Natural England

East Riding of Yorkshire Council

Risks to potential future coastal path users on the Holderness Coast

Final Report

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by

Asken Ltd

with

John Chatterton Associates

Photograph of boat compound, Easington. Dec 2013. Courtesy of East Riding of Yorkshire Council ©

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Executive Summary

In February 2015, Natural England (NE) and East Riding of Yorkshire Council (ERYC) appointed Asken Ltd and John Chatterton Associates to explore the question of risks likely to face users of the new England Coast Path (which NE has a duty to define) along the rapidly eroding and undefended sections of the Holderness Coast. The purpose of the research was to provide information that NE can use to influence its decisions over the proposed alignment of the England Coast Path where it passes along these highly dynamic sections.

Research focused on four topics:

- **Comparable situations** (Section 2): in an attempt to learn from the experience of other comparable situations, managers of national trails with coastal sections were contacted and questioned about their approach to zoning (by visitor pressure), risk assessment and risk management. Four trails were studied: Peddars Way and North Norfolk Coast Path, South West Coast Path, Pembrokeshire Coast Path and the coastal sections of the Cleveland Way. From this research, firstly it was recognised that situations in these other trails were not directly comparable (different geology and legal status of the actual route imposed different constraints). Further, it can be concluded that the approach being taken by NE/ERYC is innovative and more ambitious! In addition, consideration was given to other risks which are encountered by people in different situations and which are broadly considered 'acceptable'. Findings from a very limited literature search were:
    - risk of serious injury or death to recreational walkers caused by cattle is around 1:150,000;
    - risk of death of around 1:1,000,000 is considered broadly acceptable by the Health and Safety Executive (HSE) from work-related activities;
    - risk of a fatal injury caused by a falling tree is around 1:10,000,000.
- **Visitor pressure** (Section 3): Uncertainties in predicting numbers of visitors at any given location are such that reference is made to 'visitor pressure' so that giving any impression of accuracy is avoided. The intention is to provide indications of the variations in weight of visitor pressure. In order to provide these indications, a simple model was developed, drawing on data from Monitor of Engagement with the Natural Environment (MENE), Great Britain Day Visits Survey (GBDVS) and other surveys to:
    - Gauge the likely number of walking visits to the coast made by local residents, visitors staying in the area and visitors on day trips from further afield each year;
    - Gauge how walkers would distribute themselves along the Holderness Coast, by weighting 34 Coastal Access Points (CAPs) along the ERYC/Hull coast using a range of 'Pull Factors' agreed with the client;
    - Develop a 'distance decay function' which will spread numbers along the coast, by using survey data concerning typical length of stay data and speed of travel;

  - Rank visitor pressure into three categories at 101 specific locations (i.e. to coincide with profile locations used to monitor coastal change – see below);
  - Map visitor pressure variations (see **Figure 3.4**).

- **Erosion pressure** (Section 4.2)**:** Data are collected by ERYC on a regular basis at 123 points along the coast so that coastal change is carefully monitored. Of these, 101 are within the study area. Data captured includes location of cliff top, location of cliff toe, average annual cliff loss and maximum cliff loss events. The last variable was used to provide an indicator of erosion pressure at each profile relevant location. Outputs have been mapped (see **Figure 4.2**).
- **Severity pressure** (Section 4.3)**:** Another consideration is that not all accidents result in a severe injury. Research into injury severity suggests that it can be largely (but not entirely) accounted for by two variables – cliff height and slope. Using data from the coastal monitoring programme, these two variables can be mapped for the 101 profile locations. However, in order to provide a single indicator value, a two-axis 'sub-matrix' is used to provide outputs for the Main Matrix (see below). Outputs have been mapped (see **Figure 4.3**).

In order to bring Visitor, Erosion and Severity pressures together to obtain a single indicator value, a three-axis matrix was used (see Section 5), with scores generated by a common logarithmic scale (1 = Low; 3 = Medium; 9 = High). This produces a range of possible risk indicator scores of between 1 and 729 (i.e. from 1 x 1 x 1 to 9 x 9 x9). When mapped for each of the 101 profile locations, an indication of the variations in risk can be seen. However, the 'risk value' needs to be considered in context. It relates to the desirability of setting back the proposed England coast path from the cliff edge (it should not be seen as implying that there is a high risk to users in an absolute sense). So, the output is presented as 'Recommended set back distances'. Outputs have been mapped (see **Figure 5.2**).

A further step in the analysis was performed at three specific profile locations in an attempt to provide more specific or 'absolute' guidance on the level of risk likely to be faced at specific locations and to show how this declines as one moves back from the cliff edge at these locations. However, the data available do not support this form of analysis, having been collected for a different purpose, and data suitable for this use are available over too short a timescale to be meaningful. Therefore, this analysis has been abandoned and the results not presented.

Notwithstanding the absence of quantifiable findings referred to above, it can be concluded that the risk to users from a cliff loss event is generally low relative to comparable risks for the vast majority of situations. Even so, the further back from the cliff edge the England Coast Path can be set-back, the lower the risk to users of being directly affected by a cliff loss event.

Consequently, it is recommended that:

- NE should not align the centre line of the path within the first 6m back from the cliff top edge, meaning that the seaward boundary of the path corridor is no closer to the cliff top edge than 4m;
- Further to this, however, a route closer to the cliff edge may be acceptable where 'Severity Pressure' and/or 'Erosion Pressure' is classed as Low;
- NE and ERYC work together to explore how best to apply these findings, bearing in mind the limitations highlighted;
- NE and ERYC can repeat/extend the analysis as the dataset improves.

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1. Introduction

1.1 Introduction

Natural England (NE) and East Riding of Yorkshire Council (ERYC) awarded a contract to Asken Ltd, working in association with John Chatterton Associates, to "*estimate the degree of risk to a person passing through areas of the East Riding coast which are susceptible to high rates of coastal erosion on a promoted walking route. This should assess, in comparison with comparable stretches of coast, what may constitute an "acceptable level of risk"*."

1.2 Context

The Marine and Coastal Access Act 2009 (MCAA) introduced a duty on Natural England (NE) to develop a coastal path that would improve recreational public access on foot to the English coast. The power derives from a combination of the National Parks and Access to the Countryside Act 1949 (which enables NE to create long distance paths) and Countryside and Rights of Way Act 2000 (CROW) (which extends the definition of 'open country' to include coastal margin). However, the focus of this research is on the alignment of the national trail itself, which will be referred to throughout as the England Coast Path.

It was recognised at the early stages of planning (including Asken's option appraisal work[1]) that coastal processes are dynamic and change relatively rapidly in some areas. The Holderness Coast is thought to be one of the most rapidly eroding stretches of coast in the country. Made of soft boulder clay, subject to longshore drift southwards and powerful waves coming in from the North Sea, land is eroded at the rate of around 2 metres per year on average. However, with coastal erosion, averages mask single events, which can see no change for some years, then experience a large collapse. The largest recorded so far is around 23m.

Based on Shoreline Management Plan (SMP) policy, much of the East Riding coastline is being allowed to erode to maintain natural processes (the exceptions being larger communities and some other important assets). Much of the coastal frontage that is countryside, and through which the new National Trail will pass, will be undefended and allowed to erode.

This creates a challenging environment through which to align the England Coast Path. From an administrative point of view, any route that runs close to the cliff edge runs the risk of being severed at some point, requiring re-alignment on safer ground (for which a 'rollback' mechanism is available). From a risk management perspective, there is a need to consider the potential for a serious accident to occur if a collapse coincided with someone crossing that point. The two are linked, in that proposed alignment needs to take account of risk to public health and safety.

NE has some flexibility when determining the appropriate line to recommend in its reports to the Secretary of State. With respect to safety of path users, clearly a high priority, considerable emphasis is given to self-reliance and a 'light-touch' is advocated. This implies a least restrictive option approach to management and use of 'soft measures'. The Visitor Safety in the Countryside Group[2] provides guidance on managing visitor safety, including guidance on

[1] See: http://archive.defra.gov.uk/rural/documents/countryside/ca-asken.pdf

[2] See: www.vscg.co.uk

coastal rock falls[3] but this is more appropriate to rock falls rather than rapidly eroding cliff faces. People will require little education to recognise some risks – for example the risk of falling over a sheer drop if one gets too close to the edge. However, cliff erosion has the potential to be an unexpected risk.

In recognition of this, NE's guidance on how it will apply its Approved Scheme for developing the new England Coast Path[4] says (at para 7.1.12) that where there are soft cliffs "*it may be necessary to adjust the route of the trail before or after [periodic landslip] happens*". However, an initial starting point is needed and the insights gained from the analyses performed in the course of this project should provide such insight.

1.3 Methodology

The following chapters explain the methodology employed at each stage of the data assembly and analysis process. However, there are some important methodological considerations of a more general nature worth mentioning first.

With respect to visitors, it is important to recognise from the outset that it is not possible to provide a figure that can be taken as precise, even though it may be expressed in apparently precise numbers; such precision is spurious. Therefore, the variable to be used will be referred to as 'visitor pressure' so as to avoid giving readers/officers any suggestion of precision (which would perhaps be conveyed if the term 'visitor numbers' was used). With this in mind, the aim will be to capture the majority of the variation in visitor pressure by focusing on the major factors, but not all. This is because some may take a disproportionate amount of effort to factor in with little gain in the end result. A degree of judgment needs to be applied here.

A further factor to be borne in mind is the desirability of employing methods that have the potential to be scaled-up for use at a wider or national level. This is not an over-riding imperative but the most important datasets used are national in coverage. However, reliance has been placed on site-specific information/datasets when estimating 'tourism day visits' to the Holderness Coast, and extending the approach to the country as a whole is not straightforward in this respect.

It is also important to note that risk management does not rely completely on the alignment of the England Coast Path, because:

- Users will have a right of access to 'spreading room' – that is almost any land on the seaward side of the defined trail (see **Box 1.1** below for a more detailed explanation of spreading room). Any number of different activities may be undertaken within that area and it is impractical to consider the implications of cliff erosion/collapse for each of these. Examples include enjoying the improved access over land to engage in beach net fishing; participating in the annual European Open Beach Fishing Championship, collecting fossils, digging for bait, and power-kiting;
- There may already be various 'de facto' walked routes within what will become the spreading room and probably represent 'desire lines' that have evolved over time. However, it is assumed that these would be largely overshadowed by the new coastal trail in future;

[3] See: http://vscg.co.uk/good-practice/published/managing-the-risk-from-rock-falls-at-coast-and-countryside (visited 23rd March 2015)

[4] See: http://publications.naturalengland.org.uk/publication/5327964912746496?category=50007

- The standard method used by NE when determining the most appropriate line assumes that users will have primary responsibility for their own safety;
- There are a number of other risk management measures that can be employed (e.g. signage, fencing) to reduce risks to users.

Finally, it is important to draw attention to the local Imminent Risk Line (IRL) which is based upon coastal erosion data gathered routinely by the Council since the 1950s. Applied in undefended residential locations since 2010, the IRL marks the distance back from the current cliff edge which corresponds to the maximum recorded single cliff loss event in that area. The Council uses powers under s78 of the Building Act 1984 to remove homes and other permanent structures which, having crossed the IRL, are considered to be imminently dangerous. (Where residential properties are the subject of s78 notices, the Council works very hard with residents to ensure that they are relocated.) However, the IRL is less relevant to walkers using the England Coast Path. Someone living within the IRL could be exposed to risk for many hours per day, some of it during sleep, when the ability to take action to save oneself is limited and for almost all days of the year. In contrast, a transient walker will spend a relatively small amount of time at any given point and could possibly take action to avoid a fall.

Box 1.1: Extent of coastal access rights

Approval by the Secretary of State of NE's proposed route leads to the creation of new public rights along the parts of the trail that are not currently public rights of way. By default, the land within 2 metres of the route on either side becomes subject to such rights. However, NE often proposes adjusting the landward edge of the trail to coincide with a particular physical feature on the ground such as a fence or pavement edge. Also, there are powers under the 1949 Act to provide alternative routes or temporary routes for the trail, at times when access to the ordinary route is unavailable. The position of the approved route also determines the inclusion of land to either side of it as coastal margin:

- Land on the seaward side of the trail automatically becomes coastal margin; and
- Other land of certain specific types also becomes coastal margin if it lies on the landward side of the trail.

Once approval is gained and preparation is complete, public access rights under section 2(1) of Countryside and Rights Of Way Act 2000 are brought into force by Order on the affected stretch of coast. These access rights are called "coastal access rights" in the Scheme. As with CROW rights, these can be affected by, for example – pre-existing rights (so-called s15 land), exclusion of rights over 'excepted land' (as listed in CROW Sch 1). NE use the term 'spreading room' to refer to those parts of the coastal margin, other than the trail itself, that will be available to the public for enjoyment on foot. This does not include areas of the coastal margin that are excepted land.

Source: NE (2013) Approved Scheme Ref NE 446. See:
http://publications.naturalengland.org.uk/publication/5327964912746496?category=50007
(visited 23rd March 2015)

2. Comparable Situations

2.1 Introduction

The purpose of looking at comparable situations is not only to identify approaches used elsewhere but also to allow some degree of calibration of what could be deemed 'acceptable level of risk'. Two types of situation could provide helpful comparisons:

- Existing National Trails that run along the coast;
- Situations where walkers are exposed to risk and where this is generally found to be 'acceptable'.

Whilst there may be lessons to be learnt from making comparisons with national trails with coastal sections, it is important to remember that the Holderness Coast perhaps offers a unique challenge. The geology and marine influence, and therefore the patterns of erosion, are quite different in the study area – being something of a constant concern. Further, existing trails almost always follow legally-defined (including location) public rights of way which the local highway authority is obliged to secure for public use and which cannot easily be re-aligned.

Following the inception meeting, an approach towards developing these comparators was agreed. This involved direct contact with trails managers responsible for some coastal National Trails in England and Wales, drawing on findings from earlier work of relevance, and internet searches.

2.2 Coastal National Trails

The situation being encountered by visitors to the Holderness Coast has parallels elsewhere. For example, visitors to the Peddars Way and North Norfolk Coast, South West Coast Path (SWCP), the Pembrokeshire Coast Path and the coastal sections of the Cleveland Way (all of them National Trails) may become exposed to hazards where the trail runs close to cliff edges. In these cases, the trail usually follows a defined public right of way, with less scope for use of 'spreading room' and decisions over alignment only arise if the line of the way is cut by an erosion event. Nonetheless, contact was made with the Trails Officer for each of these trails and information obtained about their approach to risk management in general and accounting for visitor pressure in particular.

2.2.1 Peddars Way and North Norfolk Path

The Peddars Way and North Norfolk Coast Path is a National Trail and the coastal section (along the eponymous North Norfolk Coast) shares some characteristics in common with the Holderness Coast – particularly that of a rapidly eroding coastline. A section of the coast has just been designated as part of the England Coast Path[5], using for the most part the existing National Trail. Consequently, the managers of this section of the trail have had recent experience of coastal trail development in a rapidly eroding length of coastline.

Key points emerging from discussions with the trails officer are:

[5] See: http://www.nationaltrail.co.uk/peddars-way-and-norfolk-coast-path/news/norfolks-first-section-england-coast-path-opens-today (Visited 26th March 2015).

