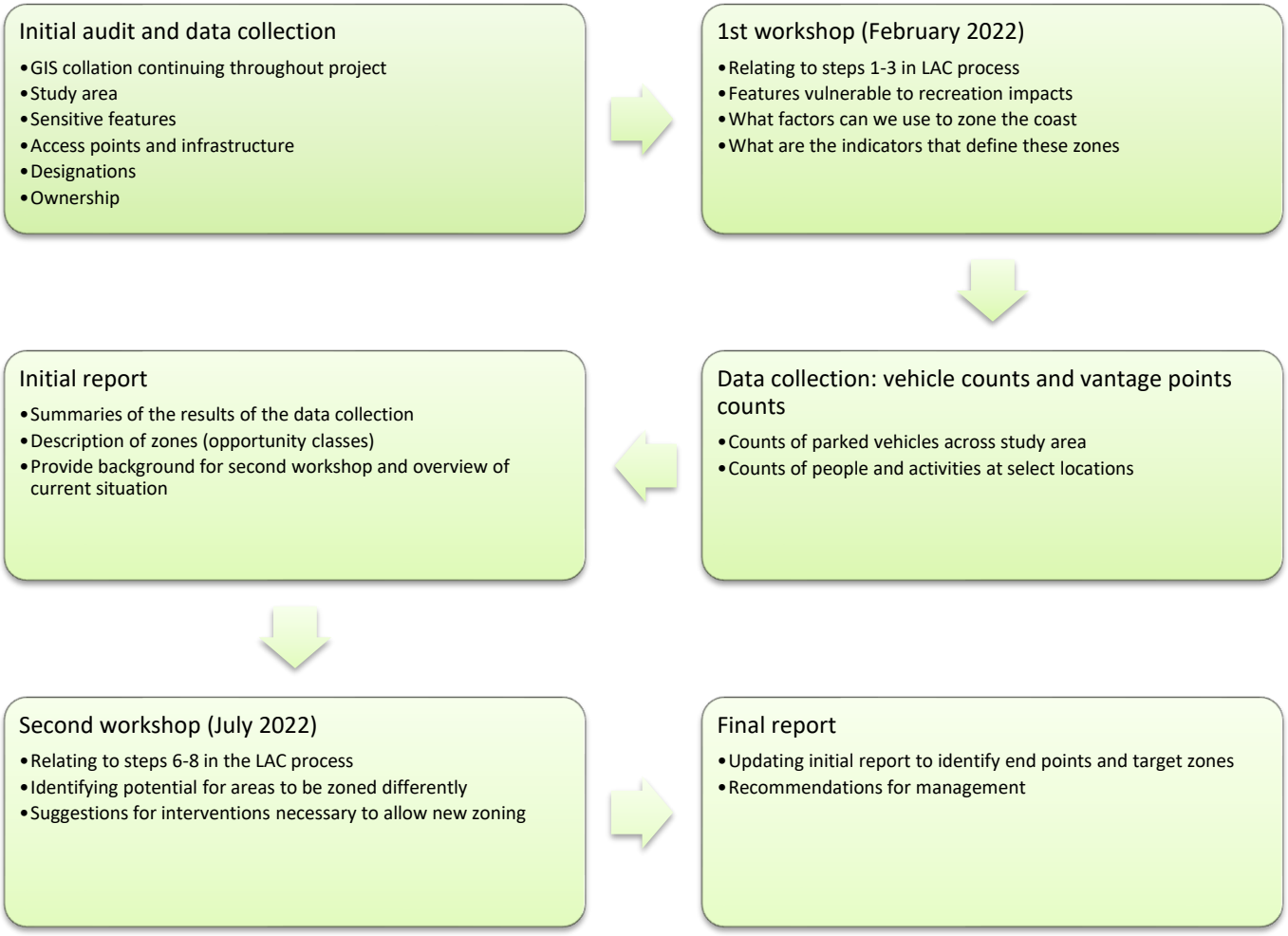


Figure 2: Summary of approach.

Initial audit and data collection

2.6 A wide range of existing GIS data were collated from relevant partners, stakeholders and other data sources during the initial audit, with the data collected falling into the following broad categories: designated sites, landscape, visitor infrastructure and habitats.

Data collection: vehicle counts and vantage point surveys

2.7 The inventory stage involved the collection of new data on visitor numbers and behaviour across the entire study area, as the collection of comparable data was identified at the outset of the contract. In areas with relatively low levels of local housing, most visitors will arrive by car (as visitor data shows, for example see Panter et al., 2017). We therefore mapped all parking locations within the study area, drawing on our knowledge of the coast and from checks on a range of GIS data sources (including the Department of Transport[2], OpenStreetMap[3], and aerial images). The type of parking location (i.e. formal car park, informal roadside parking, or verge/layby/gateway, etc) and the location's capacity were also recorded.

2.8 Five transects of the entire study area coastline were then undertaken, during each of which a team (comprising five separate surveyors) simultaneously counted all parked vehicles within the pre-identified parking locations (i.e. both informal and formal parking localities). In total, 177 different parking locations were surveyed during each transect. All vehicles were counted and in addition certain types of vehicle were also differentiated in the following subcategories:

- Vans;
- Branded vehicles of professional dog walkers;
- Campervans or cars with caravans;
- Horse boxes;
- Motorcycles;
- Vehicles with roof/rear racks[4]; and,
- Minibuses or coaches.

2.9 In addition to the car park counts, vantage point surveys were undertaken at 24 pre-determined locations in proximity to the surveyed parking sites. The vantage points consisted of localities with good fields of view (i.e. along a beach or from a dune top) that could be easily accessed from parking locations along the transect

[2] Contains public sector information licensed under the Open Government Licence v3.0.
[3] © OpenStreetMap contributors https://www.openstreetmap.org/copyright
[4] The roof racks / bars are clear additional structures; not roof rails which are often built on cars.

route. During each vantage point count, all people visible to the surveyor were counted within a previously mapped recording area (the latter taking into account the field of view available to the surveyor). The counts were broken down to record counts of people undertaking the following activity types:

- Walking (without a dog);
- Dog walking (with the number of dogs on/off lead also recorded);
- Jogging;
- Bird/wildlife watching;
- Cycling;
- Angling/fishing (with rod from shore);
- Bait digging;
- Watersports (including kayaks and paddleboards); and,
- All other activities not listed above.

2.10 In addition, the number of 'active' boats (excluding ones clearly moored and not in use), were counted. Whereas the other categories involved counts of 'people' the boats were simply the number of craft, as it is often difficult to ascertain how many people are on board. The counts of boats excluded kayaks, paddleboards etc. which were counted under watersports and reflected a head count rather than a count of craft.

2.11 Surveyors also recorded the tide state at the time of the count and the % visibility of the vantage point count area (e.g. where fog, mist, rain or haze meant that the entire count area was not clearly visible). Counts were carried out on five dates over the spring period (March – May) and were scheduled to provide a range of day types and times (therefore coinciding with days of peak visitor use and more quiet, off-peak, times). Survey dates and times are summarised in Table 2, with summary metrics for each of the five transect routes provided in Appendix 1.

2.12 Weather conditions during transects were generally fair and fairly typically for the time of year. Although the months were generally drier and sunnier than the long-term average[5]. Rain was not recorded during any of the transects.

[5] https://www.metoffice.gov.uk/research/climate/maps-and-data/summaries/index

Table 2: Summary of the survey dates and times, with associated information on weather and tides.

Date	Day of week	Description	Start time (24hrs)	Average temperature	Weather description	% of vantage point surveys carried out made in given tide states		
						High	Rising/falling	Low
30/03/2022	Wednesday	Weekday in term time	08:00	6°C	Cool, overcast, and calm, with infrequent sun/drizzle	13	67	21
11/04/2022	Monday	Easter bank holiday Monday	14:00	14°C	Mild and dry, with a mix of sun and cloud and a gentle breeze	38	63	0
16/04/2022	Saturday	Weekend during Easter school holidays (not the Easter weekend)	10:00	15°C	Warm, clear, and sunny, with a gentle breeze	0	50	50
02/05/2022	Monday	May bank holiday	14:00	15°C	Mild and overcast, but with some hazy sun, feeling a little muggy at times, and a very light breeze	0	21	79
08/05/2022	Sunday	Weekend in term time	11:30	19°C	Started cool, but quickly warmed and became sunny and warm, with infrequent cloud and a cool, gentle, breeze	42	58	0

Workshops

2.13 An initial workshop was held remotely (via Zoom) on 23rd February 2022 with a range of invited stakeholders (19 in total) separated into several parallel break-out groups. Stakeholders were identified by the Partnership and comprised those organisations who are directly involved in either the day-to-day management of coastal sites of biodiversity value within the study area and/or in strategic planning and tourism management and development.

2.14 The main objectives for the workshop were to: (1) collaboratively identify the key biodiversity features within the study area that are vulnerable to visitor impacts; (2) the ways in which access is currently affecting them; and (3) a range of characteristics and indicators that can be used to zone the study area and allow future monitoring. The outputs from the workshop were then used by Footprint Ecology to identify key receptors/metrics and produce narratives for a range of coastal zones (i.e. "opportunity classes" under LAC terminology).

2.15 A second, face-to-face, workshop was held on 7th July 2022, during which a similar range of invited stakeholders (18 in total) were able to discuss the coastal zone narratives and view the GIS spatial datasets collected as part of the LAC process (see Section 3). Workshop attendees were then split into five breakout groups, each corresponding to a discrete section of the study area. Attendees were asked to identify their preferred section (i.e. that most relevant to their geographic area of expertise) in advance of the workshop. The five sections comprised the following:

- Gibraltar Point to Boston;
- Boston to King's Lynn;
- King's Lynn to Hunstanton;
- Hunstanton to Wells-next-the-Sea; and,
- Wells-next-the-Sea to Sheringham.

2.16 During the first part of the workshop each breakout group was asked to map areas within their respective section which they decided could be classified within one of the LAC-defined coastal zones. This was achieved using large scale colour maps/aerial photographs and coloured pens, with a minimum mappable parcel size of 30ha indicated as a guide on all base maps used. The choice of 30ha was a pragmatic choice reflecting the scale of the maps printed, the time available in the workshop and the level of accuracy it was felt could be achieved. These maps were then digitised within the workshop by Footprint Ecology staff to allow presentation and discussion of those areas mapped across the entire study area at the end of the day. Access to the digitised map was subsequently made available to workshop

attendees via a live QGIS Cloud[6] link, with further comment invited from all. The map was then revised/adjusted following any feedback, prior to finalisation within this report.

2.17 During the second workshop session of the day the same five break out groups were asked to identify specific management interventions that could be used to monitor progress towards achieving the coastal zoning (within their respective geographic areas) identified during the previous workshop session.

[6] https://qgiscloud.com/

3. Overview of study area and background

3.1 This section of the report sets the scene and provides context for the application of the LAC process.

Sites designated for nature conservation

3.2 There are 15 European sites[7] (comprising Special Protection Areas (SPAs), Special Areas of Conservation (SACs), and Ramsar sites) located within, or in close proximity to, the study area boundary (see Maps 2, 3, and 4[8] and Appendix 2). Several of the sites overlap and they cumulatively cover most of the study area coastline. Several inland sites (such as Roydon Common, Dersingham Bog and the Norfolk Valley Fens) support non-coastal habitats/species but are nevertheless located within close proximity to the coast, with some found within the 5km of it.

3.3 It is the following European sites that form the priority focus for this report:

- Gibraltar Point SPA;
- North Norfolk Coast SPA;
- The Wash SPA; and,
- The Wash & North Norfolk Coast SAC.

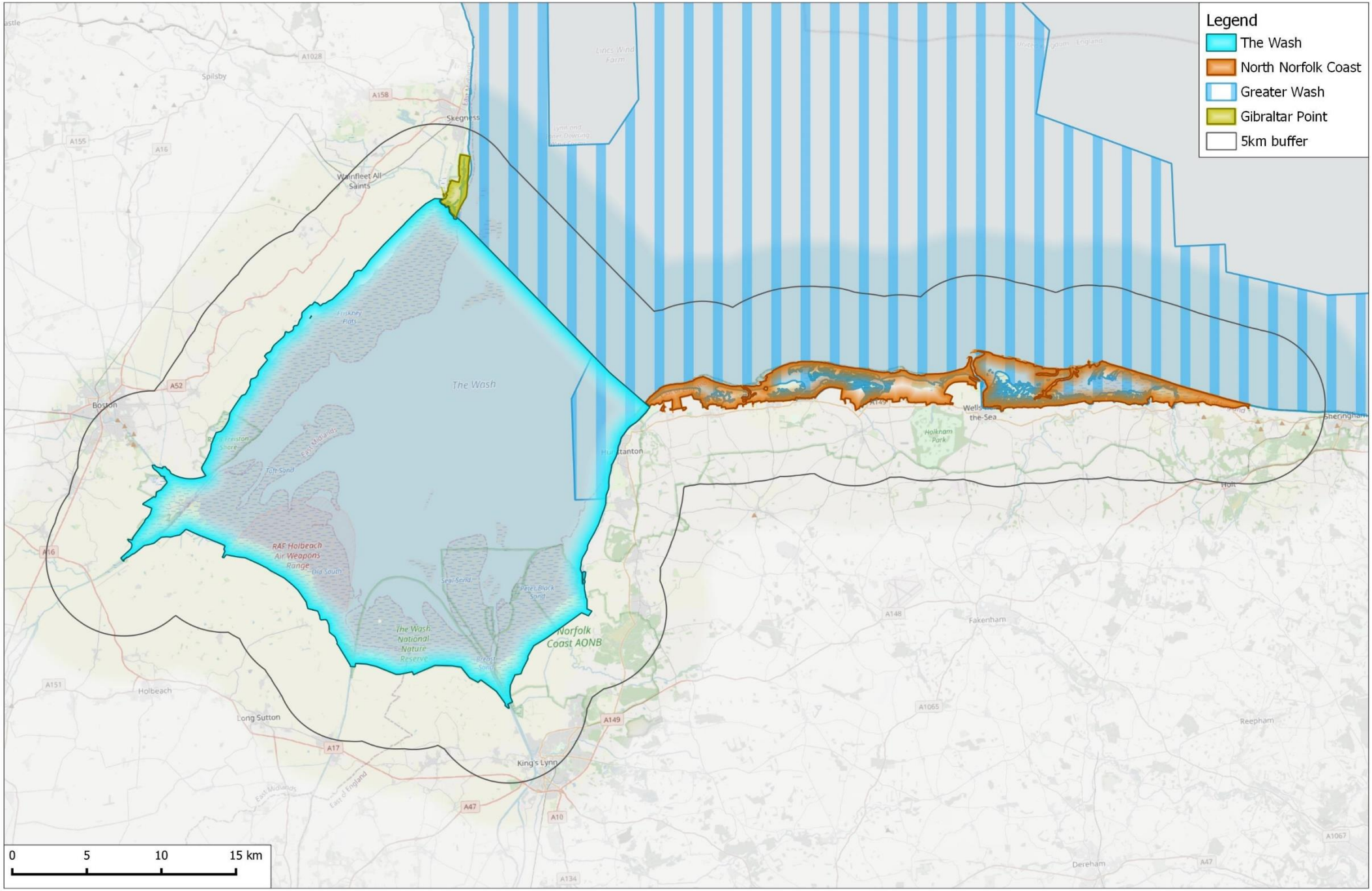
3.4 A total of 22 Sites of Special Scientific Interest (SSSI) are encompassed fully or partially within the 5km study area (see Map 5[9]), cumulatively totalling 273,699 ha in extent. These sites are mostly encompassed within the boundaries of the previously identified European sites, but also include some notable coastal grassland, marshland, and heathland habitats not subject to designation at the European scale. Many are National Nature Reserves (NNR).

[7] We use the term 'European Site' to refer to any site over which the provisions of the Habitats Regulations (2017, as amended) exert an influence, whether by way of statue or policy. This is the general accepted use and follows Tyldesley & Chapman (2021) (for which see for context) and the term remains relevant following Brexit.

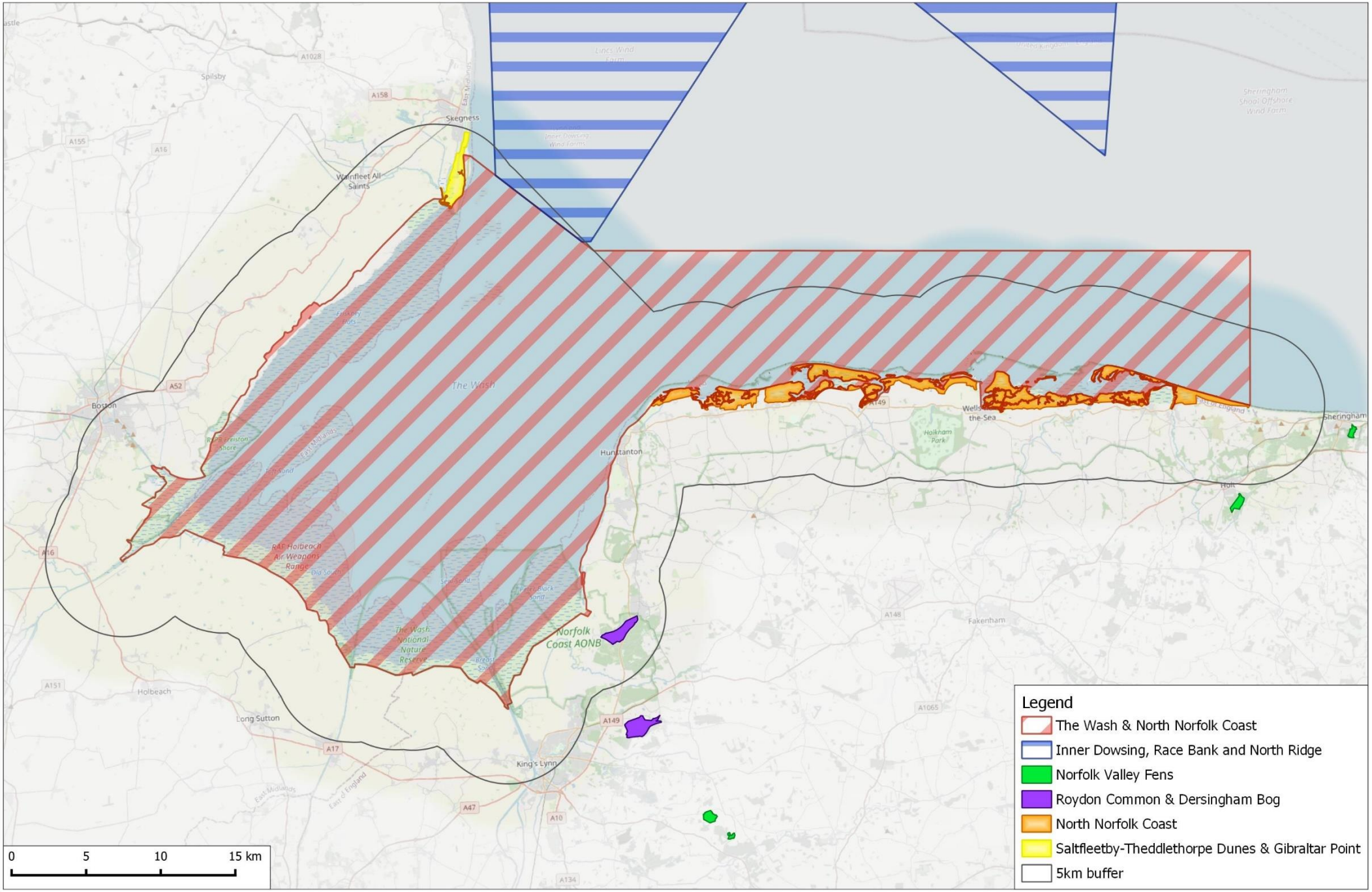
[8] https://naturalengland-defra.opendata.arcgis.com/

[9] https://naturalengland-defra.opendata.arcgis.com/

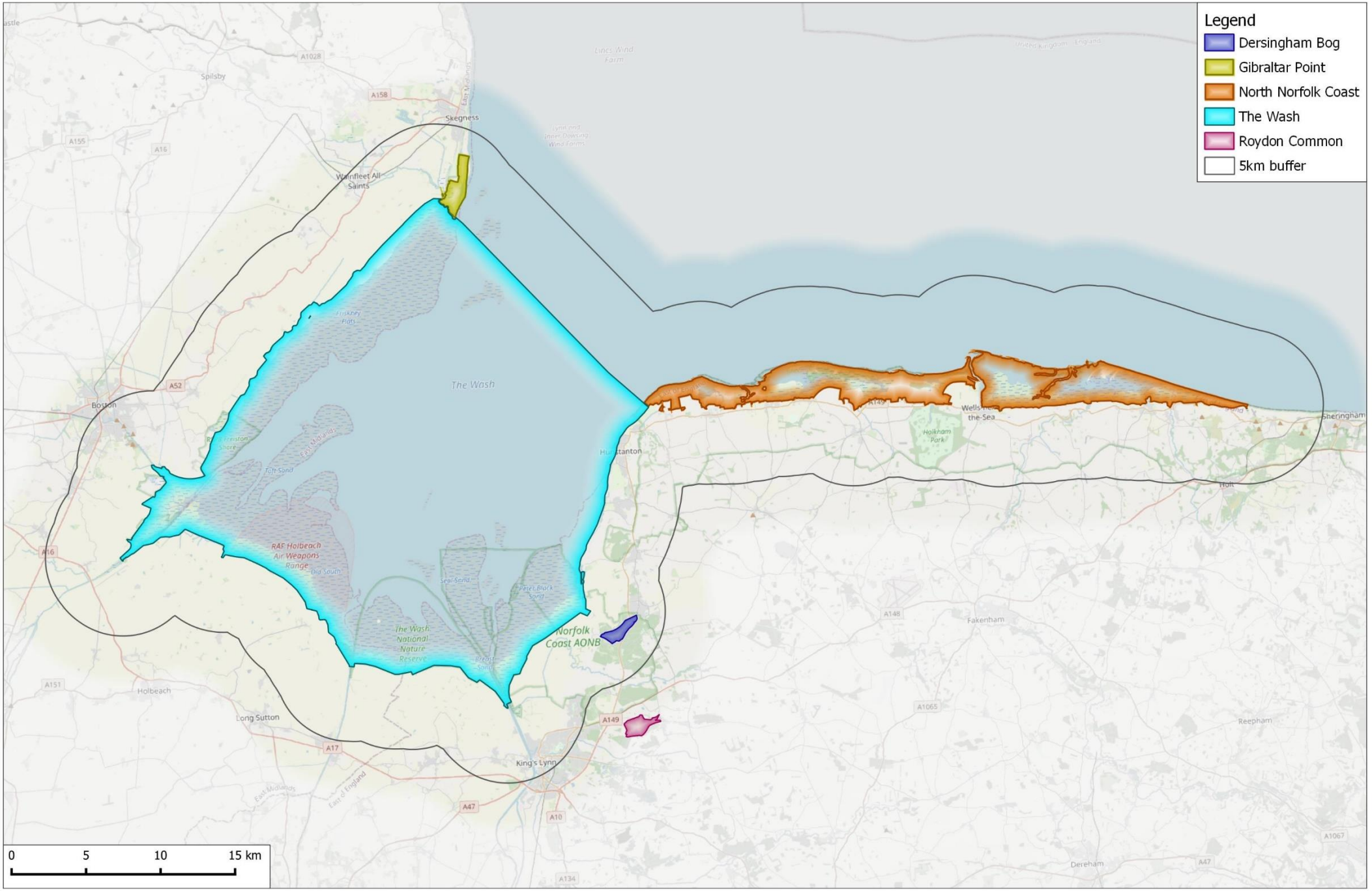
Map 2: Special Protection Areas



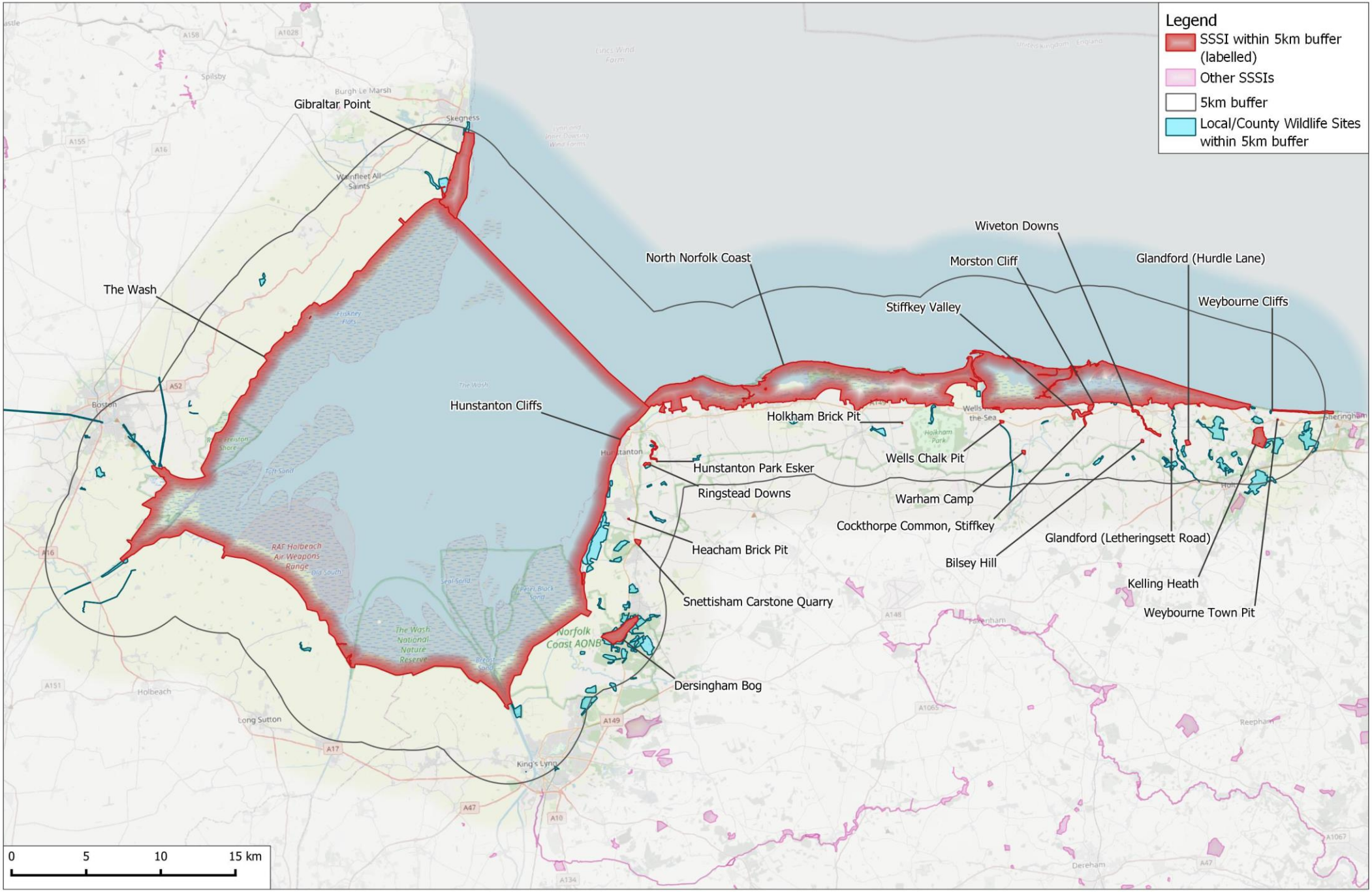
Map 3: Special Areas of Conservation



Map 4: Ramsar sites



Map 5: Sites of Special Scientific Interest (SSSI) and local wildlife sites



Landscape

3.5 The Norfolk Coast Area of Outstanding Natural Beauty[10] (AONB) covers an extensive area of the coast, totalling some 450 km^2. The extent of the AONB, which closely follows the boundary of the 5km study area, is shown in Map 6. It should be noted however that the AONB continues eastwards along the coast for a further 20km, extending as far as Mundesley and Paston.

3.6 The study area comprises 5 National Character Areas (NCA), also shown in Map 6[11]. These consist of the following:

- *Lincolnshire Coast and Marshes*: a long coastal plain dominated by arable, with more open pasture and associated narrow dykes located closer to the coast;
- *The Fens*: an expansive, flat, open landscape dominated by major rivers and heavy agricultural use, with a long history of human influence;
- *North Norfolk Coast*: an open and remote coastal plain with a range of coastal features, including; tidal flats, sand dunes, saltmarsh, and grazing marsh;
- *North West Norfolk*: characterised by a rolling topography which discretely contrasts with the thin Norfolk Norfolk Coast NCA; and,
- *Central North Norfolk*: an undulating arable area with winding lanes, heaths, and woods, alongside a exposed, dynamic, coastal cliffs.

3.7 The study area coastline has a unique topography, ranging from sheer coastal cliffs (in proximity to Sheringham and at Hunstanton) to wide expanses of arable land around The Wash, with the area between Kings Lynn and Boston mostly <2m above sea level (see Map 7[12]).

3.8 Heritage features also form an important component of the study area landscape, often comprising visitor attractions and of use in further defining landscape character. Data from Historic England (see Map 8[13]) highlight a large number of Conservation Areas[14] along the North Norfolk coast, including almost all of the smaller villages present and often coinciding with concentrations of listed

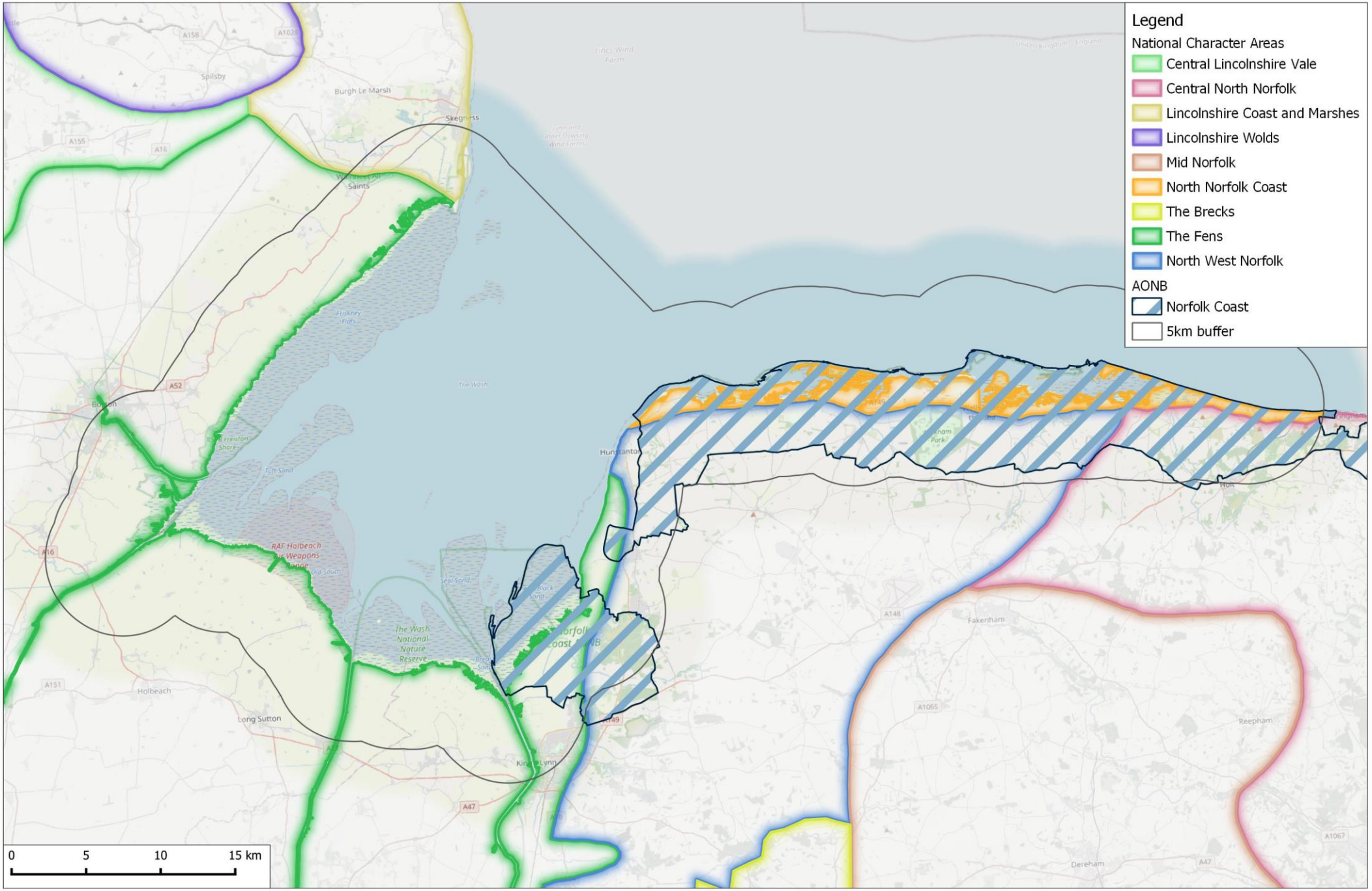
[10] https://naturalengland-defra.opendata.arcgis.com/datasets/Defra::areas-of-outstanding-natural-beauty-england/explore?location=52.764102%2C-2.528092%2C7.47
[11] https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles
[12] https://data.gov.uk/dataset/8311f42d-bddd-4cd4-98a3-e543de5be4cb/lidar-composite-dtm-2019-10m
[13] https://historicengland.org.uk/listing/the-list/data-downloads/
[14] https://historicengland.org.uk/advice/hpg/has/conservation-areas/

buildings[15]. Comparatively few Conservation Areas are present within the largely arable Lincolnshire landscape.

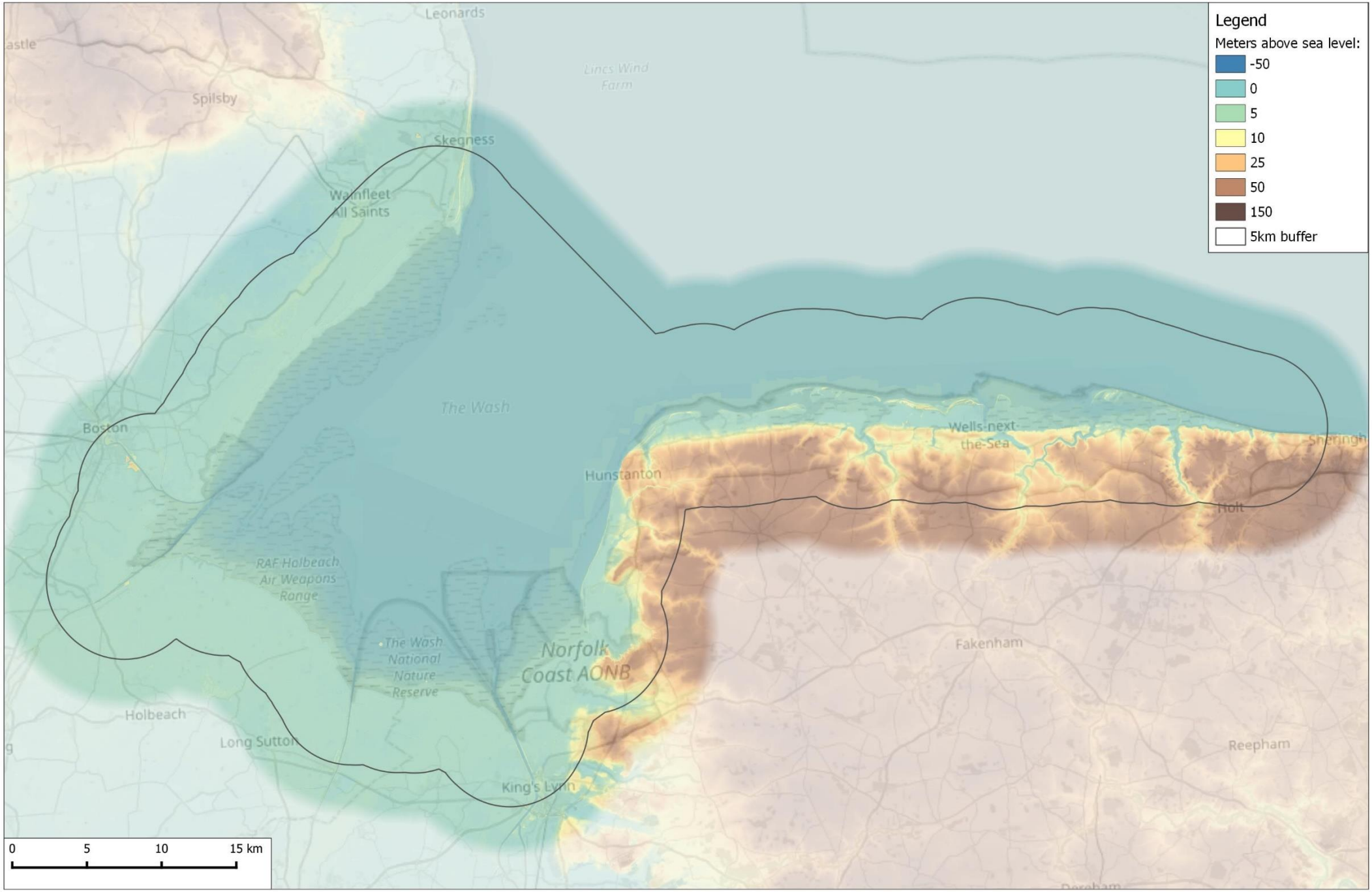
3.9 The presence of settlements, roads etc. influences the landscape character and Map 9 therefore shows the locations of large urban areas and main roads.