- Whilst there is clear recognition of the existence of 'honeypots' and less popular areas, they did not attempt to divide these into sections on the ground;
- Emphasis in the future will be to encourage users to spread more evenly amongst the coast through better linkages between the trail and local communities and continuations of the Coasthopper bus service (which allows circular routes to be done);
- There was a subjective recognition of the risks posed by high cliffs and/or rapid erosion in certain places (e.g. Hunstanton Cliffs) and this was factored into the thinking about route alignment. However, this was not done systematically and was constrained by landowner views;
- There has not been any attempt to determine what would be an 'acceptable level of risk' to trail users from cliff collapse or to measure/map it along the coastline;
- There are plans to monitor developments and the effect of management measures, and to review the alignment over time, with an emphasis being on the use of consensus building amongst those with a direct interest.

2.2.2 South West Coast Path

The SWCP team has divided its coastal path into four categories:

- Urban
- Honeypot/urban fringe/ambling
- Rural/rambling
- Rugged/scrambling

In the context of Holderness, the 'urban' category broadly equates to defended areas. The others equate to the three categories used in the Project Brief. However, on the SWCP, a descriptive approach is taken to defining them and there is no reference to visitor numbers. A different aspect to the typology is the physical/technical difficulty of the trail being included as one of the categorisation criteria, which is probably not relevant to the Holderness Coast, where remoteness is perhaps the more pressing criterion.

A description of the approach used to define different zones is provided in **Appendix 1 (**SWCP, 2006[6]).

2.2.3 Pembrokeshire Coast Path

In its safety statement (PCNPA, 2010), Pembrokeshire Coast National Park Authority describes its approach to safety management. This varies according to the nature of the route and the proximity of the location to an access point. They deem it to be generally appropriate to manage to different standards depending on remoteness, level and type of use. They work with three different categories:

- In relatively remote areas, it may be assumed that the majority of users having already walked part of the route and, being committed to a significant journey, will be prepared for the wilder and more natural experience of the Coast.

[6] References are listed in full in **Section 6**

- By contrast within these areas there are areas of intensive use - usually within easy reach of a major access point, car park or beach or where the Coast Path serves as a beach access or approach to a viewpoint. Here the user may be expected to be using the National Trail almost incidentally and, although some realisation of the hazards of the coast may be assumed, a higher standard of path surface and maintenance may reasonably be expected.
- Other parts of the Coast Path fall between these two extremes with the response to hazard management being dealt with in the Coast Path Risk Assessment.

Again, no attempt is made to develop hard and fast criteria for zone definition or to predict numbers of visitors by location. Also, their categories equate to the three proposed in the Project Brief.

2.2.4 Cleveland Way

The Cleveland Way team does not attempt any risk mapping or to divide the length of the trail according to levels of risk, with perhaps a single exception, which is The Blue Dolphin Holiday site north of Filey. Here, staff visit the Site Manager on occasion and circulate a safety leaflet. This is because it is an area of high cliff, and some of the users of the holiday camp may not have experience of walking in such an environment. By inference, there is no attempt to 'manage' the alignment of the route at this point but to make sure people are aware of the risks.

Re-alignment of the path has always been a compromise between what the trail managers can achieve and what the land manager/owner will accept (which can vary considerably). The preference of the team is to have a width of 5 metres at least between fences and cliff edge, but this is not always possible.

Concerning height of cliff, every case is different as both height and slope and degree of coastal scrub (protection) are factors. As a general rule, the Cleveland Way team is not happy where the width is down to a metre irrespective of the slope angle. That said, where there is a sheer drop, the safety margin would be at least 2 metres and if it is a high visitor pressure area they would consider a seaward fence for safety at this width (only rarely on a section – such as near Whitby).

It is understood that there has not been a single case of anyone falling due to cliff collapse in the last 46 years. With a minimum of 200,000 walks on the coastal Cleveland Way each year, risk is probably less than 1 in nine million.

2.3 Other situations involving risks to walkers

Walkers face a multitude of risks when they visit the countryside. In research done for the 'relevant authorities', Asken et al (2002) identified over 500 'hazard plus effect combinations' representing 64 specific risks. Not surprisingly, most of these were assessed as posing very low risks to walkers, although three were identified as being of potential concern:

- Falls in abandoned quarries;
- Walking with dogs through land occupied by livestock with young;
- Some zoonoses of domestic animals.

It was accepted that not all hazards provided suitable comparators so others were explored which were thought could yield an absolute value of acceptable level of risk. These are considered below.

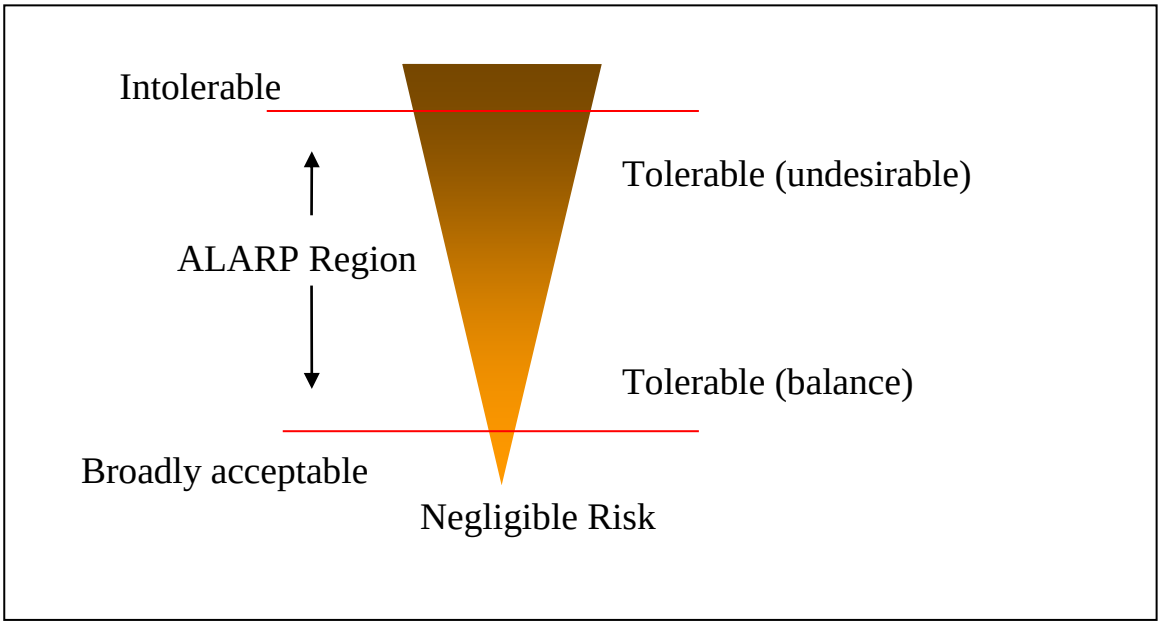
2.3.1 Health and Safety Executive (HSE)

The HSE is concerned with risks to employees and members of the public arising from work-related activity. Consequently, its work is not directly relevant to recreational activity. However, it has established some broad principles of risk management, including a framework of risk acceptability. In its document 'Reducing risks, protecting people' (HSE, 2001), it defines three broad categories of risk:

- Intolerable
- Tolerable
- Broadly acceptable

They represent this framework as a triangle (see **Figure 2.1**) of increasing level of 'risk' for a particular hazardous activity (measured by the individual risk and societal concerns it engenders) as one moves from the bottom of the triangle towards the top. The HSE advise that "*the darker zone at the top of the triangle represents a region where the level of risk is intolerable, and a risk (score) falling into this region is regarded as being unacceptable whatever the benefits. Any activity or practice giving rise to risks falling in this region should be halted unless the activity or practice can be modified to reduce the degree of risk so that it falls in one of the other regions of the triangle*".

Figure 2.1: The Risk Triangle



The lighter zone at the bottom of the triangle represents a broadly acceptable region. Risks falling into this area are regarded as "*insignificant and adequately controlled. Further action to reduce risks will not usually be required unless evidently reasonably practicable measures are available. The levels of risk characterising this region are comparable to those that people regard as insignificant or trivial in their daily lives. They are typical of the risk from activities that are inherently not very hazardous or from hazardous activities that are so well controlled that risk control measures are at the limit of practicability. Further resources involved for reducing risks will usually be grossly disproportionate to the risk reduction achieved.*

Nonetheless, if it is possible to reduce the risks at minimal costs, such action would be warranted".

The zone between the intolerable and broadly acceptable regions is the tolerable region. The HSE consider that risks in this region are "*typical of the risks from activities that people are prepared to tolerate in order to secure benefits, in the expectation that:*

- *The nature and level of the risks are properly assessed and the results made available;*
- *The risks are not unduly high and kept as low as reasonably practicable (ALARP);*
- *The risks are periodically reviewed to ensure that they still meet the ALARP criteria, for example, by ascertaining whether further or new control measures need to be introduced to take into account changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks*".

The HSE believes that "*an individual risk of death of **one in a million per annum** for both workers **and the public** corresponds to a very low level of risk and should be used as a guideline for the boundary between the broadly acceptable and tolerable regions*" of the risk triangle (our emphasis). This is very small when compared to the background level of risk that most people choose to expose themselves to in everyday life.

It is also interesting to note that HSE consider benefits alongside risk. Implicit in this, is the recognition that some risks are worth taking (such as risk of falling off a cliff) if the benefits are sufficiently great relative to the risk (such as to be gained from engagement with nature, physical exercise etc.).

2.3.2 Risks accepted by walkers in the countryside - cattle

A risk that appears to be broadly acceptable and which affords a useful comparator is that faced by members of the public from cattle. Sadly, each year a small number of people are badly injured and some killed by cattle whilst they are out walking in the countryside. In 2002, HSE provided results of a search of their incident reports for accidents involving livestock over the last 10 years (reported in Asken et al, 2002). There were 27 serious incidents in England and Wales over the period 1991 to 2000 (although it should be noted that accidents are often under-reported) – an average of 2.7 per year. During this period, visit survey data (UKDVS) on Leisure Day Trips suggest that there were 1.181m visits to the countryside of England and Wales in 2002/03. This equates to 1 serious injury or fatality for every 437,000 countryside visits. UKDVS records that the main (but not necessarily the only) activity was to 'walk/hill walk/ramble' in 32% of countryside visits in GB. This equates to around 378,000 visits. The risk of serious injury/death to walkers/hillwalkers/ramblers was thus around 1 in 140,000.

At a meeting of NE's Livestock and Access Group in 2010[7], a representative from HSE reported that, on average, there are up to 2 fatalities and 5 serious injuries per annum to members of the public from livestock (mostly cattle). MENE data for 2009-10 suggest that 1.38m visits were made to the countryside that year and 81% were for walking (with or without a dog). This suggests that there are 1.118m countryside walks. Consequently, the rate of serious injury/death from cattle is 1 in about 160,000.

[7] See: http://shropshire.gov.uk/committee-services/Data/Shropshire%20Local%20Access%20Forum/20100204/Agenda/Livestockand%20Access%20meeting.pdf (visited 23/02/15)

2.3.3 Risks accepted by walkers in the countryside – trees

Trees are an important and near ubiquitous feature of the English landscape. Anyone going for a walk in the countryside is likely to cross by or under a tree at some stage. Should a tree fall when someone is passing underneath, there is a risk of injury or death if struck by the trunk or branches. The National Tree Safety Group commissioned research (Middlesex University, 2011) into the risks to members of the public concerning trees.

The researchers identified 64 deaths during the 10 years after 1 January 1999 and about 55 non-fatal injuries per year (the number of accident and emergency cases attributable to being struck by trees, With a UK population of roughly 60 million, this leads to an overall estimated risk of about one death in 10 million people per year from falling or fallen trees and branches and 5.5 in 10 million risk of receiving an injury sufficiently serious to justify a visit to accident and emergency department of a hospital.

To put this in context, a table is included which compare the risk of fatality from trees to that of other 'everyday' risks (see **Table 2.1** below).

Table 2.1: Comparison of a selection of 'everyday' risks of fatality

Cause of death	Annual risk	Basis of risk and source
Cancer	1 in 387	England and Wales 1999
Injury and poisoning	1 in 3,137	UK 1999
All types of accidents and other external causes	1 in 4,064	UK 1999
All forms of road accident	1 in 16,800	UK 1999
Lung cancer from radon in dwellings	1 in 29,000	England 1996
Gas incident (fire, explosion or carbon monoxide poisoning)	1 in 1,510,000	GB 1994/95–1998/99
From trees	1 in 10,000,000 or less if high wind incidents are excluded	Middlesex University 2011
From lightning	1 in 18,700,000	England and Wales 1995–99

Source: Middlesex University (2011)

Key points to note here are that:

- The figures are based on fatalities only;
- The assessed risk of 1:10,000,000 includes risks to all members of the public, not just those enjoying a recreational visit;
- The rate is a tenth of the 'level of acceptable risk' used by HSE (which uses 1:1,000,000 as the threshold of acceptability in the workplace).

2.4 Conclusion

From this very limited comparison with some coastal national trails in other parts of England and Wales, it appears that safety management (including risk assessments) is sometimes geared

towards a three tier categorisation based around visitor pressure. However, the division of the trail into the three different categories relies on subjective/expert judgment rather than criteria based on visitor numbers (whether actual as defined by monitoring or predicted, as defined by some sort of modelling). The division then influences level of management intervention (in the form of path standards, maintenance and signage) rather than path alignment. From this, it can be concluded that:

- Other authorities faced with similar (but not identical) challenges have not felt it necessary to attempt to assess risks to users in a quantified way;
- The approach being taken by NE/ERYC is innovative and more ambitious.

With respect to non-coastal risk comparisons, the review has produced a very broad range of acceptable levels of risk, albeit from differing situations. The range stretches from:

- Risk of death of around 1:1,000,000 from work-related activities;
- Risk of serious injury or death to recreational walkers caused by cattle of around 1:150,000
- Risk of a fatal injury caused by a falling tree is around 1:10,000,000.

3. Variation in visitor pressure

3.1 Introduction

The aim of this part of the analysis is to be able to split the Holderness Coast into zones which correspond to 'honeypot' (high numbers of visitors), quiet/remote sections (low numbers of visitors) and those which are within these extremes (medium numbers). However, it is worth defining the basic components of the model used in this part of the analysis:

- **Number of visits**: the number of occasions when a member of the public would decide to venture out onto the coastal trail. The propensity of a population to undertake such an activity will depend on a variety of demographic factors;
- **Coastal Access Points (CAPs)**: the places to which visitors might travel (by whatever mode) where they can gain easy access to the undefended sections of coast to undertake their coastal recreational visit. These will be found at certain points such as where a road reaches the coastal frontage or the end of an urban coastal defence;
- **Pull factors**: the range of considerations a visitor may take into account when deciding which CAP they will choose to visit. Some CAPs will exert a stronger pull than others. For example, a CAP with a car park, public house and visitor centre will exert a greater pulling effect than one where there is just a road end;
- **Distribution along the coast**: once at the CAP, there is a need to anticipate how far along the England Coast Path a user would venture during their single visit.

Different or related datasets have been used to construct the predictive model. In developing this, experience gained in research undertaken by Entec and Asken to develop a predictive model for use on open access land (Entec et al, 2002) has been drawn upon. This model was used by the then Countryside Agency to determine the possible need for access restrictions on sites of high biodiversity value under s26 of CROW. It is now described in Natural England documents under the heading of 'Access Assessments'[8]. However, more recent data have been used and adjustments made to reflect the fact that the model is for a coastal situation.

Each step in the model is described below.

3.2 Number of visits

In broad terms, visits are drawn from three different populations:

- Local residents;
- Overnight stayers from further afield;
- Those resident in locations further afield.

[8] See: http://publications.naturalengland.org.uk/publication/30005?category=40032 (TIN073); http://publications.naturalengland.org.uk/publication/34008?category=40032 (TIN074); and http://publications.naturalengland.org.uk/publication/33009?category=40032 (TIN075)

In order to estimate the number of visits, information is needed about the total population of each.

3.2.1 Local residents

Perhaps the easiest of the datasets to obtain are those on local residents. The latest national census was in 2011 and it provides population data down to ward level[9]. At this fine-grained level of geographical distribution[10], we can place the origin of visits with a good level of accuracy. Given the close proximity of Kingston upon Hull, data for the city are also included within the definition of 'local residents'. While the same argument could be used for residents from further afield (such as Scarborough), it is suggested that any residents of that town seeking a 'coastal experience' would do so on the section of coast closer to their home area (e.g. in the case of Scarborough, between there and Bridlington). The Humber Estuary provides a meaningful and realistic southern boundary to the extent for the definition of 'local residents'. The census records that there were around 593,000 people permanently resident in ERY and Hull council areas.

Output from this will be reasonably accurate data of the resident population, spread by ward across the two local authority areas – ERY and Hull. For the purposes of the geographical analysis, the centroid of the ward would be used to represent the start point for all visits from the entire ward.

3.2.2 Overnight stayers from further afield

Overnight stayers from further afield are less easy to identify as they could stay at various types of accommodation: paid accommodation such as caravan site or hotels; or with family or friends. Fortunately, data on 'staying visitors' are common currency within the tourism industry and are readily available. For example, the economic regeneration/tourism departments of many local authorities use the Cambridge or STEAM models to produce estimates of numbers of overnight stayers in given areas (and what they spend, although this is not relevant here).

The East Riding tourism survey (Tourism South East - TSE, 2013) uses the Cambridge Model to estimate that about 2.676 million tourism nights were spent in ERY in 2013. The types of accommodation used by these overnight stayers were as shown in **Table 3.1**.

Table 3.1: Number of overnight tourism nights by type of accommodation

Type of accommodation	No. of tourist nights ('000s)	% of total
Serviced (hotels, B&B)	520	19
Self-catering	49	2
Caravans	486	18

[9] See: Table SAPE12DT1: 2012 Ward population estimates for England and Wales, mid-2012 (experimental statistics)

[10] It is possible to reduce the granularity even further by using Super Output Areas. These were designed to improve the reporting of small area statistics but are probably over-precise for the model. However, they could be introduced if the model were to be made more sophisticated.

Static pitches	621	23
Second homes	35	1
Moored boats	19	1
Other	42	2
Staying with friends and relatives (SFR)	905	34
Total	2,676	100

Source: TSE (2013)

It can be seen from this that SFR accounted for a significant proportion of overnight stays by tourists (34%). It seems logical to assume that where they stay will be a function of the resident population amongst which are their friends and relatives. If it is assumed that these 905,000 nights are spent equally across all the permanent residents (of which there are 336,000 in ERY), they can be distributed pro rata across the different wards within ERY.

It needs to be recognised that this approach ignores SFR tourists staying in Hull. Rather than seek to undertake a similar analysis for Hull (for which data may or may not be available) it is proposed to apply the same 'SFR staying rate' to the population of Hull. This adds another 693,000 tourism nights. However, it should be remembered that these are stays for the whole year.

As for the balance (1.771 million), they will have stayed in the other forms of accommodation. Scott Wilson (2009) undertook an inventory of the stock of accommodation in ERY, by type, in 2008. Table 4.1 of their report shows the volume of stock by 'Tourism Character Area' (TCA) and the data are summarised in **Table 3.2** below.

Table 3.2: Calculation of Geographical Spread of tourism nights (other than SFR)

Tourism Character Area	Size of existing stock (no. of places, as per Scott Wilson, 2009)	% of total	Number of overnight tourism nights derived from TSE 2013 ('000s)
Beverley & Hinterlands	1903	9.7	172
Bridlington Area	10779	55.2	983
Southern Holderness	4827	24.7	437
North West	568	2.9	51
South West	298	1.5	27
Yorkshire Wolds	1161	5.9	104
Total	19536	100	1774

Note: the slight discrepancy in numbers is due to rounding

Scott Wilson (2009) provides a map (reproduced in **Figure 3.1** below) which shows the TCAs. Unfortunately, the areas do not correspond to wards, so we will need to create these as new areas. These additional person nights have been distributed geographically across the different TCAs and coastal visit multiplier (see below) applied to them, as per other residents.

In summary, the analysis above has produced estimates of:

- 1.598 million tourist nights per year spent with friends and relatives who reside in ERY and Hull spread geographically in proportion to the resident population;
- 1.771 million tourist nights per year spent in other forms of temporary accommodation within ERY spread geographically in proportion to the available stock of accommodation. Visits from within each TCA are assumed to start from the centroid of that area (although it is recognised that some of these areas are quite large).

A value for tourists staying overnight in Hull is also needed and, as a 'quick fix', it is assumed that the same number as for another major urban area - Bridlington.

These tourists staying within the area will give rise to a number of visits to walk along the Holderness Coast. So, these estimates are fed into the analysis along with the resident population (see below).

3.2.3 Visitors from further afield

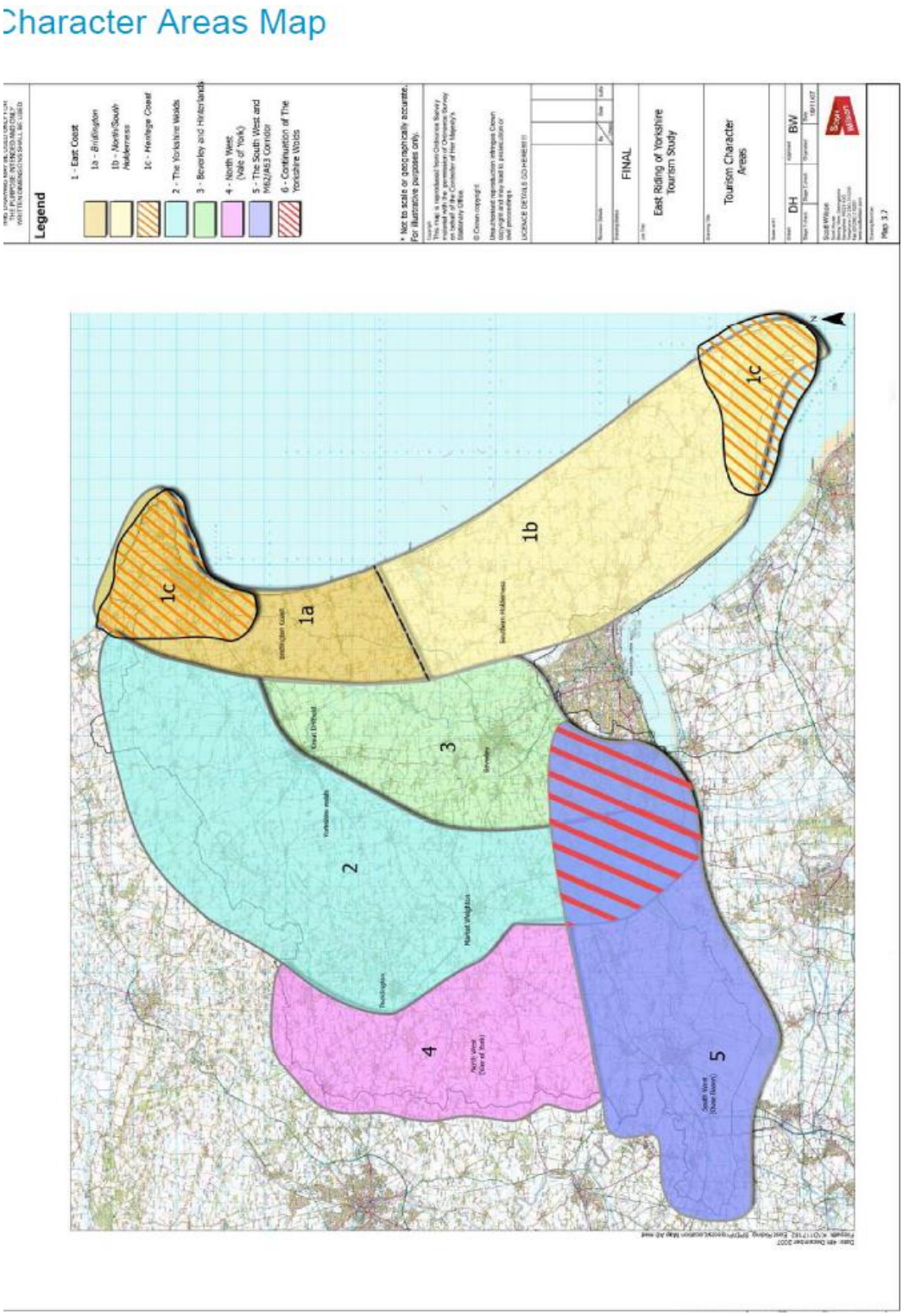
It is likely that a proportion of visitors to the coast will have set out that day from further afield. However, for this to be used within the model, population data would be needed from (in theory) the whole of the UK; for example, at any given time, there is a possibility (albeit a very small one) that someone has travelled from London, or Edinburgh, or Kendal, to spend a day at the Holderness Coast. In practice, the number is likely to be very small, because of the 'distance decay function' – describing a relationship between declining numbers as distance to destination increases. Even so, it is worth exploring this assumption further.

Some examples of this distance decay function can be teased out from readily available data. There will be many such surveys available but it seems reasonable to give priority to large/nation-wide surveys (such as MENE and GBDVS[11]) but with comparisons to more specific surveys (either geographical or activity) as a cross-check, where feasible. A review of a sample of surveys is included in **Appendix 2**. This review serves two purposes, to:

- Demonstrate the relative impact on numbers of day visitors from further afield; and
- Give values to be used when distributing visits amongst coastal destinations (see **Section 3.3.3** below).

[11] It should be note that these two surveys are very similar and are currently conducted by the same company (TNS). Where the same questions are asked, the same answers are used in both survey analysis.

Figure 3.1: Character Areas Map (from Scott Wilson 2009)



From the review of surveys in Appendix 2, it can be seen that the majority of people travel relatively short distances (say 30 miles or less) to undertake a day visit, although the size of this majority varies. There is some evidence that people will travel further to assets of national value

(e.g. National Trails) but generally less to a broader category of sites coved by the term 'Natural Environment'. For the purposes of the predictive model, it is considered reasonable to conclude that around 90% of visitors to the Holderness Coast will either live or be staying overnight within 30 miles of the coast. Given that numbers coming from further afield are expected to be quite low, and the massive difference in effort needed to accommodate these in the predictive model, it is proposed to derive predictions from the other two populations and then add 10% to the value to allow for visitors on day trips travelling from further afield.

3.2.4 Propensity to visit the coast

The propensity to want to go for a walk or do some other outdoor activity will vary considerably across the resident population. Research shows that it is higher amongst (for example):

- People in socio-economic classes A, B and C1;
- Middle aged;
- White ethnic groups.

However, by using data from MENE/GBDVS covering all demographic groups (apart from children), we can ignore the different propensities of these different demographic splits. Market Research Society rules generally do not allow minors (people under 16 years of age) to be interviewed without parental consent. Consequently, sample characteristics and behaviour patterns are those of adults. However, in the absence of any suitable, easily accessible data to suggest otherwise and for the purposes of this model, it is assumed that children behave in the same way as adults (as they will probably accompany them on day trips to the coast).

MENE annual reports contain information about the types of places people visit when engaging with the natural environment, and two of the categories from which they can choose are relevant here – 'beach' and 'other coastline'. It is possible that the interviewee may have chosen a different category (for example, 'path, cycleway, bridleway' or 'country park') that is located at the coast but this cannot easily be identified separately. In 2013/14 (TNS, 2014b), a total of 250m visits were made to these two destination types by the resident population of England. ONS[12] provides a mid-2013 estimate of the population of England as 53.9m. So, it seems that English residents visit the coast about 4.64 times per year.

Not all visits to the beach/coast will be for an activity that is relevant to the study. However, Q4 asks respondents to state what they did during the visit selected from those they made in the last 7 days. Again, we can cross-tabulate to tease out those visits that are of relevance to the study, and the results are shown in **Table 3.3** below.

[12] See: http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-uk--england-and-wales--scotland-and-northern-ireland/2013/index.html (Visited 25 February 2015)

Table 3.3: Visits involving relevant activities (% of total, 2009-2014)

Activity	East Riding (%; n=645 unweighted base)	England (%; n=25,473 unweighted base)
Picnicking	1	3
Visit beach	8	10
Walking without dog	32	27
Walking with dog	47	26
Running	1	2
Watch wildlife	1	3
Other outdoor activity	1	1
Total	91	72

It is clear that walking is a much more popular activity at the coast amongst residents of the East Riding than for England as a whole. What this means is that each resident of the East Riding could make around 4.27 visits per year on average to the beach/coast in order to undertake activities of interest to the study. By extension, we will assume the same visit frequency for people under 16 years of age and residents of Hull.

Within the list of activities, two fit the description of non-transitory uses: 'Picnicking' and 'Visiting beach'. So, of these 4.27 visits per year, about 0.42 are for non-transitory uses (0.60 for England as a whole).

By applying this multiplier to the data on the size of the populations of residents from which these visits will be drawn, we expect to produce estimates of numbers of resident visits to the Holderness Coast in a typical year.

The question remains about whether the transient residents (i.e. those staying overnight somewhere other than their own home) behave in a similar way. It may be different, for example, if they are on holiday, they may have more free time to spend on recreation and so their visit rate could be higher per night spent than for the resident population. However, they will not be there all year. In the absence of any specific data that give insight into the behaviour of this specific group, the following stages are proposed:

- Adjust the number of transient visitor days into resident year equivalents (i.e. dividing by 365);
- Apply the same variables to the transient visitors as for the residents;
- Accept that this may build in an under-estimate of number of visits.

With that approach, it is estimated that the equivalent of a further 9,230 residents, visiting on average 4.27 times per year. Again, this is something of a quick-fix and a more sophisticated approach could be developed and applied, given more resources. For example, it is possible (indeed likely) that people who live near the coast visit it more frequently than those living inland. So, for example, one might expect residents of ERY to have a higher visit rate than someone living in (say) Derbyshire, Northamptonshire or other central England counties, MENE data at a smaller resolution would tease out some of these differences.

This consideration aside, it is estimated that there will be a potential for 2.842m individual visits to the coast from people staying within ERY and Hull (either residents or visitors) and those on day visits from further afield. It is not proposed to attempt to estimate how these visits will spread across the year, although this could be done if a more sophisticated analysis were required.