[15] https://historicengland.org.uk/listing/what-is-designation/listed-buildings/

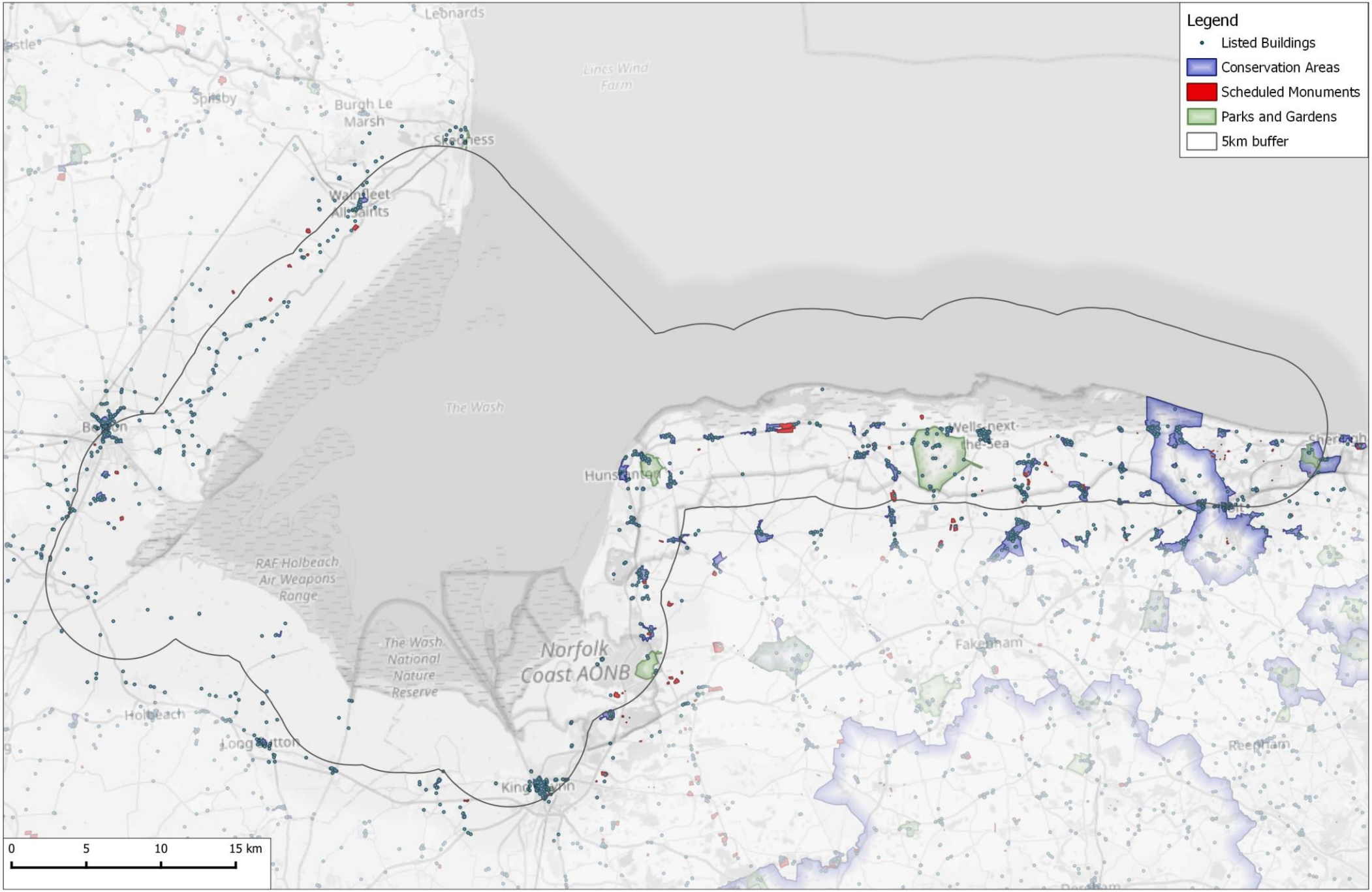
Map 6: National Character Areas and the Norfolk Coast Area of Outstanding Natural Beauty (AONB)



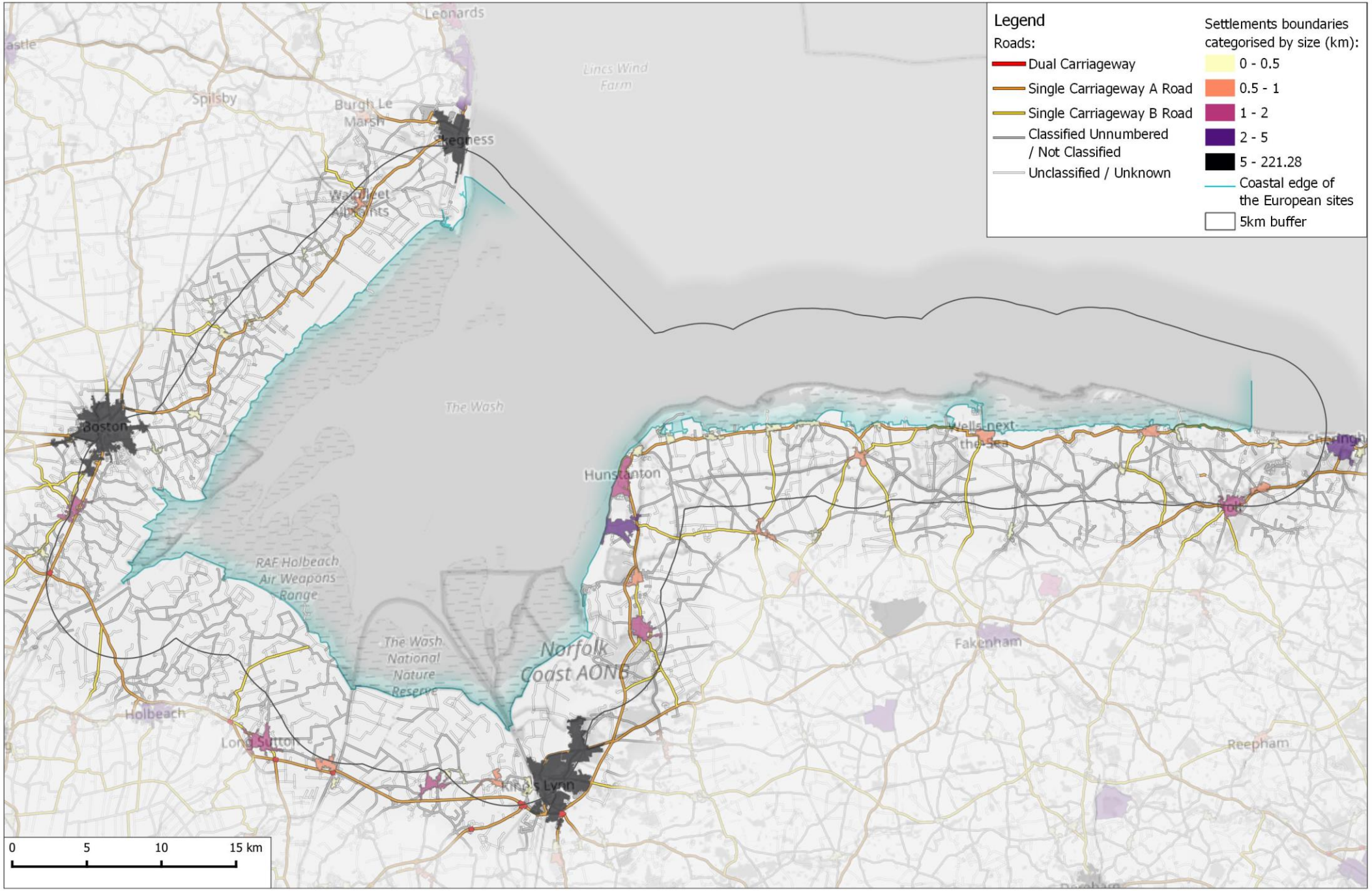
Map 7: Elevation above sea level (LIDAR Composite Digital Terrain Model)



Map 8: Distribution of key heritage features; Scheduled Monuments, listed buildings, parks and gardens, and conservation areas



Map 9: Large urban areas and main roads



Visitor infrastructure

3.10 There are around 55,434 residences within 5km of the study area coastline, and 100,787 residential properties within 7.5km of the coast, and this will increase in the future with new housing growth. These are concentrated within the largest settlements of Kings Lynn, Boston and Skegness, and (to a lesser extent) within Sheringham, Hunstanton, Holt, Dersingham, and Heacham. A few medium-sized settlements are also located immediately adjacent to the coast in Lincolnshire (see Map 10).

3.11 The distribution of tourist accommodation (as defined by OpenStreetMap) is provided in Map 11. Such accommodation is concentrated along (and inland of) the Norfolk coastline, with comparably few caravan or camp sites found in Lincolnshire (with the exception of the Skegness area). Concentrations of guesthouses and hotels are found within the larger towns, such as Boston and Kings Lynn, whilst little tourist accommodation is located along and inland of the southern extent of The Wash.

3.12 A suite of different nature reserves are visitor destinations and include Wildlife Trust reserves (such as Cley and Gibraltar Point), RSPB Reserves (e.g. Titchwell) and National Trust sites (e.g. Blakeney) are found within the study area (see Map 12), several of which are concordant with land that has a right of open access under the Countryside and Rights of Way (CRoW) Act 2000. A wide range of visitor infrastructure (including viewpoints and golf courses) is also found within the study area, although such features are largely concentrated along the North Norfolk coast (see Map 13, which maps visitor attractions as defined by OpenStreetMap).

3.13 The path network is shown in Map 14 and includes some long distance paths across the area (sourced from OpenStreetMap) and registered public rights of way across Norfolk and Lincolnshire, with long distance paths particularly concentrated within North Norfolk. The England Coast Path passes through the entire study area[16].

3.14 Parking locations are shown in Maps 15 and 16. These form the focus of survey work (vehicle counts) described in later sections of the report (see Section 7). There are 177 parking locations shown in the maps and have a combined capacity of approximately 11,921 parking spaces. The average capacity of any given parking

[16] As of November 2022, the stretches round the Wash were approved but not yet open, establishment works planned or in progress and the proposals for the North Norfolk stretch have been published but not yet approved. See https://www.gov.uk/government/publications/england-coast-path-overview-of-progress for further details

location was 68 spaces, although approximately half of all the locations had fewer than 14 spaces. The largest 11 parking locations (all in Norfolk) had an estimated combined capacity of 6,188 spaces, accounting for just over half of all parking spaces (see Figure 3).

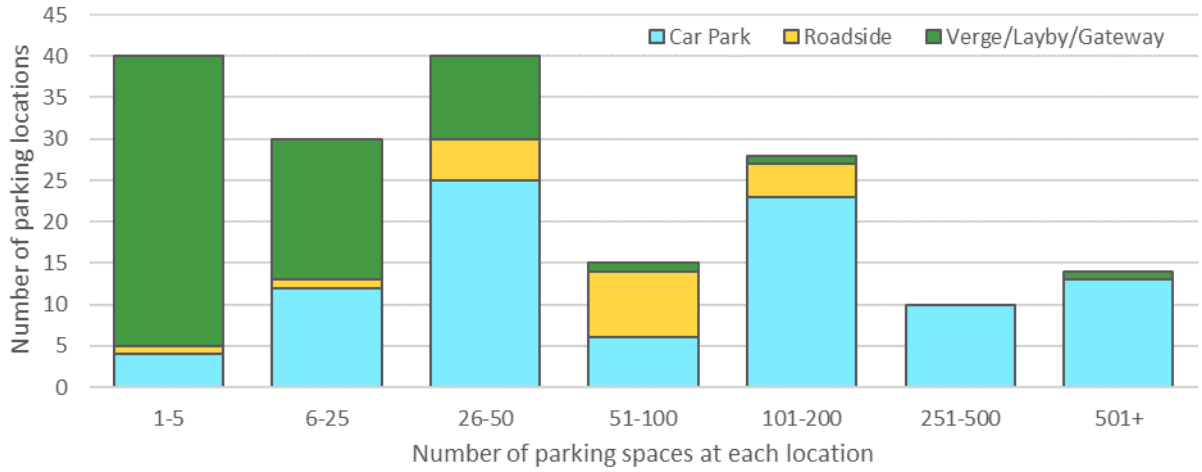
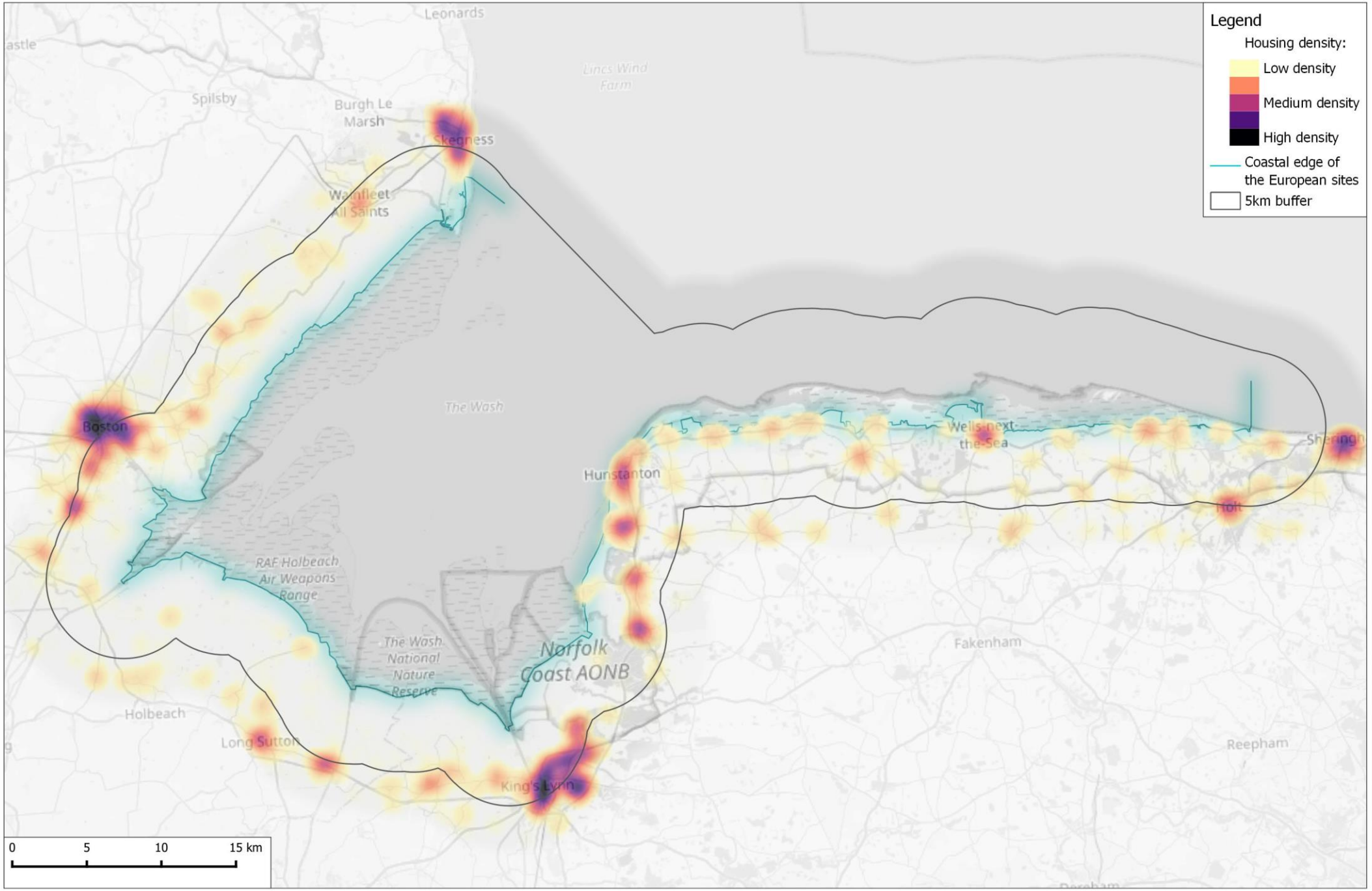


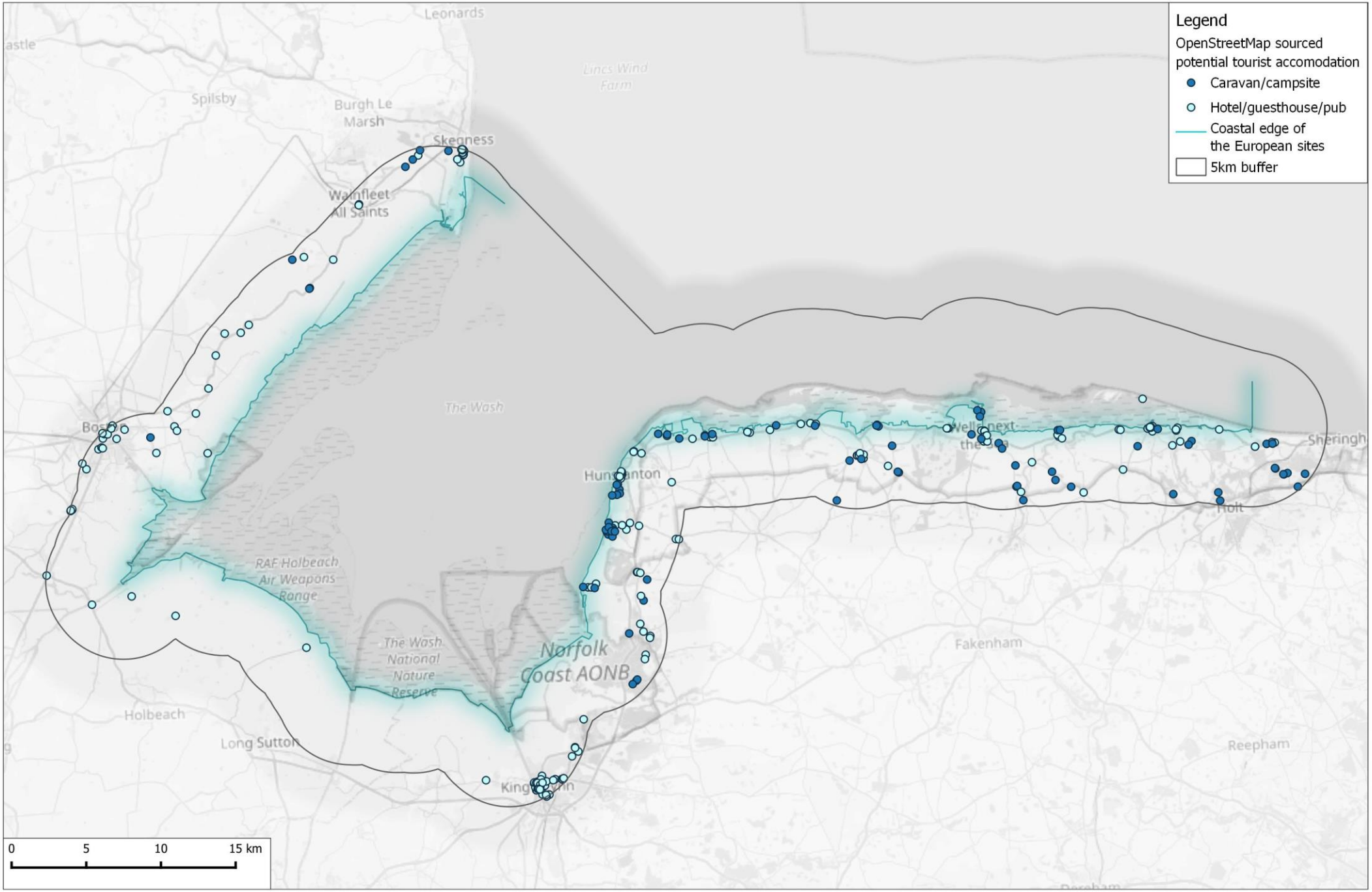
Figure 3: Surveyed parking locations categorised by location type and capacity.

3.15 Map 17 depicts the location of publicly accessible greenspaces (as defined by Ordnance Survey), comprising public parks and gardens, playing fields, and golf courses. Parks and gardens are largely found in proximity to larger settlements or estates (e.g. Holkham).

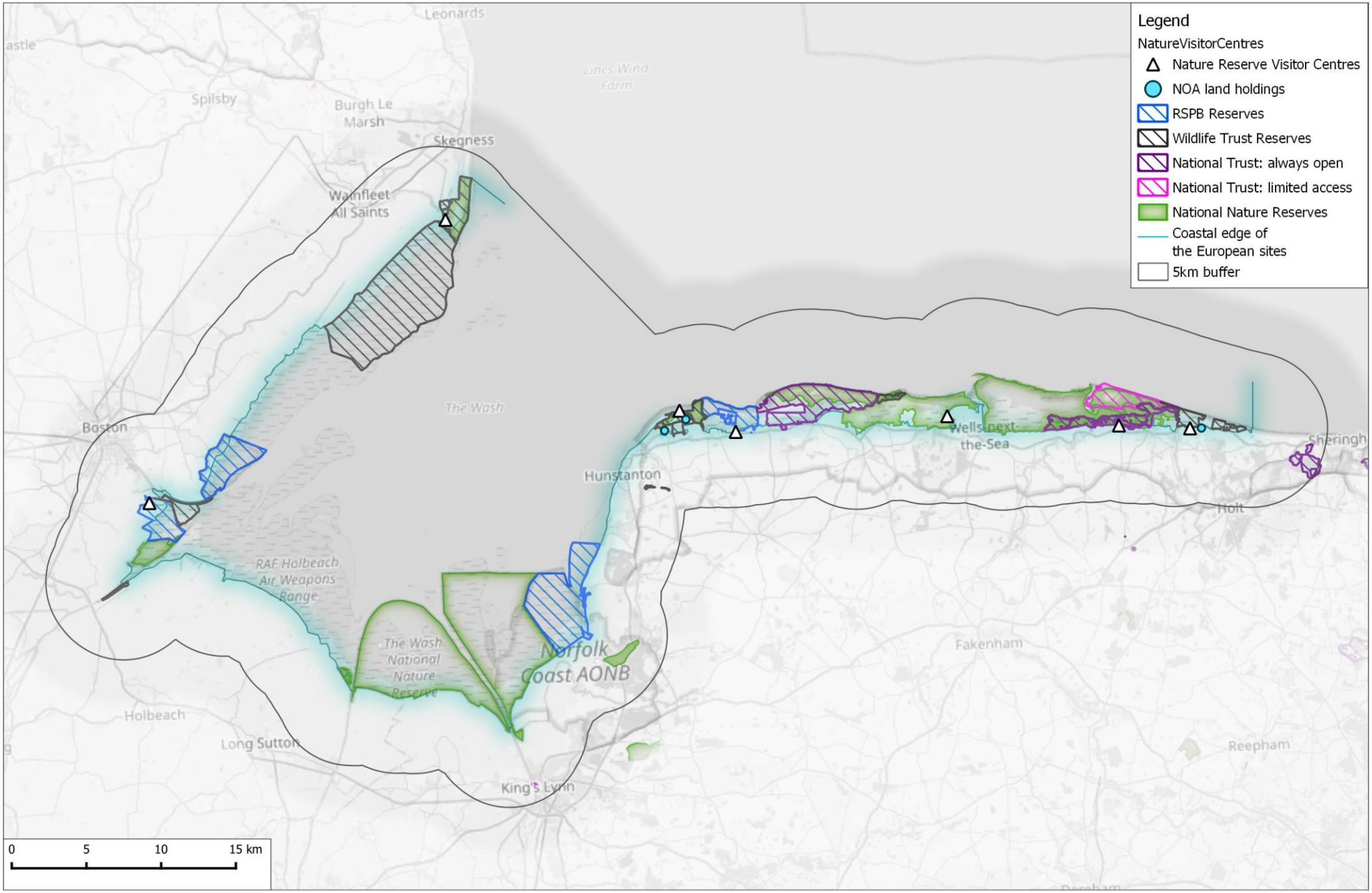
Map 10: Housing density based on residential postcode data



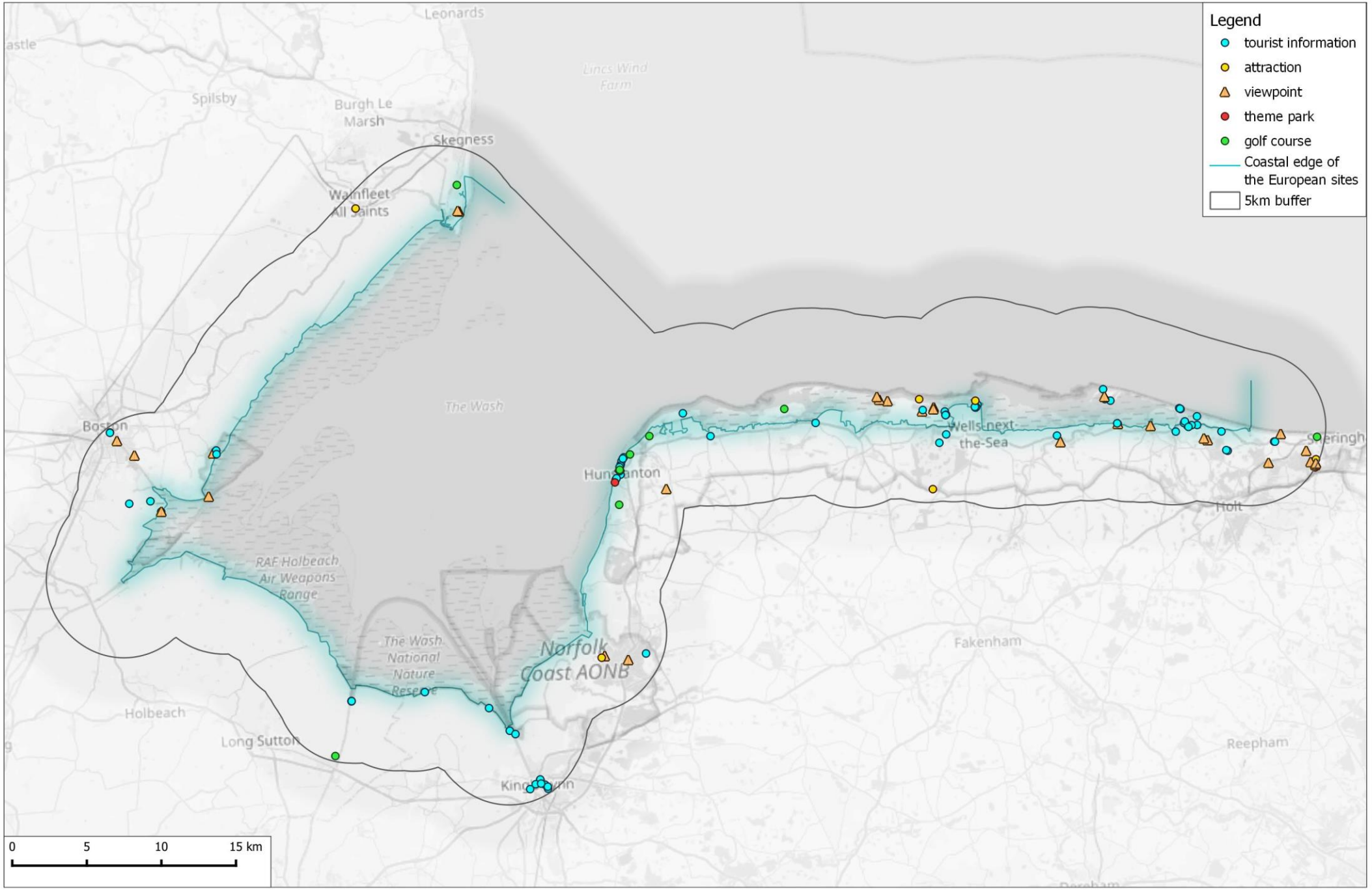
Map 11: Distribution of potential tourist accommodation



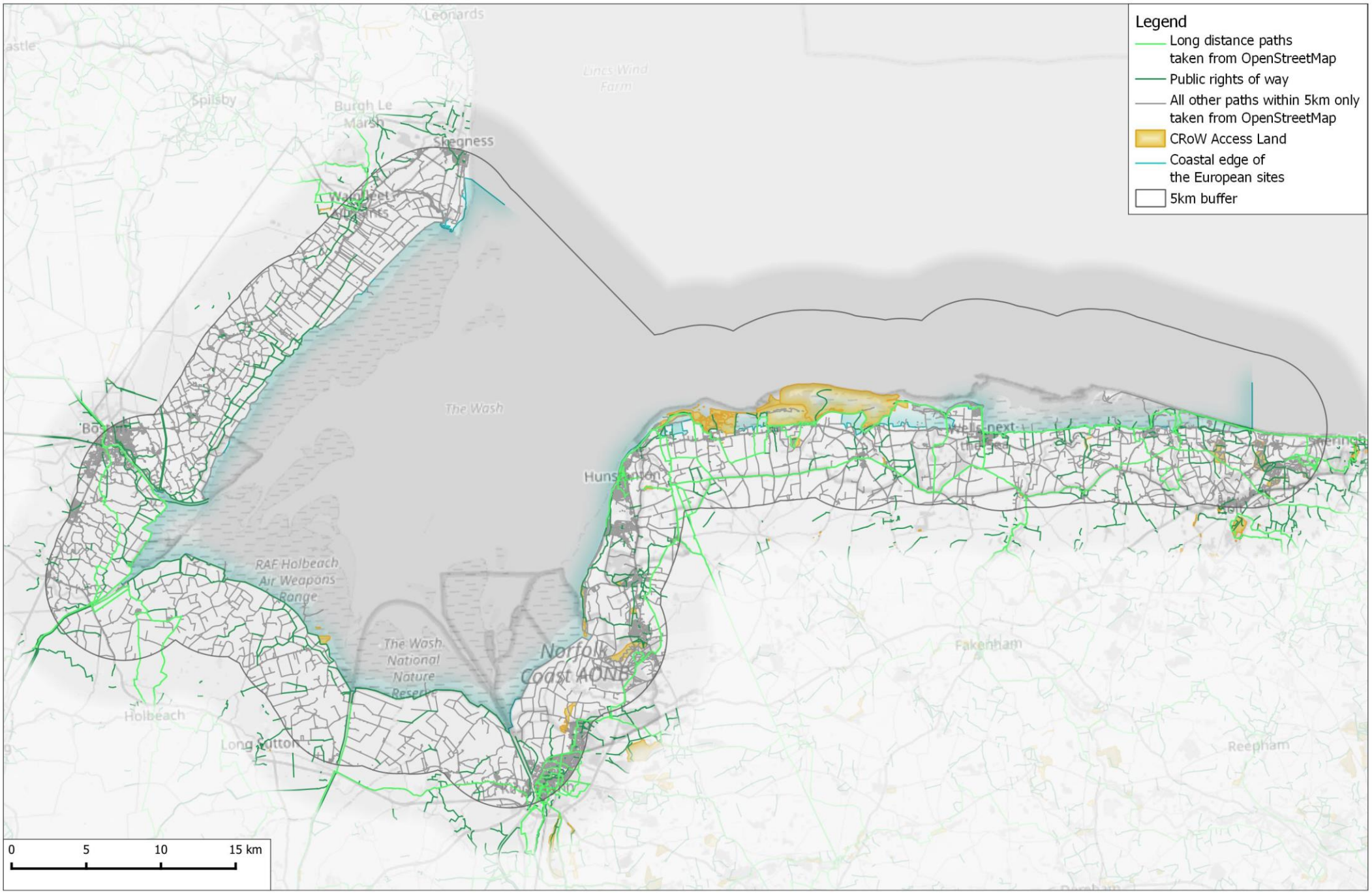
Map 12: Nature Reserves



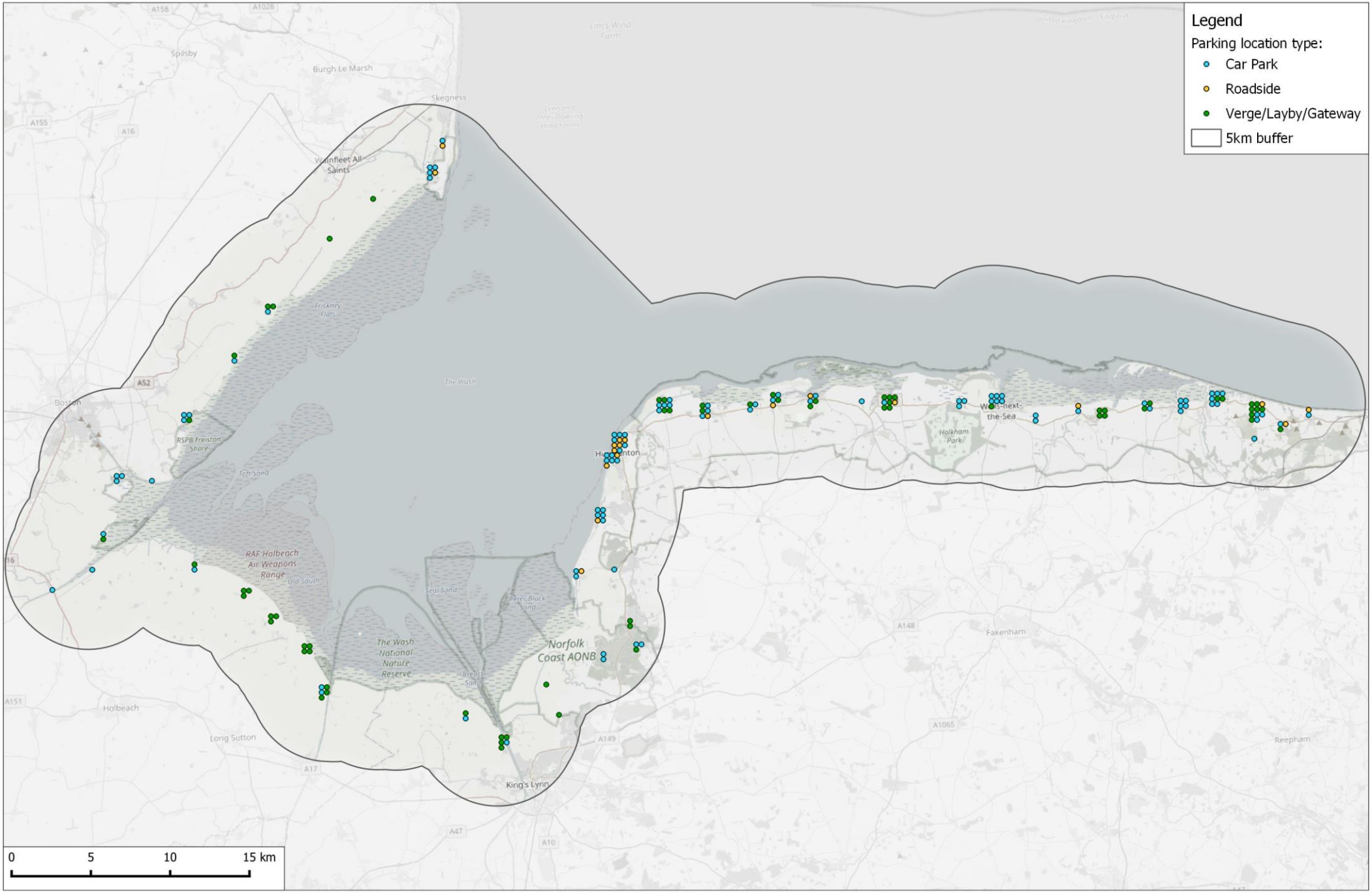
Map 13: Distribution of tourist infrastructure and amenities



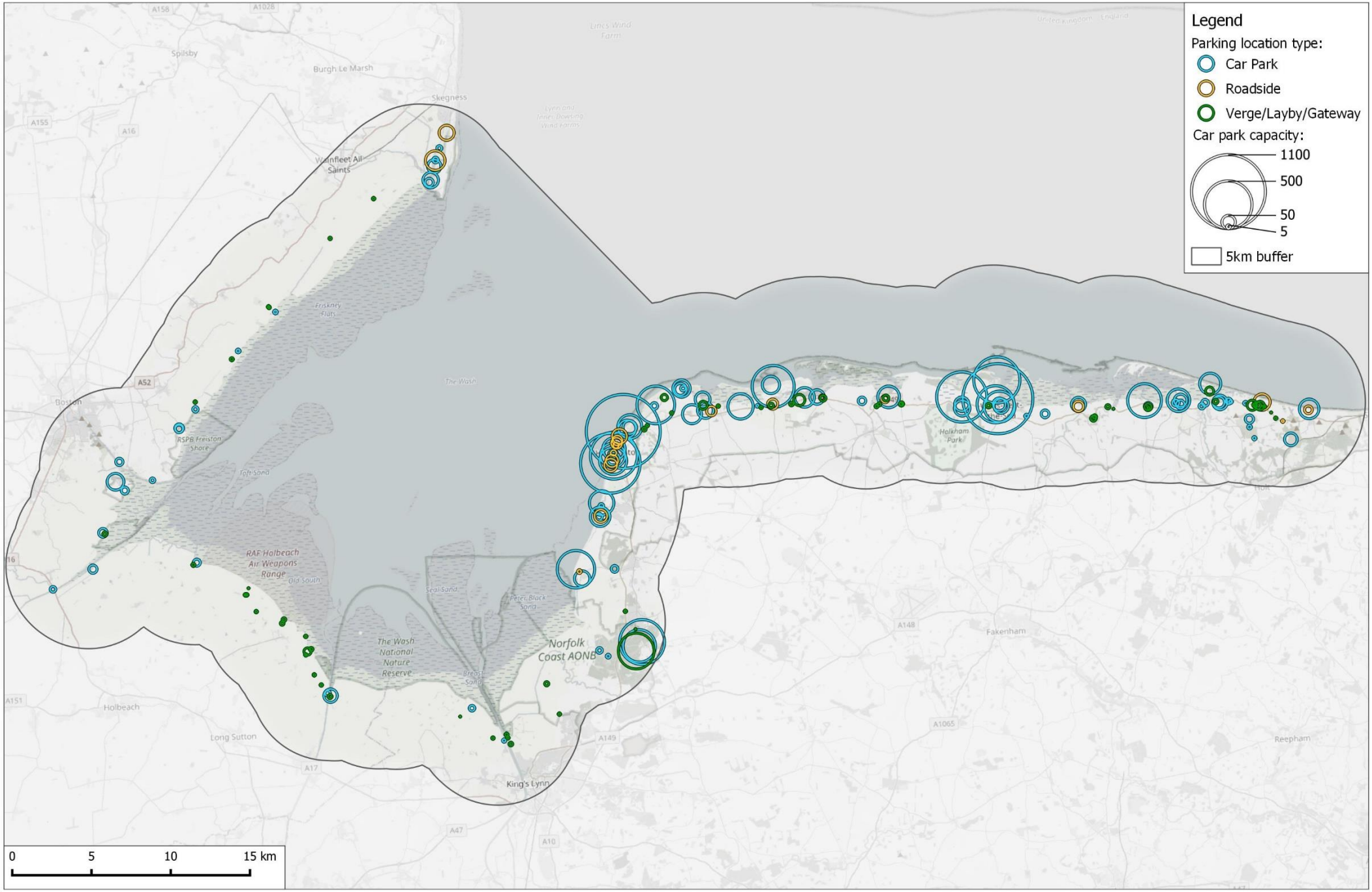
Map 14: Path network and open access land