3.3 CAPs and 'Pull Factors'

It is recognised that there are many coastal access resources available at present:

- Promenades in urban (defended) areas;
- Lengths of public highway (including public right of way);
- Permissive/de facto public routes;
- Private access points.

However, for the purpose of the analysis, the access resource of interest will be the new England Coast Path[13]. At this stage, it is not necessary to be concerned with the exact alignment; it is sufficient to work on the assumption that it would be:

- A linear route running the full length of the Holderness Coast;
- Easy to use, well maintained and well signposted (i.e. to a standard expected for national trails);
- Well promoted so that its existence would be known by a high proportion of the population from which demand is likely to arise (see Section 3.2 above).

Consequently, the existing access resources will be ignored in favour of the expectation of the whole of the coast having an 'easy to use' England Coast Path and its pulling power can be assumed to be constant throughout the length of the Holderness Coast. Which parts of it people visit will be determined by accessibility and 'pull factors'.

3.3.1 CAPs

Points where people can access the coast will be referred to as CAPs. It is also pertinent to consider how people reach their chosen start point for their walk. Visitor surveys often contain information about modes of transport used, and these are summarised in the table below (**Table 3.4**) for a selection of surveys.

[13] It is important to note that this assumption creates a significance difference between the current situation (which is of intermittent public access, with varying status and levels of promotion) and the anticipated future situation which is being 'modelled'. A consequence of this is that comparisons between actual usage now and anticipated future usage would not be a like-for-like comparison.

Table 3.4: Modes of transport used to start of activity (%)

Mode of transport used	MENE (England)		MENE (East Riding)		GBDVS (Tourism day visits) (%,; n= 1,374,000)	National Survey of Open Access land (%; n=3,389)
	Beach (%; n=6,913)	Other coast (%; n=3,617)	Beach (%; n=209)	Other coast (%; n=97)		
Private vehicle	50	48	37	52	65	68
On foot	45	43	62	48	8	28
Public transport	2	3	1	0	21	1
Other	3	6	0	0	6	3

As can be seen from this, it seems that the majority of potential visitors either walk or use their own vehicles. GBDVS is a slight difference to this general pattern in that, although car usage is high, public transport is relied upon much more heavily. However, this dataset is for Tourism Day Visits (defined as non-regular trips of 3 hours of more) and so will exclude short walks from home (such as might be expected of dog walkers, for example). Consequently, this dataset is probably best ignored.

In practice, it may not be necessary to concern ourselves with mode of transport used, as ultimately, how they get to the start of their walk is immaterial, it is how far they will go to get to their start point that matters. Consequently, it is sufficient to identify CAPs on the basis of their accessibility to members of the public travelling either by car or on foot from their homes.

Looking at CAPs from a user's perspective, choice of coastal destinations is not limited to just those in the study area. Consequently, provision is needed for the model to distribute visits to other locations along the ERY coast, even if the predictions for these areas are then not used. (It is also pertinent to note that, as one moves north and south along the coast, visits from other centres of the population – such as Scarborough and Grimsby – would become increasingly significant relative to visits from within ERY/Hull.)

Consequently, the northern and southern limits have been taken as:

- Flamborough Head in the north;
- The Humber Bridge in the south (which we understand will be where the coastal path will cross the estuary).

The suggested CAPs can be identified easily from OS maps, with the exception of 'beach access', data for which have been provided by ERYC. They are listed in **Appendix 3**. In addition, CAPs within defended areas, such as from promenades, are ignored.

3.3.2 Pull factors

The model assumes that the anticipated coastal visits by people from within ERY and Hull would be directed towards these CAPs. However, it is unlikely that these different CAPs exert the same power of attraction. Therefore, it is necessary to reflect the differences in some way. Following discussion amongst the steering group, it was agreed that pull factors should:

- (Ideally) be identifiable from OS maps but in this case aided by an ERYC publication (2012);
- Be weighted to reflect the different pulling power of different attributes.

Using the steering group's professional judgment and local knowledge, the following pull factors were identified and relevant weighting (on a 1 to 3 scale, with 3 exerting the greatest pull) allocated, as follows:

Pull factor	*Weighting*
- Road end	1
- End of urban area	3
- Car park	2
- Public conveniences	1
- Viewpoint	1
- Accommodation/refreshment provider	2
- Country Park/Nature Reserve	3
- Information centre	3
- Beach access	3

With this approach, and looking at the table in Appendix 3, there are a total of 34 potential start points (CAPs) for a relevant visit to the coast (23 of them in the study area) sharing 202 pull factor attributes (114 in the study area) amongst them.

In summary, a point has now been reached whereby an estimated 2.842m individual visits per year will be made to 34 potential coastal access points, with distribution skewed in favour of those with a greater pulling power. Of these, around 300,000 of these will be for 'non-transitory' activities.

3.3.3 Willingness to travel

Consideration was given to the introduction of a further factor at this point – the first distance decay function. This would recognise the fact that different people are willing to travel different distances to visit the coast, with the distribution skewed heavily in favour of the shorter distances, with only a small minority being willing to travel more than (say) 20 miles. This has been examined by looking at visitor surveys (see **Appendix 2**). However, given that the data selected from MENE relate to 'Beach' and 'Other coastal' visits only, there is no need to apply this function – by definition all the visits will be to the coast. (Note, though, that if the model were to be extended to cover a larger area, the omission of this step would need to be re-visited.) The only question at this stage is where the assessed demand for coastal visits will be satisfied,

Combining the steps so far, the model has identified:

- Where people will come from (centroids of wards and TCAs) and in what numbers (see **Figure 3.2**);
- The CAPs where people will go, taking into account their relative 'pulling power' (see **Figure 3.3**).

In Figure 3.3, the five categories are relative (i.e. 'very low' for example means very low for this set of data. There has been no attempt to calibrate predicted visitor pressure with other coastal or countryside access locations).

Figure 3.2: Origins of coastal visits

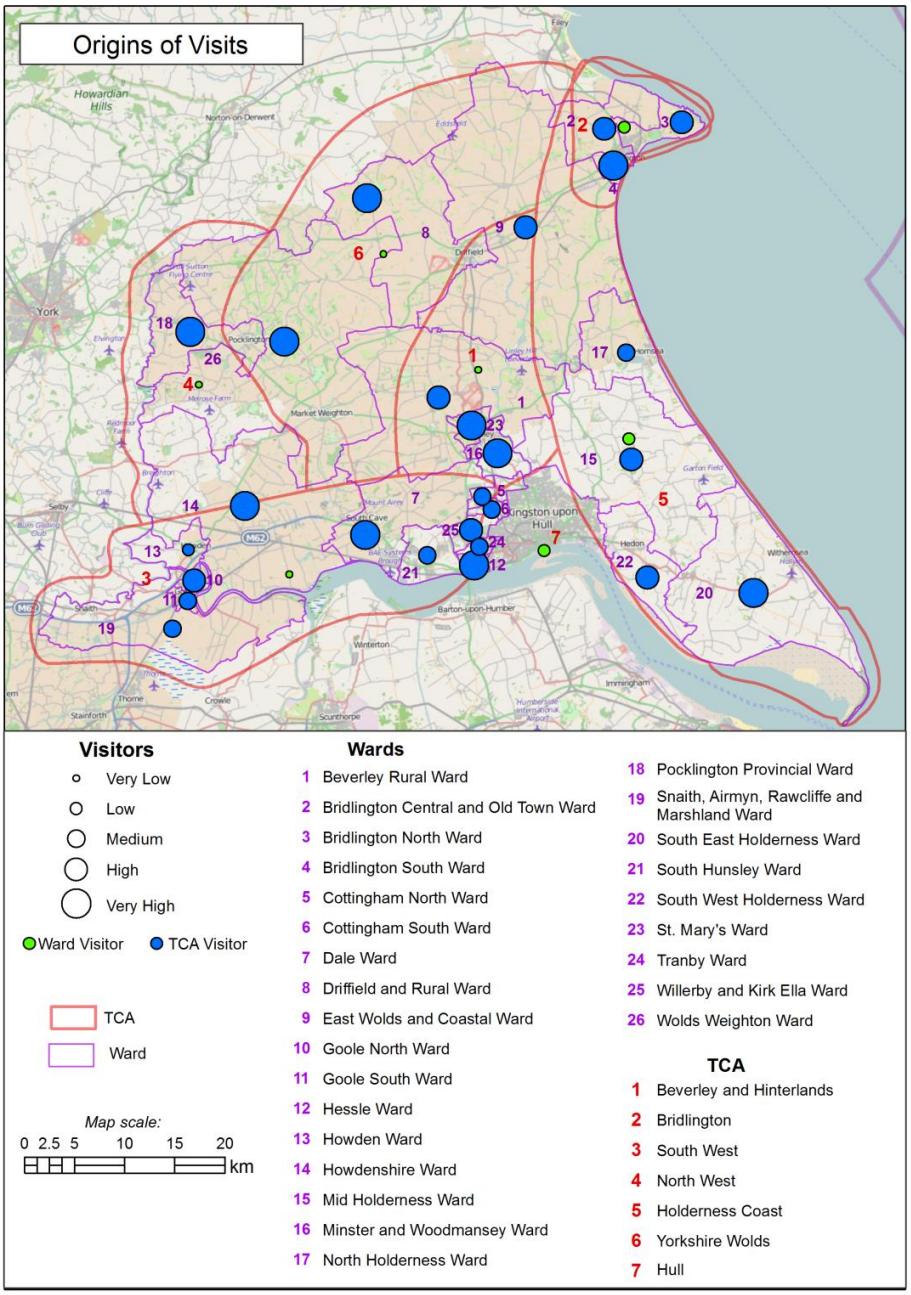
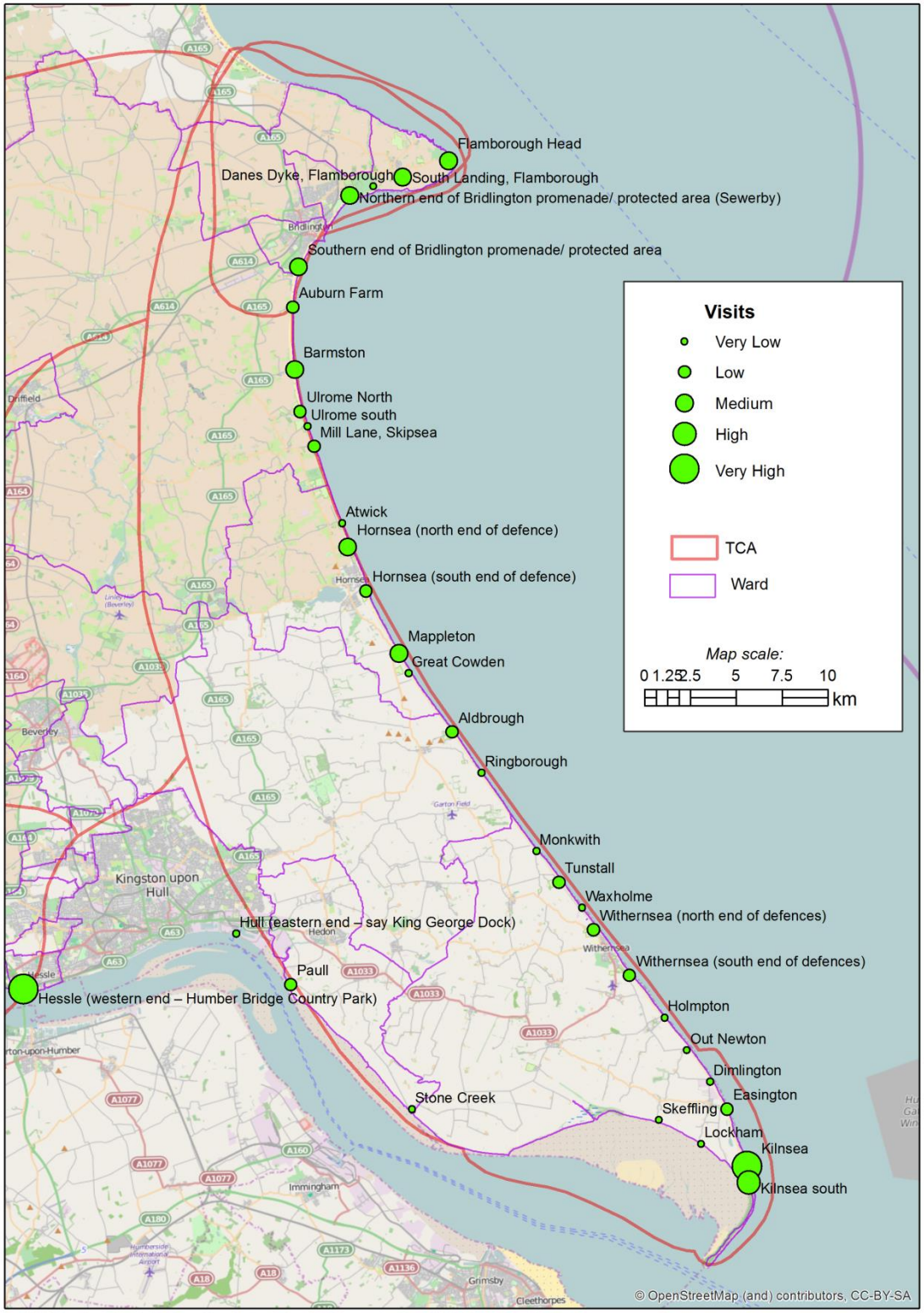


Figure 3.3: Destinations of coastal visits



Note – in the analysis those destinations north of Bridlington, west of Kilnsea and defended areas are not included in further analyses.

3.4 Distribution of visits along the coastal path

It is taken as read that most people who visit the England Coast Path will distribute themselves along it by walking. The distance they walk will vary depending on individual choice and ability. However, visitor survey data tend not to record distances covered but more regularly record time spent at the site. If an average speed of travel on foot can be determined, then it is possible to assess distance travelled during the stay.

3.4.1 Time spent on site

Data are available from various surveys which give typical visit duration, broken down by time ranges and percentage of visitors whose visit falls within that range. Unfortunately, MENE does not record this information and GBDVS only provide data for tourism day visits (and some characteristics of such visits are likely to differ markedly from leisure day visits). Nonetheless, there are examples from national level surveys, as described below.

National open access visitor survey 2006 - 2008

This NE research gives some guidance – see **Table 3.5** below.

Table 3.5: Time spent on open access sites in England

Time spent on site	% (n=1685)
Under 30 minutes	9
30 – 59 minutes	29
1 – 2 hours	26
2 – 3 hours	14
3 - 4 hours	9
4 -5 hours	5
5 – 6 hours	3
6 – 7 hours	2
Over 7 hours	2

Source: FaberMaunsell et al (2009)

National Trails user survey 2007

This survey found that:

- 6% of users spent less than 1 hour on the trail;
- 44% of spent between 1 and 4 hours; and
- 50% spent more than 4 hours on the trail.

A third of those surveyed (presumably taken from the half of interviewees who spent more than 4 hours on the trail) were seeking to complete the whole trail. However, users of the coastal path trail are unlikely to be intending to walk the whole trail (several thousand kilometres). For the SWCP, the proportion of dedicated trail walkers fell to 22%.

Although the England Coast Path will be a National Trail, it is expected that its use will be dominated by people out for short day trips from home or temporary accommodation, rather than doing multi-day walks. Consequently, the distance decay function to be used in the model is that identified from the National open access visitor survey (see above), especially given that is has a good sample size.

3.4.2 Speed of travel

It is self-evident that, all other things being equal, some people will progress on foot faster than others over a given stretch of terrain. So, how fast do people walk? This question was addressed in Entec et al (2002) (in which all the quoted secondary sources are referenced) and the answer is reproduced in the bullet points below:

- *"Tradition has it that the army marches at 4 miles/hour.*
- *In the data review, only one other report was found in which the question of rate of progress was considered, and this was also an assumption (rather than an actual observation). The rate assumed was 2,500m/hour (1.56 miles/hour) (Leonard Massaneh & Ptners, 1975).*
- *Many guidebooks to walking in open countryside give a general guide to times and a measure of distance. The times tend to be arrived at through informed estimation rather than scientific analysis. Personal experience suggests that around 2 miles per hour is reasonable.*
- *A general rule used (e.g. by Poucher, 1988) is the so-called Naismith's rule, which suggests that progress over upland areas is at a rate of 3 map miles per hour plus 0.5 hours/1000 feet of ascent.*
- *The Mountain Leadership Training Board (MLTB) in their educational work and training of mountain leaders work on the basis of 1.5 minutes per 100m plus 1 minute for every 50ft of ascent for short distance navigation (2.5 miles per hour). They also recognise, however, that rates of progress will vary with slope, conditions underfoot, experience and fitness of the party and so on (Mr I McMorrin, pers comm.)".*

These sources are for people who are generally fit and active and may be too high for the population of coastal visitors as a whole. Therefore, in the model, it will be assumed that progress will be at a rate of two miles/hour.

It could be argued that those visiting the coast to 'picnic' and 'visit beach' will not progress very far. However, it is to be expected that they will travel some distance to find a spot that meets their selection criteria for a picnic or beach visit. Also, these are a relatively small proportion of the total (around 10%), so it is proposed to subject these to the same distance decay analysis as other visitors.

3.4.3 Conversion of time on site into distance travelled

Given that the vast majority of people visiting the countryside (and, by extrapolation, countryside that is by the sea) travel by car or from their home, they will return to the same place. It is often difficult to create circular walks along the coast and reliance on public transport for part of the journey is likely to be limited, so for simplicity of analysis, it is assumed that all visitors will do 'there-back' walks. Therefore, for any given visit and start point, we can plot likely distribution by calculating:

Distance travelled (miles) = $\frac{\text{Average time on site (hrs)}}{\text{Speed (mph) x 2}}$

Using these assumptions, time spent on site can be converted into distances as follows (see **Table 3.6**).

Table 3.6: Time Spent on Site Converted to Distances

Time spent at destination (hrs)	Distance walked in that time (km)	Extent (there/back walk) (km)	% of population	
			As per UKDVS	Aggregated for use in the Model
<0.25	<0.8	<0.4	8	38
0.25-0.5	0.8-1.6	0.4-0.8	9	
0.5-0.75	1.6-2.4	0.8-1.2	6	
0.71 – 1	2.4-3.2	1.2-1.6	15	
1-2	3.2-6.4	1.6-3.2	26	24
2-3	6.4-9.6	3.2-4.8	15	15
3-4	9.6-12.8	4.8-6.4	9	9
4-5	12.8-16	6.4-8	5	11
5-6	16-19.2	8-9.6	3	
6-7	19.2-22.4	9.6-11.2	1	
>7	>22.4	>11.2	2	

As the journey could be in either direction, the model needs to show half the journeys going north of the start point and half going south.

For the purposes of the model, the distance decay function shown in **Table 3.7** has been used.

In undertaking their walk, the visitors will pass the ‘Profile locations’ – those points along the coast which are used as reference points for monitoring coastal change. Along the length of the study area, there are 101 of these, approximately 500 metres apart. For convenience, it is assumed that attributes of each ‘Profile location’ will extend 250m on each side.

Table 3.7: Distance decay function – distances walked from CAP

Time at CAP (hrs)	Distance walked (km)	Extent (there-back) (km)	% of visits
<1	0 - 1.6	0.4	38
1 – 2	1.6 -3.2	1.2	24
2 - 3	3.2 – 4.8	2.0	15
3 – 4	4.8 – 6.4	2.8	9
4 – 5	6.4 – 8.0	3.6	5
5 – 6	8.0 – 9.6	4.8	3
6 +	9.6+	6.0 (say)	3

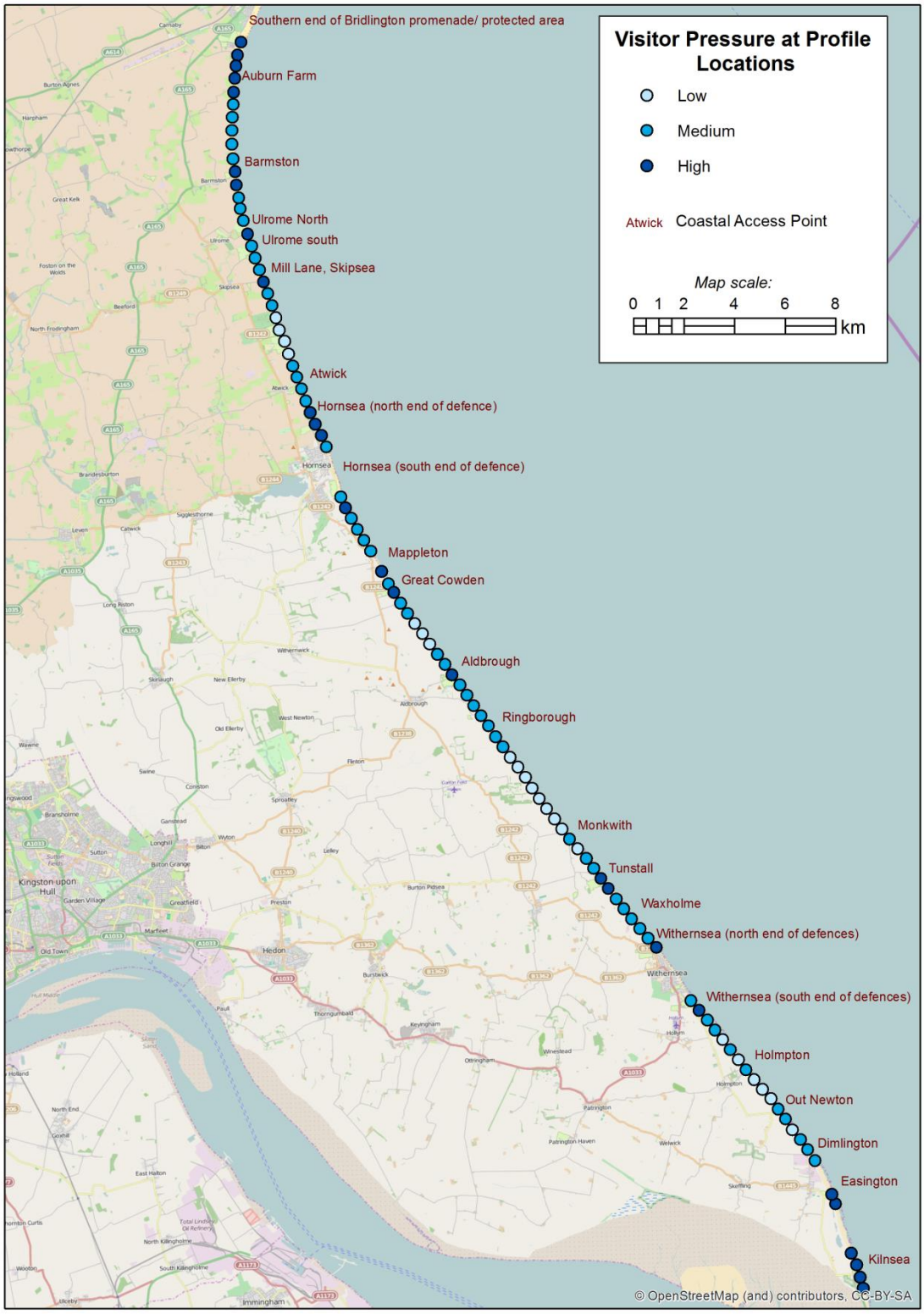
3.5 Outputs

The output from the model is a series of predictions of visitor numbers for each profile location along the relevant section of coastline, with a prediction for every 500 metres (i.e. at each profile location). However, in order to avoid giving the impression that these predictions are in some way precise and to meet the requirements of the Project Brief, the numbers will be used to identify zones of 'High', 'Medium' and 'low' visitor pressure, with each representing the categories provided in the Project Brief. The estimates used to determine the range of each of these different bands is open to debate but for the purposes of this report, the following have been used:

- Very High: 70,000 per annum or more predicted visits
- High: 50,000 to 69,999 predicted visits
- Medium: 25,000 to 49,999 predicted visits
- Low: 5,000 to 24,999 predicted visits;
- Very Low: fewer than 5,000 predicted visits.

Using these ranges, the coastline within the study area can be zoned by Visitor Pressure indicators, as shown in **Figure 3.4**. This zoning is, however, a means to an end. The results need to be incorporated with indicators derived from coastal processes (see **Section 4** below).

Figure 3.4: Visitor pressure at profile locations (CAPs)



4. Data on Coastal Processes

4.1 Introduction

It is not proposed to discuss in the report the process of erosion along the Holderness Coast; this and its implications are discussed at length in the Shoreline Management Plan (SMP) (Scott Wilson, 2010). The focus here is on the data used to analyse risks to walkers. Two variables are of significance here:

- Erosion rate;
- Severity of injury.

4.2 Erosion rate

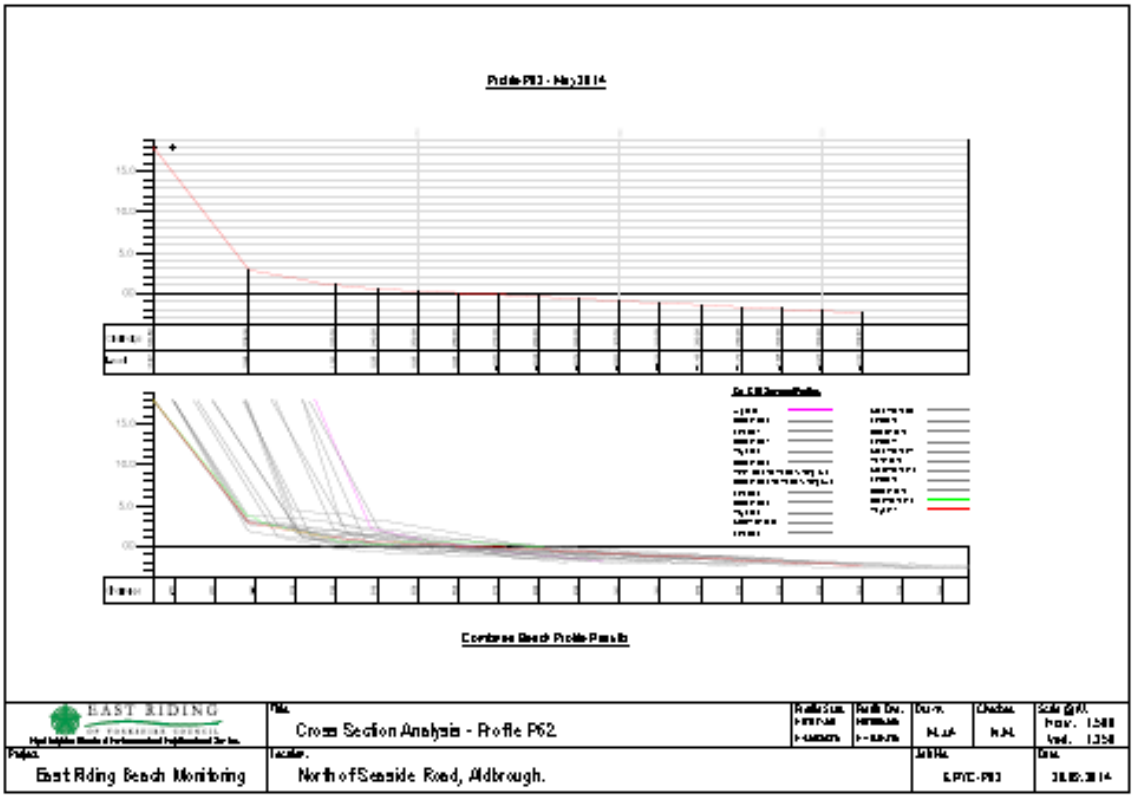
The erosion rate is the speed with which the edge of the cliff top is moving inland. In practice, there are two key elements – average rates (metres per year) and maximum single cliff loss event (metres). These variables are measured in relation to 101 profile locations spread along the study sections of the Holderness Coast. This effectively provides a series of coastal stretches. Using geospatial information collected by ERYC, erosion rates (average and maxima) have been calculated for each stretch, with rates interpolated between the bounding profile locations (i.e. erosion rates are assumed to be the same for 250m in each direction from the profile location).

For each erosion point a number of attributes are available to indicate the rate and propensity to erode. These are:

- Mean rate of erosion in metres per year;
- Maximum recorded individual loss in metres;
- Cliff height in metres;
- Current (May 2014) and historical erosion profiles (cliff slope can be derived from the current profile).

Figure 4.1 below shows a typical ‘profile’.

Figure 4.1: Example of an erosion profile at a given profile location (in this case No. 62)



The Imminent Risk Line (IRL) can be plotted as the perpendicular distance inland from the May 2014 profile equivalent to the maximum recorded individual loss from one single event.

In order to make use of this data for the analysis, another system of ranking is used, based on a 3-point scale (low, medium and high) using the Holderness Coast dataset. The chosen variable is the maximum cliff loss event (as this is the theoretical maximum risk to which walkers could be exposed). ERYC advised that the data ranges to be used are:

- High: over 10m
- Medium: 2.1m to 10.0m
- Low: up to and including 2.0m.

These ranges produce a higher number of 'High' and 'Medium' readings than if one split the range into quartiles (e.g. lowest 25% of readings are classed as 'Low'; middle 25% - 75% of readings classed as 'Medium' and the highest 25% classed as 'High'). Using the data for the 101 profile locations and the above system of ranking, the Erosion Pressure indicators are as shown in **Figure 4.2** below. The preponderance of 'High' and 'Medium' scores reflects the fact that this is a coastline that is eroding faster than most other coastal stretches in England.

Figure 4.2: Map showing relative erosion rates (max event in metres)

4.3 Severity of injury

One of the requirements of the Project Brief is to take account of injury severity in the analysis of risks to walkers using the Holderness Coast. Consequently, some exploration of this factor was undertaken (presented in Appendix 4). From this research, it can be concluded that:

- There is a ready-to-use typology for categorising injury severity and the 5 point scale seems best. From this, interest for this piece of research lies in the three most severe – Major, Severe and Fatal;
- The most critical factor which determines severity of injury caused by a fall from a cliff is height fallen;
- Other factors come into play – some related to the physical attributes of the cliff (e.g. verticality of slope, nature of the 'fall zone') and some the attributes of the injured party (e.g. age). However, how these factors interplay is hard to predict;
- In practice, it is really only possible to map physical attributes of the cliff;
- Data on frequency of severe injuries arising from falls from people walking along cliff tops (as distinct from rock climbers) are likely to be hard to isolate.