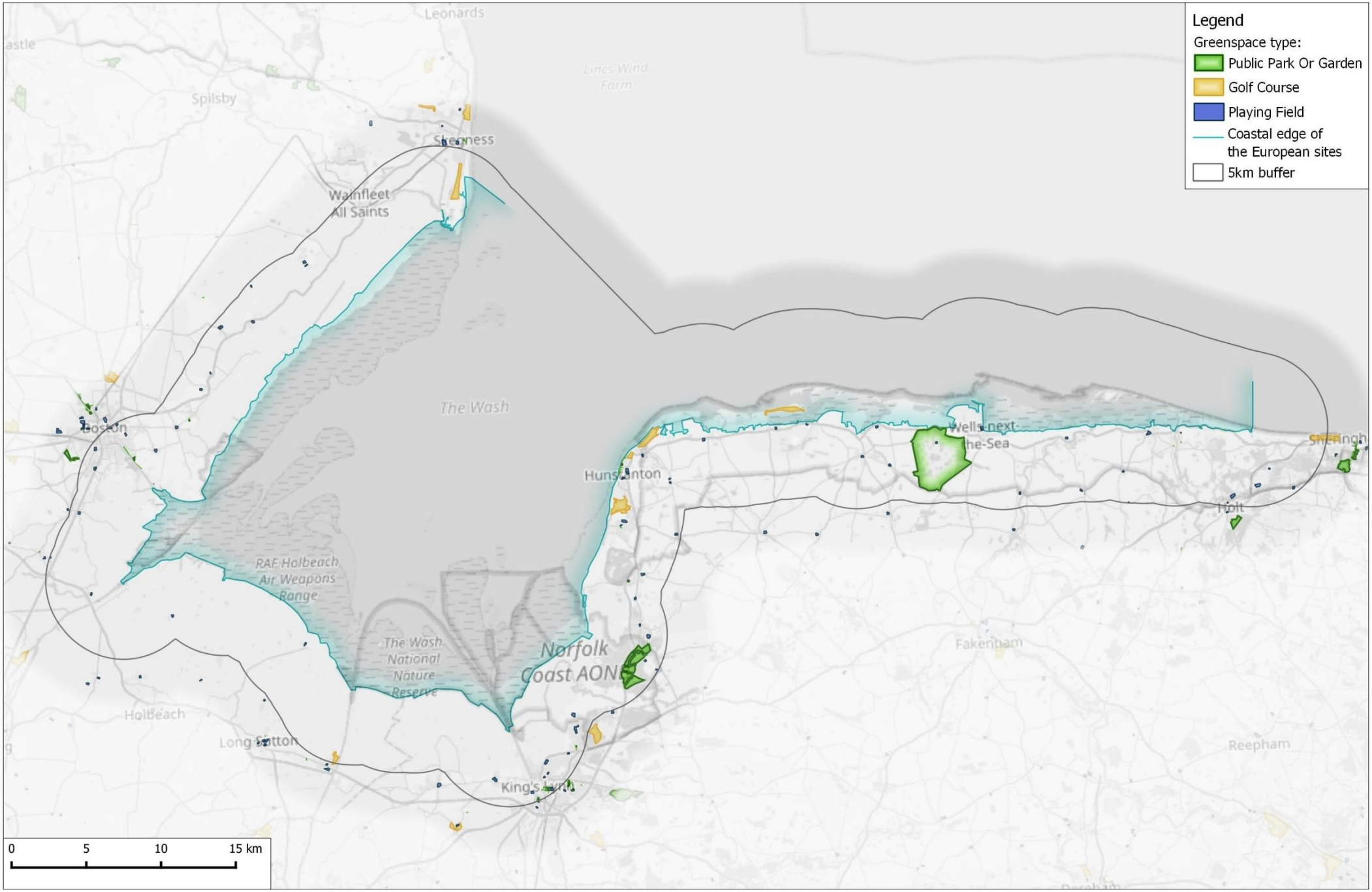
Map 15: Parking locations categorised by type (locations within 1.5km of one another offset as a grid)



Map 16: Parking locations by type and capacity



Map 17: Distribution of publicly accessible greenspaces: parks or gardens, golf courses and playing fields



Habitats

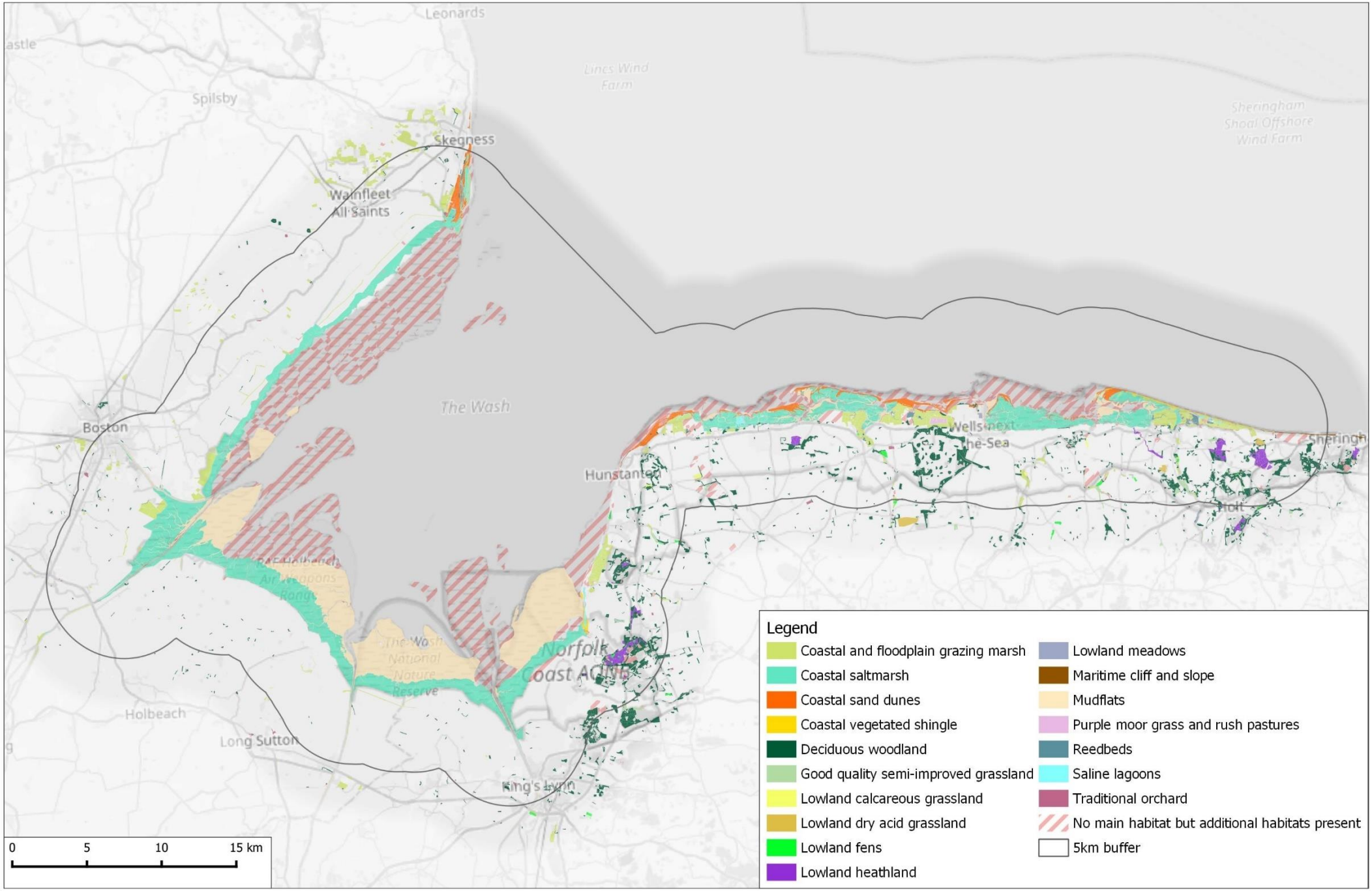
3.16 Map 18 depicts priority habitats, drawn from Natural England Priority Habitat GIS data. A wide range of Priority habitats are identified, although coastal saltmarsh, mudflats, coastal and floodplain grazing marsh, and coastal sand dunes are particularly prevalent. The distribution (and zonation) of saltmarsh is further defined using Environment Agency data in Map 19.

3.17 The distribution of agricultural land within the study area is presented in Map 20. Extensive areas of high quality (Grade 1) land are primarily located along the western and southern flanks of The Wash, with most of the North Norfolk coastline comprising non-agricultural land. The majority of the area inland from the Norfolk coast comprises medium quality (Grade 3) agricultural land, however.

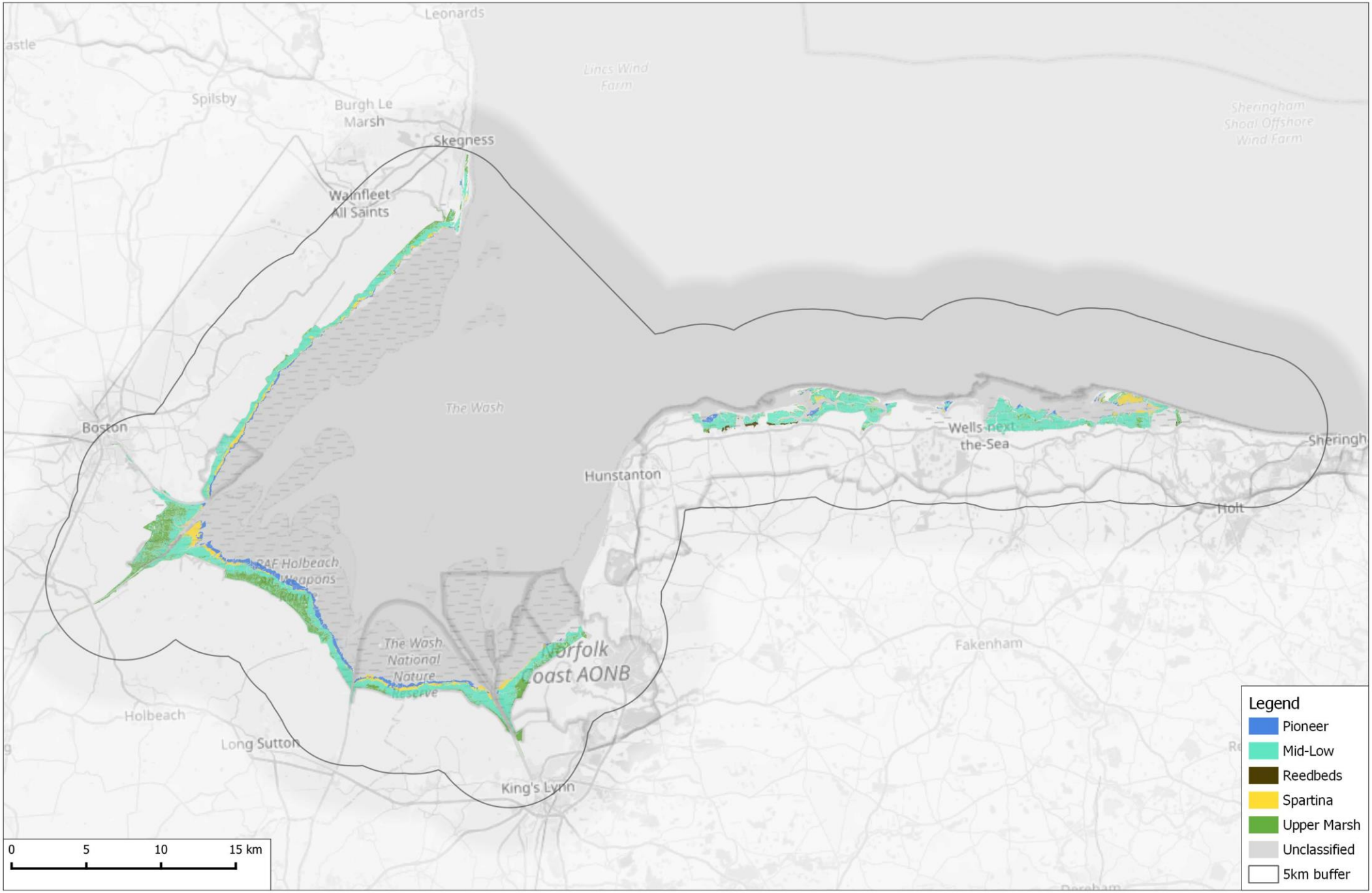
3.18 Map 21 identifies the vulnerability of Priority Habitats using the National Biodiversity Climate Change Vulnerability Model[17]. The model takes into account the habitats conservation value, its intrinsic sensitivity to climate change, and the habitat's adaptive capacity. The map indicates that the majority of the coastline located within the study area is much more vulnerable to climate change impacts than neighbouring inland areas.

[17] http://publications.naturalengland.org.uk/publication/5069081749225472#:~:text=The%20National%20Biodiversity%20Climate%20Change,be%20used%20(in%20conjunction%20with

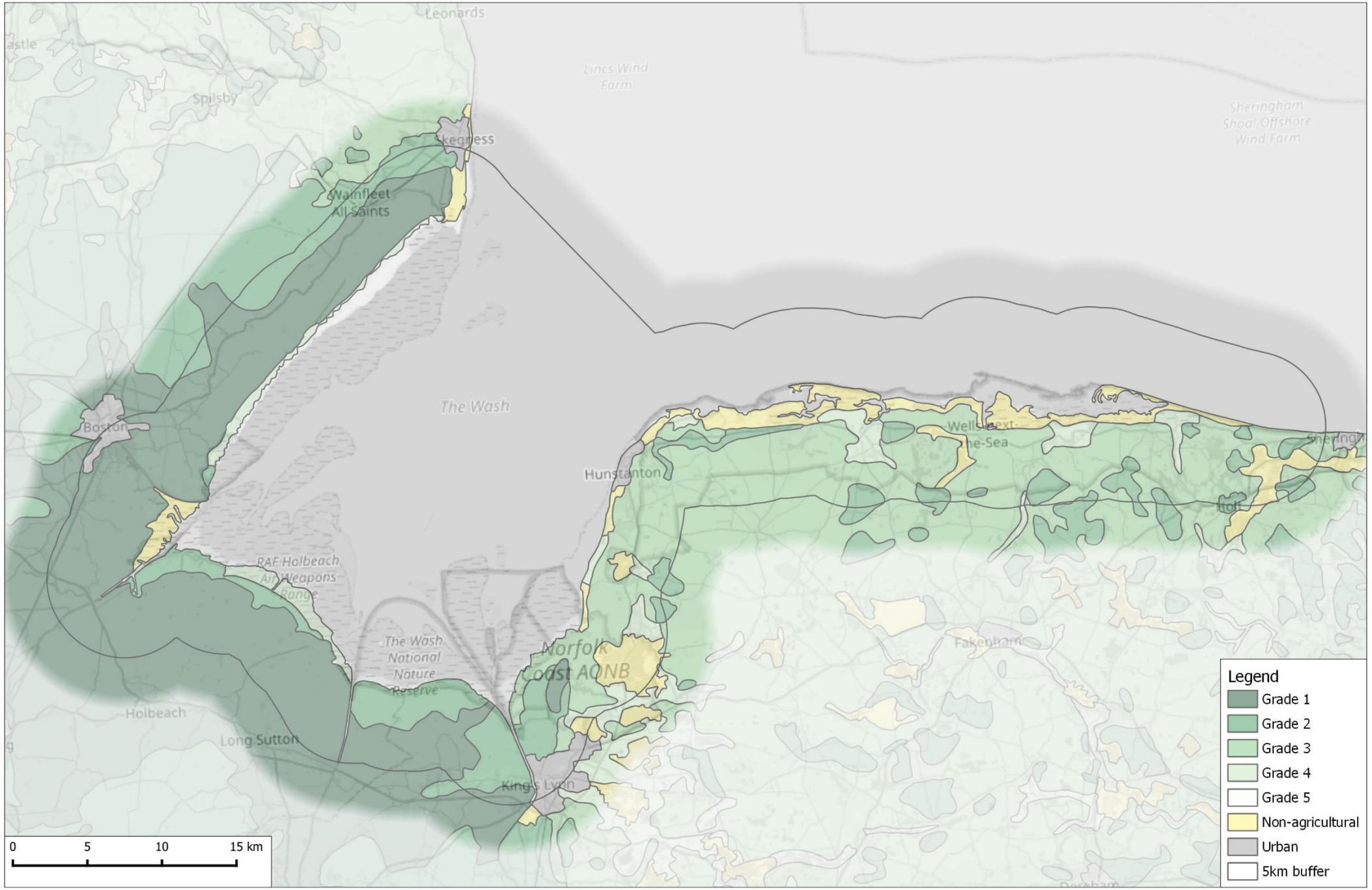
Map 18: Natural England Priority Habitat Inventory data



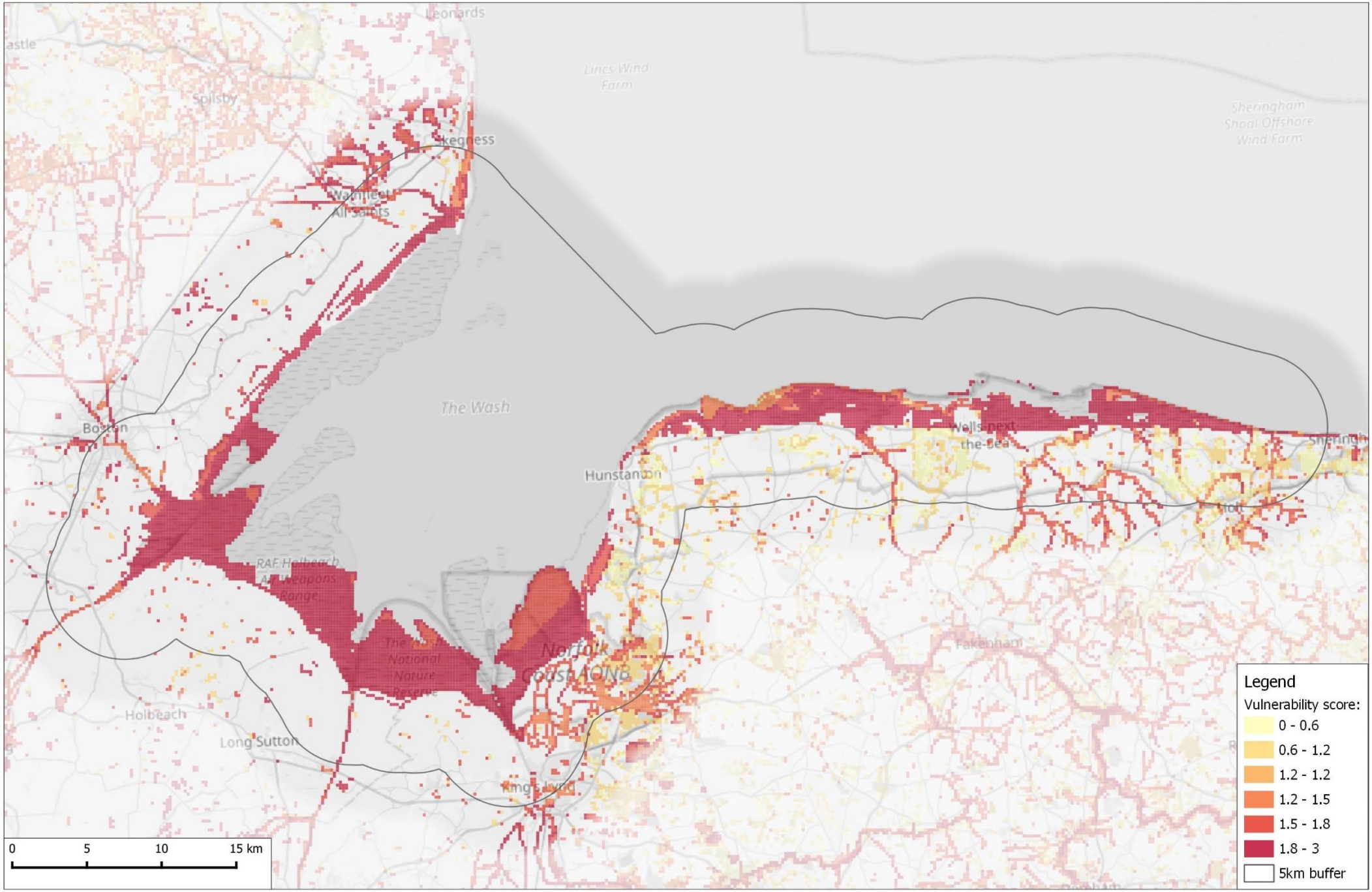
Map 19: Environment Agency Saltmarsh extents and zonation



Map 20: Agricultural Land Classification data



Map 21: National biodiversity climate change vulnerability model



4. Area issues and concerns

4.1 Step 1 of the LAC process is to identify issues and concerns relating to recreation use, i.e. those habitats and species that are vulnerable to recreation impacts.

Previous work

4.2 Issues around recreation impacts in the area have long been recognised. The sites around the coast have a long history of management (and indeed some of the country's oldest nature reserves) to protect the nature conservation interest and manage sites for wildlife and visitors. Current management includes wardening, restrictions on access, hides and provision of viewing facilities, fencing to protect bird colonies, nest protection and a range of signage, interpretation, and engagement.

4.3 Previous work has included the review by Liley (2008) of recreation impacts on the European sites along the North Norfolk coast, with particular reference to the impacts associated with increased housing growth. White (2012) assessed the capacity of international sites in Norfolk to accommodate visitor pressure, and summarises impact pathways and levels of visitor use at the time.

4.4 Natural England's site improvement plan for the North Norfolk Coast and The Wash[18] identifies Public Access/Disturbance as one of the key threats (ranked second after inappropriate water levels) and highlights the cumulative risks from a wide range of recreation, including licenced activity (such as shellfish harvesting, samphire collection and wildfowling) and also commercial activity. The plan suggests that '*further collaboration between stakeholders and local people may be needed with the aim of more holistic management of the area*'.

4.5 A range of studies have also been produced that provide management recommendations around recreation impacts and the nature conservation interest within the study area:

- The Norfolk Green Infrastructure and Recreational Impact Avoidance Strategy provides a mechanism for mitigation delivery

[18] See http://publications.naturalengland.org.uk/publication/5327498292232192

from new housing growth and summarises issues from recreation for European sites (Hooton and Mills, 2020);
- The WNNMP commissioned advice on the management of visitors with dogs (Jenkinson, 2018);
- The Norfolk Coast Partnership commissioned a Coastal Disturbance Study which launched the 'share with care' theme (document doctor, 2009);
- The Norfolk Coast Project produced a guidance map and table for visitor management zones for the Norfolk Coast AONB, highlighting areas of fragile and vulnerable wildlife habitat (Norfolk Coast Project, 1995); and,
- A visitor management handbook, produced by the Norfolk Coast Project (Mahon, 1994).

4.6 We have drawn on the studies outlined above, national reviews (Lowen et al., 2008; Penny Anderson Associates, 2009; Saunders et al., 2000), a range of single-species studies, and the results from the first workshop to collate information on key concerns. Appendix 3 lists all of the features identified as potentially vulnerable to recreation impacts (some 32 species and 8 habitats), the potential issues, and relevant references. From this overview we can identify a small number of key themes that provide the focus for the rest of the report.

Key themes

4.7 Key themes for this report are:

- Disturbance and beach nesting birds;
- Disturbance and non-breeding waterbirds;
- Disturbance and seals; and,
- Trampling damage to coastal habitats.

4.8 These are discussed in more detail below. Mapped locations of the key species are shown in Map 22 and other important species in Map 23 (habitat data are shown in Map 18). These map data have been provided primarily by the RSPB/Norfolk Coast Partnership who have collated GIS data on sensitive features for the Norfolk Coast[19]. These data have been supplemented with additional information (including data on seal haul outs, extracted from Furlong and Holmes, 2021). The maps are not necessarily comprehensive and for example there may be extensive areas of saltmarsh that support

[19] Full and up-to-date species data for Norfolk are available from the Norfolk Coast Partnership and will be updated as part of a sensitivity mapping project.

breeding Redshank that are not mapped. Arguably the whole mudflats and saltmarsh within the study area (including the whole of The Wash) could be shown as feeding/wintering waterbirds, however we have used the data provided for Norfolk and based the maps on those. Many of the key locations and concentrations are shown. It should also be recognised that the mapped data simply reflects a snapshot in time and distributions can change with time. Public access (and a suite of other factors) may well also be influencing the distribution, so these data shouldn't necessarily be used to indicate the only areas the species/habitats could occur.

Beach nesting birds

4.9 A suite of birds nest on open sand and shingle beaches, typically favouring the same kinds of areas popular with people. Of primary concern are the following species which could nest wherever open beach habitats occur:

- Ringed Plover;
- Oystercatcher; and,
- Little Tern.

4.10 In addition, other terns – Sandwich Tern and Common Tern – can nest on beaches, with large colonies at Blakeney and Scolt Head. However, these species tend to congregate in large colonies rather than at more scattered locations, making them easier to safeguard.

4.11 The open beach species are well studied and there is strong evidence of recreation use limiting distribution and impacting breeding success through trampling of nests (Liley et al., 2021a; Liley and Sutherland, 2007; Ratcliffe et al., 2008; Tratalos et al., 2021). There is evidence of marked declines for these species in within the study area (e.g. Liley et al., 2021a) yet the area still supports a significant percentage of the English breeding population. All three species are ground-nesting (see Figure 4) and as such are vulnerable to nests being lost to high tides and from predation (as well as trampling from people). The available habitat is increasingly restricted (as a result of sea level rise, stabilisation of beach habitats, and disturbance) making them more vulnerable. The breeding success for all three species is increasingly dependent on human intervention and management.

4.12 Ringed Plovers and Oystercatchers are present on the beaches, and establish territories, from the late winter while Little Terns are summer migrants present from late April.

4.13 Impacts relate to the high numbers of people on the open beach habitats and dogs off leads, in particular. Map 22 shows the key areas for beach nesting birds but it should be noted that the beach habitat is dynamic and otherwise suitable habitat with high levels of recreation use is not used by the birds (Liley and Sutherland, 2007; Ratcliffe et al., 2008). As such the maps reflect only areas used in recent years and do not necessarily show all the locations where the birds could occur.

Figure 4: Beach nesting birds (from left to right: Ringed Plover (eggs and chick), Oystercatcher, Little Tern) and suitable breeding habitat. All images Footprint Ecology apart from Little Terns by Andy Morffew is licensed under CC BY 2.0.

Non-breeding waterbirds

4.14 Wintering and passage waterbirds are qualifying features of The Wash SPA, the North Norfolk Coast SPA, and Gibraltar Point SPA, with the sites being classified for a range of species, as well as for their overall wintering waterbird assemblage (in the case of The Wash and North Norfolk Coast SPAs).

4.15 The Wash is the UK site with the highest counts of non-breeding waterbirds and recent summed maximum counts have exceed 420,000 birds, while the North Norfolk Coast is ranked 8th, with summed maximum counts approaching 150,000 birds (Frost et al., 2021).

4.16 Waders feed over the expanse of open intertidal habitats exposed at low tide and at high tides gather to roost, with sites such as Snettisham, Holme, and Gibraltar Point supporting huge flocks on the extreme high tides. Roost sites can include farmland, beaches and gravel pits. Wildfowl such as Pink-footed Geese feed on farmland, grazing marsh and saltmarsh and again can roost in large aggregations.

4.17 Recreation can have impacts for wintering and passage birds through disturbance, for example resulting in:

- A reduction in the time spent feeding due to repeated flushing (taking flight)/increased vigilance (Bright et al., 2003; Fitzpatrick and Bouchez, 1998; Stillman and Goss-Custard, 2002; Thomas et al., 2003; Yasué, 2005);
- Increased energetic costs (Nolet et al., 2002; Stock and Hofeditz, 1997);
- Avoidance of areas of otherwise suitable habitat, potentially using poorer quality feeding/roosting sites instead (Burton et al., 2002; Cryer et al., 1987; Gill, 1996); and,
- Increased stress (Regel and Putz, 1997; Thiel et al., 2011; Walker et al., 2006; Weimerskirch et al., 2002).

4.18 Whereas a single event is unlikely to have implications, chronic levels of use may mean birds entirely avoid otherwise suitable habitat or repeated disturbances have the potential to affect fitness. Collop et al (2016) deliberately disturbed a range of different species on The Wash by directly approaching them and recording the amount of lost feeding time and other impacts. These results were then placed in context with modelling data to estimate the costs of disturbance. The models suggest that the species studied could potentially cope with levels of access higher than those

currently taking place on the mudflats of The Wash before survival might be compromised.

4.19 The models are useful in that they highlight the potential for repeated flushing events to have impacts on survival for the key species. While the authors suggest that the large, remote expanses of open feeding habitat on The Wash would mean disturbance is of limited concern for birds foraging on the intertidal, the study does not consider the physiological impacts (stress) or the potential impacts of habitat loss from disturbance (e.g. loss of roost sites) and the results are site specific (i.e. cannot necessarily be applied to the North Norfolk Coast). While the open mudflats of the Wash are largely inaccessible to people, at high tides and certain times of year birds can be concentrated close to shore and in areas where disturbance is a risk.

4.20 There have been marked declines in wintering waders on the North Norfolk coast at sites such as Holme (Liley et al., 2021b), particularly in the number of Knot. Causes of the decline are hard to pin-point and may involve multiple factors, including habitat change and disturbance.

Seals

4.21 The Harbour Seal is a qualifying feature of The Wash and North Norfolk SAC and The Wash supports the largest population of the species in England. Grey Seals also occur widely around the Norfolk coast and Norfolk has become a celebrated destination for people to see seals of both species. Seals can be seen from many beaches around the Norfolk coast (Figure 5) and in particular the boat trips to Blakeney Point are popular (Figure 5). The status of the two Seal species in Norfolk are summarised by Skeate and Perrow (2008) who describe the marked increase in Grey Seals and decline of the Harbour Seal. The paper suggests that Harbour Seals are now unable to breed on the mainland in Norfolk and pinpoint the pressure from humans and dogs.

4.22 Other studies support these suggestions. For example, Harbour Seal distribution has been shown to relate to the distribution of people on the coast, with seals shifting to more remote haul out sites when there were high numbers of people present (Granquist and Sigurjonsdottir, 2014). Experimental studies from Denmark show Harbour Seals (Andersen et al., 2012) to respond at greater distances when approached by boats compared to people on foot and to take flight at distances of up to 850m when

approached by boats. Other studies have shown powerboats and kayaks to disturb Harbour Seals (Johnson and Acevedo-Gutiérrez, 2007).

4.23 The participants in the workshop raised concerns about unregulated tourist provision. Concerns therefore relate to people and dogs on the beach in the vicinity of haul out sites, people approaching seals, and boat traffic around haul out sites.

Figure 5: Seal boat trip and walker approaching seal on beach.

Trampling damage to coastal habitats

4.24 The passage of feet and wheel can result in vegetation wear, soil compaction and erosion. This can lead to changes in the vegetation present (for example shorter vegetation), loss of vegetation, increased bare ground and damage to substrates. These can have consequences for the range of species present.

4.25 Map 18 shows habitat data. Along the Norfolk and Lincolnshire coast the key concerns relate to a number of coastal habitats that are qualifying features of relevant European sites including the North Norfolk Coast SAC, Saltfleetby- Theddlethorpe Dunes and Gibraltar Point SAC and The Wash and North Norfolk Coast SAC. These habitats include:

- Coastal vegetated shingle;
- Sand dune; and
- Saltmarsh.

4.26 The shingle survey of Great Britain (Sneddon and Randall, 1993) notes trampling as causing damage to fragile shingle vegetation at a number of sites. Trampling can destroy the ridge structures and also break up the surface layers of vegetation and the fine humic layer that may take many years to be deposited. As a result, damage to vegetation may not be possible to reverse (Liley et al., 2010). Communities with abundant lichens are particularly susceptible to trampling. Studies such as those by Spokes (1997) and Hewitt (1973) demonstrate that untrampled areas are more diverse than the trampled areas. A single pass may be sufficient to cause irreparable damage (Doody and Randall, 2003). Disturbance of habitat from trampling or vehicles also has a negative impact on the majority of shingle invertebrates (Kirby, 2001; Shardlow, 2001).

4.27 On sand dune habitats, in general the vegetation response is such that the more stressed the environment and unstable the substrate, the greater the impact. Thus, fore dunes with marram may be very susceptible to trampling, while rank grasses and dune heath are moderately susceptible and short turf and scrub most resilient (Boorman and Fuller, 1977). In unmanaged dune grassland, trampling results in a progressive decline in height of vegetation and less litter; and also some increase in pH associated with compaction (Slatter, 1978). As with other grasslands, the increase in available phosphorus noted (Milwain, 1984) could be directly linked to the use of paths for dog walking. While some light trampling in otherwise unmanaged dune grassland may benefit less competitive plants such as some annuals

and invertebrates, dunes are very prone to erosion and the creation of increasingly wide, bare pathways. It is generally accepted that recreational pressure results in a decrease in species diversity within dunes (Bonte and Hoffman, 2005), and that a threshold can be reached where irreversible damage can occur (Covey and Laffoley, 2002; Curr et al., 2000; Ritchie, 2001).

4.28 Comparative studies of trampling impacts on different coastal habitats indicate that saltmarsh is more resilient relative to sand dunes, coastal grasslands etc. (Andersen, 1995; Coombes, 2007; Lawesson, 1998). Trampling can however result in permanently distinguishable paths where vegetation has been altered (some examples are shown in Figure 6) and any damage to the vegetation cover of the saltmarsh carries with it the risks of erosion damage over a much wider scale and possible consequences for the functioning of the marsh ecosystem as a whole (Boorman, 2003). Trampling damage also results in changes to the infaunal community (Chandrasekara and Frid, 1996).

4.29 Coombes (2007) explores the relationship between the amount of passes (footfalls) and reduction in vegetation cover in different soft coastal habitats on the Norfolk coast. For most habitats (yellow dunes, grey dunes and saltmarsh) the relationship appears to be linear, suggesting that the impact is proportional to the amount of access. The slope is steepest for yellow dunes and shallowest for saltmarshes, suggesting that of these, yellow dunes are the more sensitive. The relationship for foredunes appears—uniquely among the habitats assessed—to be curvi-linear, with a small amount of trampling resulting in a disproportionately high impact.

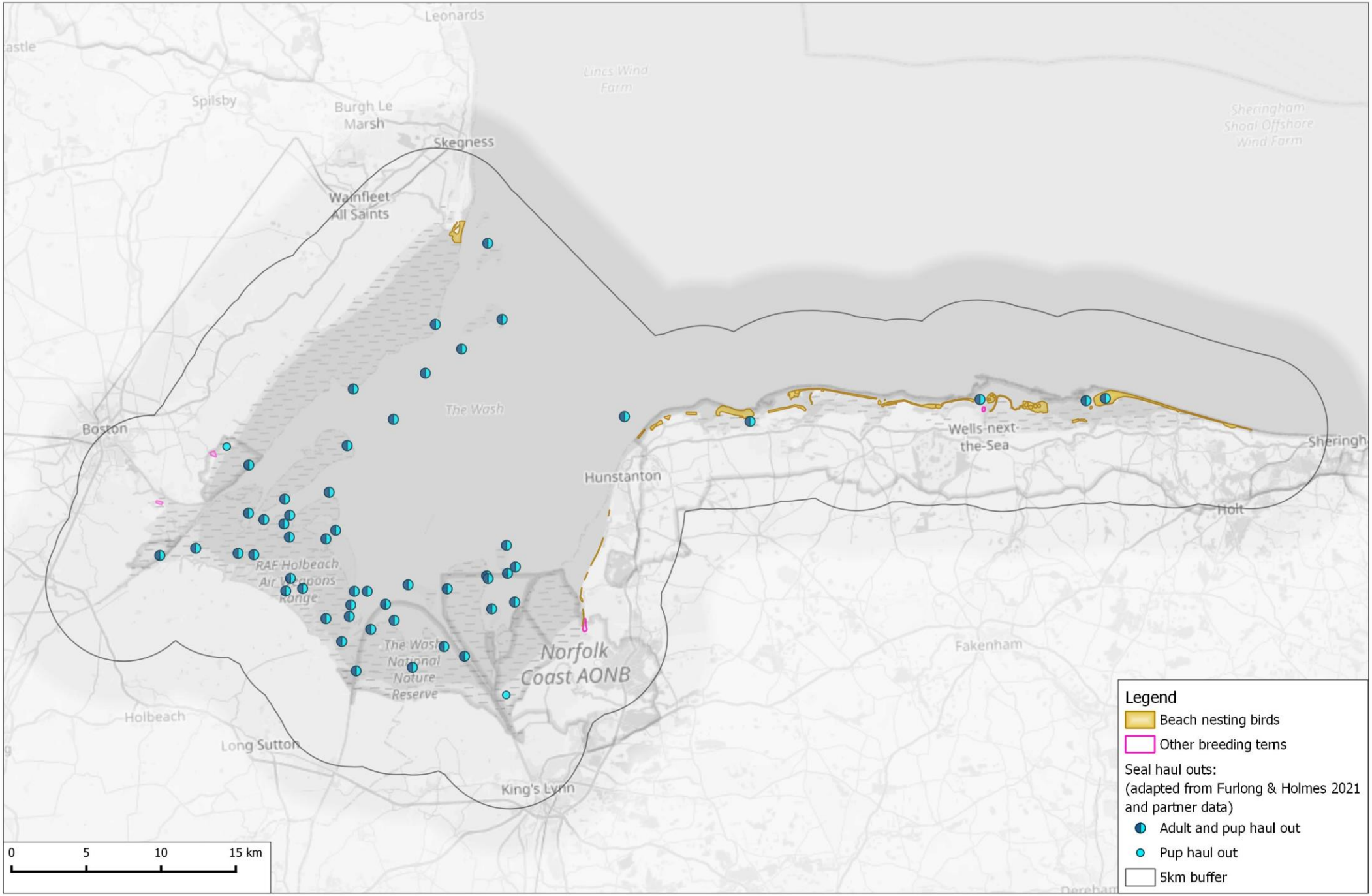
4.30 The inaccessibility of coastal habitats and challenges accessing some areas – such as crossing saltmarsh creeks – reduces some of the risks. The highest concerns are perhaps at those locations and general areas where access is focussed along a narrow strip or where footfall is concentrated, for example the pioneer saltmarsh at Holkham Gap (Figure 6) or the shingle at Blakeney/Cley. As such impacts are perhaps more localised than the other themes. However, there is clearly cross-over with the breeding bird theme, as foredune and vegetated shingle are potential breeding habitat.