Consequently, work related to 'severity of injury' focused on two factors:

- Cliff height;
- Cliff slope.

Information supplied by ERYC included height of cliff top and cliff shape (i.e. cross-sectional profile) at each of 101 profile locations between South of Bridlington and Kilnsea (except coastal sections where a 'hold the line' policy has been adopted). By comparing the height variation and cliff shape, cliff height and slope along the length of the Holderness Coast can be calculated. As with other variables, it is assumed that these variables remain the same for 250m in each direction away from the profile location.

In order to provide a 'severity indicator' for use in the main matrix, it is necessary to bring these two elements (slope and height) together. The approach has been to use a sub-matrix with two axes. The sub-matrix is shown below:

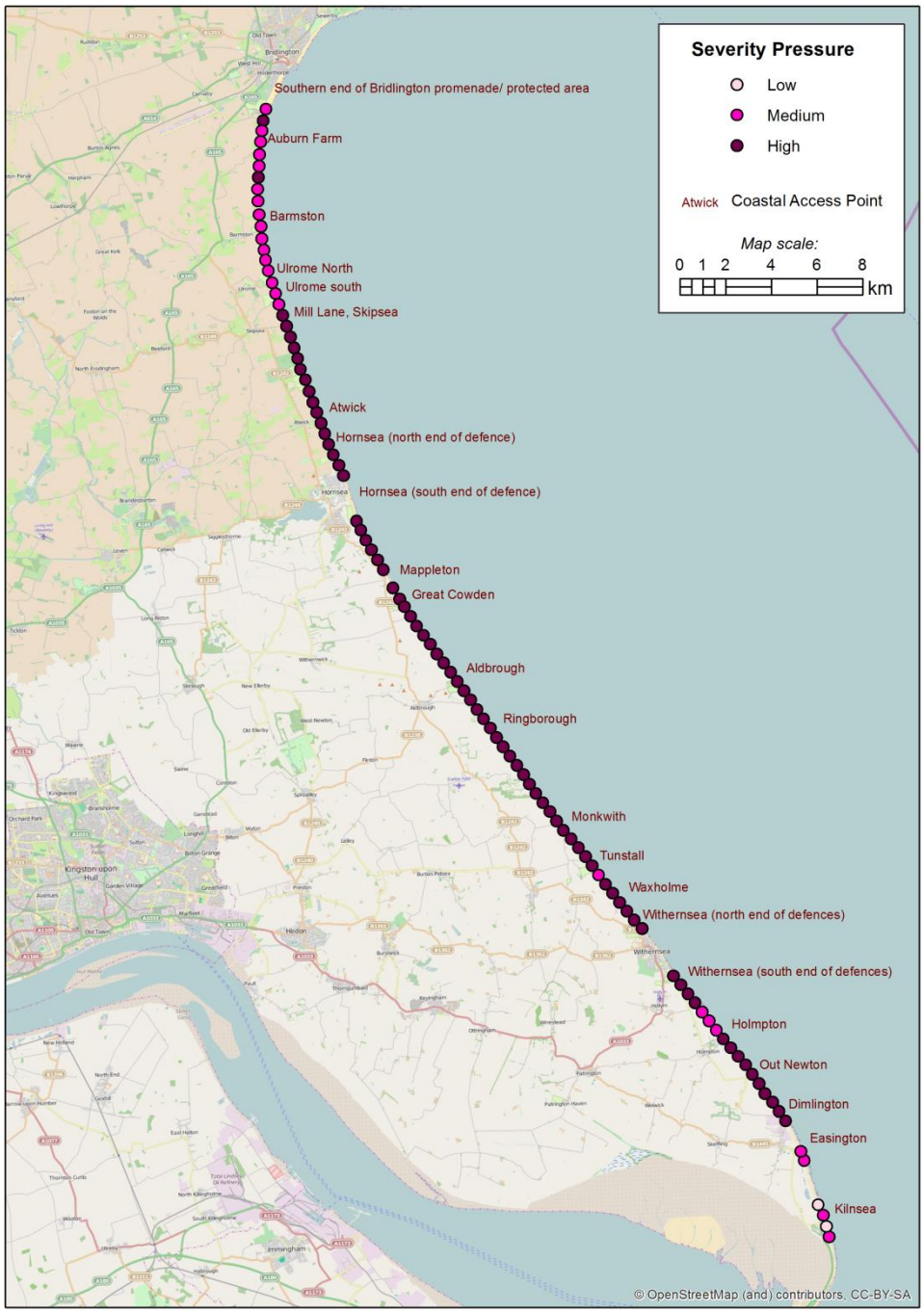
Slope angle			0 - 30°	31 - 60°	60 - 90°	
Cliff			L	M	H	
Height (toe to top)			1	3	9	Risk index
0 - 3m	L	0	0	0	0	
3 - 5m	M	1	1	3	9	
5 - 10m	H	3	3	9	27	
10+m	VH	9	9	27	81	

.

The value of the severity indicator can be calculated for each stretch of coast and ranked according to the 'High/9', 'Medium/3', 'Low/1' scale and then fed into the Main Matrix (see **Section 5** below). The output from this stage in the analysis is shown in **Figure 4.3** below.

Again, there is a predominance of 'High' readings but this reflects the fact that the cliffs are high and the slopes typically at a steep angle.

Figure 4.3: Severity index along the Holderness Coast



5. Combined analysis

5.1 Introduction

In order to provide field officers with an 'easy to use' guide to risk of serious injury to walkers from cliff collapse at points along the Holderness Coast, it is necessary to bring the risk factors – visitor numbers, cliff height and likelihood of collapse – into some sort of single indicator. This section explains how this has been done.

5.2 Matrices

The required single indicator has been derived using 'multi-attribute matrices'. Given the short timescale available, a simplistic approach has had to be adopted, with reliance to some extent on professional judgement, and it would benefit from further consideration and refinement. However, it is believed to yield an indicator of sufficient quality to help guide officers when deciding where to align the England Coast Path.

The Main Matrix is shown below, broken into two steps to aid understanding (**Figures 5.1a** and **5.1b**). Firstly, values for 'Erosion Pressure' and 'Severity Pressure' are combined to give a risk index (which is valued at 1, 3, 9, 27 or 81). This value is then used in Figure 5.1a, together with the 'Visitor Pressure' value to produce a final risk score.

Figure 5.1a: Main Risk Analysis Matrix – Step 1 (Erosion and Severity Pressure)

		Erosion Pressure			
		Low	Medium	High	
Severity Pressure	Risk Index	1	3	9	Risk Index
L	1	1	3	9	
M	3	3	9	27	
H	9	9	27	81	

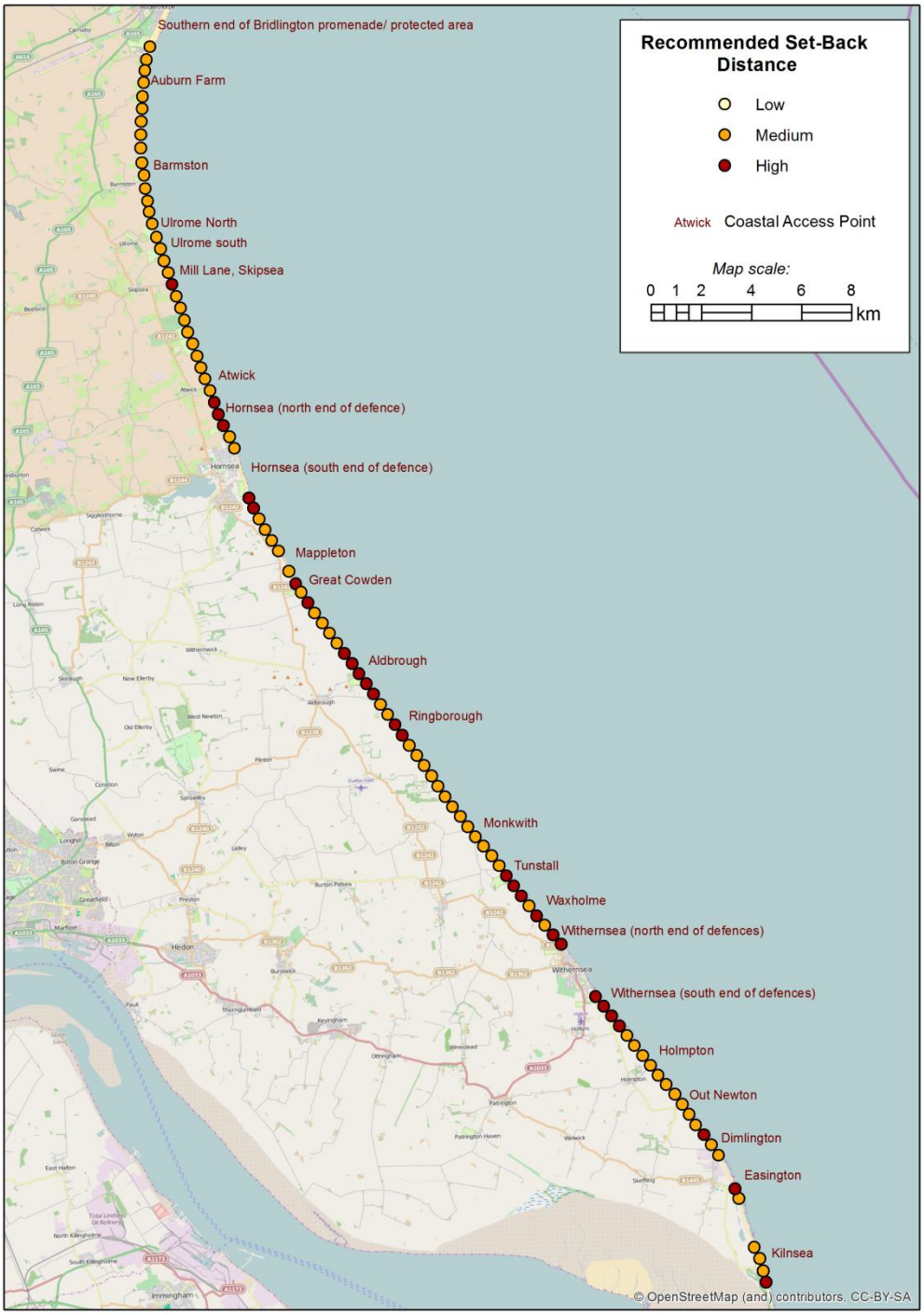
Figure 5.1b: Main Risk Analysis Matrix – Step 2 (Erosion/Severity and Visitor Pressure)

		Erosion/Severity Pressure Score (from Fig 5.1a)				
Visitor Pressure	Risk Index	1	3	9	27	81
L	1	1	3	9	27	81
M	3	3	9	27	81	243
H	9	9	27	81	243	729

In this way, an overall 'risk ranking' can be generated (ranging from 1 to 729) for each profile location along the relevant stretch of the coast. The results have been separated into 'Low', 'Medium' and 'High', as seen with the colour coding. However, the 'risk ranking' needs to be considered in context. It relates to the desirability of setting back the proposed England coast

path from the cliff edge (it should not be seen as implying that there is a high risk to users in an absolute sense). So, the output (see **Figure 5.2** below) is presented as 'Recommended set back distances'.

Figure 5.2: Recommended scale of set-back distance



5.3 Application of findings from the analysis

5.3.1 Introduction

NE wants to be able to derive guidance from the analysis to help them align the new coastal path, taking into account the principle that the path corridor is ideally 4m wide. In an attempt to provide this guidance, a further analysis was undertaken, using three areas chosen to give data from different sections of the coast:

- Profile No. 23: Ulrome;
- Profile No. 64: Aldbrough;
- Profile No. 99: Holmpton.

This section describes the additional analysis and findings.

5.3.2 Working assumptions

It is important to recognise that a number of working assumptions had to be made, even though these may be questionable:

- Any output from the analysis need only be indicative;
- Erosion rates in the future will be the same as those in the recorded past;
- As one moves back from the cliff edge, the risk of collapse reduces, to a point where the maximum historical recorded event line is reached (aka the IRL), inland of which the probability of a collapse is negligible;
- Probability of collapse and likelihood of a visitor being present is uniform from the mid-point between two profile points on one side and the mid-point between two profile points on the other.

5.3.3 Analysis

The first step was to analyse data from the chosen profile points to produce a family of event probabilities (similar to flood events). The bands for the cohorts can be varied to suit the end use but for the purposes of this study, we have chosen 4m intervals to correspond with the suggested 4m width for the path, with the centre line of the path running down the middle of this 4m corridor.

Data was provided by ERYC from their coastal monitoring programme. It was quickly realised that these data have significant limitations when considered for this purpose:

- The cliff event loss data is measured differently at different times and is likely to be crude in the years before about 1989;
- Prior to 1989, the cliff line was measured as ‘snapshots’ when new OS maps were issued, sometimes nearly 30 years apart;
- Even where more frequent and accurate recording has been done (since about 1999), the measurements are at best at intervals of around 6 months and again, this could mask one large event or a series of smaller ones;
- There are very few records of larger cliff loss events, as is often the case with large but very infrequent events (e.g. comparable to flood events) and, for these, the time series is

actually not very long and so probabilities at this end of the spectrum are of low reliability;

- It is clear from comparing erosion data of just these three profiles, that relative erosion rates do not remain constant when viewed over short periods (say decades). For example, erosion at Profile 23 was fairly high during the 19th and early 20th century but then declined, whereas the reverse is true for Profile 64.

These limitations present a dilemma. Either the good quality data can be used but the results would have to be regarded as unreliable, because of the short time frame; or, the data from the whole period (160 years) can be used but with so much 'averaging' of results that the analysis loses meaning.

Both approaches were tried and produced broadly similar results in terms of estimated probability of a cliff loss event occurring in a given year at the three chosen locations at points 0 - 4m; 4 – 8m; 8 – 12m and so on back from the cliff edge. A series of assumptions and calculations were also set and a combined probability of a collapse occurring when an individual may have been walking along the cliff top was calculated.

Superficially, it seems that this approach would be ideal for the purposes of deciding where to align the new England Coast Path. However, NE and ERYC should **not be so easily seduced**: although the results 'feel' right and could be helpful, the data on which they are based are not suitable for this purpose and so little reliability can be placed on the findings derived from them. Even in the absence of anything better, the outputs would have to be treated as indicative only. Their weaknesses could easily be revealed if subject to close scrutiny. Nonetheless, as the record of good quality events data grows, the value of the data for this purpose will increase, although it will be many years before a dataset capable of producing reliable findings is available.

Notwithstanding the above, it can be concluded that:

- The risk to users is generally low relative to comparable risks for the vast majority of situations;
- The further back from the cliff edge the England Coast Path can be set-back, the lower the risk to users of being directly affected by a cliff loss event;
- It would be highly undesirable to align the centre line of the path within the first 6m back from the cliff top edge, meaning that the seaward boundary of the path corridor is no closer to the cliff top edge than 4m;
- Further to this, however, a route closer to the cliff edge may be acceptable where 'Severity Pressure' and/or 'Erosion Pressure' is classed as Low;
- NE and ERYC can work together to explore how best to apply these findings, bearing in mind the limitations highlighted;
- NE and ERYC can repeat/extend the analysis as the dataset improves.

6. Conclusions

A number of conclusions can be drawn.

- Natural England is obliged to take account of risks to public health and safety when choosing the proposed alignment of the England Coast Path, including those posed by possible cliff loss events.
- The Holderness Coast is eroding rapidly in comparison with other coastal stretches around England and so, in relative terms, can be considered to be a high risk area in this respect.
- A promoted national trail along the Holderness Coast is likely to attract many visitors. The majority will be local residents and people staying locally on holiday but their level and pattern of visits are likely to be different than current usage patterns.
- Access to the coast from the road and edges of urban areas (access within these urban/defended areas has not been included) is limited to 23 key locations (referred to as Coastal Access Points – CAPs) within the study area, although the extent to which they exert a 'pulling power' will vary depending on the attributes of each.
- Using national datasets on visitor behaviour when engaging with the natural environment (MENE) and making day visits (GB DVS), broad indications of likely visit numbers to the coastline in the study area can be made. The estimate used in the predictive modelling is 2.84m/year.
- These can be allocated to the various CAPs in proportion to each point's relative pulling power, using a range of attributes (such as existence of a car park, beach access, a visitor centre).
- Using published data, estimates can be made of the distance walked by such visitors, by creating a distance decay function (i.e. the proportion of people prepared/able to walk a specific distance decreases as that distance increases). The predictive model is crude but capable of being made more sophisticated. Therefore, there would be merit in discussing possible improvements by making better use of data held by MENE (for example, making more use of ERYC/Hull specific data held in the MENE database).
- Data on coastal processes collected by ERYC can be used to provide indications of erosion rates and severity of injury in the event of a fall (a function of cliff height and steepness of slope). In view of the topography and geology, the majority of locations along the cliffs are rated as 'high' for both erosion and severity but again this is relative when compared to other areas with lower cliffs and/or slower erosion rates.
- These different 'pressures' can be mapped for the Holderness Coast, using the 101 profile locations as reference points (see **Figures 3.4**, **4.2** and **4.3**).
- A three-axis matrix can be used to relate each of the three 'pressures' (Visitor, Erosion and Severity), although this is shown as a two stage process to facilitate understanding (see **Figures 5.1a** and **5.1b**). In this way, the 'pressures' can be combined to generate a single indicator of relative risk along the coast (see **Figure 5.2**).

- It is very important, though, to recognise that:

- The actual level of risk, which is virtually impossible to quantify in any meaningful way, is expected to be very low in absolute terms in the majority of locations.

- When considering what is an acceptable level of risk, regard should be had to comparable figures such as:

    - The risk to recreational walkers of serious injury by cattle is around 1:150,000;

    - HSE consider an acceptable level of risk of a fatality in the workplace to be 1:1,000,000;

    - Risk of fatal injury to the public from falling trees is estimated at about 1:10,000,000.

- Lessons to be learnt from other national trails which run along sections of coastline are limited because of the often significant differences. However, none of those contacted had attempted any analysis of the kind performed here, and so this research should be seen as innovative. That said, there are sufficient characteristics in common with North Norfolk Coast path to suggest that intelligence and experience should be shared.

- In theory, the output from the analyses in Section 5 could quantify how quickly the level of risk of collapse in any given point in time declines as one moves back from the cliff edge. However, the quality and quantity of the data (both in terms of cliff erosion rates and visitor pressure) are such that the degree of confidence that could be placed on the findings would be so low as to render them unhelpful.

- Notwithstanding the limitations referred to above, it can be concluded that the risk to users is generally low relative to comparable risks for the vast majority of situations and that the further back from the cliff edge the England Coast Path can be set-back, the lower the risk to users of being directly affected by a cliff loss event. Consequently, it is recommended that:

    - NE should <u>not</u> align the path so that any of the path corridor falls within the first 4m back from the cliff top edge;

    - Further to this, however, a route closer to the cliff edge may be acceptable where ‘Severity Pressure’ and/or ‘Erosion Pressure’ is classed as Low;

    - NE considers repeating the analysis (done here for only 3 profile locations) when a longer time series of good data has accrued to see if further lessons can be learnt from the outputs;

    - NE and ERYC work together to explore how best to apply these findings, bearing in mind the limitations highlighted.

7. References

Asken Ltd, Entec UK Ltd, FPD Savills (2002). Advice on management of risks to public health and safety on access land. Unpublished report to Countryside Agency, Forestry Commission and Countryside Council for Wales.

Entec UK Ltd, Asken Ltd (2002). Predicting levels and patterns of recreational use of open access land. Unpublished report for the Countryside Agency.

ERYC (2012). Explore the east Riding Coast.

FaberMaunsell, et al (2009). National open access visitor survey 2006 – 2008. NECR036a/b/c. (See: http://publications.naturalengland.org.uk/publication/48005?category=216216)

Fearnley, H., Liley, D. & Cruickshanks, K. (2012). Results of the recreational visitor surveys across the Humber Estuary. Footprint Ecology, unpublished report for Humber Management Scheme. See: http://humbernature.co.uk/admin/resources/footprint-ecology-humber-visitor-report-6th-july-2012.pdf).

GB DVS (2004). Report of the 2002-03 Great Britain Day Visits survey. See: http://publications.naturalengland.org.uk/publication/219029?category=47018

HSE (2001). Reducing risks, protecting people. HSE. See: http://www.hse.gov.uk/risk/theory/r2p2.pdf

MENE (2011). Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment - Annual Report from the 2009-10 survey (NECR049). See: http://webarchive.nationalarchives.gov.uk/20140910073652/http://publications.naturalengland.org.uk/publication/40014?category=47018

Middlesex University (2011). Common sense risk management of trees. Report for the National Tree Safety Group. See: http://www.forestry.gov.uk/pdf/FCMS024.pdf/$file/FCMS024.pdf (visited 23rd March 2015)

Natural England and Countryside Council for Wales (2008). National Trails User Survey 2007.

Pembrokeshire Coast National Park Authority (2010). Pembrokeshire Coast Path National Trail – Safety Statement.

Scott Wilson (2009). East Riding Tourism Accommodation Study. Summary, Conclusions and Recommendations Report. ERYC, Beverley

Scott Wilson (2010). Flamborough Head to Gibraltar Point Shoreline Management Plan. Report for Humber Estuary Coastal Authorities Group. See: http://www.nelincs.gov.uk/council/planning-policy/evidence-base/sub-regional-documents/shoreline-management-plan/ (visited 9th March 2015)

See: http://www.caithnesswindfarms.co.uk/fullaccidents.pdf (visited 5th November 2014)

South West Coast Path Team (2006). Safety Guidance for Rangers & Wardens Involved in Managing the South West Coast Path National Trail. Devon County Council.

TNS (2014a). GB Day Visits Survey 2013. Report for VisitScotland, VisitWales and VisitEngland. (See:

http://www.visitengland.org/Images/GBDVS%20Annual%20Report%202013_Redesigned%20version%20v1%2016%2009%2014_tcm30-42547.pdf – visited 23/02/15)

TNS (2014b). Annual Report from the 2013-14 survey. (Survey v2). See: http://publications.naturalengland.org.uk/publication/6579788732956672 (visited 25 February 2015)

Tourism South East (2013). The Economic Impact of Tourism on East Riding District 2013. Report for ERYC, Beverley.

Appendix 1
SWCP method for categorising zones

3 Pages

To help assess the risk the Coast Path can be divided into broad zones dependant on the habitat crossed and the type of user each section attracts. The zones based on those developed by the VSCG and the National Trail Quality Standards are described below.

Zone 0: Urban

Description: This zone covers the sections where the Coast Path passes through towns and villages. This includes footways, parks, urban car parks, seafront promenades etc, where the maintenance of the surface and adjacent fencing is undertaken by non-Coast Path managers, and Coast Path use is incidental to its main use as urban path, or park. Typically the surface of these sections is sealed or paved and maintained as a footway, in the same manner as other paths in the vicinity, or is undefined crossing public open space.

Users: Only a small minority of the public using those sections do so because they want to walk the Coast Path, and many users will be unaware that they are even on the Coast Path.

Examples: Plymouth Hoe, Newquay town centre, Teignmouth & Dawlish sea walls, Weymouth seafront.

Level of support and hazard management: Coast Path users do not experience a higher risk than the general public using these areas and the responsibility for site maintenance does not lie with Coast Path Managers (who this document is aimed at). As such it is not considered appropriate for Coast Path managers to undertake risk assessments or risk control measures within this zone, and the management of such areas is outside the scope of this document. Instead Coast Path management is limited to signing the route to enable walkers to easily find their way, and advice on this is given in the SWCP Signing Good Practice guide.

Zone 1: Honeypot / Urban Fringe / Ambling

Description: These areas cover a small proportion of the route and are typically:

- easily accessible by foot or car, and have large numbers of visitors.
- adjacent to settlements or formal (pay) car parks
- have facilities such as public toilets, and shops or vans selling refreshments close by.
- extend for short distances (max. 1/2 mile or so), except where they link two ‘honeypot’ sites.

The path will typically:

- have a man-made surface that is free of mud or standing water throughout the year, and so can be walked in ‘normal’ shoes.
- have no long or steep ascents, that would deter casual walkers.
- be at least 1m wide and level to allow walkers to pass easily.

- be segregated by fencing from farmland.

Users: For the purposes of assessing risk it is assumed users will:

- have a low awareness of hazards that may be present, and so an expectation that the site is very safe;
- be unfamiliar with the site or are first time visitors;
- have young children or dogs that are not under close supervision of an adult;
- not have suitable footwear to undertake a 'country' walk;
- planning a short walk, typically no more than 1 mile.

Examples: Valley of the Rocks to Lynmouth, Ilfracombe to top of Hillsborough, Mullion Cove (car park to beach), Babbacombe beach to Oddicombe beach, Mountbatten to Jennycliff, Beer to Seaton, Lulworth Cove to Durdle Door.

Level of support and hazard management: The management of the path within these areas should be based on the principle that many visitors to these areas will assume that the site is safe. If hazards exist, measures should be taken to remove hazards and where this is not feasible, to ensure users become aware of the hazards before encountering them, and what action they can take to minimise the risk to themselves. As these areas will already have a significant amount of man-made infrastructure, the need for path surfacing, and furniture to be very durable may take precedence over the use of natural materials.

Zone 2: Rural / Rambling

Description: These areas cover the largest proportion of the route and typically:

- have a moderate level of use, with obvious signs of human activity on the landscape, e.g. lowland farmland (improved grassland or arable), or managed woodland
- **or** be a more natural landscape, but is heavily used e.g. Boscastle to Tintagel, Pentire Point, Morte Point.

The path will typically:

- have a natural surface for most of its length
- may include some steep ascents and descents.

Users: For the purposes of assessing risk it is assumed users will:

- be aware of the typical coastal hazards they may encounter.
- be specifically going for a walk along the Coast Path and have planned their route,
- have children and dogs under close supervision of an adult
- be wearing reasonable footwear for the conditions that could be expected at that time of year
- be capable of, and planning to walk for several miles, or typically for half a day.

Examples: Most of; South Cornwall, particularly between Helford and Plymouth, East Devon and Dorset

Level of support and hazard management: In these areas the management should be based on the principle that walkers will know that they are in a potentially hazardous environment and so need to take care. Management intervention should be limited to areas where a hazard is not obvious or where users cannot easily take action to avoid the hazard e.g. a narrow path close to a cliff edge.

Zone 3: Rugged / Scrambling

Description: This zone covers those sections of the Coast Path that typically

- have comparatively few visitors
- is quite arduous to walk, with steep ascents and descents
- has few options to undertake a short walk, or 'escape' inland.
- are wild or remote, where there the influence of man on the landscape is less obvious e.g. coastal heaths, uncultivated cliff land, or extensive grazing.

The path is typically

- a natural surface which in many locations can be rough and uneven, and also muddy or slippery in some conditions.

Examples: Crackington Haven to Boscastle, St Ives to Pendeen Watch, Prawle Point to Hallsands

Typical user: For the purposes of assessing risk it is assumed users will have all the characteristics of those in the rural zone, but have greater experience and fitness level.

Appendix 2
Exploration of distance decay function of leisure day visitors

3 Pages

Monitor of Engagement with the Natural Environment (MENE)

Data obtained through the MENE survey over the 5-year period to February 2014 show the distance travelled to various destinations. Data are available at county level (i.e. ERY). The results are shown in **Table A3.1**, for ERY only as there are no data specific to Hull.

Table A3.1: Response to question: How far did you travel to reach this place?

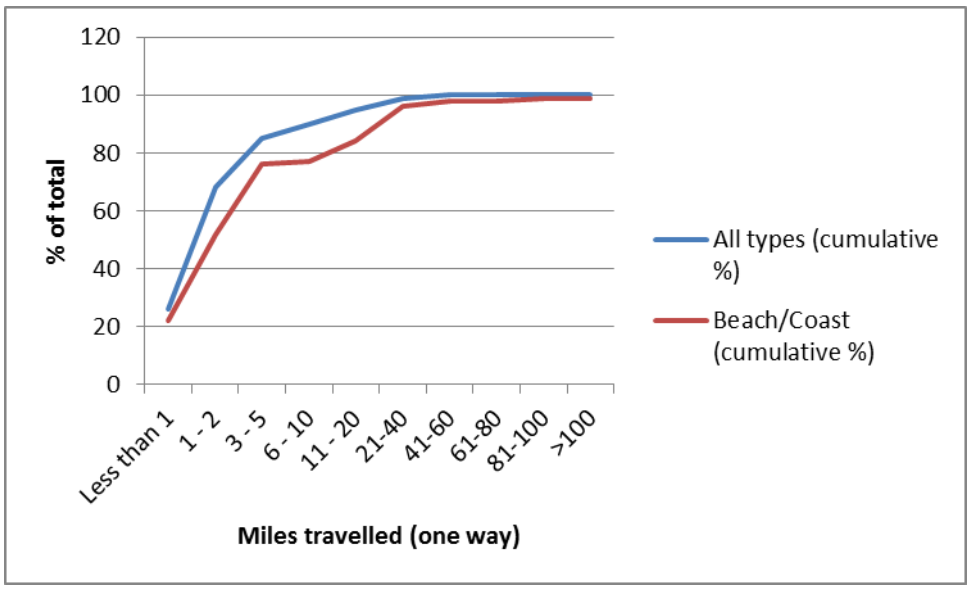
Distance travelled (one way) (miles)	All types of place (%)	Those visiting beach or other coastline (%)
0-10	90	77
11-20	5	7
21-40	4	12
41-60	1	2
61-80	0	0
81-100	0	1
>100	0	0

Source: MENE Cross tabulations

This clearly shows the tendency for people to engage with the natural environment close to their homes. Interestingly, though perhaps not surprisingly[14], people tend to travel further to get to the beach/other coast. This can be seen when the above figures are shown cumulatively, although the difference is not very great (see **Figure A3.1**).

[14] It is not surprising because someone living inland is surrounded on all sides by opportunities to visit other types of countryside, whereas the coast is normally only available through an arc of 180 degrees of less.