4.31 Risks are also compounded by a range of factors. Management measures to counter over-stabilisation, nutrient enrichment, hydrological change and invasive species issues are all linked to the use of coastal habitats for recreation (e.g. Ratcliffe et al., 2020). In dune habitats in particular, there is increasing recognition in the importance of periodic disturbance and

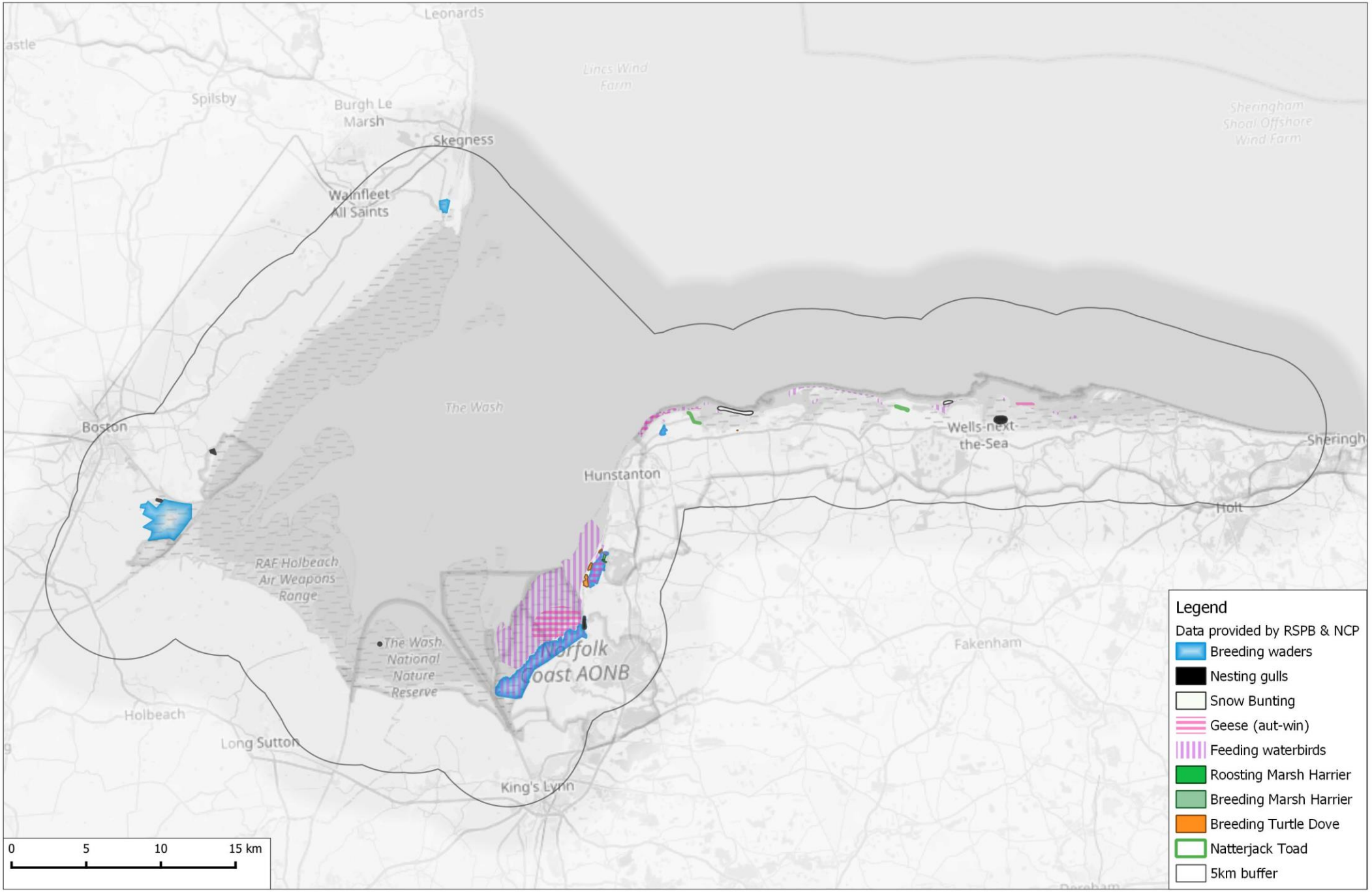
dynamism, which is potentially difficult to maintain where there are high levels of access along fixed routes and a perception of how dunes should be managed and maintained.

Figure 6: Trampling impact examples. Main image - Holkham Gap and routes crossing pioneer saltmarsh (taken in 2017); lower images (from left) - sign at Holkham, path crossing saltmarsh at Brancaster, vegetated shingle within exclosure (image from Suffolk coast), and fore dune trampling at Burnham Overy.

Map 22: Distribution of key species vulnerable to recreation impacts



Map 23: Distribution of other species potentially vulnerable to recreation impacts



5. Descriptions and definitions of opportunity classes: zoning the coast

5.1 Step 2 of the LAC process identifies the potential zones that could be applied to the coast. In the LAC process these are referred to as 'opportunity classes' whereas we use the term zone in this report. Zones differ in the kinds of resource and social conditions acceptable for that class and the type of management activity considered appropriate.

Zones

5.2 In the first workshop, participants provided information on the different characteristics and variation around the study area that zones would need to encompass. We have used these to define 6 zone types, which are summarised in Table 3 and Figure 7.

Table 3: Overview of the opportunity classes ('zones').

Zone	Description	Resource Conditions	Social Conditions	Type of Management	Key words
Town and Village	Areas with hard sea defences, sea fronts, houses and a range of infrastructure including harbours.	Little available habitat for wildlife and disturbance levels high.	Busy with a range of places to eat/drink and visitor attractions. Range of parking and public transport options. Wide mix of activities.	Beaches and coast areas with lots of visitor infrastructure (jetties, slipways, beach facilities) and management to control anti-social behaviour and visitor safety.	Urban, developed, busy destinations.
Local Greenspace	Local countryside providing for a range of local access.	Potential for disturbance impacts where habitat is suitable but potentially little spatial overlap between people and vulnerable wildlife. Where overlap occurs, impacts readily apparent due to high numbers of people.	Busy, providing space for regular, local recreation use, dog walking, exercise etc.	Encompassing public rights of way and the wider countryside through to sites such as Country Parks. Dedicated infrastructure for dog walking (bins, fencing, parking) could be present alongside other recreation use. Not over promoted.	Country Parks, greenspace, local, doorstep.
Destination Sites	Attractive sites with expansive open beaches and other habitats.	Resource impacts apparent with the potential for widespread disturbance due to the numbers and distribution of people, with areas of beach potentially unsuitable for birds and seals due to numbers of people.	Well known sites with wide draw and appeal, attracting a range of recreation use and types of access. Mix of tourist activities and local use, but focussed around tourism and people from further afield.	Management focused around car parks and entry points. Well promoted sites and destinations for particular activities. Localised management around specific features/seasonal or particular activities.	Scenic, tourist, beach.
Wildlife Tourism	Nature reserves where infrastructure and management focussed around people and wildlife.	Disturbance impacts localised due to the types of visitor and infrastructure in place.	High visitor volumes but focus on nature viewing from boats, hides etc. Inspiring wildlife experiences with viewing strictly controlled and managed.	Promoted sites. Highly managed with fixed trails, screens, hides, face-face engagement. Sites promoted and visitors set back from wildlife and facilities to view.	Nature reserves.

Zone	Description	Resource Conditions	Social Conditions	Type of Management	Key words
Wild Places	Remote areas incorporating expansive open beaches and saltmarsh and other coastal habitats.	Potential for impacts from disturbance to seals and birds but likely to be low and limited in time and space such that impacts are temporary.	Low visitor numbers and wilder areas with fewer people. Use by more intrepid visitors and for permitted activities.	Limited management provision and low key. Access potentially limited due to topography and terrain.	Wild, remote.
Wildlife Only	Large (>10ha) areas with sensitive wildlife or other features present. Access restricted seasonally or permanently.	No resource impacts due to access restrictions.	No recreation use (navigation, monitoring and permitted activities may still occur at low levels).	Access for general recreation use restricted through fencing, signs, barriers etc.	Restricted.

Figure 7: Representative images of the different zones (all examples from outside Norfolk).

6. Indicators for resource and social conditions

6.1 Step 3 of the LAC process involves the identification of indicator-specific variables that, singly or in combination, are taken as indicative of the condition of each zone. Such measures allow managers to unambiguously define desired conditions and to assess the effectiveness of various management practices.

6.2 Indicators need to capable of being measured in cost effective ways, relate to the issues and concerns, and also ideally relate to management control, such that changes in management will be reflected in the data. No single indicator is likely to provide a comprehensive measure and a range of different variables are likely to be relevant.

Selected indicators

6.3 Potential indicators were identified in the first workshop and further refined by the Footprint Ecology team. Selected indicators are summarised in Table 4.

Table 4: Summary of indicators and rationale for their selection.

Indicator	Rationale	Specific details
Number of dogs off lead	Dogs have particular impacts in terms of disturbance. Clear measure of potential impact in certain habitats.	Number of dogs off lead per km of shore, on beach habitat (i.e. above and around tideline).
		Density of dogs off lead on intertidal habitat (mudflat, sandflats and saltmarsh).
		Number (%) of groups who have dogs with them per km of shoreline.
Number of people on foot	Differential impacts from people on foot depending on where they are and distribution.	Total people on beach habitat (i.e. above and around tideline) per km of shore.
		Total people on intertidal habitat per ha.
Numbers of kayaks/stand up paddleboards/small boats close inshore	Craft have the potential to cause disturbance when approaching birds or seals too close.	Total numbers of craft within 1km of key stretches of shoreline.
		Total numbers of vehicles.

Indicator	Rationale	Specific details
Numbers of vehicles in car parks	Vehicle counts provide indication of overall visitor numbers and importantly the relative distribution.	% occupancy (i.e. how full each parking location is).
Distribution of breeding birds	Birds will avoid areas of high disturbance so key measure of impact on habitat availability.	Territory maps to show locations of relevant species: e.g. Ringed Plover, Oystercatcher territories plus colonies of Little Tern.
Distribution of beach habitat	Quality and extent of beach habitat will change over time.	Mapping suitable beach habitat to identify suitable areas for beach nesting waders and terns.
Breeding success of beach-nesting birds	Breeding success determines how well population doing. Will change between years and a range of factors likely to influence success besides disturbance.	Number of nests and number fledged for each of the three species, with simple breakdown of causes of failure.
Number of seals at haul out sites	Harbour Seals will avoid areas of high disturbance so provides a check on impacts of disturbance. Numbers will however fluctuate for a range of reasons.	Total number of each species of seal.
Distribution of wintering and passage waterbirds	Birds will avoid areas of high disturbance so provides a check on impacts of disturbance. Numbers will however fluctuate for a range of reasons.	Numbers of feeding waders and waterbirds at low tide along stretches of foreshore.
Distribution and presence of roosts	Roosts are key points at which large numbers of birds gather and potentially vulnerable to disturbance.	Distribution of roosts.
		Use of selected roosts in terms of numbers of birds and species present.
Distribution and condition of relevant habitats	Will provide a check on any loss of habitat or change in condition as a result of trampling damage, contamination etc.	Relevant for saltmarsh, dune and vegetated shingle habitats in particular

7. Data collection

7.1 Step 4 of the LAC process involves the inventory of the existing resource and social conditions. Much of the bird and other ecological data are already collected through breeding bird monitoring and Wetland Bird Counts (WeBS). In this section we therefore focus on the results from systematic visitor counts (people and cars) of the whole study area.

Vehicle Count results

7.2 The transect route used for the vehicle counts is shown in Map 24 and included 177 locations. All locations were synchronously counted on 5 separate dates, apart from 5 locations where access was not possible due to closures on 6 separate occasions (including twice at location 96: Hunstanton Pitch & Putt).

7.3 A total of 15,812 vehicles were recorded across all counts, producing a mean of 3,149 vehicles and a median of 2,961. The total vehicles on each transect date are shown in Figure 8. The highest count was made on a weekend in the Easter holidays, when a total of 5,914 vehicles were recorded, with the lowest count (of just 704 vehicles) made on a term time weekday in May.

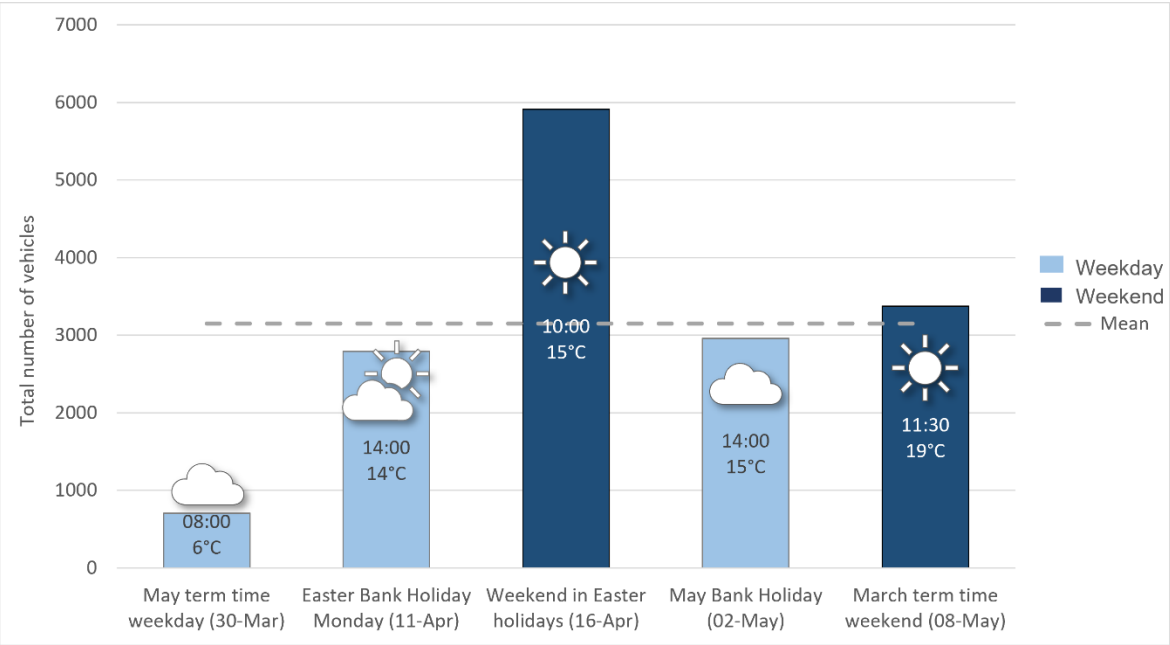
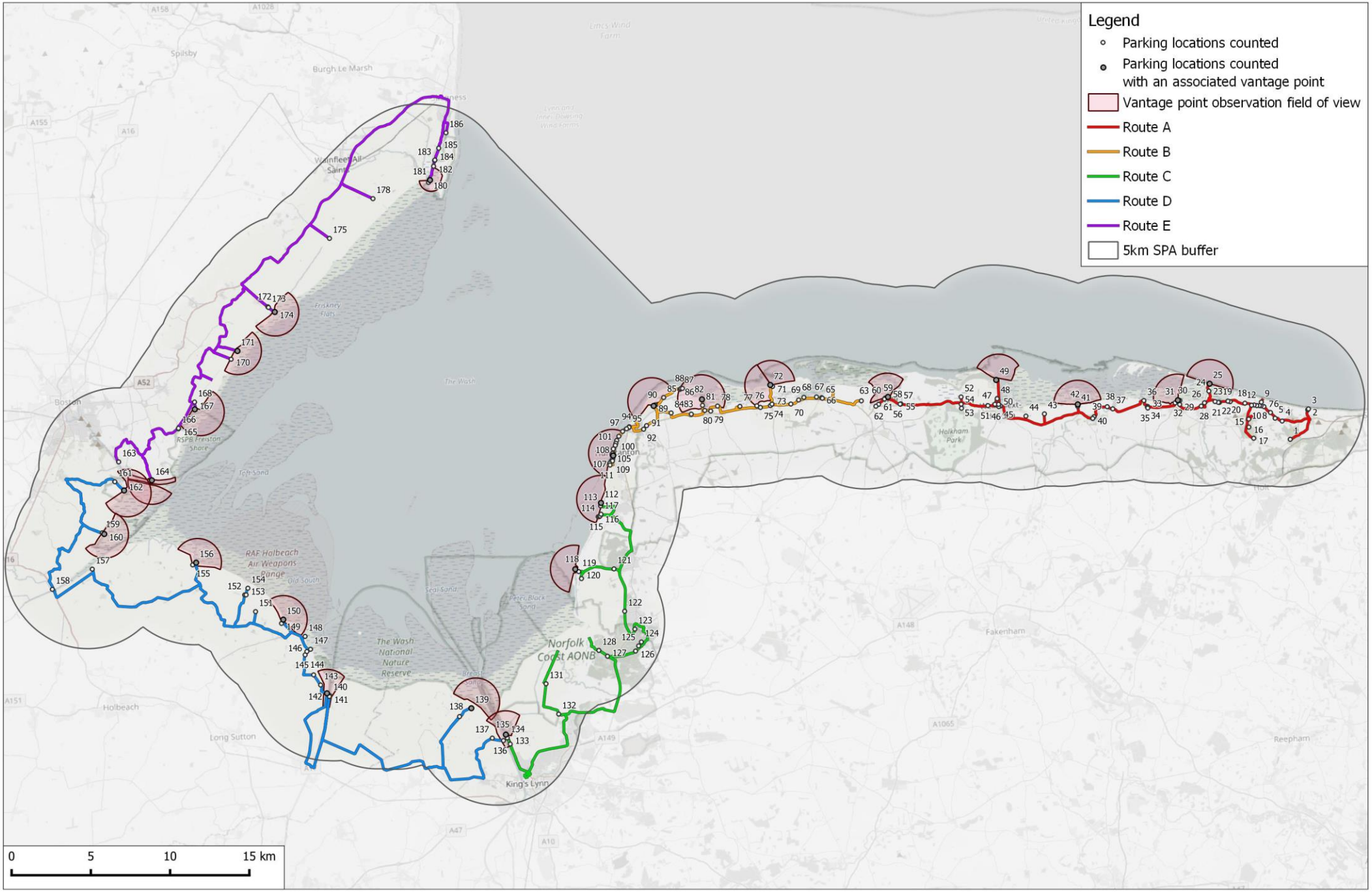
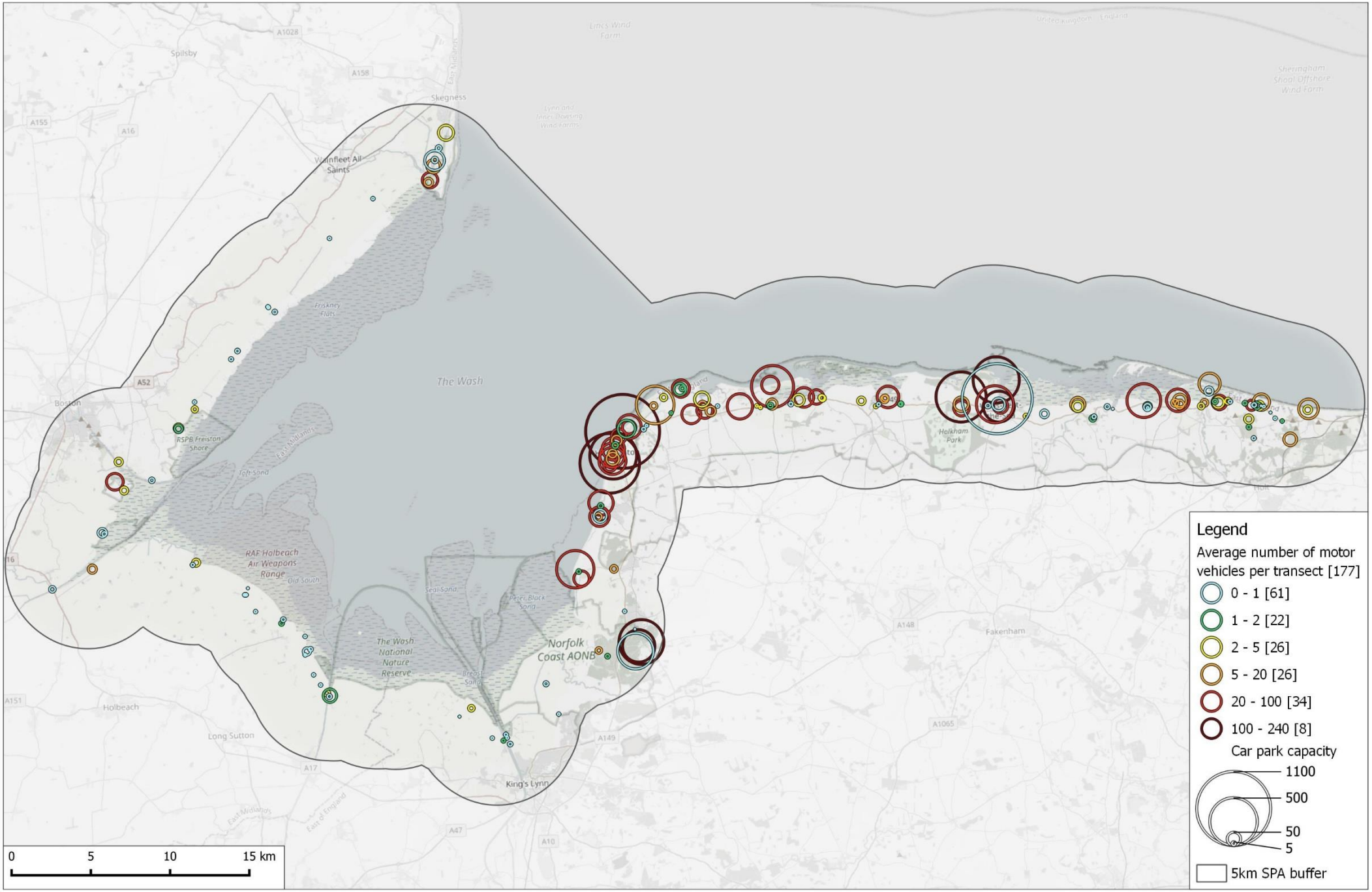


Figure 8: Total number of vehicles recorded on each transect date, stratified by day type.

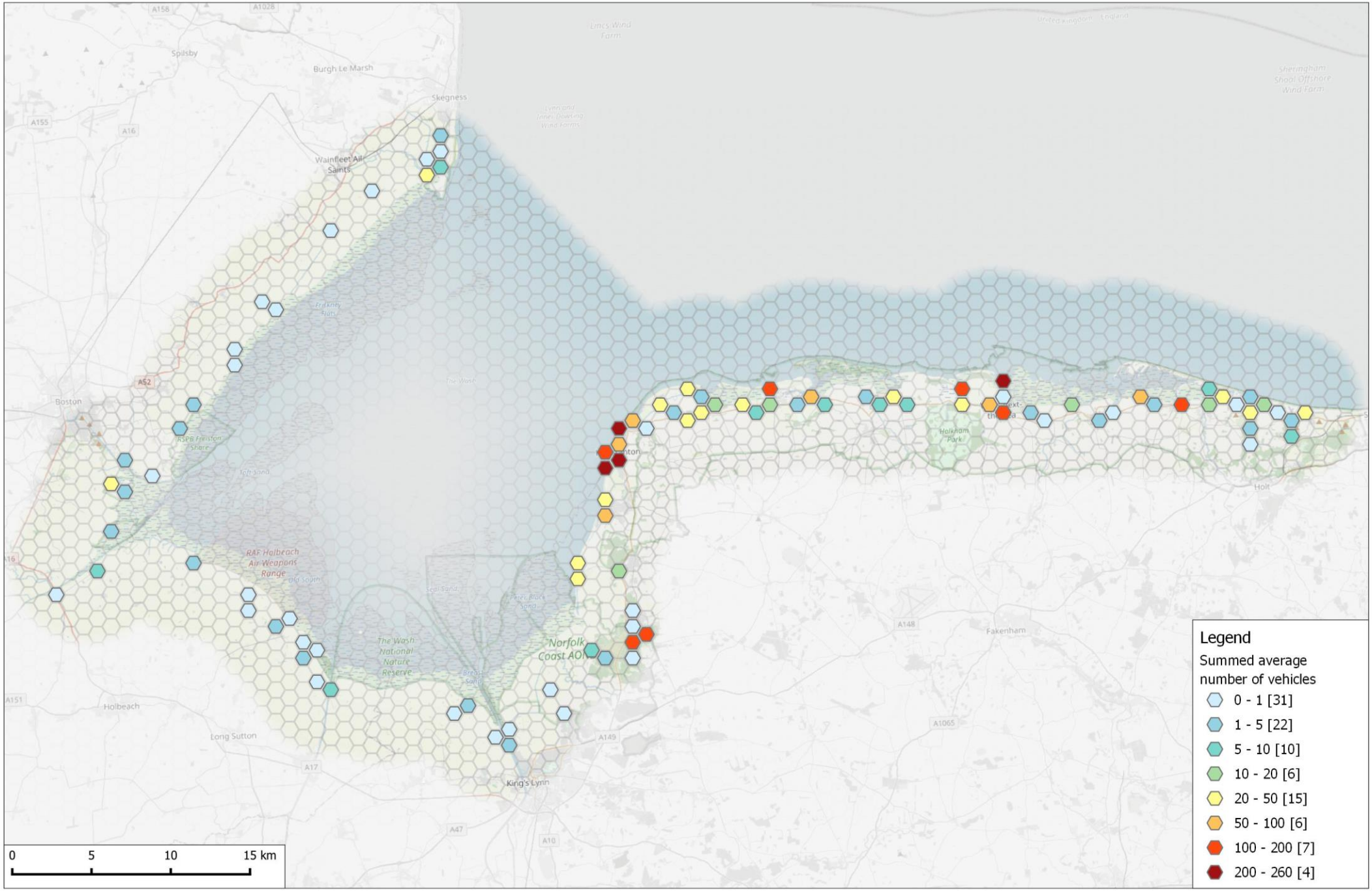
Map 24: Driving transect route and locations where vantage points undertaken



Map 25: Parking locations categorised by the average number of motor vehicles recorded on a transect, with symbols sized by the number of parking spaces



Map 26: Average number of vehicles shown on hexagonal grid



7.4 The distribution of vehicles shown in Maps 25 and 26 highlights a clear concentration of access around Hunstanton, with high levels also recorded at several locations along the North Norfolk coast. Nevertheless, there are still extensive areas with very low levels of vehicular access across the study area.

Vehicle types

7.5 Most of the vehicles recorded were cars. Besides cars, the most commonly recorded subset of motorised vehicles comprised campervans and caravans (469 in total; approximately 3.0% of all vehicles). This was followed closely by vans (468; 3.0%) and vehicles with rear/roof racks (378; 2.4%). Other vehicle types were recorded very infrequent, with 234 motorcycles (1.5%), 51 minibuses/coaches (0.3%) and just 2 branded commercial dog walker vehicles (<0.0%). No horse boxes were recorded in any of the counts. The distribution of vehicles along the transects are depicted in Map 27 and the count of each vehicle type is provided for each transect in Table 5.

Map 27: Heatmaps to show the density of vehicle, types of vehicles and overall percentage occupancy

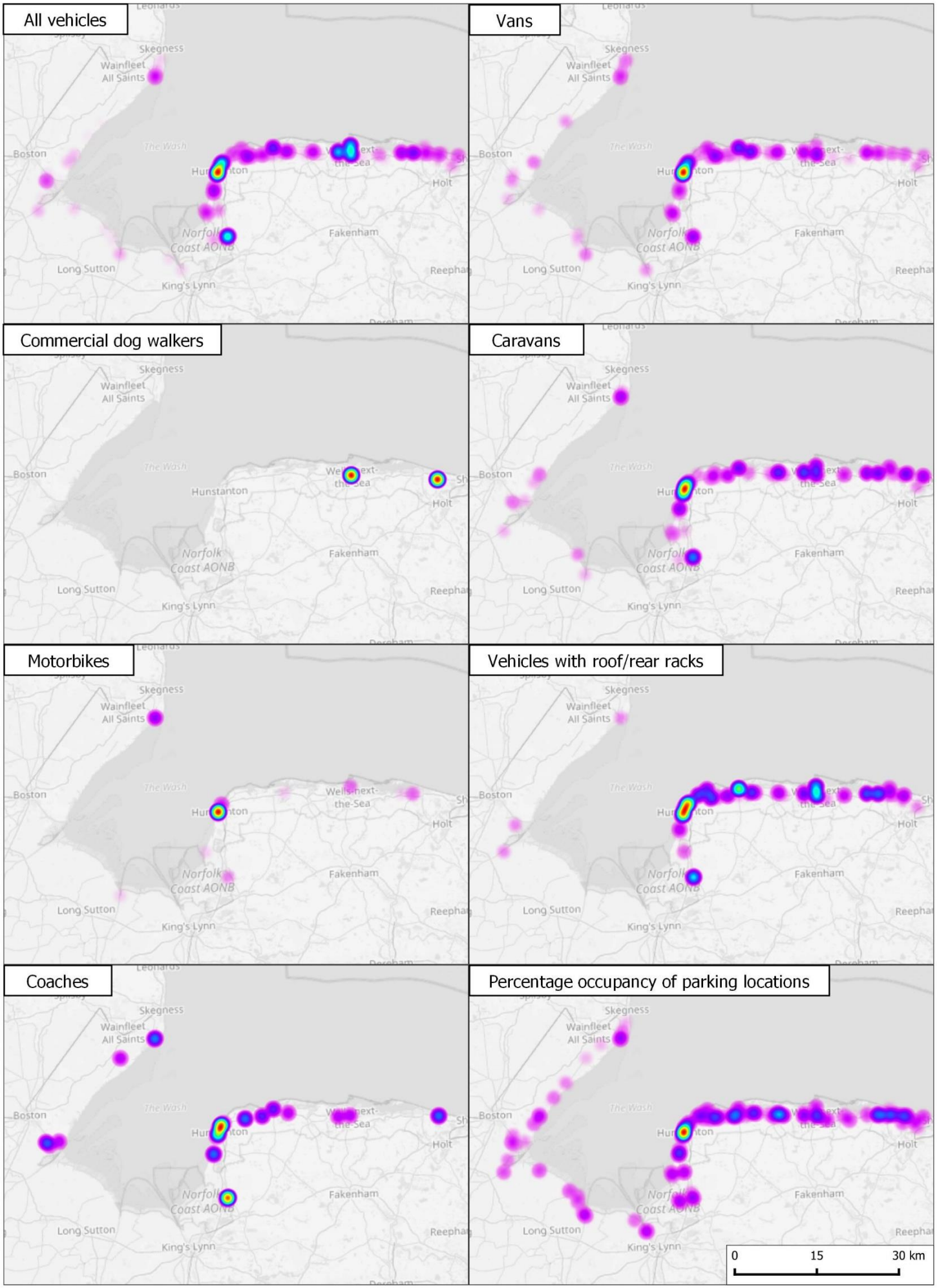


Table 5: Summary of parking data of the number of motor vehicles, including subsets for the types of vehicles on each of the transect dates.

Date	Day	Number of locations closed/inaccessible	Total motor vehicles	Camper-vans/ caravans	Vans	Vehicles with rear/roof racks	Motorcycles	Minibus, coach	Branded dog walking vehicles	Averaged percetnage occupancy
30-Mar	May term time weekday	4	**704**	**12 (1.7%)**	**59 (8.4%)**	**8 (1.1%)**	**0 (0.0%)**	**1 (0.1%)**	**0 (0.0%)**	**11%**
11-Apr	Easter Bank Holiday Monday	0	2,801	71 (2.5%)	103 (3.7%)	**83 (3.0%)**	8 (0.3%)	14 (0.5%)	**1 (0.0%)**	24%
16-Apr	Weekend in Easter holidays	0	**5,973**	176 (2.9%)	**113 (1.9%)**	157 (2.6%)	78 (1.3%)	9 (0.2%)	**1 (0.0%)**	**41%**
02-May	May Bank Holiday	2	2,961	97 (3.3%)	78 (2.6%)	45 (1.5%)	31 (1.0%)	8 (0.3%)	**0 (0.0%)**	29%
08-May	March term time weekend	0	3,373	**113(3.4%)**	115 (3.4%)	85 (2.5%)	**117 (3.5%)**	**19 (0.6%)**	**0 (0.0%)**	34%
Average		**-**	**3149.2**	**93.8 (3.0%)**	**93.6(3.0%)**	**75.6(2.4%)**	**46.8(1.5%)**	**10.2(0.3%)**	**0.4(0.0%)**	**27%**

7.6 The occupancy of vehicles at roadside locations was often greater than at car park locations, despite formal car parks typically being much larger (Table 6). The roadside locations often had more vans, campervans and caravans, whilst formal car parks more commonly had greater numbers of vehicles with rear/roof mounted racks.

Table 6: Summary metrics of number of vehicles and types of vehicles shown for the 3 types of parking locations.

Type	Average.capacity	Averaged percetnage occupancy	Average no. of total motor vehicles (±SE across all locations)	Average no. of vans	Average no. of camper-vans/ caravans	Average no. of vehicles with rear/roof racks
Car Park	113.4	30.6	30.8 ± 5.3	2.5	2.7	3.0
Roadside	34.1	51.3	12.2 ± 3.3	2.9	3.4	1.6
Verge/Layby/ Gateway	11.5	16.0	1.4 ± 0.4	1.2	1.6	1.3
Total	**67.5**	**27.5**	**18.0**	**2.4**	**2.7**	**2.7**

Vantage point results

7.7 Vantage point observations comprised a total of 7,913 people, 617 dogs, and 24 (active) boats. As such, the average numbers recorded on a single count were 1,582.6 people, 123.4 dogs, and 4.8 boats. The count totals on each date are summarised in Table 7 and plotted as an average count for each location in Map 28.

7.8 The activities conducted are summarised in Map 29, with key figures for the percentage of people dog walking and walking given in Table 7. The location of these people on the coast are shown as a percentage in Map 30, with the percentage of people below Mean High Water Mark (MHWM), including those on the water or on the seawall/ promenade/ dunes provided in Figure 9 and Table 7.

Table 7: The total numbers recorded from the 3 count units of people, dogs, and 'active' boats for each transect date. Along with a summary for key metrics, such as the percentage of dogs off lead and percentage of people below MHWM (including those on the water) or on the seawall/ promenade/ dunes. Tide states are indicated with a primary and secondary in brackets with the following codes (I = Intermediate, L = Low, H=High).

Date	Tide	People	Dogs	" Active " boats	% dog walking	% walking	% dogs off lead	% people below MHWM (inc. on water)	% people on the seawall/ promenade/ dunes
30/03/2022 May term time weekday	I (L)	130	55	0	45%	48%	87%	11%	69%
11/04/2022 Easter Bank Holiday Monday	I (H)	1016	103	1	13%	75%	54%	20%	61%
16/04/2022 Weekend in Easter holidays	I/L	3780	201	1	7%	75%	57%	22%	63%
02/05/2022 May Bank Holiday	L (I)	1223	149	7	18%	56%	64%	21%	56%
08/05/2022 March term time weekend	I (H)	1764	109	15	10%	62%	44%	28%	49%
Total		**7963**	**617**	**24**	**11%**	**69%**	**59%**	**23%**	**58%**
Average		**1592.6**	**123.4**	**4.8**	**11%**	**69%**	**59%**	**23%**	**58%**

7.9 Figure 10 and Map 31 provide temporal and spatial information on the proportion of dogs recorded on and off the lead during the vantage point counts, whilst Map 32 displays the distribution of the dogs recorded across the coastal profile.

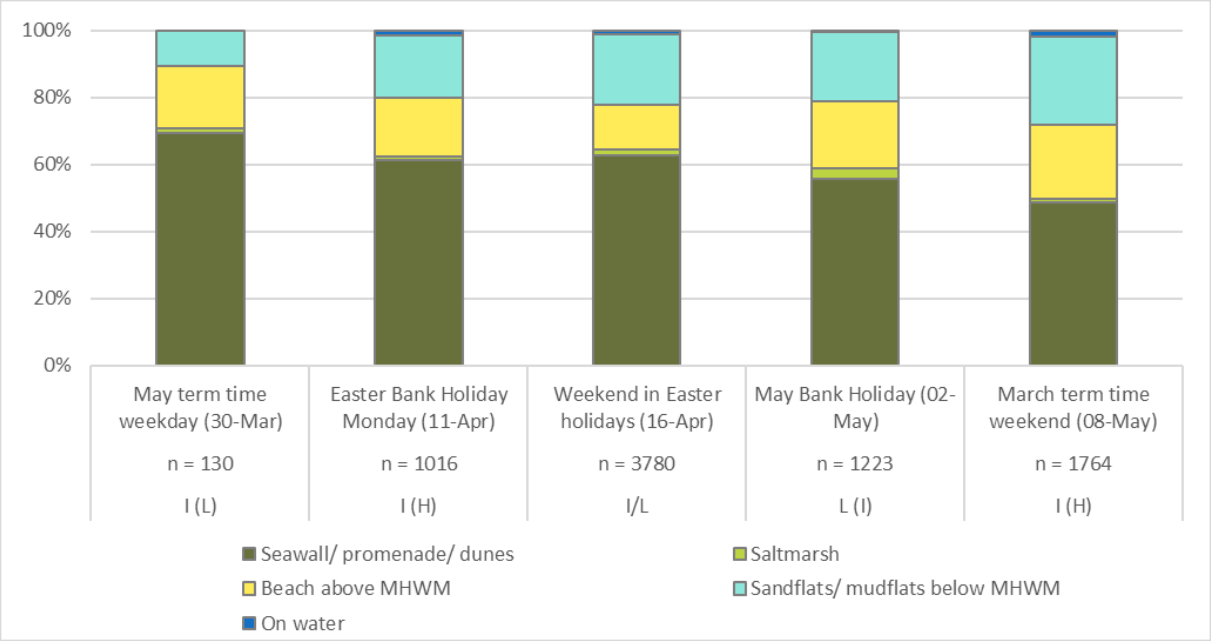


Figure 9: Relative proportion of people located in the different habitats on the 5 different dates. The sample size (n) for the number of people is given and the tide state.

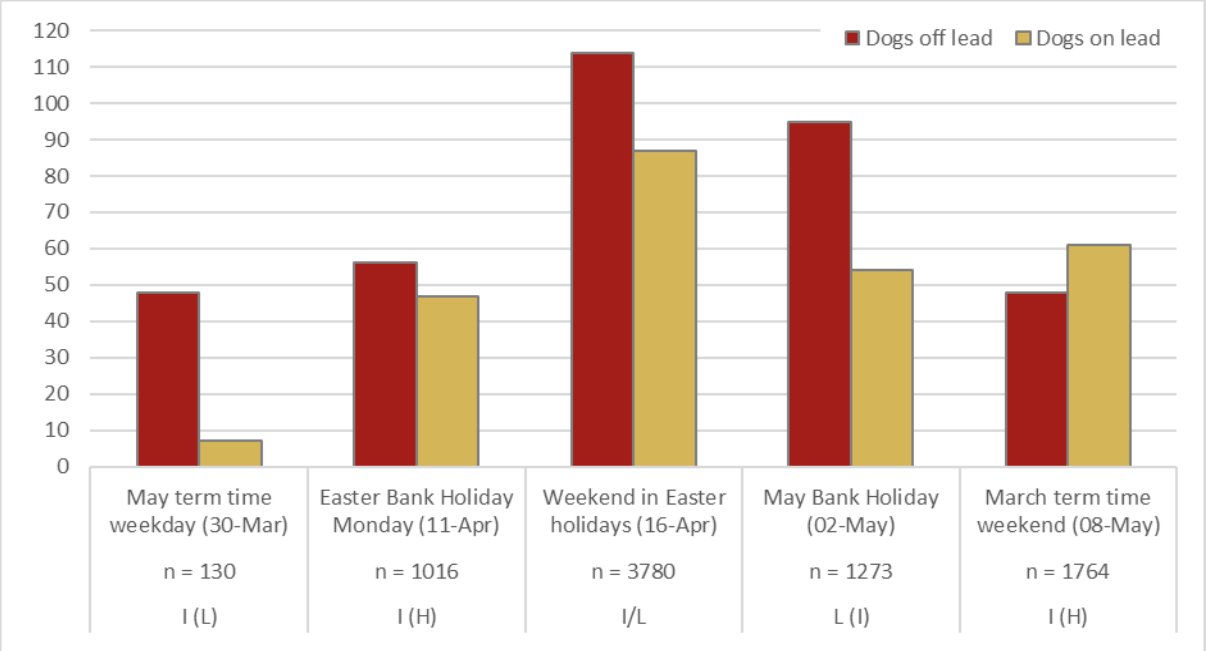
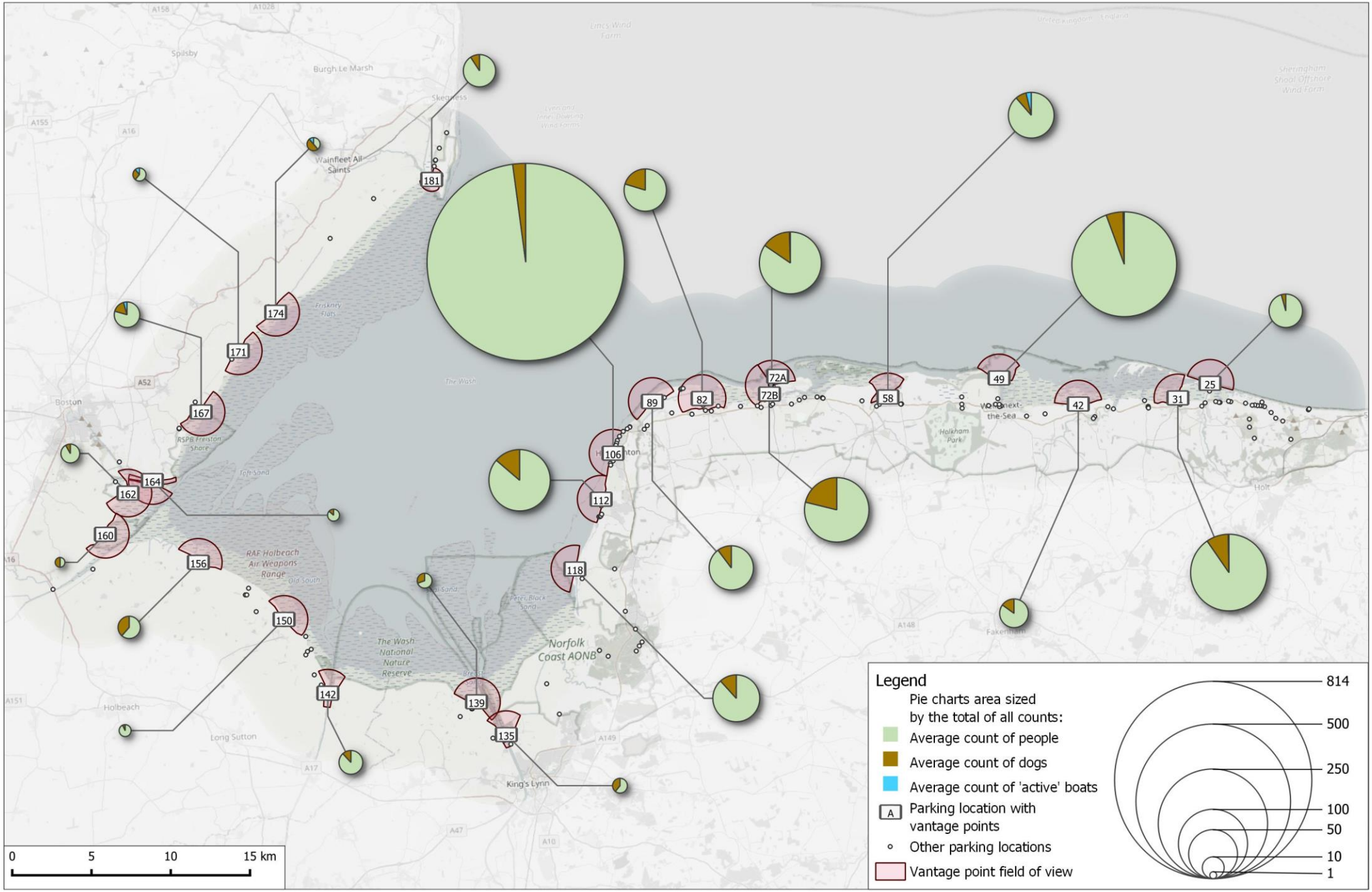
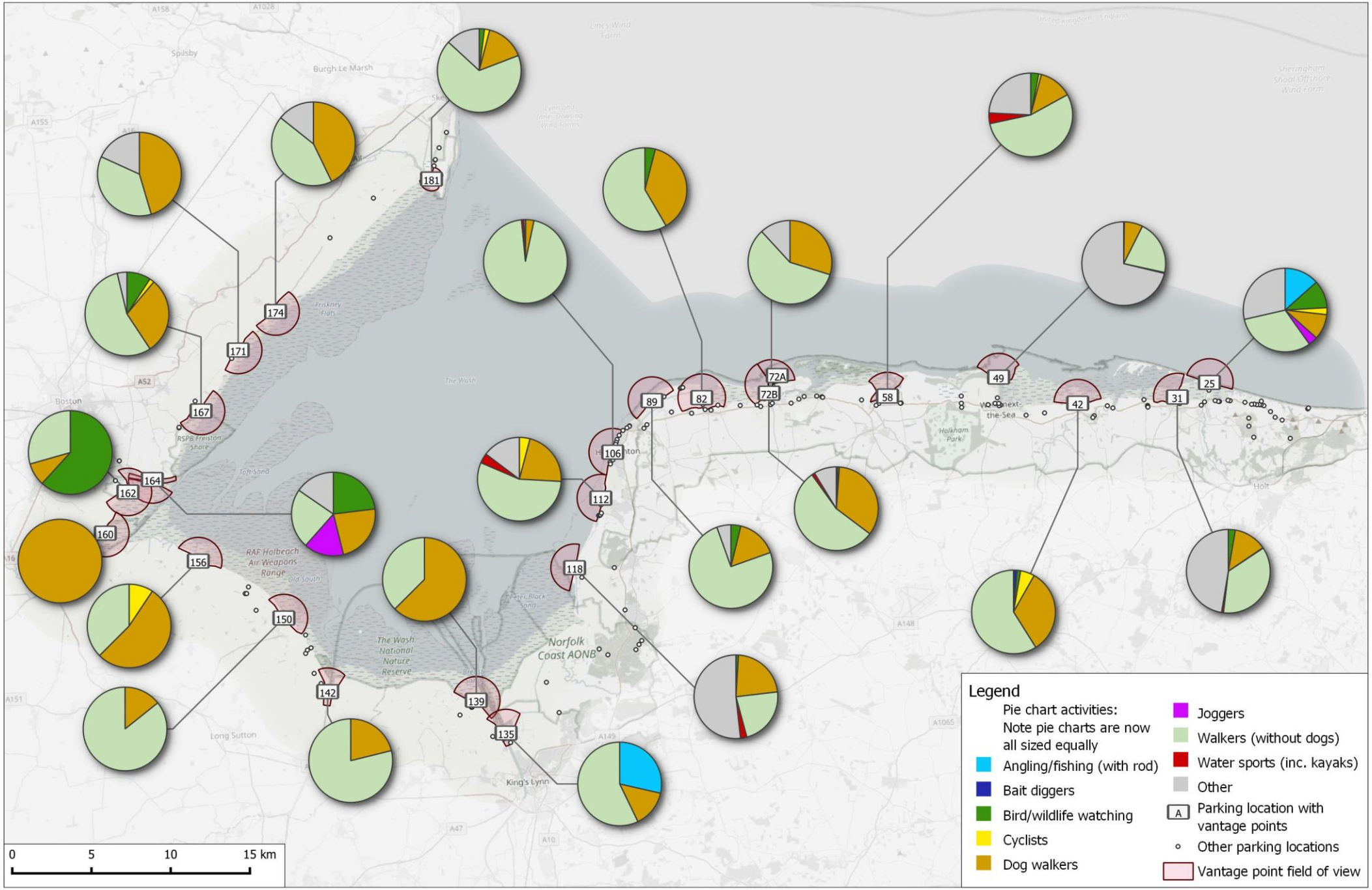


Figure 10: The total number of dogs on and off lead on the 5 different dates. The sample size (n) for the number of people is given and the tide state.

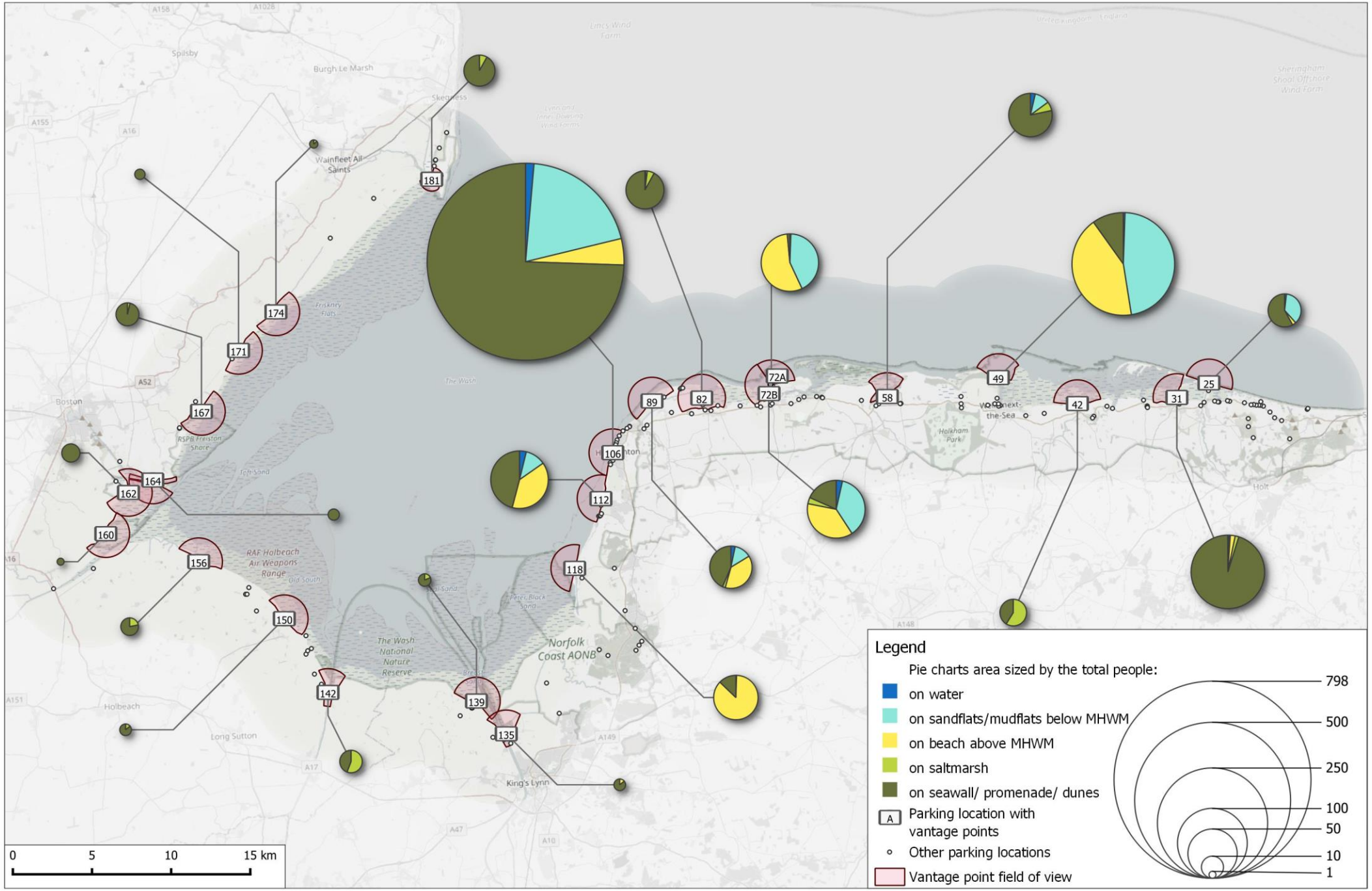
Map 28: Vantage point observations with pie charts to show average number of people, dogs and 'active' boats at each location



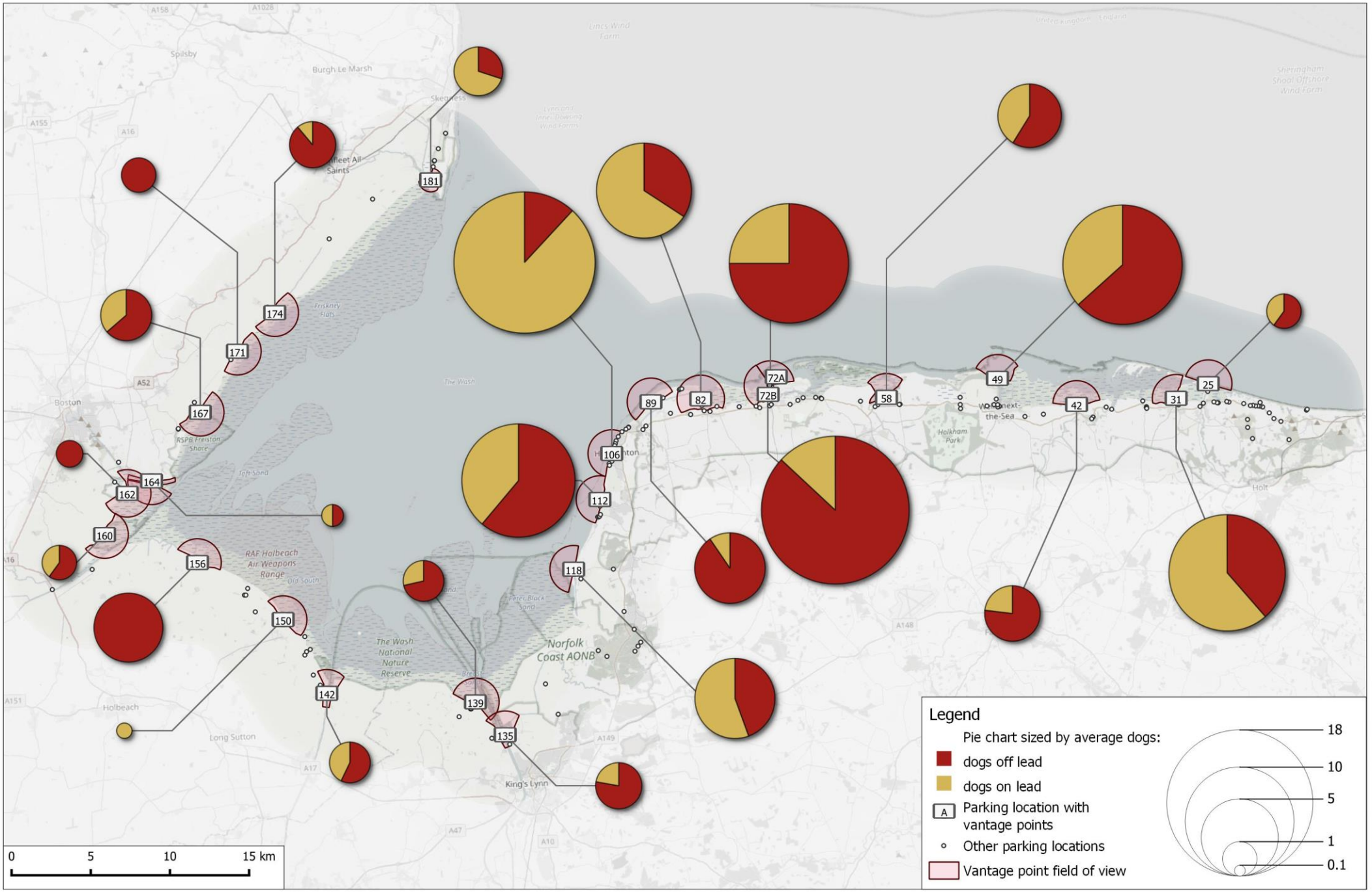
Map 29: Vantage point observations with pie charts to show average number of proportion of people conduting different activities



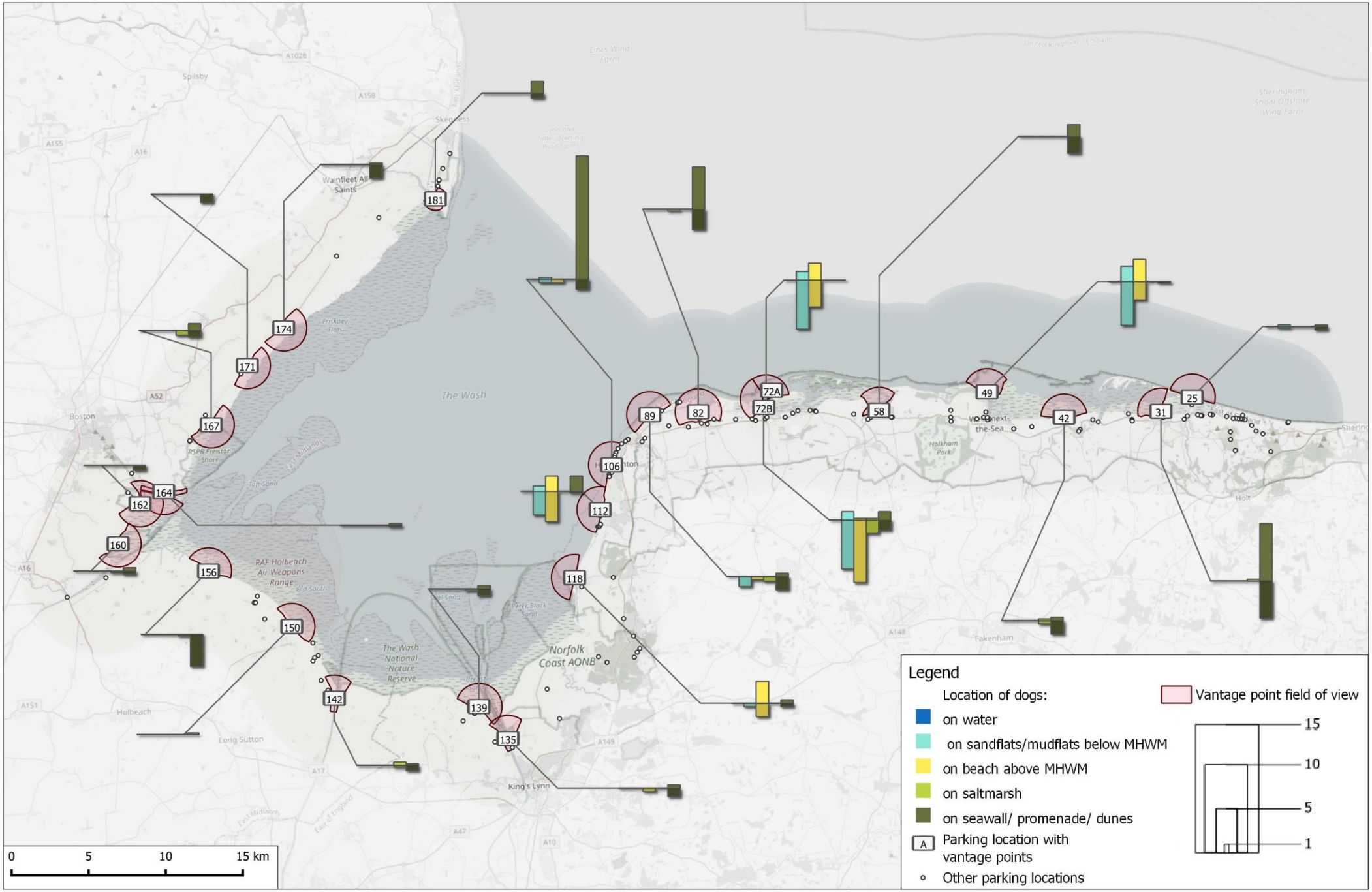
Map 30: Vantage point observations with pie charts to show average number of people, at each location, and where people where located on the coast



Map 31: Vantage point observations with pie charts to show average number of dogs, at each location, and whether dogs were on or off lead



Map 32: Vantage point observations of dogs and the location of the dogs. Lighter, positive bars are those on lead, while darker, negative bars are off lead



8. Standards required for each zone

Overview

8.1 Step 5 of the LAC process assigns quantitative measures to the indicators. These standards are the conditions that site managers and others would aim to achieve within each zone.

Data sources

8.2 Standards can potentially be derived in part using the data from the vantage point surveys and vehicle counts. Figure 11 provides an overview of the count data for selected metrics relevant to the standards. Vantage point counts were conducted at 24 locations and repeated 5 times. For each site we derived the mean value from the 5 visits and these data (for the 24 locations) are used in the figure. For those metrics relevant to linear length of coast we used the width of the survey arc (essentially the diameter) while the area figures are based on area of the arc. Selected metrics relating to people and vehicles for a selection of locations around the coast are given in Appendix 4.

8.3 Given that just only 5 visits were made to each location and data were collected from only a sample of locations, some caution has to be made in extrapolating these figures and using them to define our standards. The data collected provide a guide and enable us to suggest values that can be used for the standards, but over time and with long term monitoring in place these are likely to warrant review and further refinement.

8.4 Other standards can be derived from targeted monitoring of the relevant species and the habitats. Breeding terns and waders are monitored on a site-by-site basis by respective organisations and typically monitoring is undertaken annually. The supplementary advice for the relevant SPAs provides targets for the overall numbers of pairs of qualifying species (e.g. the target for Little Tern and the North Norfolk Coast SPA is 400 pairs).

8.5 Non-breeding waterbirds are counted through the Wetland Bird Survey ('WeBS')[20] with core counts (at high tide) taking place throughout the year.

[20] See https://www.bto.org/our-science/projects/wetland-bird-survey

8.6 The supplementary conservation advice for the relevant European sites sets or will set targets for particular habitat types on the European sites[21] and Natural England's Favourable Condition Tables provide an established means to assess condition.

Proposed standards

8.7 Standards are summarised in Table 8, using the data collected and other sources as available to set broad targets for each type of zone.

Discussion

8.8 Given that the data collection undertaken as part of this project involved 5 visits to each location in the spring, with data collected from only a sample of locations, some caution has to be made in extrapolating these figures and using them to define our standards. The data collected provide a guide and enable us to suggest values that can be used for the standards, but over time, with long term monitoring in place, these are likely to warrant careful testing, review and further refinement.

8.9 It should be noted that the standards do not differentiate between types of access (except for those with dogs) and this may warrant more detailed consideration once longer-term data are available. The vantage point counts did separate the counts by activity and it may be relevant to separate out permitted activities (such as wildfowling, shellfishing, bait digging etc) and even the presence of people working – for example reserve staff, Environment Agency, farmers etc.

8.10 It should also be noted that the standards relating to vehicles and % occupancy are inter-linked. For areas such as Town and Village where the aspiration is that these are busy areas and a focus for access, then the aim is that these have high numbers of vehicles and also that there are unoccupied parking spaces such that these areas can continue to absorb increases in number of visitors and people are not put off due to limited parking. By

[21] Those for the North Norfolk Coast SAC being the most relevant, however site specific details are not available at the time of writing https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0019838&SiteName=norfolk&SiteNameDisplay=North+Norfolk+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=1

contrast, Wild Places are remote, more low-key and with limited management provision. Standards for these areas would ensure these areas have low numbers of vehicles but higher % occupancy as there should be limited parking provision. Ensuring a low number of spaces potentially puts a ceiling on visitor numbers to these areas.

8.11 A further point to make is that the metrics used are less relevant for areas away from the coast, and many areas mapped as Town and Village or Local Greenspace will not necessarily have coast, intertidal habitats etc. While such sites can have standards they should potentially be calculated differently. The management aims would be around maintaining or increasing access and therefore standards could reflect high levels of use (e.g. high numbers of vehicles, high numbers of dogs off lead etc), however applying a standard based on km of shoreline or by area of intertidal habitat can't apply. Standards could therefore be people per ha of the site or total vehicles per ha rather than people per km of shoreline or area of intertidal habitat.

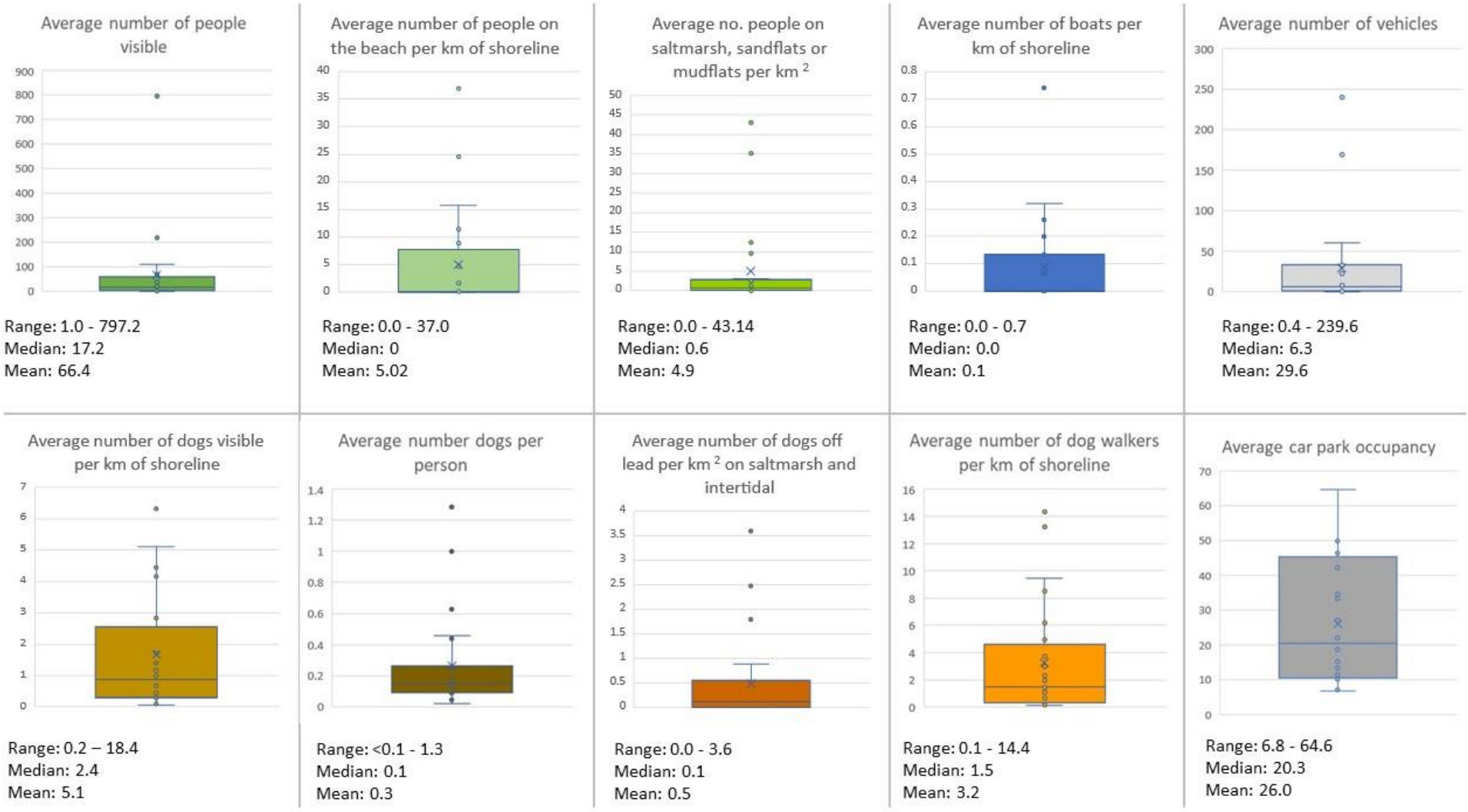


Figure 11: Summary data from counts – data from 24 locations (the vantage point locations) with 5 visits to each. Means generated for each site and used in the data here.

Table 8: Standards for the different zones. Relevant data: VP = average value from a series of vantage point counts, (as per the vantage point counts in this report); VC = average value from a series of vehicle counts (as per counts of parked vehicles in this report). Note that for Local Greenspace most standards would not apply as most (all?) sites are likely to be away from the coast.

Indicator	Relevant data	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only
Average number of dogs off lead per km of shoreline, on beach habitat (i.e. above and around tideline).	VP	High (3+)	High (3+)	Medium (2-4)	None	Low (0-2)	None
Average number of dogs off lead on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2.	VP	High (3+)	High (3+)	Medium (2-3)	None	Low (1-2)	None
Number of people dog walking per km of shoreline.	VP	High (8+)	High (8+)	High (8+)	Low (0-1)	Medium (1-8)	None
Average number of people on beach (i.e. above and around tideline), per km of shoreline.	VP	Very high (35+)	Medium (5-20)	High (20-34)	Medium (5-20)	Low (0-5)	None
Total people on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2.	VP	Very high (30+)	Medium (10-20)	High (20-30)	Low or None (0-5)	Low (0-10)	None
Total numbers of boats per km of shoreline.	VP	Very high (0.25+)	Medium (0.1-0.2)	High (0.2-0.25)	Low or None (0-0.1)	Low (0-0.1)	None
Total numbers of vehicles per km of shoreline	VC	Very high (100+)	Medium (15-75)	High (75-100)	High (75-100)	Low (0-15)	Low or None (0-15)
Average occupancy of car park – the % of car park spaces occupied, on average	VC	Low (0-15)	Medium (15-45)	Low - Medium (15-45)	Low (0-15)	High (45+)	High (45+)
Territory maps to show locations of Ringed Plover, Oystercatcher territories plus colonies of Little Tern	Dedicated monitoring of each species	Low chance that suitable habitat occupied	Low chance that suitable habitat occupied, if present	Some suitable habitat occupied	All suitable habitat utilised	Most suitable habitat occupied	All suitable habitat utilised

Indicator	Relevant data	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only
Number of territories and number fledged for each of the three species	Dedicated monitoring of each species	Low proportion successful or None	Low proportion successful or None	Medium proportion successful	High proportion successful	Medium proportion successful	High proportion successful
Total number of each species of seal	Dedicated monitoring of each species	Low or None	Low or None	Low to Medium (remoter areas only)	High	Medium to High	High
Numbers of feeding waders and waterbirds at low tide along stretches of foreshore	Low tide WEBs	Low or None	Low or None	Low to Medium (remoter areas only)	High	Medium to High	High
Distribution and presence of roosts	Core Count WeBS	Unlikely to be any	Unlikely to be any	Remoter areas only	Present and regularly used with often high numbers	Present and regularly used with often high numbers	Present and regularly used with often high numbers
Use of selected roosts in terms of numbers of birds and species present	Core Count WeBS	Unlikely to be continued use	Unlikely to be any	Remoter areas only	Present and regularly used with often high numbers	Present and regularly used with often high numbers	Present and regularly used with often high numbers
Area and condition of saltmarsh	Condition assessment	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access
Area and condition of vegetated shingle (perennial vegetation of stony banks)	Condition assessment	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access

Indicator	Relevant data	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only
Area and condition of foredune ('shifting dunes')	Condition assessment	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access	Where present & designated, no loss or deterioration due to access	Where present, no loss or deterioration due to access

9. Acceptable zones

Overview

9.1 A map of zones was generated in the face-to-face workshop held in King's Lynn in July 2022 (see Section 2.5 for details). The following section provides the results of the mapping exercise. The map represents the main output from this project, and it is anticipated this will provide a basis for the strategic management of access around the coastline and be subject to regular review and update in the future by partners.

Workshop

9.2 The workshop was well attended, with a wide mix of stakeholders, including representatives from Local Authorities, nature conservation organisations, tourism agencies, and wildfowling groups. An attempt was made to ensure that a cross-section of stakeholder types was represented within each of the five geographically split break out groups, although this was not entirely possible due to last-minute cancellations from several invitees. The subsequent sharing of the draft map online however allowed those invitees unable to attend on the day to comment upon the workshop output.

9.3 A corollary of the unplanned non-attendance described above was an imbalance in the group size or type of stakeholder organisations represented within a small number of breakout groups, such that certain groups for certain parts of the coast were relatively small.

Feedback and points arising from the workshop and generation of the maps

Within workshop

9.4 At the start of the workshop some participants were initially challenged by the zone definitions, although any such confusion was allayed by the facilitation team. In particular, clarity was sought on permitted activities within Wild Places and Wildlife Only zones and it was agreed that permitted activities could occur in both, with the zone descriptions updated to reflect these changes. Once these initial questions had been addressed the zones typology worked well and seemed relatively intuitive to many. Once groups were drawing on the paper maps there was lively and informed discussion,

and many found the exercise beneficial in helping them consider what relative proportions of different types of zone would be most appropriate in different locations.

9.5 Some breakout groups mapped a larger proportion of their respective section than others, with this influenced both by the time available for discussion and the confidence/specific knowledge base within the group. For example some groups went further inland or were more consistent in the coverage they achieved.

9.6 The systematic application of the same minimum mapping scale (30ha), and the process by which habitat mosaics were dealt with, also varied across different breakout groups. This was particularly the case for coastal wildlife sites supporting a network of open terrestrial or wetland habitats and incorporating a network of formalised access routes (such as Snettisham RSPB and Cley NWT Reserves). In the case of the former, the entire site was classified within a single zone type, whereas at the latter site, wetland areas and the small-scale raised bank/pathway network running between them were placed within different zones (i.e. the paths were assigned to be wildlife tourism and the open wetlands viewed from the paths as wildlife only).

9.7 Furthermore, one group came up with two different zone options, reflecting different views within the group while other groups reached a broad consensus and single map. The extent to which this was aspirational however perhaps varied between groups.

Post-workshop feedback

9.8 Subsequent to the workshop, comments were received on the initial draft map (as digitised in the workshop) from a range of stakeholders, with detailed feedback provided by Natural England and the RSPB in particular. This led to the following main revisions, reflecting comments received and our review of the mapping to ensure some further consistency across the study area: map:

- The reclassification of Snettisham RSPB as a Wildlife Tourism site;
- The classification of Frampton Marsh RSPB and Frieston Shore RSPB as Wildlife Tourism sites;
- The entirety of Cley NWT Reserve being reclassified as a Wildlife Tourism site;
- The presentation of two zoning options for the south-western Wash; and,

- Areas of the saltmarsh along the edge of the South Lincolnshire Wash being reclassified as Wild Places (formerly lumped with adjoining areas of mudfalt as Wildlife Only areas).

9.9 It is important to note that there was however some disparity in the suggestions with respect to how areas of saltmarsh and mudflat around The Wash should be mapped. The presence of navigation channels within Wildlife Only Zones across The Wash were also identified as an important consideration during any subsequent communication of the mapped output/zoning with the wider public.

9.10 Stakeholders also questioned the validity of only mapping the terrestrial/intertidal units of marine designated sites, suggesting that the unmapped marine areas should be classified as Wild Places. We have nevertheless retained the terrestrial scope of this report and suggest that the delineation of marine zones is considered by a wider range of stakeholders during future rounds of consultation.

9.11 Some stakeholders also suggested that specific parts of the study area are suitable for enhancement/rewilding and, as such, should be mapped as Wild Places when using an aspirational zoning approach. We have however avoided doing this at this stage of the process and would again recommend that such proposals are discussed more widely amongst stakeholder groups prior to their application.

Map of zones

9.12 The maps are shown in Maps 33 – 39. Map 33 is the map generated during the workshop and crudely digitised during the day, it includes a different option proposed for one area of the coast where the group could not reach consensus. Map 34 shows a more refined version of the main map shown in Map 33, following comments and reflection after the workshop. Maps 35-39 show the same information as Map 34, this time for different sections of the coast.

9.13 These outputs highlight that a large proportion of the study area was mapped during the workshop, with a tendency to mapping smaller contiguous areas east of The Wash producing a more varied mosaic of zones. Relatively large expanses were classified as Wildlife Only zones (some 60% of the area mapped, Table 9), including large areas of mudflats across The Wash, Holme NOA/NWT Reserve, Scolt Head, Burnham Saltmarshes and much of Blakeney Point and outer Blakeney Harbour. Wild Places accounted

for a further 18% of the area mapped (Table 9), primarily encompassing the saltmarsh and intertidal habitat bordering The Wash and sections of the north-west Norfolk coastline. This zoning was however also applied to inland riparian corridors in the eastern half of the study area.