Figure A3.1: Cumulative responses to: How far did you travel to reach this place?



Source: MENE Cross tabulations

Great Britain Day Visits Survey (GBDVS)

The tourism organisations in England, Scotland and Wales undertake surveys from time to time of 'Leisure' and 'Tourist' day visits, using data gathered from a large number of members of the public. Information 'Leisure' trips describes the characteristics of recreational visits undertaken, whereas the 'Tourist' day trips are a subset of the 'Leisure' trips and describe characteristics of trips of over 3 hours which are not taken regularly. Data from the Leisure survey are reproduced in **Table A3.2** below.

Table A3.2: Distances travelled as revealed in GBDVS.

Distance travelled (one way) (miles)	GB visits to the seaside (%; n=142 million)	England visits to all destinations (%; n=1,370 million)	GB visits for outdoor activities(%; n=111 million)
Less than 5	13	18	14
5-10	13	17	20
11-20	12	16	18
21-40	14	14	17
41-60	10	8	10
61-80	6	5	4
81-100	6	4	3
>100	15	10	6
Don't know	11	8	8

Source: GBDVS 2013 (TNS, 2014a)

National Trails

A survey of visitors to National Trails was conducted on behalf of NE and CCW in 2007 (NE/CCW, 2009). The table below (**Table A3.3**) shows data about distances travelled for all trail and for a selection of Trails with coastal sections.

Table A3.3: Distances travelled by visitors to coastal national trails

Distance travelled (miles)	Peddars Way and Norfolk Coast (%; n=88)	SWCP (%; n=161)	Cleveland Way (%; n=218)	Pembrokeshire Coast (%; n=146)
< 5	13	10	7	10
5 – 20	21	13	20	11
20 - 60	13	10	19	4
>60	52	60	44	68
Outside UK	1	7	10	3

Source: National Trails Visitor Survey 2007 (NE/CCW, 2008).

This shows a rather different distribution of propensity to travel than non-designated locations and testifies to the 'drawing power' of national trails. It was also recorded that around 50% of people had stayed away from home. The inclusion of overseas visitors suggests that the data show how far people had travelled from their normal place of residence to visit their chosen trail, rather than where they had stayed the night before the interview. Consequently, it is probably not directly comparable.

Data has been requested from Gavin Stark on the 2014 survey and hopefully this will arrive in time.

National Visitor surveys at Open access Land Sites (2006 – 2008)

Over a 3 year period, surveys were carried out at a large number of sites around England, each with open access land. In total, nearly 4,500 survey responses were obtained and each respondent gave a response to the question about how far they had travelled to get to the site. Results are as follows shown in **Table A3.4** below.

Table A3.4: Distances travelled by people visiting open access land sites across England outside National Parks

Distance travelled (one way) (miles)	All sites (%) (n=4473)
0-10	72
11-20	12
21-40	9
41-100	6
>100	1

Source: FaberMaunsell (2009).

Footprint Ecology (FE)

FE (Fearnley et al, 2012) undertook a survey of visitors to the Humber Estuary in 2012 at 20 locations, one them being at Spurn Head. It is a different study area to the Holderness Coast,

there is likely to be a greater preponderance of 'wildlife watchers' amongst the survey sample and the data is dominated by interviews undertaken in winter. Even so, it is gives information of where people started out for their visit that may be indicative of visits to the area more generally.

At paragraph 2.1, the authors report that:

"The majority of interviewed visitor groups (88% / 542) were local residents and had travelled to the site from their home (92% / 462 in the winter and 71% / 80 in the summer). 6.5% (40 groups) of interviewees were on holiday in the area and staying away from home and a further 3.3% (20 groups) were on a day trip or short visit and were staying with friends and family. The remaining 0.7% (4 groups) of visitors gave other reasons for their visit to the survey locations. Excluding the category 'other' there was a significant difference in the proportion of visitors in each visitor type category ($\chi 2=99.4$, 2df, $p<0.001$). As to be expected, more visitors were on holiday in the summer surveys compared to the winter surveys."

Appendix 3
Coastal Access Points

3 Pages

CAP (i.e. start point for walks)	Pull Factors	Weighting	Approx Grid Ref
North of study area – for use in analysis only			
1. Flamborough Head	Car park Road end Viewpoint Refreshment / accommodation provider WC Beach Access **Total**	2 1 1 2 1 3 **10**	255708
2. South Landing, Flamborough	Road end Visitor centre Car park WC Beach Access **Total**	1 3 2 1 3 **10**	230696
3. Danes Dyke, Flamborough	Car park Road end Toilets Visitor centre/shop Local Nature reserve Beach Access **Total**	2 1 1 3 3 3 **13**	214694
4. Northern end of Bridlington promenade/protected area (Sewerby)	Urban area Road end Car park Refreshment / accommodation provider WC **Total**	3 1 2 2 1 **9**	201689
Study area			
5. Southern end of Bridlington promenade/protected area	Urban area Road end Car park WC Beach Access **Total**	3 1 2 1 3 **10**	173650
6. Auburn Farm/ Fraisthorpe	Road end Car park WC Beach Access **Total**	1 2 1 3 **7**	170628
7. Barmston	Road end Car park Refreshment / accommodation provider Beach Access **Total**	1 2 3 3 **9**	171594

CAP (i.e. start point for walks)	Pull Factors	Weighting	Approx Grid Ref
8. Ulrome North	Road end Car park Refreshment / accommodation provider **Total**	1 2 3 **6**	174571
9. Ulrome South	Road end **Total**	1 **1**	178563
10. Mill Lane, Skipsea	Road end Refreshment / accommodation provider **Total**	1 3 **4**	182552
11. Atwick	Road end **Total**	1 **1**	197510
12. Hornsea (north end of defence)	Urban area Road end Car park WC Beach Access **Total**	3 1 2 1 3 **10**	Say 200497
13. Hornsea (south end of defence)	Urban area Road end Car park **Total**	3 1 2 **6**	Say 210473
14. Mappleton	Road end Car park WC Refreshment / accommodation provider Beach Access **Total**	1 2 1 3 3 **10**	228439
15. Great Cowden	Road end **Total**	1 **1**	233428
16. Aldbrough	Road end Car park Refreshment / accommodation provider **Total**	1 2 3 **6**	257396
17. Ringborough	Road end Car park **Total**	1 2 **3**	Say 273374
18. Monkwith	Road end **Total**	1 **1**	301333
19. Tunstall	Road end Beach Access **Total**	1 3 **4**	315314
20. Waxholme	Road end **Total**	1 **1**	328300
21. Withernsea (north end of defences)	Urban area Road end **Total**	3 1 **4**	Say 334288
22. Withernsea (south end of defences)	Urban area Road end **Total**	3 1 **4**	354263
23. Holmpton	Road end **Total**	1 **1**	373240
24. Out Newton	Road end **Total**	1 **1**	384322

CAP (i.e. start point for walks)	Pull Factors	Weighting	Approx Grid Ref
25. Dimlington	Road end **Total**	1 **1**	398205
26. Easington	Road end Refreshment / accommodation provider Beach Access **Total**	1 3 3 **7**	407190
27. Kilnsea	Car park Road end Visitor centre Nature reserve Refreshment / accommodation provider WC Beach Access **Total**	2 1 3 3 3 1 3 **16**	418159
South of study area – for use in analysis only			
28. Kilnsea south	Car park Visitor centre Nature reserve Refreshment / accommodation provider Road end **Total**	2 3 3 3 1 **12**	410159
29. Lockham	Car park Road end **Total**	2 1 **3**	393171
30. Skeffling	Car park Road end **Total**	2 1 **3**	370184
31. Stone Creek	Road end **Total**	1 **1**	235190
32. Paull	Road end Car park Refreshment / accommodation provider **Total**	1 2 3 **6**	169258
33. Hull (eastern end – say King George Dock)	Urban area Total	3 **3**	139286
34. Hessle (western end – Humber Bridge Country Park)	Urban area Car park Information centre Country park Refreshment / accommodation provider Viewpoint Beach/river/foreshore access **Total**	3 2 3 3 3 1 3 **18**	022254

Appendix 4
Injury Severity

3 Pages

What is a severe injury?

The first step is to consider what is meant by 'severe injury'. HSE focus on work-related injuries and use:

- Fatal injuries;
- Major injuries;
- Over-3-day injuries.

Asken et al (2002) – in giving advice to the 'Relevant Authorities' on managing risks to public health and safety on open access land - used the following typology (derived from HSE) (see **Table A4.1**).

Table A4.1: Significance Criteria - Severity

Column Heading	Definition	Rationale
1	Irritation	noticeable harm but of no significant consequence - full recovery
2	Minor	injury that can be treated locally - full recovery
3	Major	injury requiring external help and rescue - full recovery
4	Severe	injury resulting in permanent damage
5	Fatal	injury resulting in a fatality (immediate or delayed)

The Association for the Advancement of Automotive Medicine[15] (AAAM) is a professional multidisciplinary organisation based in the USA which works with people involved in motor vehicle crashes. They have a more elaborate typology.

Table A4.2: AAAM system of classifying injury severity

AIS-Code	Injury	Example	AIS % prob. of death
1	Minor	superficial laceration	0
2	Moderate	fractured sternum	1 – 2
3	Serious	open fracture of humerus	8 – 10
4	Severe	perforated trachea	5 – 50

[15] See: http://www.aaam.org/about-ais.html (visited 9th March 2015)

5	Critical	ruptured liver with tissue loss	5-50
6	Maximum	total severance of aorta	100
9	Not further specified (NFS)		

On balance, the one used in the advice to relevant authorities scale looks most suitable. On this basis, we are probably concerned with the more serious three categories – Major, Severe, Fatal. That said, it may be difficult to isolate data on cliff fall injuries that are Major/Severe/Fatal. In this way, we can probably assume that our definition of 'Major' closely corresponds with HSE's 'Over 3-day injury', and our definition of 'Severe' corresponds with HSE's 'Major'.

Factors affecting severity

It was accepted that several factors may conspire to cause a fall to result in a serious injury. These are described below.

Height of fall

Data is available from two sources within HSE:

- RIDDOR: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 - Workplace injury data from 2001/02 – 2010/11.
- LFS: Labour Force Survey - Workplace injury data from 2001/02 – 2012/13 and work-related ill health data from 2001/02 – 2011/12.

Their data shows severity (using their typology) of injury for falls of less than or more than 2 metres (see **Table 4.3**).

Table A4.3: Severity of injury from falls more/less than 2m

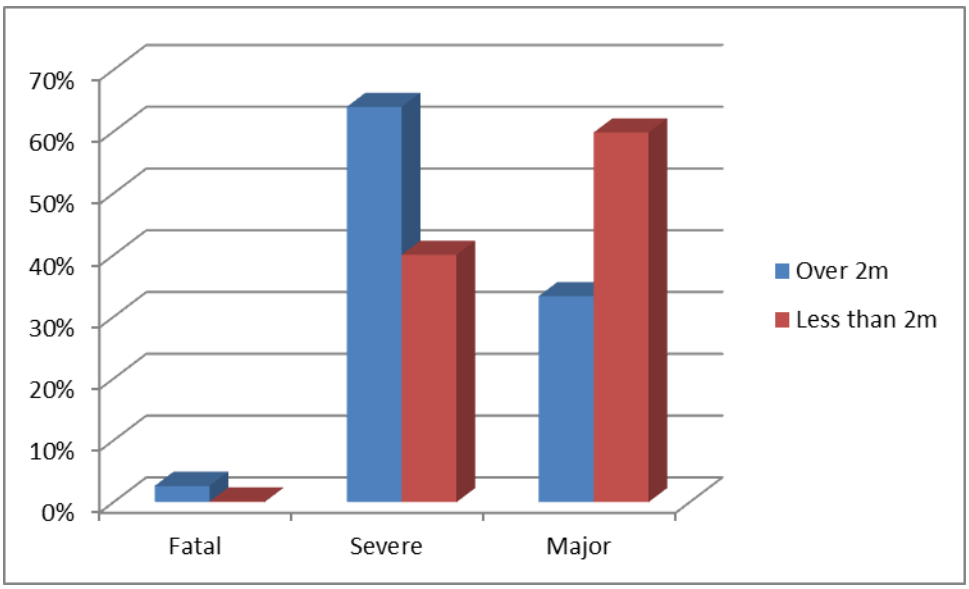
	Fatal	**Major**	**Over 3-day**	**Total**
High fall over 2 metres	25	608	317	950
Low fall up to and including 2 metres	8	3,148	4,705	7,861

Shown graphically and as percentages (**Figure A4.3**), it can be seen that a fall which is notified to HSE of over 2m is more likely to result in a fatal or severe injury. It is worth noting again that these are work-related accidents and so it may be dominated by falls onto hard surfaces.

The shorter falls are much more common (89%) than the greater falls (11%), although we have no data on 'Minor' and 'Irritation' type incidents, so cannot gauge the overall picture (i.e. what percentage of all falls result in a major/sever/fatal injury).

Telephone discussion with local HM Coastguard confirmed that height of fall was a critical factor in determining injury severity (pers comm).

Figure A4.1: Frequency of fall injuries by severity



Personal Factors

It could be argued that an older person may be more vulnerable to more severe injuries than a younger one. The Health and Social Care Information Centre records data on hospital admissions and categorises them by type of incident. Category W15 is 'Falls from Cliffs'. It is not clear from this whether an injured rock-climber would be placed in this category; it is likely that they would be as none of the other 'falls from…' categories would be more appropriate. The most recent data (for 2012/13) record:

- 121 consultations, of which 109 were emergencies
- This resulted in 119 admissions, of which 99 were male and 22 female
- Of the 121 consultations, the breakdown by age group was:
    - 0- 16: 14
    - 17 – 29: 38
    - 30 – 49: 42
    - 50 – 69: 20
    - 70+: 7

It seems from this that a high proportion of people injured from a cliff fall are male and between 17 and 69 in age – a cohort into which the majority of rock climbers would fit. However, no data are available on the total population of cliff top visitors from which the subset who fell, or the subset of these who suffered injuries sufficiently severe to visit a hospital, was drawn. Therefore, it is not possible to derive accident rates or severity indicators.

Other Factors

HM Coastguard also listed:

- Whether the tide is in (which means there is a risk of drowning, even if the injured party survives the fall);
- What they are falling on to (e.g. rocks, rocks submerged by water).

Frequency

RoSPA has data on its website from the National Water Safety Forum 2013 showing water related *fatalities*. It includes suspected crime and suicide; directly relevant data are shown in the table below (**Table A4.4**).

Table A4.4: Fatal accidents at the coast/shore/beach (for 2012)

Activity	Number of fatalities
Walking/running	37
Person/object in water, person of uncertain status	5
Swimming	20
Jumping/diving in	1
Waterside activity/in water play	5
Angling	6
Sub aqua diver	1
Commercial	5
Sailing	4
Motorboating	1
Manually powered boats	2
Climbing/cliff	3
Cycling	1
Surfing	2
Total	**93**

Figures from the same source showing fatalities related to 'Climbing/cliffs' at the coast/shore/beach were 8 in 2011. Again, this is not a particularly 'clean' dataset and 'Climbing/cliff' could easily relate to rock climbers, not someone walking across the cliff top, and probably does in many cases.