9.14 A smaller area overall was identified as Wildlife Tourism zones, with these largely comprising the 'destination' nature reserves such as Titchwell RSPB Reserve and Cley NWT Reserve. Destination Sites were, with the exception of the Skegness beachfront, largely restricted to Norfolk, with concentrations along the coastal strip between Hunstanton and Heacham, Wells Quay/Wood, and Brancaster Harbour.

9.15 Areas of Town and Village corresponded with existing settlements, with areas of Local Greenspace largely contiguous with them, or located in close proximity. Holkham Park and the Coastal Park at Heacham were also classified as this zone type.

Table 9: Summary of each zone and the area (hectares) of each zone, and the relative percentage of each zone.

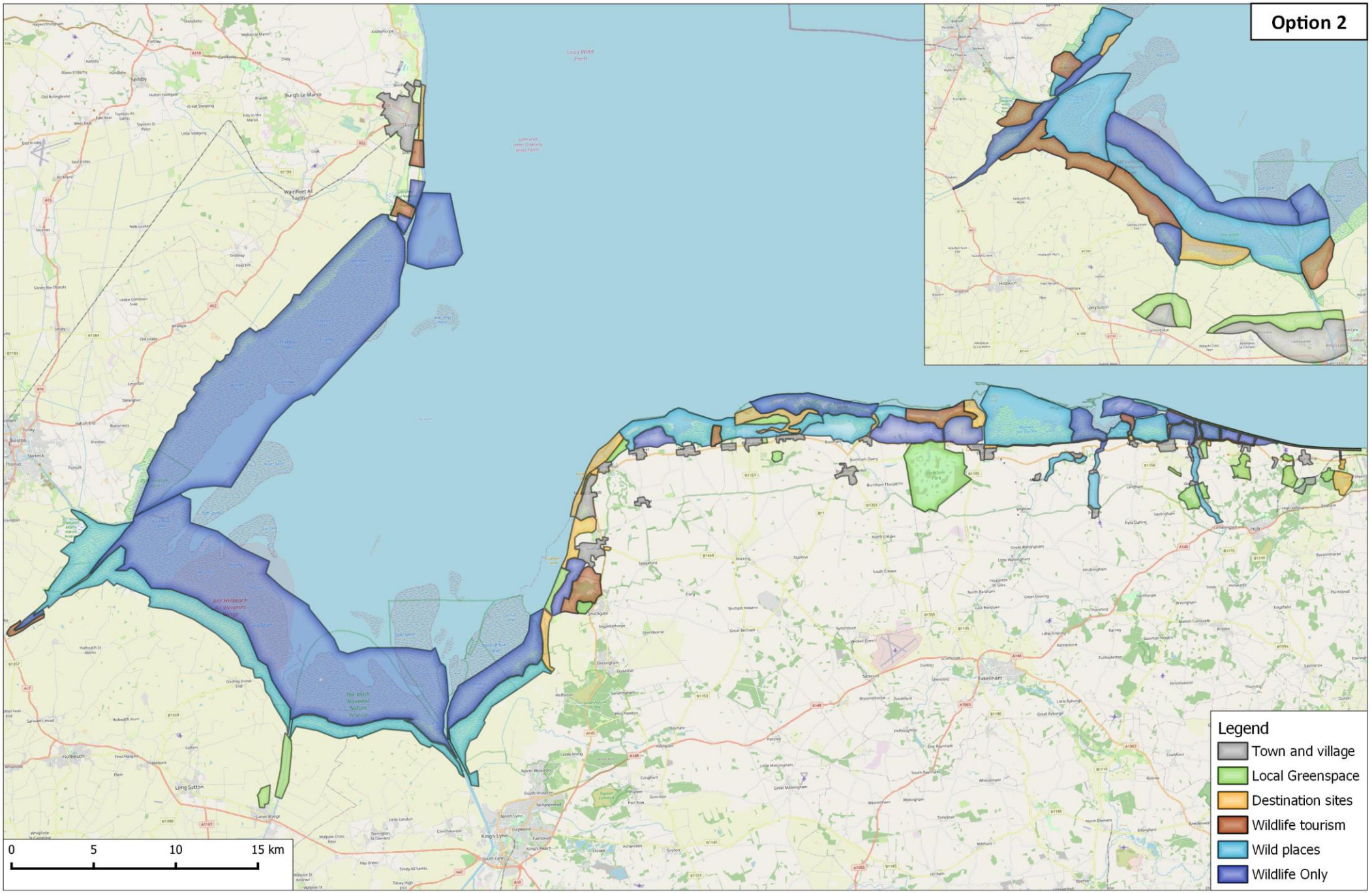
Zone	Area (Ha)	% of area categorised in each zone
Town and Village	1801	4%
Local Greenspace	2319	6%
Destination Sites	1172	3%
Wildlife Tourism	3759	9%
Wild Places	7447	18%
Wildlife Only	25,023	60%
Total	**41,521**	**100%**

9.16 The relative amounts of different priority habitats are summarised in Table 10. This highlights that Town and Village, Local Greenspace and Destination Sites are the only zones to have significant areas of woodland while almost all the lowland heathland included in the zones has been mapped as Local Greenspace. Areas mapped as Local Greenspace do also include some coastal habitats such as saltmarsh and sand dunes.

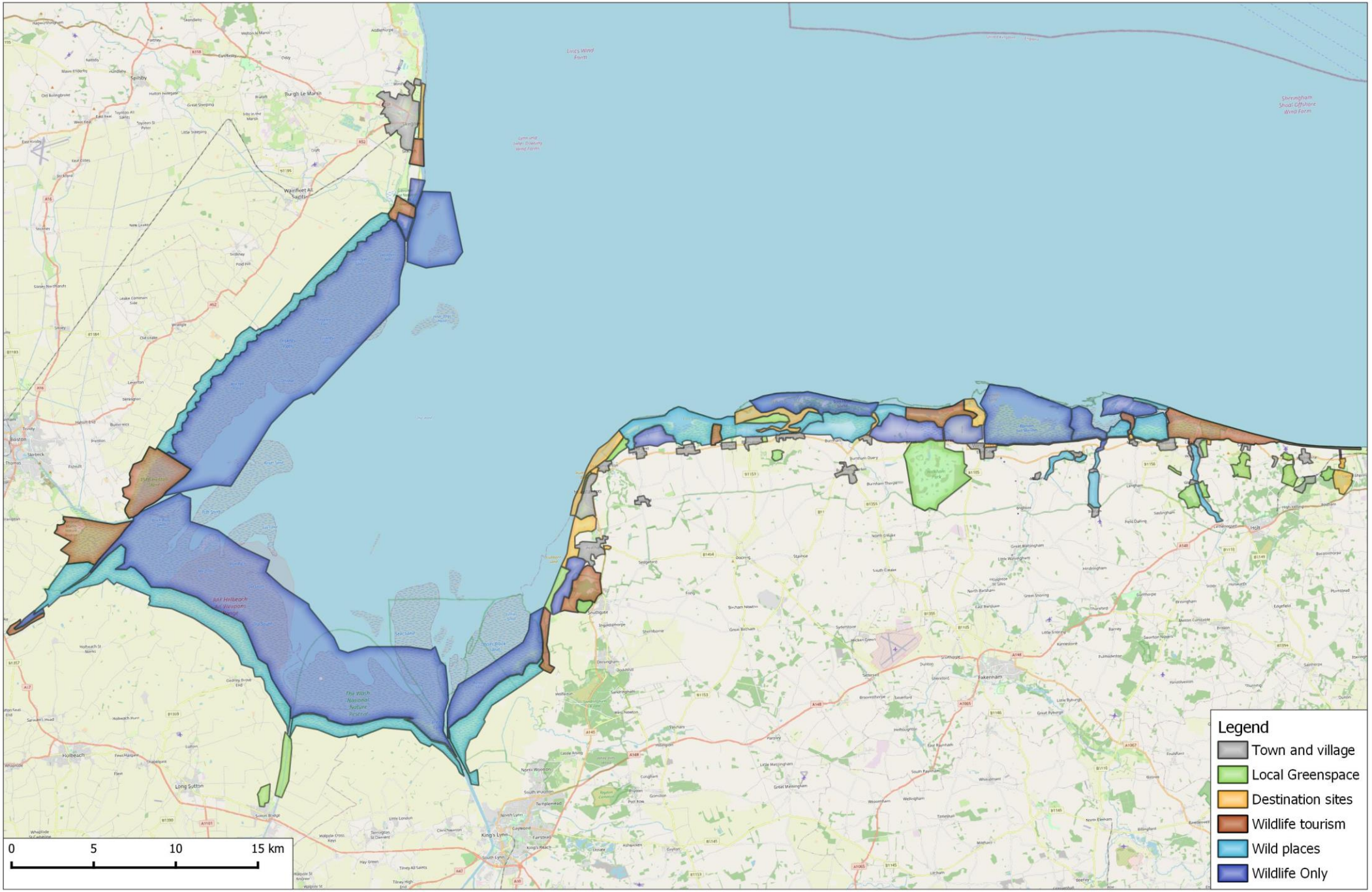
Table 10: Area (hectares) and percentage of priority habitat within each of the 6 types of zone. Bold text indicates a value in the top 3 for each column. *No single habitat relates to areas with a mosaic or where the main habitat is not necessarily clearly defined.

	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only
No single main PHI habitat present*	**9.4 (1%)**	88.6 (4%)	**544.4 (46%)**	**912.7 (24%)**	**945.2 (13%)**	**10456.4 (42%)**
No PHI habitat present	**1725.5(96%)**	**1311.7 (57%)**	**417.7 (36%)**	**612.7(16%)**	**555.9 (7%)**	**6391.6 (26%)**
Coastal saltmarsh	1.4 (0%)	22.2 (1%)	24.0 (2%)	**1055.8 (28%)**	5283.6 (71%)	**1659.1 (7%)**
Mudflats	0.4 (0%)	6.0 (0%)	59.7 (5%)	165.2 (4%)	**254.5 (3%)**	5619.1 (22%)
Deciduous woodland	**49.6 (3%)**	**498.7 (22%)**	**87.8 (8%)**	100.0 (3%)	34.9 (0%)	13.4 (0%)
Coastal and floodplain grazing marsh	6.2 (0%)	46.0 (2%)	<0.1 (0%)	535.3 (14%)	173.6 (2%)	560.7 (2%)
Coastal sand dunes	3.8 (0%)	124.2 (5%)	25.0 (2%)	133.5 (4%)	135.0 (2%)	199.8 (1%)
Lowland heathland	0.2 (0%)	**192.6 (8%)**	0 (0%)	10.3 (0%)	0 (0%)	0 (0%)
All other habitats	2.3 (0%)	28.5 (1%)	12.3 (1%)	231.1 (6%)	65.2 (1%)	124.5 (0%)
Total	**1798.8 (100%)**	**2318.4 (100%)**	**1171.0 (100%)**	**3756.7 (100%)**	**7447.8 (100%)**	**25024.5 (100%)**

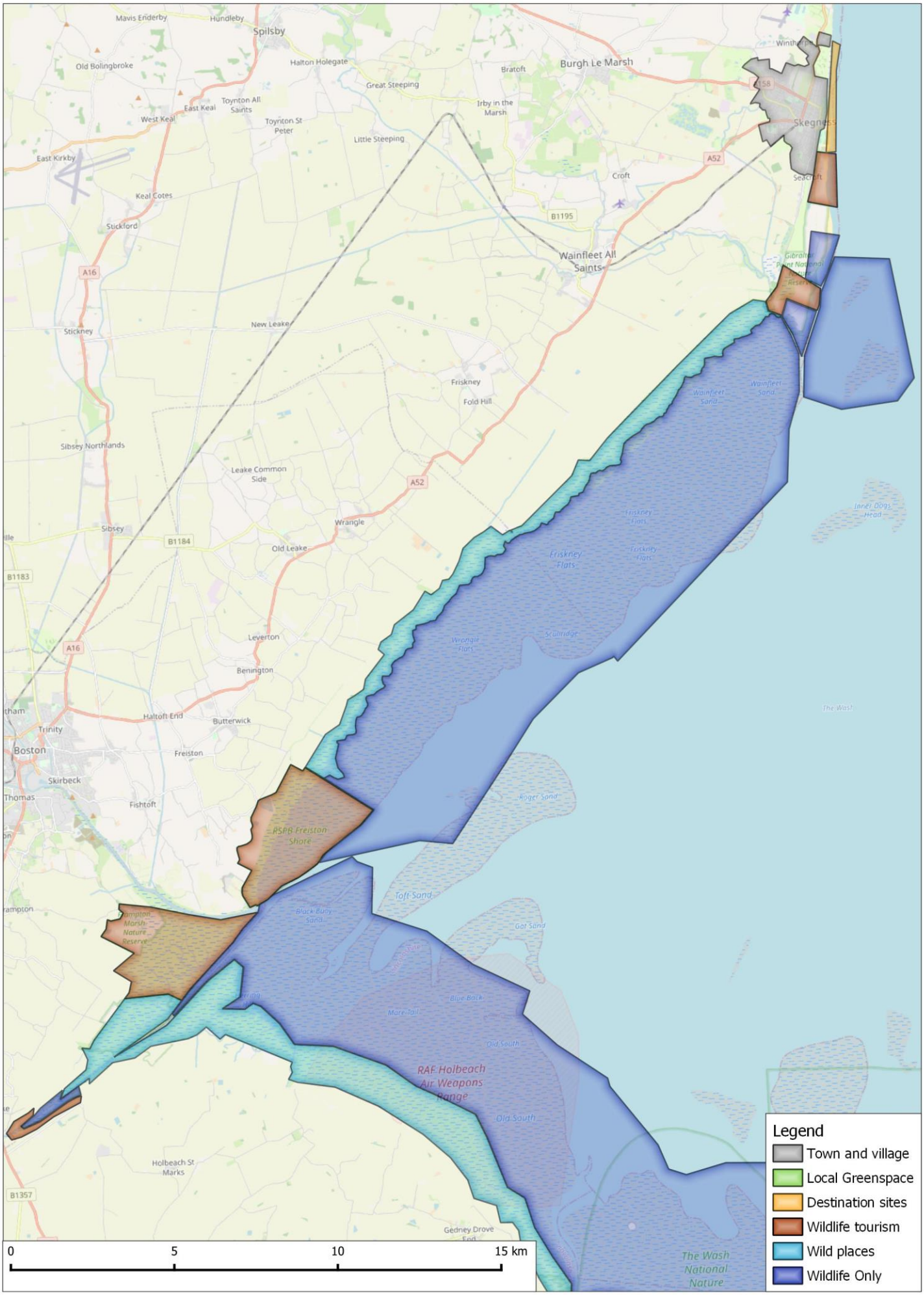
Map 33: Overview of zones as produced as a first draft from the workshop, with an inset map of a second option produced by one group



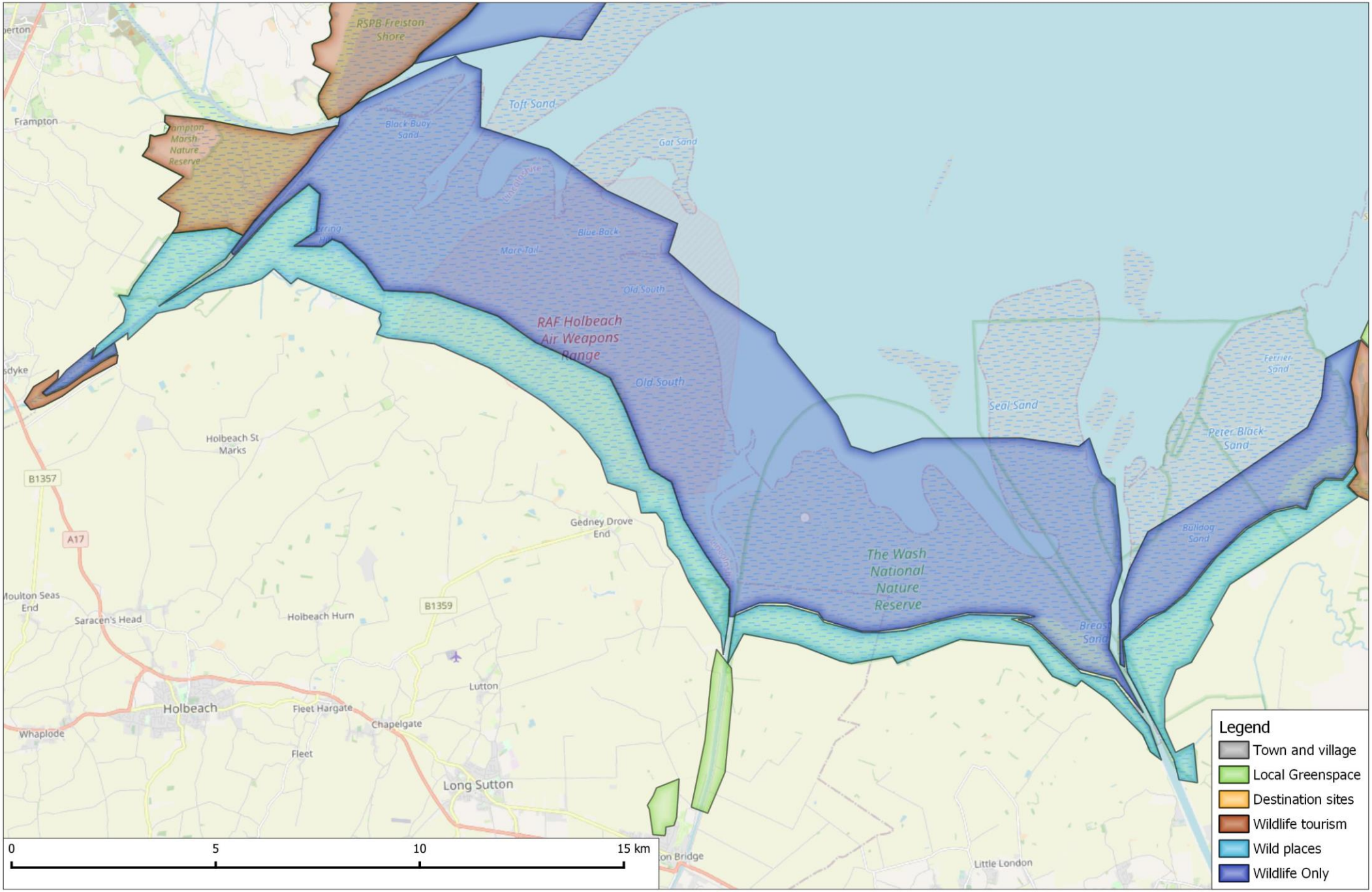
Map 34: Overview of aspirational zones around The Wash & North Norfolk Coast (as produced following further comments after the workshop)



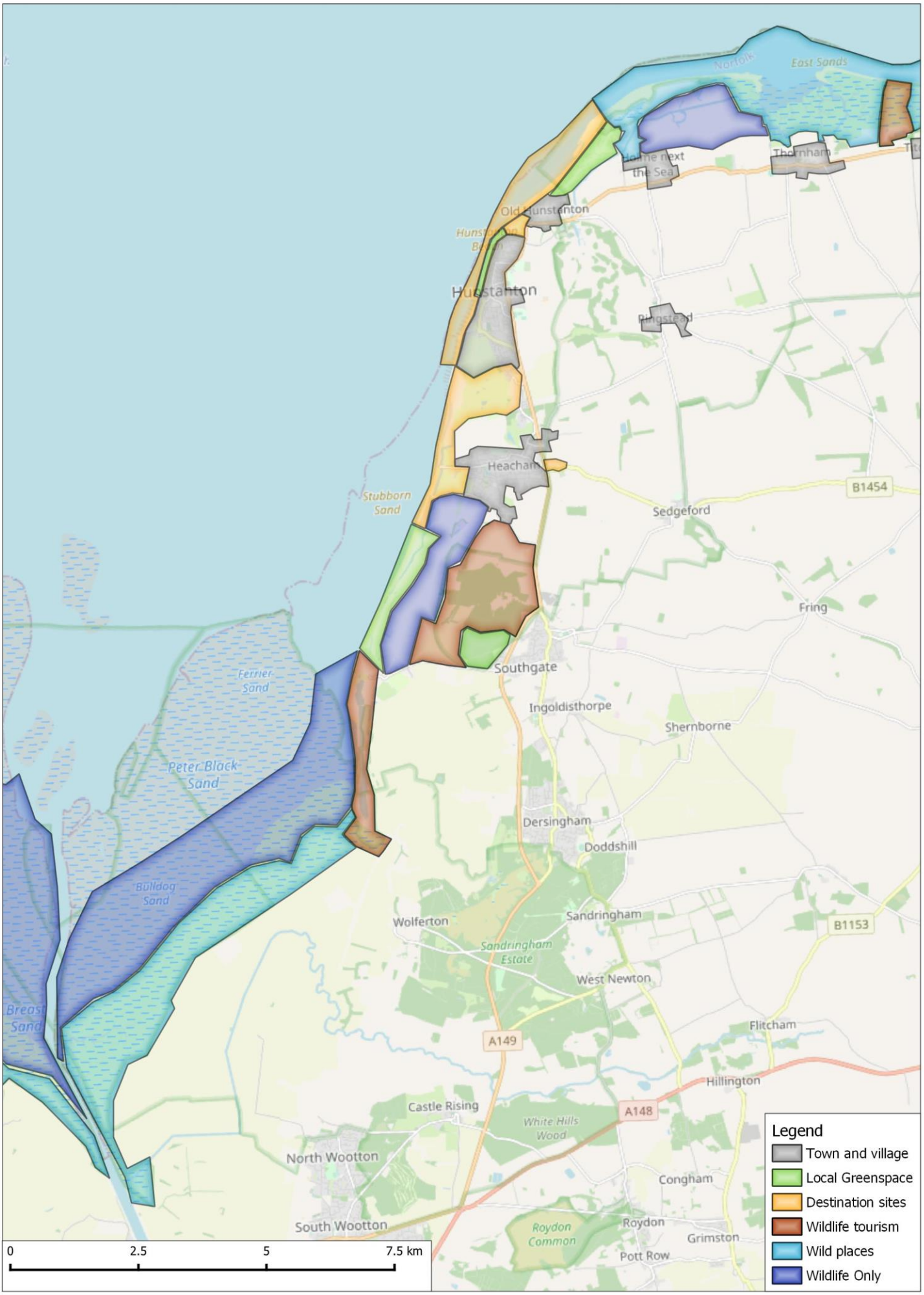
Map 35: Overview of aspirational zones - Gibraltar Point to Boston (produced following further comments after the workshop)



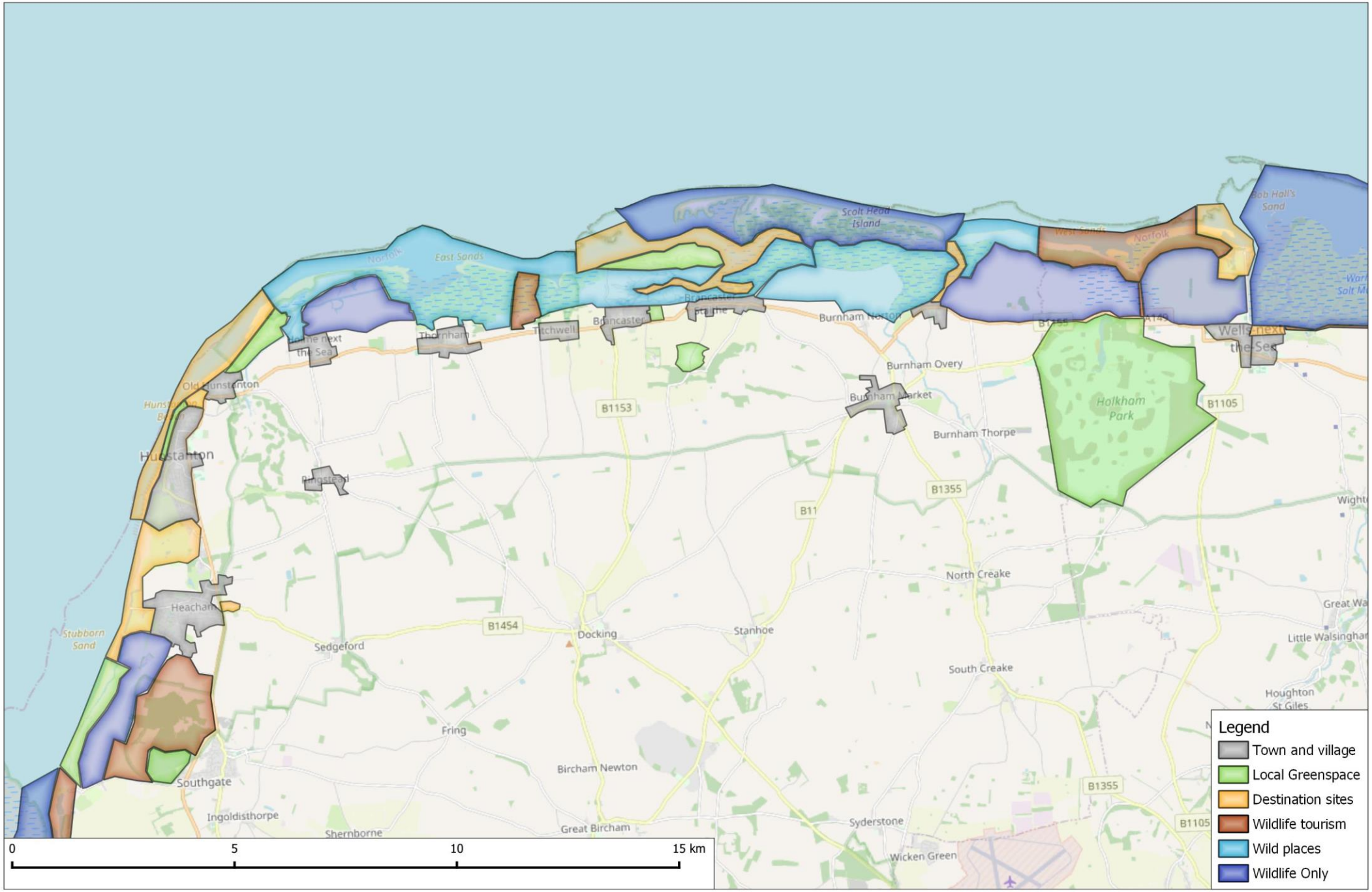
Map 36: Overview of aspirational zones - Boston to King's Lynn (produced following further comments after the workshop)



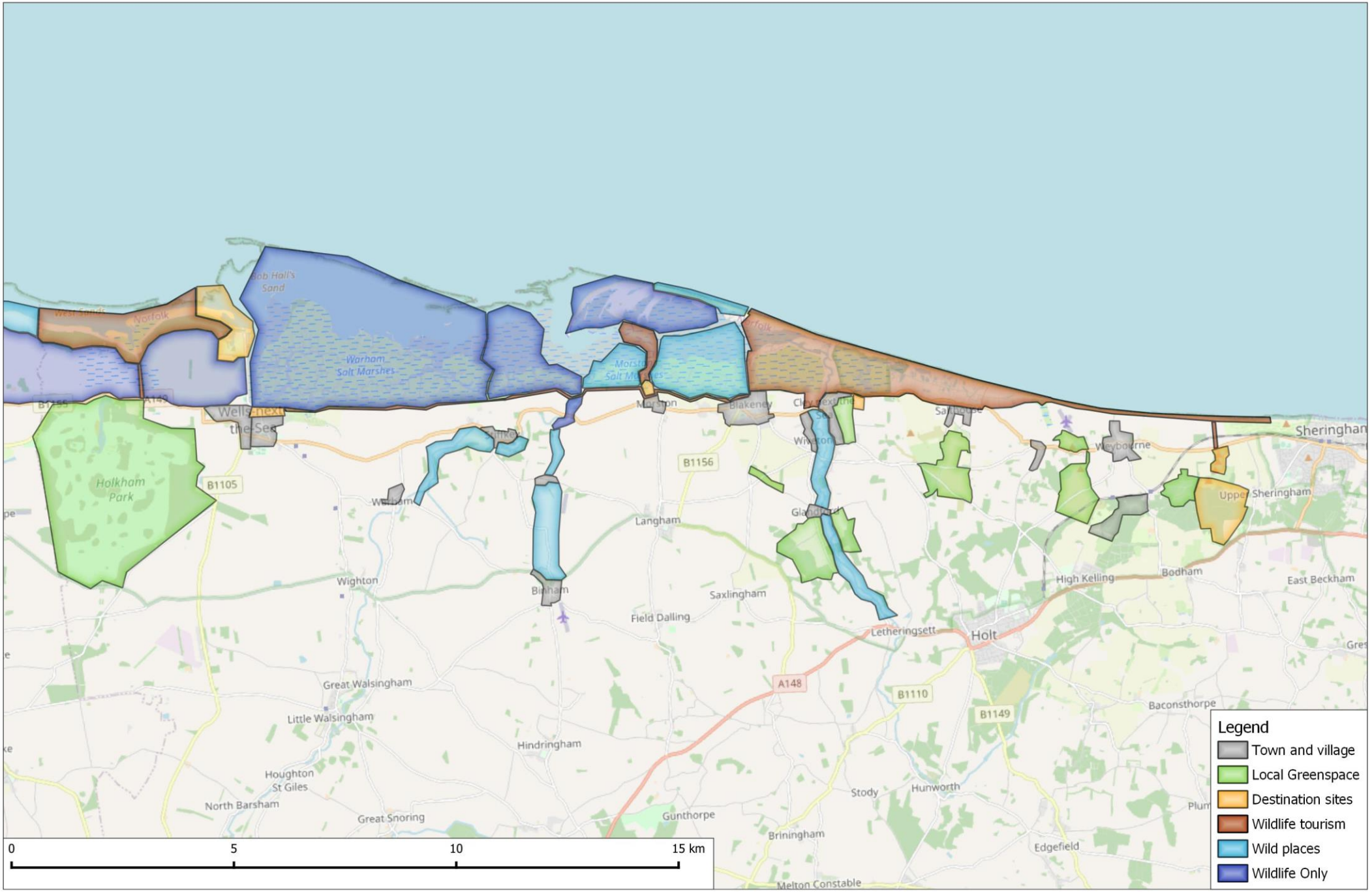
Map 37: Overview of aspirational zones - King's Lynn to Hunstanton (produced following further comments after the workshop)



Map 38: Overview of aspirational zones - Hunstanton to Wells (produced following further comments after the workshop)



Map 39: Overview of aspirational zones Wells to Sheringham (produced following further comments after the workshop)



10. Management Actions

Overview

10.1 This section sets out the range of visitor management approaches that are likely to be relevant and highlights which are appropriate for each kind of zone. It essentially provides a toolkit of measures that can be used to maintain the standards within each zone and – in line with monitoring results – be applied as necessary where standards are exceeded.

Introduction

10.2 The zone definitions are very broad and within each type of zone a range of opportunities for access will exist and a range of management options might be relevant. Types of management are identified in the zone definitions (see Table 3) and these describe the broad management for access that is relevant in each zone. The descriptions are repeated below:

- **Town and Village**: Beaches and coast areas with lots of visitor infrastructure (jetties, slipways, beach facilities) and management to control anti-social behaviour and visitor safety.
- **Local Greenspace**: Encompassing public rights of way and the wider countryside through to sites such as Country Parks. Dedicated infrastructure for dog walking (bins, fencing, parking) could be present alongside other recreation use. Not over promoted.
- **Destination Sites**: Management focused around car parks and entry points. Well promoted sites and destinations for particular activities. Localised management around specific features/seasonal or particular activities.
- **Wildlife Tourism**: Promoted sites. Highly managed with fixed trails, screens, hides, face-face engagement. Sites promoted and visitors set back from wildlife and facilities to view.
- **Wild Places:** Limited management provision and low key. Access potentially limited due to topography and terrain.
- **Wildlife Only**: Access for general recreation use restricted through fencing, signs, barriers etc

10.3 As such, there are four zones where visitors are encouraged and access promoted and a range of visitor facilities are provided. Town and Village and Destination Sites in particular will aim to draw visitors from a wide area including tourists, and the facilities and management are very much

focussed around accommodating high visitor numbers undertaking a range of activities. Wildlife Tourism caters more for those wanting to see wildlife again potentially with a national draw, while Local Greenspace provides for local recreation use and those wanting places to visit for exercise, regular dog walks etc.

Management actions

10.4 A general overview of different access management interventions is provided by Leung *et al.* (2018) along with a range of case studies and examples. Drawing on that guidance, we have provided an overview of a range of different actions that are relevant to this project in Appendix 5, with details of which are relevant to which types of zone and types of impact. Some examples are illustrated in Figure 12. Within the Appendix measures are grouped under the following headings:

- Access infrastructure (e.g. paths, fencing, bins etc.);
- Directing access (to influence where people go within sites);
- Engagement and information provision (to raise awareness and influence behaviour);
- New Green Infrastructure (GI) (to increase the amount of greenspace available for recreation and deflect use);
- Parking (e.g. measures that restrict parking or influence where people park);
- Restrictions/enforcement (such as permits, ticket systems or requirement to keep dogs on leads);
- Travel related (i.e. measures that relate primarily to active travel and opportunities beyond car use);
- Catering (i.e. opportunities to purchase food and drink); and,
- Other.

10.5 While each action is treated as a discrete intervention within Appendix 5, it should be noted that many are likely to not be effective in isolation and many will work best as a package. For example, rangers providing face-face engagement, signs, cordons/exclusion areas, codes of conduct and interpretation material can all reinforce messages and dovetail. People are likely to respond to measures best where well informed as to the reasons and when changing behaviour is easy and there are alternatives.

10.6 It is important that interventions consider the wider societal benefits and equality of access, ensuring that certain sectors of society are not disadvantaged. Many interventions are also likely to be best tailored to particular circumstances, sites and issues and will need careful

implementation. For example, signage is commonly used to provide instructions to visitors such as requiring dogs to be on leads or asking people to keep away from certain areas.

10.7 Some very different examples of signage and messaging are provided in Figure 12, drawn from the Dorset Heaths, Pebblebed Heaths and North Norfolk. The messaging, wording, placement and how the signs fit with other interventions and communication will all influence their effectiveness. Ham *et al.* (2009) provide guidance on strategic communication for managers who want to influence visitor behaviour and highlight how measures can be tailored to specific issues. There is a body of research available on behavioural change and a range of approaches are relevant to influence and nudge visitor behaviour (see Barker and Park, 2021; Rare and the Behavioural Insights Team, 2019 for toolkit and examples).

10.8 It should be noted that measures include ones that work to draw or enhance access and others that restrict or limit access. Deflecting access from one area to another is one way to change visitor numbers and there are a range of options that work to 'push' and 'pull' visitors. In general, the zones should work to complement each other and the Town and Village, Destination Sites, Local Greenspace and Wildlife Tourism should all work to draw access. Measures around transport and parking (park and ride, charging, limiting spaces, creating new spaces, highlighting where there is space to park) and communication (promoted events, gazeteers, online provision etc) can work to influence where people go, in many cases before they have left the house.

10.9 Creating additional visitor resources is another option, which is particularly relevant for Local Greenspace. There are a range of new greenspaces across the country that have been created with the purpose of deflecting access and accommodating growing pressure for access to the countryside. These sites are often referred to as SANGs (Suitable Alternative Natural Greenspace) and image shown in Figure 12 is from Upton Country Park in Dorset. Guidelines for SANG design are provided by Natural England (anon, 2021).

Need for management as triggered by the zone map

10.10 The zone map is aspirational and it follows that some areas will currently not meet the standards identified. The vantage point data are summarised in Table 11. Virtually all locations exceed at least one standard; in many cases (particularly around The Wash) the vantage points had been mapped as Wild

Places and the only standard that wasn't being met related to % occupancy for parking. For these locations the data suggest many more cars could be accommodated and the occupancy is too low (i.e. too many options for people to park). Two locations stand out as exceeding almost all the standards derived from the vantage point data: Brancaster Golf Club (looking west) and off Sea Lane, on the Lincolnshire shore of The Wash. The former was mapped as Wild Places and the latter as Wildlife Only.

10.11 It should be noted that we do not have data for all standards and for every part of the coast and as such there may be other areas where standards are being exceeded. One of the key standards where we do not have existing data is the extent of suitable habitat that could potentially support the breeding bird interest.

Figure 12: Images with examples of management actions. Clockwise from top left: New dedicated greenspace ('SANG'), temporary signage relating to dogs on leads and ground nesting birds (Dorset Heaths), code of conduct for dog walkers (Pebblebed Heaths), ground nesting bird sign (Norfolk), waymarking sign and QR code with information sources from SW Coast Path, Ringed Plover nest cage, ranger on the Solent interacting with dog walkers, low fence to protect coastal vegetation at Portland Bill, unstaffed visitor centre in Assynt providing interpretation and low key focal point for visitors in a remote location.

Table 11: Vantage points and those where the data collected suggests the standards are not being met. Values in cells give the actual value from the vantage point surveys and the target range in parentheses. Cells with numbers indicate those where the standard is exceeded (red text) or below the target level (blue text). Black text indicates the standards are close or there is some uncertainty due to multiple zones being mapped within the vantage point arc.

Map ref	Name	Zone as mapped in Workshop	Average number of dogs off lead per km of shoreline, on beach habitat (i.e. above and around tideline)	Average number of dogs off lead on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2	Average number of people dog walking per km of shoreline	Average number of people on beach (i.e. above and around tideline), per km of shoreline	Total people on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2	Total numbers of boats per km of shoreline	Average occupancy of car park – the % of car park spaces occupied, on average
25	NWT Cley	Wildlife Tourism	**0.1 (0)**						
31	Blakeney Carnser car park	Wild Places			**9.5 (1-8)**			**0.27 (0-0.1)**	
42	Stiffkey Saltmarshes car park	Wild Places/Wildlife Tourism							15.3 (45+/0-15)
49	Wells Beach Car Park	Destination Site						**0.32 (0.2-0.25)**	**50.4 (15-45)**
58	Burnham Overy harbour car park	Wild Places						**0.74 (0-0.1)**	**27.0 (45+)**
72A	Royal West Norfolk Golf Club car park (looking east)	Destination Site						**0.26 (0.2-0.25)**	**46.3 (15-45)**
72B	Royal West Norfolk Golf Club car park (looking west)	Wild Places		**4.5 (1-2)**	**14.4 (0-10)**	**15.7 (0-5)**	9.6 (0-10)	0	
82	Thornham Old Harbour	Wild Places / Wildlife Only			3.7 (0/0-10)				
89	Holme Beach Rd	Destination Site / Wild Places							**64.6 (15-45/45+)**
106	Southend car park	Destination Site						**0.07 (0.2-0.25)**	
112	North Beach Car Park	Destination Site						**0 (0.2-0.25)**	
118	Snettisham Beach car park	Destination Site						**0 (0.2-0.25)**	**6.8 (45+)**
135	end of Cross Bank Rd	Wild Places							**10.0 (45+)**
139	Ongar Hill	Wild Places							**22.0 (45+)**
142	West Nene Lighthouse	Wild Places							**33.3 (45+)**

Map ref	Name	Zone as mapped in Workshop	Average number of dogs off lead per km of shoreline, on beach habitat (i.e. above and around tideline)	Average number of dogs off lead on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2	Average number of people dog walking per km of shoreline	Average number of people on beach (i.e. above and around tideline), per km of shoreline	Total people on intertidal habitat (mudflat, sandflats and saltmarsh) per km^2	Total numbers of boats per km of shoreline	Average occupancy of car park – the % of car park spaces occupied, on average
150	off Marsh Lane	Wild Places							**8 (45+)**
156	Shep Whites car park	Wild Places							**18.7 (45+)**
160	Kirton Marsh	Wild Places							**13.3 (45+)**
162	RSPB Frampton	Wildlife Tourism							**16.0 (0-15)**
164	Cut End Road	Wild Places							**11.4 (45+)**
167	off Sea Lane	Wildlife Tourism / Wildlife Only		**0.6 (0)**	**1.1 (0-1/0)**		0.1 (0-5/0)	**0.20 (0-0.1/0)**	42.2 (45+/0-15)
171	off Oldfield Lane	Wildlife Only			**0.3 (0)**			**0.13 (0)**	**16.0 (45+)**
174	Sea Lane (Wrangle)	Wildlife Only			**0.2 (0)**			**0.13 (0)**	**8.0 (45+)**
181	Gibraltar Point	Wildlife Tourism			**2.0 (0)**				**49.9 (0-15)**

11. Monitoring

Overview

11.1 Long term monitoring is necessary to pick up change and identify when particular standards are not being met. This would trigger a need for management. Section 8 of this report describes the different standards we have identified and a range of metrics, and in this section, we describe how these data could be collected in the longer term.

11.2 The standards in Section 8 include data from:

- Counts of parked vehicles;
- Vantage point counts;
- Breeding bird monitoring;
- Wetland Bird Survey (WeBS);
- Seal counts; and
- Habitat condition and distribution.

11.3 These are considered in more detail below.

Counts of parked cars

11.4 Counts of parked vehicles provide an easy and straightforward way to record levels of use and the distribution of access at a relatively strategic level.

11.5 While many locations will have ticket machines or even automatic counters in place, these are certainly not ubiquitous, and the application of a standard metric is difficult. We mapped all the parking locations around the coast and undertook repeated visits to these to count cars, simply by visiting the car park quickly counting all vehicles within a set time window. Such an approach would seem the best way to monitor use in the long term. In order to compare across years and between sites it is necessary to have a consistent approach, and what is practical and feasible will ultimately determine whether this can be achieved annually and the number of replicates possible within a year.

11.6 For this project, we had 5 transect routes on a given day (i.e. 5 people simultaneously doing the surveys) and we undertook the counts on 5 different dates to encompass a bank holiday, school holidays, weekdays during term time etc. A total of 177 different locations were counted each time. An example recording form is provided in Appendix 6.

11.7 Ideally the surveys should cover multiple seasons and include holiday and non-holiday periods, potentially focussing around the times of year when the interest features are vulnerable (e.g. late winter through the spring for seals, non-breeding waterbirds and breeding birds). This will potentially mean around 10-12 counts per location per year. Ideally a protocol should be established and the same time windows used from year to year. This protocol could be extended to include more Local Greenspace sites. Clearly how these are established and run in the future will influence the standards. For example, if multiple bank holidays are included the average value is likely to be higher, and as such the standards will need reviewing and checking once the monitoring protocol is established in the long term.

Vantage point counts

11.8 Vantage point counts provide a simple means of gathering data on the numbers of people, dogs and boats present at a given point of time and the types of activities taking place. They can easily be combined with the vehicle counts and are a cost-effective means of gathering data on visitor numbers and activity patterns.

11.9 Many of the suggested standards have been based on the vantage point count data collected for this project. We collected vantage point count data from 24 locations and an example form is provided in Appendix 7. At each location an arc extending out to a maximum of 1.5km from the point was used to define the count area (the 1.5km was adjusted to account for sight lines and areas that were invisible from the vantage point). For long-term monitoring it would be possible to add other vantage point count locations and these could be extended to inland sites so as to include Local Greenspace.

Breeding bird monitoring

11.10 We have applied standards relating to occupancy of suitable habitat, and this will require mapping the extent of suitable habitat around the coastline (regardless of whether it is used or not by birds). Habitat requirements for Ringed Plover, Oystercatcher and Little Tern overlap but are not the same and defining and accurately mapping habitat in a consistent way around the coast is not straightforward.

11.11 Mapping would likely to be best achieved based on recent aerial imagery with ground truthing by an experienced ornithologist. The presence of

breeding birds could be used to test and develop the mapping approach, however it may be necessary to not include areas with high levels of access as these may contain suitable habitat that is otherwise not used.

11.12 Once a set of maps is obtained, these could be revised as necessary, potentially at 3-5 year intervals with more regular updates if conditions change, e.g. there are marked storm surges.

11.13 Standards also relate to the number of nests and fledging success. These data are collected routinely at many sites by site-based staff and volunteers and existing monitoring protocols are in place. We have deliberately avoided using hatching success or the number of nests as a metric as these are more labour intensive and detailed. While such data could be used to underpin the standards it would require a much greater resource commitment and consistency of survey effort to achieve.

Wetland Bird Survey (WeBS) data

11.14 WeBS counts usually provide data for high tide on an annual basis (counts monthly) and low tide counts are also undertaken in occasional years. The survey covers the UK and is run by the BTO and the data are used by the statutory agencies to inform site condition and designation. WeBS has been running for decades and the data are used to highlight where species numbers are changing at a particular site and whether such changes are specific to that site or consistent with widespread changes at other sites in the region or nationally. Total figures and key species declines (at a site level) are available through the BTO website and the WeBS alerts system[22].

11.15 WeBS data should therefore be able to provide the data to underpin the standards. If there are gaps in coverage (such as a lack of volunteers) it may be necessary to ensure these are filled. There will be some challenges in applying the data as the WeBS relate to fixed count sectors which will not necessarily match the zone boundaries. There will therefore need to be some kind review of the WeBS data, potentially involving WeBS surveyors, to cross reference where there are roosts or feeding areas that are within particular zones. Where there are multiple zones within a WeBS sector it will

[22] See https://www.bto.org/our-science/projects/wetland-bird-survey/publications/webs-alerts

be quite likely that the main roost site will be within a single zone and therefore it should be possible to broadly match the WeBS data to the zones.

Seal counts

11.16 The number and distribution of both species of seals in SACs and SSSIs is collected routinely at a national basis and underpins the condition assessment of the sites. Monitoring is undertaken on a national basis by the Sea Mammal Research Group (SMRU)[23] which reports annually to the Special Committee on Seals (SCOS)[24]. Monitoring for Harbour Seal focuses on the number present during the moulting season while for Grey Seals pup production is used as an indicator of population size.

11.17 These data could provide the necessary information for the standards. There will be some challenges in applying the data to the zone boundaries and this will require having the seal count data in a way that allows data to be extracted for discrete areas. Some trialling may be required and additional monitoring may be necessary to establish this metric in the long term.

Habitat condition and distribution

11.18 Monitoring and reporting on the condition SSSIs is part of Natural England's statutory responsibility and is conducted in part to understand long-term changes in the natural environment, including the delivery of Favourable Conservation Status for habitats and species.

11.19 Condition monitoring should provide the necessary detail and background to inform this standard, and for example can include recording of loss of saltmarsh vegetation to trampling (e.g. Haynes and Beal, 2015). The challenges with using the condition assessment data will relate to the SSSI unit boundaries (which will not necessarily fit with the zone boundaries) and the relative frequency with which assessments are undertaken (which may not be frequent enough). Condition monitoring results are therefore likely to need supplementing with reviews of satellite images and site visits undertaken systematically on a more regular basis. This will need to be established.

[23] See http://www.smru.st-andrews.ac.uk/
[24] See http://www.smru.st-andrews.ac.uk/reports/

12. Discussion

12.1 The Wash and North Norfolk Coast is a complex landscape which is important for both people and nature. How to balance the importance of tourism to the local economy and the need for new houses with the impacts on the natural environment is a difficult challenge and likely to be met only through partnership working (Natural England, 2018).

12.2 This report is a novel and innovative step towards achieving sustainable management of access along the coast and the results provide a framework to enable partners to work together to achieve a common goal. By taking a strategic view and involving a range of stakeholders, we have come up with a map that shows how the coast could work for both nature conservation and access. The different zones act like a coloured wash on the map to highlight the kinds of management approaches that could be deployed. The list of management actions provides a toolkit and means to identify potential interventions that are appropriate to different locations. We have identified potential management actions that are appropriate in different locations, set out monitoring approaches and set standards to apply in relation to that monitoring data.

12.3 The coast is dynamic and there are a complex mix of features and the distribution and extent of these may change over time. Access patterns and demand will also change and as such this represents an initial step that will require regular review, revision and update in line with monitoring results. The LAC approach provides a means to allow continued checks and adjustment of management in light of the monitoring. The ultimate aim should be to ensure that the designated wildlife features benefit and certainly none are adversely affected.

LAC process

12.4 The overall approach of defining key issues, identifying different types of zone and mapping them worked well and the workshop generated very positive feedback regarding the process. The process works well at a strategic level to help identify a common purpose and give an overview. It provides an overarching framework.

12.5 We have used 6 different zone types, and this is the maximum recommended in the original LAC work. This highlights how strategic the approach is intended to work. Many locations around the coast will not

necessarily fall neatly into those 6 categories or indeed change over very short distances. Zones can vary markedly with variation in visitor levels and management (for example a Destination site might be very busy around the car park but further away may include areas with much lower levels of access and even areas fenced off to support breeding birds). The zone definitions therefore are necessarily broad and the standards also equally broad. A further example would be that many nature reserves around the coast have marked trails and hides and which are set back to provide space for wildlife which can be easily viewed from the trails and hides. At the level we are working it makes sense for the whole area to be Wildlife Tourism and the definition allows for this, as opposed to mapping different small parts of the site (such as the trails, lagoons, visitor centre etc) differently. If the process were being applied at an individual reserve level then perhaps a finer level of detail would be more relevant (and a different set of zones might be more relevant).

Scope for interventions

12.6 It should be noted that we do not specify any particular intervention or apply any formal designation to any particular part of the coast, but rather the report is a general aspiration with no intended course of future action. As such the LAC process, as applied here, does is not constitute a plan or project under the Habitats Regulations and does not require Habitats Regulations Assessment. Some of the management actions listed may however require such assessment, as well as in some cases requiring planning permission should a particular action be identified as necessary.

12.7 The LAC process should help to provide justification and clarity as to measures required at different locations and these can be clearly linked to the site interest and qualifying features through the monitoring results. This combined approach may also facilitate access to funding streams for management interventions. The management interventions fit with a range of different strategies and agendas such as the Norfolk Green Infrastructure and Recreation Avoidance and Mitigation Strategy (Hooton and Mills, 2020), Local Nature Recovery Strategies[25], health and well-being and Environmental Land Management (ELMs).

[25] E.g. https://glnp.org.uk/our-services/nature-strategy

Further data requirements

12.8 This report should be seen as an initial step and a snapshot in time. Further data are continued review will be necessary. In terms of the standards, additional data collection or data collation (and subsequent refinement of standards) will be necessary in relation to:

- Mapping and describing the extent of breeding bird habitat (i.e. that could support the bird interest);
- Use of WeBS data and potential to apply at a relatively fine (zone) scale;
- Use of seal monitoring data and potential to apply at a relatively fine (zone) scale; and,
- Habitat condition and distribution data, drawing on condition assessments and potential for further data collection and more regular review;

Next steps

12.9 The LAC process requires continued monitoring and adaptive management in response to the monitoring data and this report therefore represents an initial step rather than an any kind of end point.

12.10 There is scope for further refinement of the zone maps and this would be best taken forward by the partnership of organisations and landowners involved in managing the coastal strip. There is scope to further adjust the zones in order to achieve consistency of approach and a consensus that all are comfortable with, and this could include wider engagement with user groups and those who were at the various workshops. Adjustments could include changes to the zone descriptions or the boundaries to ensure a workable and achievable overall map. We suggest that the following as next steps in the work:

- Ensure partnership buy-in and consensus for the LAC approach and relative merit of expanding scope to include standards that relate to the historic environment and social impacts;
- Ensure buy-in on the zones as mapped in this report and need for any refinement in light of potential management required to achieve standards, incorporation of historic environment/social impacts and additional time to review output from the report;
- Ensure coordinated monitoring for the standards in the long-term so that coast wide data are available, reported and shared on a regular basis;

- Review and ground-truth the standards in light of further field data collection and revise as appropriate; and,
- Continue to collect monitoring data and target adaptive management accordingly.

References

Acevedo-Gutierrez, A., Acevedo, L., Belonovich, O., Boren, L., 2011. How Effective are Posted Signs to Regulate Tourism? An Example with New Zealand Fur Seals. Tourism in Marine Environments 7, 39–41. https://doi.org/10.3727/154427310X12826772784874

Allbrook, D.L., Quinn, J.L., 2020. The effectiveness of regulatory signs in controlling human behaviour and Northern gannet (Morus bassanus) disturbance during breeding: an experimental test. Journal for Nature Conservation 58, 125915. https://doi.org/10.1016/j.jnc.2020.125915

Allinson, E., 2018. The role of suitable alternative natural greenspace in protecting high value wildlife sites (PhD). Southampton.

Andersen, S.M., Teilmann, J., Dietz, R., Schmidt, N.M., Miller, L.A., 2012. Behavioural responses of harbour seals to human-induced disturbances. Aquatic Conservation-Marine and Freshwater Ecosystems 22, 113–121. https://doi.org/10.1002/aqc.1244

Andersen, U.V., 1995. Resistance of Danish coastal vegetation types to human trampling. Biological Conservation 71, 223–230. https://doi.org/doi:10.1016/0006-3207(94)00031-K

anon, 2021. Guidelines for Creation of Suitable Alternative Natural Greenspace (SANG) – August 2021.

Autralian Government, 2012. Limits of acceptable change.

Barker, J., Park, T., 2021. Using Behavioural Insights to Reduce Recreation Impacts on Wildlife: Guidance and Case Studies from Thames Basin Heath and the Solent

(Natural England Commissioned Report No. 329). Behvioural Insights Team for Natural England.

Bonte, D., Hoffman, M., 2005. Are coastal dune management actions for biodivesity restoration and conservation underpinned by internationally published scientific research?, in: Herrier, J.-L., Mees, J., Salman, A., Syes, J., Van Nieuwenhuyse, H., Dobbelaere, I. (Eds.), International Conference on Nature Restoration Practices in European Coastal Habitats. VLIZ, Koksijde, Belgium, pp. 165–178.

Boorman, L.A., 2003. Saltmarsh Review. An overview of coastal saltmarshes, their dynamic and sensitivity characteristics for conservation and management. JNCC.

Boorman, L.A., Fuller, R.M., 1977. Studies on the impact of paths on dune vegetation at Winterton, Norfolk, England. Biological Conservation 12, 141–148.

Bright, A., Reynolds, G.R., Innes, J., Waas, J.R., 2003. Effects of motorised boat passes on the time budgets of New Zealand dabchick, Poliocephalus rufopectus. Wildl. Res. 30, 237–244.

Burton, N.H., Rehfisch, M.M., Clark, N.A., 2002. Impacts of disturbance from construction work on the densities and feeding behavior of waterbirds using the intertidal mudflats of Cardiff Bay, UK. Environ Manage 30, 865–71.

Chandrasekara, W.U., Frid, C.L.J., 1996. Effects of human trampling on tidalflat infauna. Aquatic Conservation: Marine and Freshwater Ecosystems 6, 299–311.

Cole, D.N., 1995. Experimental Trampling of Vegetation. I. Relationship Between Trampling Intensity and Vegetation Response. Journal of Applied Ecology 32, 203–214.

Collop, C., Stillman, R.A., Garbutt, A., Yates, M.G., Rispin, E., Yates, T., 2016. Variability in the area, energy and time costs of wintering waders responding to disturbance. Ibis 158, 711–725. https://doi.org/10.1111/ibi.12399

Coombes, E.G., 2007. The effects of climate change on coastal recreation and biodiversity. University of East Anglia, School of Environmental Sciences, Norwich.

Covey, R., Laffoley, D. d'A., 2002. Maritime State of Nature Report for England: getting onto an even keel. English Nature, Peterborough.

Cryer, M., Linley, N.W., Ward, R.M., Stratford, J.O., Randerson, P.F., 1987. Disturbance of overwintering wildfowl by anglers at two reservoir sites in South Wales. Bird Study 34, 191–199.

Curr, R., Koh, A., Edwards, E., Williams, A., Davies, P., 2000. Assessing anthropogenic impact on Mediterranean sand dunes from aerial digital photography. Journal of Coastal Conservation 6, 15–22.

document doctor, 2009. Coastal Disturbance Study.

Doody, P., Randall, R., 2003. A Guide to the Management and Restoration of Coastal Vegetated Shingle (English Nature contract report).

Fitzpatrick, S., Bouchez, B., 1998. Effects of recreational disturbance on the foraging behaviour of waders on a rocky beach. Bird Study 45, 157–171.

Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E., Austin, G.E., 2021. Waterbirds in the UK 2019/20: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford.

Furlong, J., Holmes, A., 2021. Boston Alternative Energy Facility – Environmental Statement 57.

Gill, J.A., 1996. Habitat choice in wintering pink-footed geese:quantifying the constraints determining winter site use. Journal of Applied Ecology 33, 884–892.

Granquist, S.M., Sigurjonsdottir, H., 2014. The effect of land based seal watching tourism on the haul-out behaviour of harbour seals (Phoca vitulina) in Iceland. Applied Animal Behaviour Science 156, 85–93. https://doi.org/10.1016/j.applanim.2014.04.004

Greer, K., Day, K., McCutcheon, S., 2017. Efficacy and perception of trail use enforcement in an urban natural reserve in San Diego, California. Journal of Outdoor Recreation and Tourism 18, 56–64. https://doi.org/10.1016/j.jort.2017.02.002

Ham, S.H., Brown, T.J., Curtis, J., Weiler, B., Hughes, M., Poll, M., 2009. Promoting persuasion in protected areas. A guide for managers who want to use strategic communication to influence visitor behaviour. Sustainable Tourism Pty Ltd.

Haynes, T., Beal, S., 2015. Condition monitoring of saltmarsh features in The Wash and North Norfolk Coast SAC: Volume 2 The North Norfolk Coast (IPENS No. 026). Report by naturebureau for Natural England.

Hewitt, D.E., 1973. Human pressures on soils in coastal areas.

Hooton, S., Mills, R., 2020. Norfolk Green Infrastructure and Recreational Impact Avoidance and Mitigation Strategy. Report by Place Services for Norfolk Strategic Planning Framework.

Jacobs, M.H., Harms, M., 2014. Influence of interpretation on conservation intentions of whale tourists. Tourism Management 42, 123–131. https://doi.org/10.1016/j.tourman.2013.11.009

Jenkinson, S., 2018. Managing visitors with dogs within The Wash and North Norfolk Marine Partnership Area. Report for The Wash and North Norfolk Marine Partnership.

Johnson, A., Acevedo-Gutiérrez, A., 2007. Regulation compliance by vessels and disturbance of harbour seals (Phoca vitulina). Can. J. Zool. 85, 290–294. https://doi.org/10.1139/Z06-213

Kirby, P., 2001. Habitat management for invertebrates: a practical handbook. Royal Society for the Protection of Birds, Sandy.

Kuss, F.R., 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10, 637–650.

Lawesson, J.E., 1998. Quantitative vegetation ecology in Denmark. Journal of Vegetation Science 9, 891–896.

Leung, Y.-F., Speceley, A., Hvenegaard, G., Buckley, R., 2018. Tourism and visitor management in protected areas: guidelines for sustainability (Best Practice Protected Area Guidelines Series). IUCN, Gland.

Liddle, M.J., 1997. Recreation Ecology. Chapman & Hall, London.

Liley, D., 2008. Development and the North Norfolk Coast: scoping document on the issues relating to access. Footprint Ecology / RSPB / Norfolk Coast Partnership.

Liley, D., Lake, S., Underhill-Day, J., Sharp, J., White, J., Hoskin, R., Cruickshanks, K., Fearnley, H., 2010. Welsh Seasonal Habitat Vulnerability Review. Footprint Ecology / CCW.

Liley, D., Lock, L., Brown, A., Scott, J., Legg, W., 2021a. Beach-nesting Ringed Plovers and their conservation in England. British Wildlife 33, 157–165.

Liley, D., Panter, C., Lake, S., Caals, Z., 2021b. Visitor Management Plan for Holme Dunes (Unpub. No. 597). Footprint Ecology / Norfolk County Council.

Liley, D., Sutherland, W.J., 2007. Predicting the population consequences of human disturbance for Ringed Plovers Charadrius hiaticula: a game theory approach. Ibis 149, 82–94. https://doi.org/doi:10.1111/j.1474-919X.2007.00664.x

Lowen, J., Liley, D., Underhill-Day, J., Whitehouse, A.T., 2008. Access and Nature Conservation Reconciliation: supplementary guidance for England.

Mahon, H., 1994. A visitor management handbook. A directory for AONB site managers. Norfolk Coast Project.

Manning, R.E., 2013. Parks and Carrying Capacity: Commons Without Tragedy. Island Press.

McKay, 2006. Applying the limits of acceptable change process to visitor impact management in New Zealand's natural areas. Lincoln University.

Medeiros, R., Ramosa, J.A., Paivaa, V.H., Almeidac, A., Pedroa, P., Antunes, S., 2007. Signage reduces the impact of human disturbance on little tern nesting success in Portugal. Biological Conservation 135, 99–106.

Milwain, E., 1984. Recreational trampling pressure and its effects on the vegetation and soils of Les Quennevais - Blanches Banques Sand Dunes, St. Ouen's Bay, Jersey.

Monz, C.A., Pickering, C.M., Hadwen, W.L., 2013. Recent advances in recreation ecology and the implications of different relationships between recreation use and ecological impacts. Frontiers in Ecology and the Environment 11, 441–446. https://doi.org/10.1890/120358

Natural England, 2018. State of the North Norfolk Coast.

New Insights for Tourism, 2019. Tourism in the Wadden Sea World Heritage Destination: Identifying Limits of Acceptable Change. Report by NIT for the European Union.

Nolet, B.A., Bevan, R.M., Klaassen, M., Langevoord, O., Van der Heijden, Y., 2002. Habitat switching by Bewick's swans: maximization of average long-term energy gain? J. Anim. Ecol. 71, 979–993.

Norfolk Coast Project, 1995. Visitor management zones of the Norfolk Coast AONB.

Panter, C., Liley, D., Lowen, S., 2017. Visitor surveys at European Protected Sites across Norfolk in 2015 and 2016. Unpublished report by Footprint Ecology for Norfolk County Council.

Pearce-Higgins, J.W., Yalden, D.W., 1997. The effect of resurfacing the Pennine Way on recreational use of blanket bog in the Peak District national park, England. Biological Conservation 82, 337–343.

Penny Anderson Associates, 2009. Countryside and Rights of Way Act, 2000 Part 1: Access to the Countryside (No. NECR012). Natural England.

Pickering, C., Hill, W., Newsome, D., Leung, Y.-F., 2010. Comparing hiking, mountain biking and horse riding impacts on vegetation and soils in Australia and the United States of America. Journal of Environmental Management 91, 551–562. https://doi.org/10.1016/j.jenvman.2009.09.025

Rare and the Behavioural Insights Team, 2019. Behaviour change for nature: A behavioural science toolkit for practioners. Arlington.

Ratcliffe, J., Rees, S., Bosanquet, S., Creer, J., Howe, M., Litt, E., 2020. Conservation or Preservation; the challenge of aligning scientific, public and policy understanding of dune ecosystems to deliver Favourable Conservation Status, in: Change, Naturalness and People. Presented at the 2017 Littoral Conference, pp. 68–90.

Ratcliffe, N., Schmitt, S., Mayo, A., Tratalos, J., Drewitt, A., 2008. Colony habitat selection by little terns sterna albifrons in East Anglia: implications for coastal management. Seabird 21, 55–63.

Regel, J., Putz, K., 1997. Effect of human disturbance on body temperature and energy expenditure in penguins. Polar Biology 18, 246–253.

Ritchie, W.., 2001. Coastal dunes: resultant dynamic position as a conservational managerial objective. Coastal Dune Management: Shared experience of European Conservation Practice. European symposium on coastal dunes of the Atlantic biogeographical region.

Saunders, C., Selwyn, J., Richardson, S., May, V., Heeps, C., 2000. A review of the effects of recreational interactions within UK European marine sites. UK CEED & Bournemouth University.

Saunders, P., Liley, D., 2022. Solent Bird Disturbance Surveys 2021-22: assessment of disturbance levels at rangered sites (No. 649). Footprint Ecology / Bird Aware Solent.

Shardlow, M.E., 2001. A review of the Conservation Importance of Shingle Habitats for Invertebrates in the United Kingdom (UK)., in: Packham, J.R., Randall, R.E., K.,

B.R.S., Neal, A. (Eds.), Ecology and Geomorphology of Coastal Shingle. Westbury Academic and Scientific Publishing.

Shelby, B., Vaske, J.J., Heberlein, T.A., 1989. Comparative analysis of crowding in multiple locations: Results from fifteen years of research. Leisure Sciences 11, 269–291. https://doi.org/10.1080/01490408909512227

Skeate, E., Perrow, M., 2008. An undercurrent of change for Norfolk's seals. British Wildlife 19, 305–314.

Slatter, R.J., 1978. Ecological effects of trampling on sand dune vegetation. J. of Biological Education 12, 89–96.

Sneddon, P., Randall, R.E., 1993. Coastal vegetation shingle structures of Great Britain: Main Report. Joint Nature Conservation Committee, Peterborough.

Spokes, K.E., 1997. An investigation into the effects of trampling on shingle vegetation.

Stankey, G.H., Cole, D.N., Lucas, R.C., Petersen, M., Frissell, S., 1985. The limits of acceptable change (LAC) system for wilderness planning (General Technical Report). United States Department of Agriculture, Forest service.

Stillman, R.A., Goss-Custard, J.D., 2002. Seasonal changes in the response of oystercatchers Haematopus ostralegus to human disturbance. J. Avian Biol. 33, 358–365.

Stock, M., Hofeditz, F., 1997. Compensatory limits: energy budgets of Brent Geese, Branta b- bernicla, the influence of human disturbance. Journal Fur Ornithologie 138, 387–411.

Thiel, D., Jenni-Eiermann, S., Palme, R., Jenni, L., 2011. Winter tourism increases stress hormone levels in the Capercaillie Tetrao urogallus. Ibis 153, 122–133. https://doi.org/10.1111/j.1474-919X.2010.01083.x

Thomas, K., Kvitek, R.G., Bretz, C., 2003. Effects of human activity on the foraging behavior of sanderlings Calidris alba. Biological Conservation 109, 67–71. https://doi.org/10.1016/S0006-3207(02)00137-4

Tratalos, J.A., Jones, A.P., Showler, D.A., Gill, J.A., Bateman, I.J., Sugden, R., Watkinson, A.R., Sutherland, W.J., 2021. Regional models of the influence of human disturbance and habitat quality on the distribution of breeding territories of common ringed plover Charadrius hiaticula and Eurasian oystercatcher Haematopus ostralegus. Global Ecology and Conservation 28, e01640. https://doi.org/10.1016/j.gecco.2021.e01640

Tyldesley, D., Chapman, C., 2021. The Habitats Regulations Handbook. DTA Publications.

Vaske, J.J., Shelby, L.B., 2008. Crowding as a Descriptive Indicator and an Evaluative Standard: Results from 30 Years of Research. Leisure Sciences 30, 111–126. https://doi.org/10.1080/01490400701881341

Walker, B.G., Dee Boersma, P., Wingfield, J.C., 2006. Habituation of Adult Magellanic Penguins to Human Visitation as Expressed through Behavior and Corticosterone Secretion. Conservation Biology 20, 146–154.

Weimerskirch, H., Shaffer, S.A., Mabille, G., Martin, J., Boutard, O., Rouanet, J.L., 2002. Heart rate and energy expenditure of incubating wandering albatrosses: basal levels, natural variation, and the effects of human disturbance. J Exp Biol 205, 475–83.

Weston, M.A., Dodge, F., Bunce, A., Nimmo, D.G., Miller, K.K., 2012. Do temporary beach closures assist in the conservation of breeding shorebirds on recreational beaches? Pac. Conserv. Biol. 18, 47–55. https://doi.org/10.1071/pc120047

White, D., 2012. Study to assess the capacity of International Sites to accommodate visitor pressure. Study to assess the capacity of International Sites to accommodate visitor pressure.

Yasué, M., 2005. The effects of human presence, flock size and prey density on shorebird foraging rates. Journal of Ethology 23, 199–204. https://doi.org/10.1007/s10164-005-0152-8

Appendix 1: Breakdown of vehicle counts

Details of the five routes undertaken for the vehicle transects and the number of parking locations and vantage points in each.

Route	Approx. length (km)	Number of parking locations	Total spaces	Number of vantage points	Average time to complete (hrs)
1. Weybourne to Burnham Overy Staithe	56	60	4,280	5	03:14
2. Burnham Norton to Hunstanton	35	48	5,134	5	03:25
3. Heacham to Kings Lynn	55	22	1,817	3	02:39
4. Kings Lynn to Frampton Marsh	137	27	305	6	03:07
5. Fishtoft to Gibraltar	98	20	415	5	03:04
Total	**381**	**177**	**11,951**	**24**	**03:05**

Appendix 2: Conservation Interest of European Sites

The sites listed are those European sites that fall within the study area and we have included some (Norfolk Valley Fens, Dersingham Bog, Roydon Common) that do not include coastal habitats but are in close geographical proximity. Links in the table cross-reference to the Natural England website and the relevant page with the site's conservation objectives. In the qualifying features column, for SPAs NB denotes non-breeding and B breeding features. For SACs, # denotes features for which the UK has a special responsibility. The descriptive text is adapted from Natural England's site improvement plan or citation. For Ramsar sites, the qualifying features and description are drawn from the Ramsar spreadsheet on the JNCC website[26], and the link cross-references to the Ramsar site information page.

European site	Designated features	Description
Dersingham Bog Ramsar	Wetland invertebrate assemblage	Dersingham Bog is East Anglia's largest remaining example of a pure acid valley mire, and supports extensive bog, wet heath and transition communities over peat. These are sustained by groundwater, fed via springs and seepage, from the underlying greensand, which in places has caused the development of iron pans. The mire grades into dry heathland along the greensand scarp slope. The scarp slope is a former sea cliff, and the bog habitats are a remnant of the transition mires that formerly existed between this former shoreline and the now mostly land-claimed saltmarshes around The Wash. In addition to its internationally important plant communities, the site also supports important assemblages of birds and British Red Data Book invertebrates.
Gibraltar Point Ramsar	Bar-tailed Godwit, *Limosa lapponica* - Wintering Coastal dunes Dark-bellied Brent Goose, *Branta bernicla* - Wintering Sanderling, *Calidris alba* - Wintering Waterbird assemblage - Wintering Wetland invertebrate assemblage	Gibraltar Point consists of an actively accreting sand dune system, saltmarsh and extensive intertidal flats. All stages of dune development are represented, with the older dunes extensively colonised by scrub. There are also small areas of freshwater marsh and open water. The site accommodates large numbers of overwintering birds.

[26] https://hub.jncc.gov.uk/assets/bc9b0905-fb63-4786-8e90-5f7851bb417d

European site	Designated features	Description
Gibraltar Point SPA	Bar-tailed Godwit, *Limosa lapponica* - A157, nb Grey Plover, *Pluvialis squatarola* - A141, nb Little Tern, *Sternula albifrons* - A195, b Sanderling, *Calidris alba* - A144, nb	Gibraltar Point is located on the Lincolnshire coast in eastern England. It lies north of The Wash and consists of an actively accreting sand-dune system, saltmarsh and extensive intertidal flats. All stages of dune development are represented with the older dunes extensively colonised by scrub. There are also small areas of freshwater marsh and open water. The site accommodates large numbers of overwintering birds and significant colonies of breeding terns. The terns feed outside the SPA in nearby waters. The site is also important for waders during the spring and autumn passage period. To the south, the coastal habitats of Gibraltar Point SPA are continuous with The Wash SPA, with which area the ecology of this site is intimately linked.
Greater Wash SPA	Common Scoter, *Melanitta nigra* - A065, nb Common Tern, *Sterna hirundo* - A193, b Little Gull, *Hydrocoloeus (Larus) minutus* - A177, nb Little Tern, *Sternula albifrons* - A195, b Red-throated Diver, *Gavia stellata* - A001-A, nb Sandwich Tern, *Thalasseus sandvicensis* - A191, b	The Greater Wash SPA is located in the mid-southern North Sea between Bridlington Bay in the north and the Outer Thames Estuary SPA in the south. To the north, off the Holderness coast in Yorkshire, seabed habitats primarily comprise coarse sediments, with occasional areas of sand, mud and mixed sediments. Subtidal sandbanks occur at the mouth of the Humber Estuary, primarily comprising sand and coarse sediments. Offshore, soft sediments dominate, with extensive areas of subtidal sandbanks off The Wash as well as north and east Norfolk coasts. Closer inshore at The Wash and north Norfolk coast, sediments comprise a mosaic of sand, muddy sand, mixed sediments and coarse sediments, as well as occasional Annex I reefs. The area off the Suffolk coast continues the mosaic habitats mostly dominated by soft sediment.
Norfolk Valley Fens SAC	H4010 Northern Atlantic wet heaths with *Erica tetralix* H4030 European dry heaths H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*), (note that this includes the priority feature "important orchid rich sites") H6410 *Molinia* meadows on calcareous, peat or clay-silt soil H7210# Calcareous fens with *C. mariscus* and species of *C. davallianae* H7230 Alkaline fens H91E0# Alluvial woods with *A. glutinosa, F. excelsior*	This site comprises a series of valley-head spring-fed fens. Such spring-fed flush fens are very rare in the lowlands. The spring-heads are dominated by the small sedge fen type, mainly referable to Black Bog-rush–Blunt-flowered Rush (*Schoenus nigricans–Juncus subnodulosus*) mire, but there are transitions to reedswamp and other fen and wet grassland types. The individual fens vary in their structure according to intensity of management and provide a wide range of variation. There is a rich flora associated with these fens, including species such as Grass-of-Parnassus *Parnassia palustris*, Common Butterwort *Pinguicula vulgaris*, Marsh Helleborine *Epipactis palustris* and Narrow-leaved Marsh-orchid *Dactylorhiza traunsteineri*.

European site	Designated features	Description
	S1014 Snail, *Vertigo angustior* S1016 Desmoulin's Whorl Snail, *Vertigo moulinsiana*	
North Norfolk Coast Ramsar	Marsh and coastal habitats, Red-data book/RDB plants, invertebrates and a lichen Dark-bellied Brent Goose, *Branta bernicla* - Wintering Knot, *Calidris canutus* - Wintering Pink-footed Goose, *Anser brachyrhynchus* - Wintering Waterbird assemblage - Wintering Wetland plant assemblage Wigeon, *Mareca penelope* - Wintering	This low-lying barrier coast site extends for 40 km from Holme to Weybourne and encompasses a variety of habitats including intertidal sands and muds, saltmarshes, shingle and sand dunes, together with areas of land-claimed freshwater grazing marsh and reedbed, which is developed in front of rising land. Both freshwater and marine habitats support internationally important numbers of wildfowl in winter and several nationally rare breeding birds. The sandflats, sand dune, saltmarsh, shingle and saline lagoons habitats are of international importance for their fauna, flora and geomorphology.
North Norfolk Coast SAC	H1150# Coastal lagoons H1220 Perennial vegetation of stony banks H1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) H2110 Embryonic shifting dunes H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('White dunes') H2130# Fixed dunes with herbaceous vegetation ('Grey dunes') H2190 Humid dune slacks S1355 Otter, *Lutra lutra* S1395 Petalwort, *Petalophyllum ralfsii*	North Norfolk Coast contains a large, active series of dunes on shingle barrier islands and spits. The exceptional length and variety of the dune/beach interface is reflected in the high total area of embryonic dune. Sand Couch *Elytrigia junceais* the most prominent sand-binding grass. The site supports a large area of shifting dune vegetation, which is also varied but dominated by Marram *Ammophila arenaria*. The fixed dunes are rich in lichens and drought-avoiding winter annuals such as Common Whitlowgrass *Erophila verna*, Early Forget-me-not *Myosotis ramosissima* and Common Cornsalad *Valerianella locusta*. The main communities represented are Marram with Red Fescue *Festuca rubra* and Sand Sedge *Carex arenaria*, with lichens such as *Cetraria aculeata*. The dune slacks within this site are comparatively small and the Yorkshire-fog *Holcus lanatus* community predominates. They are calcareous and the communities occur in association with swamp communities. Some of the slacks support the liverwort Petalwort *Petalophyllum ralfsii*.
North Norfolk Coast SPA	Avocet, *Recurvirostra avosetta* - A132-A, b Bittern, *Botaurus stellaris* - A021, b Common Tern, *Sterna hirundo* - A193, b Dark-bellied Brent Goose, *Branta bernicla bernicla* - A675, nb Knot, *Calidris canutus* - A143, nb Little Tern, *Sternula albifrons* - A195, b Marsh Harrier, *Circus aeruginosus* - A081, b Montagu's Harrier, *Circus pygargus* - A084, b	The North Norfolk Coast SPA encompasses much of the northern coastline of Norfolk in eastern England. It is a low-lying barrier coast that extends for 40 km from Holme to Weybourne and includes a great variety of coastal habitats. The main habitats – found along the whole coastline – include extensive intertidal sand- and mud-flats, saltmarshes, shingle and sand dunes, together with areas of freshwater grazing marsh and reedbed, which has developed in front of rising land. The site contains some of the best examples of saltmarsh in Europe. There are extensive deposits of shingle at Blakeney Point, and major sand dunes at Scolt Head. Extensive reedbeds are found at Brancaster, Cley and Titchwell. Maritime pasture is present at Cley and extensive areas of grazing marsh are

European site	Designated features	Description
	Pink-footed Goose, *Anser brachyrhynchus* - A040, nb Sandwich Tern, *Thalasseus sandvicensis* - A191, b Waterbird assemblage Wigeon, *Mareca penelope* - A050, nb	present all along the coast. The grazing marsh at Holkham has a network of clear water dykes holding a rich diversity of aquatic plant species. The great diversity of high-quality freshwater, intertidal and marine habitats results in very large numbers of waterbirds occurring throughout the year. In summer, the site holds large breeding populations of waders, four species of terns, Bittern *Botaurus stellaris* and wetland raptors such as Marsh Harrier *Circus aeruginosus*. In winter, the coast is used by very large numbers of geese, sea-ducks, other ducks and waders. The coast is also of major importance for staging waterbirds in the spring and autumn migration periods. Breeding terns, particularly Sandwich Tern *Thalasseus sandvicensis*, and wintering sea-ducks regularly feed outside the SPA in adjacent coastal waters.
Roydon Common & Dersingham Bog SAC	H4010 Northern Atlantic wet heaths with *Erica tetralix* H4030 European dry heaths H7150 Depressions on peat substrates of the *Rhynchosporion*	Roydon Common and Dersingham Bog represent the largest and best examples of Cross-leaved Heath – Bog-moss (*Erica tetralix–Sphagnum compactum*) wet heath in East Anglia. This vegetation community is part of a lowland mixed valley mire, a complex series of plant communities grading from wet acid heath through valley mire to calcareous fen. This gradation is of outstanding interest. The mire is extremely diverse and supports many rare plants, birds and insects, including the Black Darter dragonfly *Sympetrum scoticum*, a northern species with a very local distribution in south-east England. The site also contains an area of dry heathland, which is dominated by Heather *Calluna vulgaris*, Gorse *Ulex europaeus* and young Silver Birch *Betula pendula*, and has areas of Bracken around the margins.
Roydon Common Ramsar	Mixed lowland valley mire Wetland invertebrate assemblage	Roydon Common is an area of lowland mixed valley mire surrounded by heathland. It sits on the Cretaceous greensand of west Norfolk, within a broad south-west-facing valley basin. It has a classic sequence of vegetation types associated with valley mires of this type. The dry heath of the upper slopes is hydrologically linked with wetter lower slopes, which experience seasonal waterlogging and are colonised by wet heath. This grades into the valley bottom, which is permanently waterlogged, and comprises acid bog and nutrient-poor fen communities, blending into more base-rich fen and carr woodland in the valley bottom.
Saltfleetby-Theddlethorpe Dunes &	H2110 Embryonic shifting dunes H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('White dunes')	The dune system on this composite site contains good examples of shifting dunes within a complex site that exhibits a range of dune types. The Marram *Ammophila arenaria*-dominated dunes are associated with Lyme-grass *Leymus arenarius* and Sand Sedge *Carex*

European site	Designated features	Description
Gibraltar Point SAC	H2130# Fixed dunes with herbaceous vegetation ('Grey dunes') H2160 Dunes with *Hippophae rhamnoides* H2190 Humid dune slacks	*arenaria*. These shifting dunes are part of a successional transition with fixed dunes with dune grassland and Sea-buckthorn *Hippophae rhamnoides*. The rapidly-accreting dunes on the seaward sand bars and shingle banks make this an important site for research into the processes of coastal development.
The Wash & North Norfolk Coast SAC	H1110 Sandbanks which are slightly covered by sea water all the time H1140 Mudflats and sandflats not covered by seawater at low tide H1150# Coastal lagoons H1160 Large shallow inlets and bays H1170 Reefs H1310 Salicornia and other annuals colonising mud and sand H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) S1355 Otter, *Lutra lutra* S1365 Harbour (Common) Seal, *Phoca vitulina*	The Wash is the largest embayment in the UK. It is connected via sediment transfer systems to the north Norfolk coast. Together, The Wash and North Norfolk Coast form one of the most important marine areas in the UK and European North Sea coast, and include extensive areas of varying, but predominantly sandy, sediments subject to a range of conditions. Communities in the intertidal include those characterised by large numbers of polychaetes, bivalve and crustaceans. Subtidal communities cover a diverse range from the shallow to the deeper parts of the embayments and include dense brittlestar beds and areas of an abundant reef-building worm ('ross worm') *Sabellaria spinulosa*. The embayment supports a variety of mobile species, including a range of fish, Otter *Lutra lutra* and Common Seal *Phoca vitulina*. The extensive intertidal flats provide ideal conditions for Common Seal breeding and hauling-out.
The Wash Ramsar	Bar-tailed Godwit, *Limosa lapponica* - Wintering Curlew, *Numenius arquata* - Wintering Dark-bellied Brent Goose, *Branta bernicla* - Wintering Dunlin, *Calidris alpina* - Wintering Estuary Grey Plover, *Pluvialis squatarola* - Wintering Harbour (Common) Seal, *Phoca vitulina* Knot, *Calidris canutus* - Wintering Oystercatcher, *Haematopus ostralegus* - Wintering Pink-footed Goose, *Anser brachyrhynchus* - Wintering Pintail, *Anas acuta* - Wintering Redshank, *Tringa totanus* - Wintering	The Wash is the largest estuarine system in Britain. It is fed by the rivers Witham, Welland, Nene and Great Ouse. There are extensive saltmarshes, intertidal banks of sand and mud, shallow waters and deep channels. It is the most important staging post and over-wintering site for migrant wildfowl and wading birds in eastern England. It supports a valuable commercial fishery for shellfish and also an important nursery area for flatfish. It holds one of the North Sea's largest breeding populations of Common Seal *Phoca vitulina* and some Grey Seals *Halichoerus grypus*. The sublittoral area supports a number of different marine communities including colonies of the reef-building polychaete worm *Sabellaria spinulosa*.

European site	Designated features	Description
	Sanderling, *Calidris alba* - Wintering Shelduck, *Tadorna tadorna* - Wintering Turnstone, *Arenaria interpres* - Wintering Waterbird assemblage - Wintering Wetland invertebrate assemblage	
The Wash SPA	Bar-tailed Godwit, *Limosa lapponica* - A157, nb Bewick's Swan, *Cygnus columbianus bewickii* - A037, nb Black-tailed Godwit, *Limosa limosa islandica* - A616, nb Common Scoter, *Melanitta nigra* - A065, nb Common Tern, *Sterna hirundo* - A193, b Curlew, *Numenius arquata* - A160, nb Dark-bellied Brent Goose, *Branta bernicla bernicla* - A675, nb Dunlin, *Calidris alpina alpina* - A672, nb Gadwall, *Mareca strepera* - A051, nb Goldeneye, *Bucephala clangula* - A067, nb Grey Plover, *Pluvialis squatarola* - A141, nb Knot, *Calidris canutus* - A143, nb Little Tern, *Sternula albifrons* - A195, b Oystercatcher, *Haematopus ostralegus* - A130, nb Pink-footed Goose, *Anser brachyrhynchus* - A040, nb Pintail, *Anas acuta* - A054, nb Redshank, *Tringa totanus* - A162, nb Sanderling, *Calidris alba* - A144, nb Shelduck, *Tadorna tadorna* - A048, nb Turnstone, *Arenaria interpres* - A169, nb Waterbird assemblage Wigeon, *Mareca penelope* - A050, nb	The Wash is located on the east coast of England and is the largest estuarine system in the UK. It is fed by the rivers Witham, Welland, Nene and Great Ouse that drain much of the east Midlands of England. The Wash comprises very extensive saltmarshes, major intertidal banks of sand and mud, shallow waters and deep channels. The eastern end of the site includes low chalk cliffs at Hunstanton. In addition, on the eastern side, the gravel pits at Snettisham are an important high-tide roost for waders. The intertidal flats have a rich invertebrate fauna and colonising beds of Glasswort *Salicornia* spp. which are important food sources for the large numbers of waterbirds dependent on the site. The sheltered nature of The Wash creates suitable breeding conditions for shellfish, principally Mussel *Mytilus edulis*, Cockle *Cardium edule* and shrimps. These are important food sources for some waterbirds such as Oystercatchers *Haematopus ostralegus*. The Wash is of outstanding importance for a large number of geese, ducks and waders, both in spring and autumn migration periods, as well as through the winter. The SPA is especially notable for supporting a very large proportion (over half) of the total population of Canada/Greenland breeding Knot *Calidris canutus islandica*. In summer, The Wash is an important breeding area for terns and as a feeding area for Marsh Harrier *Circus aeruginosus* that breed just outside the SPA. To the north, the coastal habitats of The Wash are continuous with Gibraltar Point SPA, whilst to the east The Wash adjoins the North Norfolk Coast SPA.

Appendix 3: Features potentially vulnerable to impacts from recreation

The table below lists features that are potentially vulnerable to access impacts, with the features selected based on the initial workshop and a review of relevant literature. The order in the table reflects the types of feature (alphabetical) and then features are listed in alphabetical order. For each feature we identify the type of impact that is relevant, categorising impacts as:

- **Damage**: encompassing trampling and vegetation wear, soil compaction and erosion, trampling can cause direct mortality for some fauna;
- **Contamination**: including nutrient enrichment (e.g. dog fouling), litter, invasive species;
- **Disturbance**: relevant to fauna only, and relating to the avoidance of otherwise suitable habitat, direct flushing and direct mortality (e.g. dogs killing wildlife);
- **Fire**: increased incidence and risk of fire, and;
- **Other**: all other impacts, including harvesting and activities associated with site management, for example the difficulties in achieving necessary grazing.

We identify which seasons are relevant, providing an indication and approximate guide where impacts are seasonal. In describing seasons, we treat Spring as March-May; Summer as June-August; Autumn as September – November and Winter as December – February.

Where there are particular types of activity that may be relevant, these are also highlighted, indicating whether dogs, high friction (wheels, horses' hooves) or large groups (i.e. impact of lots of people together) are of particular concern.

Ticks in the European site interest column indicate species and habitats listed in Appendix 2.

Feature	Feature details	Feature type	European site interest	Impact type					Season				Activity Types			Notes	References
				Damage	Contamination	Disturbance	Fire	Other	Spring	Summer	Autumn	Winter	Dogs	High friction	Large groups		
Natterjack Toad	Breeding ponds, tadpoles and adults	Amphibian			✓	✓	✓		✓	✓	✓	✓	✓		✓	Ponds vulnerable to contamination (e.g. dogs swimming). Only occurs at Holme.	Edgar (2002)
Avocet	Breeding	Bird	✓			✓		✓	✓	✓			✓		✓	Breeding mostly in reserves with limited access but colonies on saltmarsh and pairs breeding on isolated lagoons vulnerable	
Common Tern	Breeding	Bird	✓			✓			✓	✓			✓		✓	Colonial breeder and ground nesting.	
Dartford Warbler	Adults and nests	Bird				✓	✓		✓	✓	✓	✓	✓		✓	Impacts to breeding success in heather dominated territories; also risks from fire	Murison et al. (2007)
European Nightjar	Nests/ breeding	Bird				✓	✓		✓	✓			✓		✓	Disturbance impacts on breeding success and distribution; breeding locations can be particularly damaged by fire.	Murison (2002); Liley et al. (2006); Lowe, Rogers & Durrant (2014)
Herons and egrets	Heronries	Bird				✓			✓	✓					✓	Grey Heron and range of rarer herons at risk from disturbance as colonial nesters and potential for single events to impact multiple pairs.	
Little Tern	Breeding	Bird	✓			✓			✓	✓			✓		✓	Beach nesting and vulnerable to trampling and disturbance	Medeiros *et al.* (2007); Ratcliffe *et al.* (2008);
Marsh Harrier	Nest sites	Bird	✓			✓			✓	✓			✓		✓	Nest sites can be in small reedbeds or even arable and potentially vulnerable to disturbance	Fernandez & Azkona (1993)
Montagu's Harrier	Nest sites	Bird	✓			✓			✓	✓			✓		✓	Rare and sporadic breeding bird with risks from disturbance due to small population and rarity.	
Oystercatcher	Breeding	Bird				✓			✓	✓			✓		✓	Beach nesting wader with potential for similar risks as Ringed Plover.	Tratalos (2021)
Pink-footed Goose	Arable feeding areas	Bird	✓			✓					✓	✓	✓		✓	Evidence that certain otherwise suitable fields avoided due to disturbance.	Gill (1996)

Feature	Feature details	Feature type	European site interest	Impact type					Season				Activity Types			Notes	References
				Damage	Contamination	Disturbance	Fire	Other	Spring	Summer	Autumn	Winter	Dogs	High friction	Large groups		
Redshank	Breeding	Bird				✓		✓	✓	✓			✓		✓	Potentially vulnerable in areas of accessible saltmarsh	
Ringed Plover	Breeding	Bird				✓			✓	✓			✓		✓	Beach nesting wader with areas of high recreation use avoided and risk of nest loss from trampling. Disturbance also interacts with habitat change and predation.	Liley *et al.* (2021); Liley & Sutherland (2007); Tratalos (2021)
Sandwich Tern	Breeding	Bird	✓			✓			✓	✓			✓		✓	Colonial breeder and ground nesting. Large colonies at Scolt and Blakeney. Colonies potentially vulnerable to single events causing birds to desert.	Brpwn & Grice (2005)
Shorelark	Wintering	Bird				✓					✓	✓	✓		✓	Feeds in saltmarsh and beach habitats. Low population at vulnerable to disturbance from photographers in particular.	
Skylark	Breeding pairs/nests and young	Bird				✓			✓	✓			✓		✓		
Snow Bunting	Wintering	Bird				✓					✓	✓	✓		✓	Feeds on beach habitats. Small flocks and risks of disturbance from photographers and dogs in particular.	
Twite	Wintering	Bird				✓					✓	✓	✓		✓	Feeds in saltmarsh and now rare, vulnerable to disturbance as population low.	
Turtle Dove	Breeding	Bird				✓	✓		✓	✓			✓		✓	Rapidly declining species with some local hotspots within the area. Can feed on beaches (vegetated shingle) and nearby scrub and feeds on the ground where potentially at risk from flushing.	
Wintering and passage waterbirds	Intertidal foraging sites and roost sites	Bird	✓			✓			✓		✓	✓	✓		✓	Roosts can represent very large aggregations of birds in small area. Risks from disturbance with energetic costs and risks of roost site abandonment. Birds	

Feature	Feature details	Feature type	European site interest	Impact type					Season				Activity Types			Notes	References
				Damage	Contamination	Disturbance	Fire	Other	Spring	Summer	Autumn	Winter	Dogs	High friction	Large groups		
																more dispersed when foraging but risks of areas being avoided and energetic costs.	
Wintering raptors	Roost site	Bird				✓	✓		✓			✓	✓		✓	Roosts represent aggregations of birds in small area. Risks from photographers and a range of different access.	
Woodlark	Breeding pairs/nests and young; adults in winter	Bird				✓		✓	✓	✓			✓		✓	Disturbance shown to impact settlement. Other impacts may include difficulties in achieving grazing as uses short acid grassland.	Mallord et al. (2007)
Bittern	Feeding sites and nest locations	Birds	✓			✓	✓		✓	✓	✓	✓	✓		✓	Likely to be reasonably protected from disturbance impacts due to inaccessibility but perhaps potential for disturbance	
Coastal Grazing Marsh	Habitat	Habitat		✓	✓				✓	✓	✓	✓	✓			Impacts relate to grazing management and potential for loss of fringing vegetation and contamination of ditches	
Lowland Dry heath	Individual plants and habitat	Habitat	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	Issues associated with chronic trampling, changes to soil chemistry from dog fouling.	Lowen *et al.* (2008); Underhill-Day (2005)
Reedbeds	Habitat	Habitat		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	Fire, trampling and contamination all a risk, particularly in drier areas	
Saline Lagoons	Habitat	Habitat	✓	✓	✓				✓	✓	✓	✓	✓		✓	Risks from trampling damage to sediment/shores and contamination.	Lowen *et al.* (2008)
Saltmarsh	Suite of plants and habitat structure	Habitat	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	Key concerns relate to trampling damage with risks of erosion. Pioneer saltmarsh perhaps potentially vulnerable. Challenges with achieving grazing management where high levels of access.	Coombes (2007); Lowen *et al.* (2008)
Sand Dune	Structure of habitat, suite	Habitat	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	Impacts from trampling damage with risks of erosion. Contamination from dog	Coombes (2007); Lowen *et al.* (2008)

Feature	Feature details	Feature type	European site interest	Impact type					Season				Activity Types			Notes	References
				Damage	Contamination	Disturbance	Fire	Other	Spring	Summer	Autumn	Winter	Dogs	High friction	Large groups		
	of plants and invertebrates															fouling. Challenges with achieving grazing management where high levels of access.	
Seagrass Beds	Habitat	Habitat		✓	✓				✓	✓	✓	✓			✓	Potentially vulnerable to damage from boats and feet where in shallow water or any anchoring.	Collins *et al.* (2010); Unsworth *et al.* (2017); Travaille *et al.* (2015)
Vegetated Shingle	Individual plant species and habitat	Habitat	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	Sensitive to trampling damage and nutrient enrichment (e.g. dog fouling) in particular. Evidence for long term change at some sites such as Snettisham Scalp	Lowen *et al.* (2008); Liley *et al.* (2021)
Ant-lion	Larval pits	Insect		✓	✓	✓				✓	✓		✓	✓	✓	Limited range but could colonise further. Larval pits susceptible to damage/disturbance form footfall/soil compaction. Also potential for shading arising from dog-fouling induced changes in habitat structure.	
Dune Tiger Beetle	Adults and larval burrows	Insect		✓	✓	✓			✓	✓	✓	✓	✓		✓	Adults vulnerable to disturbance and fire while burrows possible at risk from trampling. Dog fouling/contamination could result in long term habitat change.	Arndt *et al.* (2005)
Ground-nesting bees and wasps	Burrows	Insect		✓				✓	✓	✓	✓	✓	✓	✓	✓	Dependent on bare ground and risks relate to any changes in the amount and quality of bare ground, e.g. path improvements, surfacing, constant trampling/damage or even loss bare ground (e.g. from restrictions in access or contamination from dog fouling).	
Petalwort	Thalli	Liverwort	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	Only known from Holme and risks potentially low. Requires open bare habitats but possible impacts from heavy trampling and contamination	

Feature	Feature details	Feature type	European site interest	Impact type					Season				Activity Types			Notes	References
				Damage	Contamination	Disturbance	Fire	Other	Spring	Summer	Autumn	Winter	Dogs	High friction	Large groups		
Grey Seal	Pupping and haul out sites	Mammal				✓			✓	✓	✓	✓	✓		✓	Increasing and appears able to adapt to relatively high levels of human pressure. Pups born September – December.	Skeate & Perrow (2008)
Harbour Seal	Pupping and haul out sites	Mammal	✓			✓			✓	✓	✓	✓	✓		✓	Declining and more vulnerable to disturbance and now believed unable to breed on mainland due to people and dogs. Pups born June - July	Andersen *et al.* (2012); Skeate & Perrow (2008)
Man Orchid	Individual plants	Plant		✓	✓		✓		✓	✓			✓		✓	Only occurs in dunes at Holme. Potentially vulnerable to fire, contamination.	
Wet Heath and Mire	Individual plants, habitat quality and indicators for other rarer species	Plant	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	Vulnerability will relate to ground conditions and waterlogging.	Lowen *et al.* (2008); Underhill-Day (2005)
Adder	Adults and basking sites	Reptile				✓	✓		✓	✓	✓		✓		✓	Issues include attacks by dogs, deliberate killing, disturbance while basking, fire.	Edgar (2002); Worthington-Hill (2015)

Appendix 4: Example visitor data from selected sites

The table below provides some summary metrics from the vantage point counts and vehicle counts. Vantage point counts relate to the pale pink arcs (e.g. as shown on Map 24) extending roughly 1500m either side of the vantage point (adjusted to reflect area actually visible). Data are average from the 5 counts undertaken at each location. For the vehicle counts the values reflect the number for the parking location/car park associated with the vantage point. Red text indicates highest value in each column and blue the lowest.

	Average dogs on beach per linear km	Average dogs per km2 on saltmarsh and intertidal	Average Total People	Average total dogs	Average dogs per person	Average total people dog walking per km shore length	Average total people on beach per km of shoreline	Average total people on saltmarsh, sandflats or mudflats per km2	Average boats per km shore	Average total vehicles	% occupancy (average number of vehicles as a % of number spaces)
Cley Eye	**0.0**	**0.1**	22.4	**1.0**	**0.0**	**0.7**	0.3	2.3	**0.0**	9.0	7.8
Wells	0.9	1.8	216.8	12.0	0.1	6.2	**37.0**	35.2	**0.3**	**239.6**	**50.4**
Brancaster (looking east)	2.1	2.5	67.8	12.0	0.2	13.2	24.6	12.3	**0.3**	37.0	46.3
Brancaster (looking west)	**4.5**	**3.6**	68.6	**18.4**	0.3	**14.4**	15.7	9.6	**0.0**	37.0	46.3
Hunstanton	0.1	**0.1**	**797.2**	16.8	**0.0**	8.5	11.5	**43.1**	0.1	168.6	34.5
Snettisham Beach Road	0.5	**0.1**	40.6	5.4	0.1	3.0	11.7	**0.1**	**0.0**	22.0	**6.8**
Holbeach	**0.0**	0.2	**6.4**	4.0	**0.6**	1.1	**0.0**	0.4	**0.0**	**2.8**	18.7
Freiston	**0.0**	0.6	10.8	2.2	0.2	1.1	**0.0**	**0.1**	0.2	3.8	42.2
Gibralter Point	**0.0**	0.0	19.8	2.0	0.1	2.0	**0.0**	1.4	**0.0**	32.4	49.8

Appendix 5: Management actions

The table below lists a range of different management actions that could be relevant to managing access in different zones. The table identifies measures that are seasonal (i.e. could be deployed for a particular time window) and also highlights which might be appropriate to reduce impacts for beach-nesting birds, wintering waterbirds, seals or habitat damage (the key themes) and which measures are relevant to which types of zone. For the themes and zones, pale red shading with a single tick (✓) indicates measures that have some relevance while dark red shading and double ticks ✓✓ indicates those measures particularly appropriate.

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
Access infrastructure														
Boardwalk and improved path infrastructure	Ability to focus use along key routes and contain people on paths		✓	✓	✓	✓✓			✓	✓			Evidence to show resurfacing paths reduces spread of people. Likely to be most effective in dune or shingle habitats where walking harder	Pearce-Higgins & Yalden (1997)
Dedicated fenced areas for dogs off lead	Dedicated areas where dogs can be let safely off lead. Can be large enclosures or small areas mores suitable for training etc.	✓	✓	✓	✓	✓	✓✓	✓	✓				Potential to facilitate better trained dogs and to provide space where unruly dogs or those that need space to run off lead can't cause harm	
Dedicated viewpoints	Creates destinations within a site, allows visitors to see and view other areas while containing access		✓✓	✓✓	✓✓	✓	✓	✓✓	✓✓	✓✓				
Dog bins and bags	Clear provision of means to dispose of waste, can be litter bins. Bags etc can be dispensed/provided free too					✓	✓✓	✓✓	✓✓		✓			
Fences and cordons to restrict access	Areas of fencing to keep people out or away from certain areas	✓	✓✓	✓✓	✓✓	✓✓	✓		✓✓	✓	✓✓		Potential to ensure localised areas that are vulnerable are protected – can include areas of sensitive habitat, areas used by	Liley *et al.* (2021a); Weston *et al.* (2012)

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
													seals, roost sites and nesting habitat or whole stretches of beach	
Good quality interpretation	Provides information to visitors about the conservation interest and importance	✓	✓	✓	✓	✓	✓	✓	✓✓	✓✓			Can be seasonal in that potential for information to be varied through the year. Better informed visitors may respond differently	Maarten & Harms (2014)
Height restriction and gated car parks	Allowing control over size and timing of when car parks used, potential to restrict overnight parking and size of vehicle		✓	✓	✓	✓		✓	✓	✓	✓		Ability to control use by campervans etc and night time use and anti-social behaviour plus associated risks such as contamination and fire	
Hides	Dedicated structures for viewing wildlife and allowing people to see and experience wildlife close up		✓	✓✓	✓✓			✓	✓	✓✓			Wide range of designs possible from simple shelters with open sides to large buildings.	
New/enhanced launching points for watersports	Can provide better parking, ease of access to water and can lead to better control of where people launch from		✓✓	✓✓	✓✓	✓✓	✓		✓				Scope to provide messaging, codes of conduct etc at launch points. Launching managed to direct users and limit damage to habitat and provided in locations where impacts can be addressed	
Picnic facilities and dedicated barbeque areas	Infrastructure to allow people to cook and tables etc to eat at		✓			✓	✓✓	✓✓	✓✓	✓			May help to limit people trying to picnic or barbeques in sensitive locations	
Provision of dog facilities (e.g. dog washing)	Facilities to draw dog walkers to particular locations and feel welcomed		✓	✓	✓	✓	✓	✓✓	✓				May help make soften other measures if there are dedicated facilities and places for dog walkiers	
Screens	wooden or reed structures to create visible barrier between people and wildlife, can have slots for viewing out		✓	✓✓	✓				✓	✓✓	✓			
Signage to influence behaviour	Signs can be temporary or permanent and targeted to particular times of year and locations	✓	✓✓	✓✓	✓✓	✓✓	✓		✓	✓	✓		Careful consideration necessary with regard to design, messaging and placement to ensure effectiveness	Mederios *et al.* (2007); Allbrook & Quinn (2020); Acevedo-

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
														Gutierrez *et al.* (2011); Ham *et al.* (2009)
Toilet provision	Provision of toilet facilities	✓				✓	✓✓	✓	✓✓	✓			May help to draw visitors to particular locations. May also help reduce contamination. Can be seasonal (e.g. portaloos in overflow car parks)	
Unstaffed visitor centre	Low key focal point, with information and shelter, permanently open and unstaffed		✓	✓	✓	✓		✓		✓	✓			
Use of artwork to inspire and draw access	Potential to use sculptures and temporary art to draw visitors, raise awareness and promote sites	✓	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓✓			Can be seasonal or temporary to attract visitors at particular times of year or to particular locations. Artwork can convey particular messages (e.g. importance for birds)	
Outdoor play structures	Infrastructure to draw visitors to particular locations		✓	✓	✓	✓	✓✓	✓✓	✓✓	✓			Can have nature theme and would be targeted to draw families to particular locations. Could work to provide space for children to play as an alternative to more sensitive locations	
Directing access														
Augmented reality and self-guiding via apps	Interactive content provided through dedicated apps, scope to target messaging to particular locations, parts of site, activities etc.	✓	✓	✓	✓	✓			✓✓	✓✓	✓		Content can be varied through the year	
Wayfinding/directional signs	Prevents people getting lost and can allow use to be focussed along particular routes		✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓		Likely to work best if shared on maps, promoted and suitable infrastructure (path surfacing etc) provided on route.	
Maps for wayfinding	Clear maps on interpretation boards and online to facilitate people finding their way		✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓			Potential for more strategic implementation across sites. Maps should indicate areas where access restricted and	

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
													direct visitors where they can go without causing damage	
Promotion of sites and routes through internet, social media, gazeteers and events	Potential to raise profile of sites and promote their use	✓	✓	✓	✓	✓	✓	✓	✓	✓			Can be varied seasonally or highlight sites to visit at particular times of year	
Engagement and information provision														
Codes of conduct	Promoted on leaflets, internet, signs and targeted to different activities	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓	✓✓	✓✓	Potential for wildlife only areas to be clearly mapped. Codes can have seasonal component and also be tailored or targeted to particular activities and issues. Important that there is clear messaging as to how visitors should behave	
Direct engagement with user groups, activity providers and those posting/hosting online	Direct liaison with certain groups to provide messaging, support and influence where they go and behaviour		✓	✓✓	✓✓	✓	✓	✓✓	✓✓	✓	✓✓	✓	Could target foragers, watersports, dog walking, tourist providers, sailing clubs etc. Relevant to wildlife only with respect to permitted activities	
Engagement and information provision														
Engagement through social media and internet	Potential to reach wider and more diverse audience and influence travel patterns, behaviour etc.	✓	✓	✓	✓	✓	✓✓		✓✓	✓		✓	Potential for remote cameras etc in wildlife only areas to show people wildlife remotely	
Face to face visitor engagement	Rangers/wardens with engagement role – able to show people wildlife, explain issues, influence behaviour etc.	✓	✓✓	✓✓	✓✓	✓✓			✓✓	✓	✓✓		May be less relevant in wild places if visitor numbers very low. Can be targeted to locations and times of year where issues occur	Saunders & Liley (2022); Mederios *et al.* (2007);
Staffed visitor centres	Focal point/destinations that provide information, education, resources and interpretation		✓✓	✓✓	✓✓	✓✓			✓✓	✓✓			Can influence where people go, what they do and how they behave as well as raise awareness	

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
Volunteer ambassadors	Members of local community providing positive examples and engagement		✓✓	✓✓	✓✓	✓	✓	✓	✓	✓✓				
New GI														
Creation of new greenspaces and routes to enhance access	Suitable Alternative Natural Greenspace (SANGS) and other spaces to provide additional space for recreation. Could include enhancement to footpath networks and linear routes		✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓	✓			Spaces could be targeted to draw access from other locations and provide for activities such as dog walking. This is essentially creating new areas of Local Greenspace	Allinson (2018); Natural England – anon (2021)
Parking														
Advance booking and parking permits	Permits (e.g. residents only) or advance booking system for parking, meaning numbers limited	✓	✓	✓	✓	✓	✓		✓	✓	✓✓		Availability and overall capacity can be varied through the year as necessary	
Car park charging	Use of charging to influence car park use (e.g. through duration, cost etc). Instigation of charging (even voluntary) may help convey messages that site is looked after and important	✓	✓	✓	✓	✓	✓	✓	✓	✓			Some evidence that locations that charge have more visitors	Weitowitz *et al.*
Enhanced car parking facilities	Increased number of spaces and ease of parking to accommodate high visitor numbers						✓	✓	✓				Could include temporary parking, overflow parking, new car parks and expansion of existing parking. Potential benefits in terms of addressing impacts through diverting people to more robust locations	
Live parking app or information on web	Allows visitors to identify where there is parking available (live)	✓							✓✓	✓✓			Potential benefits in terms of addressing impacts through diverting people to more robust locations	
Live signage to indicate parking capacity	Allows visitors to identify where there is parking	✓							✓✓	✓✓			Potential benefits in terms of addressing impacts through diverting people to more robust locations	
Physical restrictions for vehicles off highways	Restrict vehicular access at end of highway and parking on verges etc through use of		✓	✓	✓	✓			✓	✓	✓✓	✓✓		

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
	dragons teeth, gates, ditches, double lines etc.													
Provision of electric vehicle charging	Promotes sustainable transport choices and could draw visitors to particular locations						✓	✓	✓	✓			Potential benefits in terms of addressing impacts through diverting people to more robust locations	
Restrictions/enforcement														
Permits for particular activities	Certain activities only allowed where permits in place	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		Permits can easy to obtain but can ensure users comply with code of conduct etc.	
Signage to indicate access restricted		✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓	✓	✓✓	✓✓	Can be temporary or permanent	
Ticket entry/capped permit system	Purchased in advance or on-entry with potential to limit numbers	✓	✓	✓	✓	✓				✓	✓		Could allow for guided walks and events in low key way in wild places and number of permits can be varied seasonally	
Wardening with enforcement role	site presence to enforce byelaws, gather evidence, liaise with police etc.	✓	✓✓	✓	✓✓	✓					✓✓	✓✓	Can be targeted to particular times of year, issues or locations. Potential to be boat based or terrestrial	Greer *et al.* (2017)
Zoning	Dedicated zones where restrictions on particular types of access (watersports, horses, dogs)	✓	✓✓	✓✓	✓✓	✓✓	✓✓		✓✓	✓✓	✓		Zones can change with time, potentially even seasonally	
Travel related														
Bike hire	Cycle hire, with options to incentivise or subsidise to reduce car use	✓	✓	✓	✓	✓	✓✓		✓✓	✓✓			Potential for hire to include range of bikes (e.g. ebikes, mountain bikes etc), equipment (trailers, panniers) and help visitors with route choice. Can be pop up or seasonal. Potential benefits in terms of addressing impacts through diverting people to more robust locations and influencing where people cycle	
Bike washing facilities	Dedicated provision to allow cyclists to clean their bikes and kit								✓				Likely to be used only by mountain bikers and best provided alongside other	

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
													mountain bike facilities. Potential benefits in terms of addressing impacts through diverting people to more robust locations	
Boat drop off and pick-up (water taxi)	Potential to provide and control access to remote locations	✓	✓	✓	✓	✓			✓✓	✓✓	✓		Boats take visitors to Blakeney and Scolt Head at moment, use and drop-offs provide a means to control access and could be extended to other areas	
Dedicated cycle and riding routes	Allows people to reduce car use and keeps cycles, horses etc to set, promoted routes		✓	✓	✓	✓	✓✓	✓✓	✓✓	✓			Can have dedicated cycle routes to access sites and dedicated areas/ routes within sites	
Enhanced bus routes	Potential to disperse access away from car parks		✓	✓	✓	✓	✓✓	✓	✓✓	✓✓			Requires strategic implementation, could provide potential for better engagement and communication with visitors while on the bus too	
Park and ride bus system	Allows people to park and access areas by bus with potential for drop off and pick up in different areas	✓	✓	✓	✓	✓	✓	✓	✓	✓			Can be seasonal and potential to direct and influence access	
Catering														
Café and associated facilities							✓✓	✓	✓✓	✓✓			Potential benefits in terms of addressing impacts through diverting people to more robust locations. Can provide means to communicate nature positive messages around food and opportunities for engagement	
Mobile catering facilities	Ability to respond to high demand and to draw visitors (e.g. if regular on particular days)	✓					✓✓	✓	✓✓				Potential benefits in terms of addressing impacts through diverting people to more robust locations. Can provide means to communicate nature positive messages around food and opportunities for engagement	

Management action	Description	Seasonal	Beach-nesting birds	Wintering waterbirds	Seals	Habitat	Town and Village	Local Greenspace	Destination Sites	Wildlife Tourism	Wild Places	Wildlife Only	Notes	Reference
Other														
Nest cages	Metal cages over individual nests that protect nest from predators, trampling etc.	✓	✓✓				✓		✓✓	✓	✓✓		Can be used anywhere where beach nesting birds such as Ringed Plover present, and beneficial to reduce predation even if low footfall	

Appendix 6: Example recording form for vehicle counts

This appendix provides an example of the driving transect recording form. Only 5 rows are shown for the main table. Blue shading indicates main, formal car parks, orange shading indicates roadside parking and green rows are verges, lay-bys, gateways and other informal parking. Recording forms included detailed instructions, maps and space to record any general factors or observations, including anything that may have influenced visitor use (such as road closures).

Date:	Surveyor:	Start time:	Rain (y/n):	Cloud cover (8ths):	Finish time
Weather description/notes:					

SECTION A

ID	Name	Description/ notes	Approx. capacity	1. Time visited	2. Vans etc.	3. Branded dog walking vehicles	4. Camper-vans/ caravans	5. Horse boxes	6. Motorcycles	7. Vehicles with rear/roof racks	8. Minibus, coach	9. Total motor vehicles (any type)	10. Tick if closed/ inaccessible
1	Holgate Hill CP	Kelling Heath car park	45										
2	Beach lane	Parallel parking along Beach lane	18										
3	Weybourne Beach CP	Formal parking	100										
4	The Street, Kelling	Parking just opp. The tea rooms	3										
5	Coast Rd	Informal parking on verge corner (SW side)	3										

.....etc.

Appendix 7: Vantage point recording form

This appendix shows the recording form used for vantage point counts.

Vantage point ID:		**Tide state - approx. (tick just one):**		**Notes (record any unusual activities or general comments about events):**
Date:		**Low:**		
Surveyor initials:		**Intermediate:**		
Time:		**High:**		
Visibility of vantage area % (not visible due to heavy rain/fog):		**Notes on other people:**		

	Count unit	Seawall/ promenade/ dunes (above MHWM)[1]	Saltmarsh [2] (i.e. vegetated)	Beach above MHWM[3]	Sandflats/ mudflats below MHWM[4]	On water[5]	Notes
Walkers (without dogs)	**People**						
Dog walkers	**People**						
Dogs off lead	**Dogs**						
Dogs on lead	**Dogs**						
Bird/wildlife watching	**People**						
Joggers	**People**						
Cyclists	**People**						
Angling/fishing (with rod)	**People**						
Bait diggers	**People**						
Water sports (inc. kayaks)	**People**						
"Active" Boats (all kinds)	**Craft**						
All other people (not included above)	**People**						

- Record within the count area (as defined on first visit, potentially out to 1.5km or so where visible).
- Counts are quick '**snapshots'**. Scan count area systematically (e.g. left – right) and count as you do, do not add additional people if they then enter the count area after your scan. You may need to do a number of scans for the different rows in the table.
- Visibility should generally be 100% - heavy rain or fog may reduce visibility.
- Water sports includes, surfing, paddleboarding, wind/kitesurfing, canoes, kayaks etc. and these can be recorded as out of the water, or on the terrestrial habitats, if setting up/heading out. Use notes to indicate approx. types.
- "Active" boats includes all types of boats (rowing, sailing, motorised, but not canoes or kayaks) and "active" refers to only those being actively used by people (on the water or being worked on or hauled in/out on the intertidal or terrestrial habitats.

[1]"Seawall/promenade/dunes" relates to the area well above Mean High Water Mark (MHWM) – elevated and supporting vegetation or concreted, i.e. sea defence, bank, promenade or dunes.

[2] Saltmarsh is the vegetated saltings and marsh areas, and won't be present at some locations.

[3]Beach above MHWM is the upper beach areas – unvegetated or limited vegetation (e.g. shingle) where it is safe to walk during most tide states

[4]Sandflats/mudflats below MHWM are those areas that are only exposed at low time but can be extensive open flat areas accessible at low tide

[5]On water relates to people/activities actually afloat.