Built Infrastructure for Older People's Care in Conditions of Climate Change (BIOPICCC)

Report for East Riding of Yorkshire

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Prototype BIOPICCC Toolkit:
http://www.dur.ac.uk/geography/research/researchprojects/biopiccc/toolkit/

Executive Summary

It is recognized that around the country it will be necessary to develop local plans for adaptation of health and social care services to climate change (Defra 2012; Hames & Vardoulakis 2012; NHS SDU 2012).

This report presents a review of information relevant for climate change adaptation in East Riding of Yorkshire (ERY), produced as part of a research project on *Built Infrastructure for Older People's Care in Conditions of Climate Change (BIOPICCC)*, carried out by Durham and Herriot-Watt Universities, and funded by the Engineering and Physical Sciences Research Council (EPSRC).

The wider aim of BIOPICCC is to develop, trial and disseminate tools for adaptation to make the built infrastructure supporting older people's health and social care in England more resilient to the effects of extreme weather.

ERY has provided an important case study for BIOPICCC and the Universities are grateful to all of the participants from ERY who took part in this study and helped to provide parts of the information reported below.

Key messages for ERY from this review are as follows:

- Action at the scale of local authorities and local communities is needed to make health and social care systems more resilient to extreme weather related hazards and to plan for likely changes in our climate.
- We have considered how the situation in ERY compares with other parts of England in terms of present and projected future weather related hazards and vulnerabilities (Section 1 of this report).
- Through a series of consultative workshops and discussions with key informants from service agencies and local communities we have built up a picture of local knowledge about risks of extreme weather events and how they vary across ERY. We have demonstrated innovative ways to help to exchange and share knowledge from different informants (Section 2).
- Our key informants indicated that built infrastructure was an important part of the system of health and social care for older people. Built infrastructure systems are complex, and extend beyond individual buildings. We explored how to develop a more 'joined up' approach to adaption of built infrastructure supporting older people's care, using delivery of utilities to health care buildings to demonstrate the nature of the problem. We have made progress towards modelling the electricity system for example (as reported in Section 3).
- The learning from the case study work in ERY has helped to inform national adaptation policy, including guidance published by the NHS Sustainable Development Unit. The BIOPICCC toolkit is an online resource (see link above), about to be released by Durham University which draws partly on the research reported here, making the learning widely available. These findings may also be relevant for the 'Climate Local' initiative to support strategic planning by sharing good practice.
- Adaptation is not only about planning action during emergencies – it is also important to develop preparedness and resilience measures, through action by the local authority, local communities and, in some cases, by individuals;
- Local coordination of adaptation strategies varies and extra effort may need to be concentrated in some places. Also local experiences could be disseminated to share ideas about good practice.

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1. Weather-related hazards and vulnerability: Comparison of East Riding of Yorkshire with other areas of England

Key messages for ERY from national assessment of weather-related hazards and vulnerability

- We understand that ERY is moving towards an integrated approach with respect to climate change adaptation and resilience planning. The BIOPICCC team have worked with support from ERY on a case study of older people's health and social care which considered weather-related hazards, and also vulnerability of populations and systems at local level.
- Compared with other local authorities nationally, ERY will be particularly affected by weather-related hazards associated with flooding.
- ERY is projected to see an increase in the frequency of heatwave events, although not to the same extent as in more southerly regions. Given the large elderly population, ERY needs to keep heatwave planning under review. The latest weather projections do not give precise estimates of these events for the future.
- In ERY, as in other parts of the country, the risk of coldwaves is projected to decrease. However, coldwaves may continue to cause disruption and extra pressure for care systems for older people. ERY may need to give attention to how it will execute coldwave plans for health and social care.
- The large and growing population of older people in ERY means that the vulnerability of the population to weather-related hazards, especially among those who are frail, will continue to be a significant issue.
- Since ERY is a large and diverse unitary Local Authority, there is variation in local conditions which should be considered when planning for weather-related events. This means that the appropriate response and strategies to build resilience will vary in light of local conditions.
- We have identified routinely available indicators relating to present conditions that ERY may find particularly relevant to inform robust planning and adaptation at the locality level.

1.1 Hazard and vulnerability: approach to risk assessment

The research has produced information on weather-related hazard and vulnerability across England. This allows us to 'benchmark' ERY in comparison with other parts of England. ERY has several attributes which suggest that it is among those local authorities in England where it will be particularly important to adapt the health and social care system to reduce the potential impact of climate change on older people's care.

Our approach is informed by a model of **risk assessment** which considers **hazards** (presented by more frequent extreme weather events impacting on infrastructure supporting older people's care, and on the population using these services). The impact of these hazards will depend on the **vulnerability** of health and social care infrastructure and the populations concerned. Risk assessment can support

responses to build resilience including **adaptation** to infrastructure and to human behaviour (see Figure 1.1).

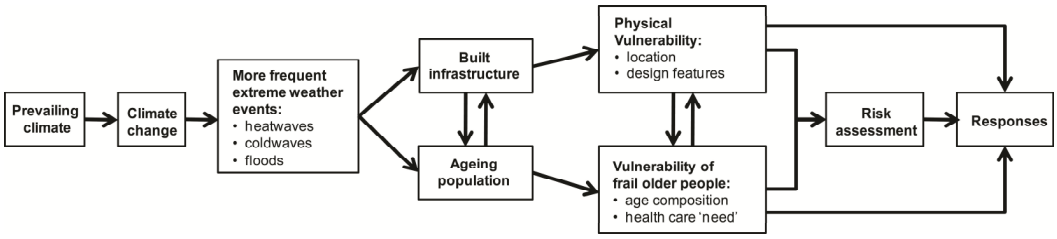

Figure 1.1 Model of Risk Assessment. Source: Oven et al. (2012: 17).

1.2 Weather-related hazards

The weather-related hazards considered in this report are coldwaves, heatwaves and floods. To assess future heatwave and coldwave hazards, we conducted an analysis of regional variations in daily temperature projections across England for the 2030s, using the latest UKCP09 Weather Generator tool (version 2). The hazard maps in Figure 1.2 show the projected future scenario produced by our modelling and indicate broad regional variations for the likelihood of weather-related events. Where the probability of occurrence is highest, extreme weather events which require special measures, are projected to occur most frequently in future. The maps also show the projected percentage change in the probability of these hazards. Areas projected to see the most significant increases in the probability of these hazards are likely to need to adapt most quickly, making forward planning especially important.

The maps suggest the greatest likelihood of **heatwaves** to be in the South and South West of England, while areas such as the East of England, North West, and Yorkshire and Humber (including ERY) are projected to experience an *increase* in heatwave events compared with conditions experenced in the baseline period (1960 – 1990). Heatwave conditions may be associated with greater mortality, illness and health service demand among older population. ERY may need to give attention to how it will execute heatwave plans for health and social care (see: NHS 2012).

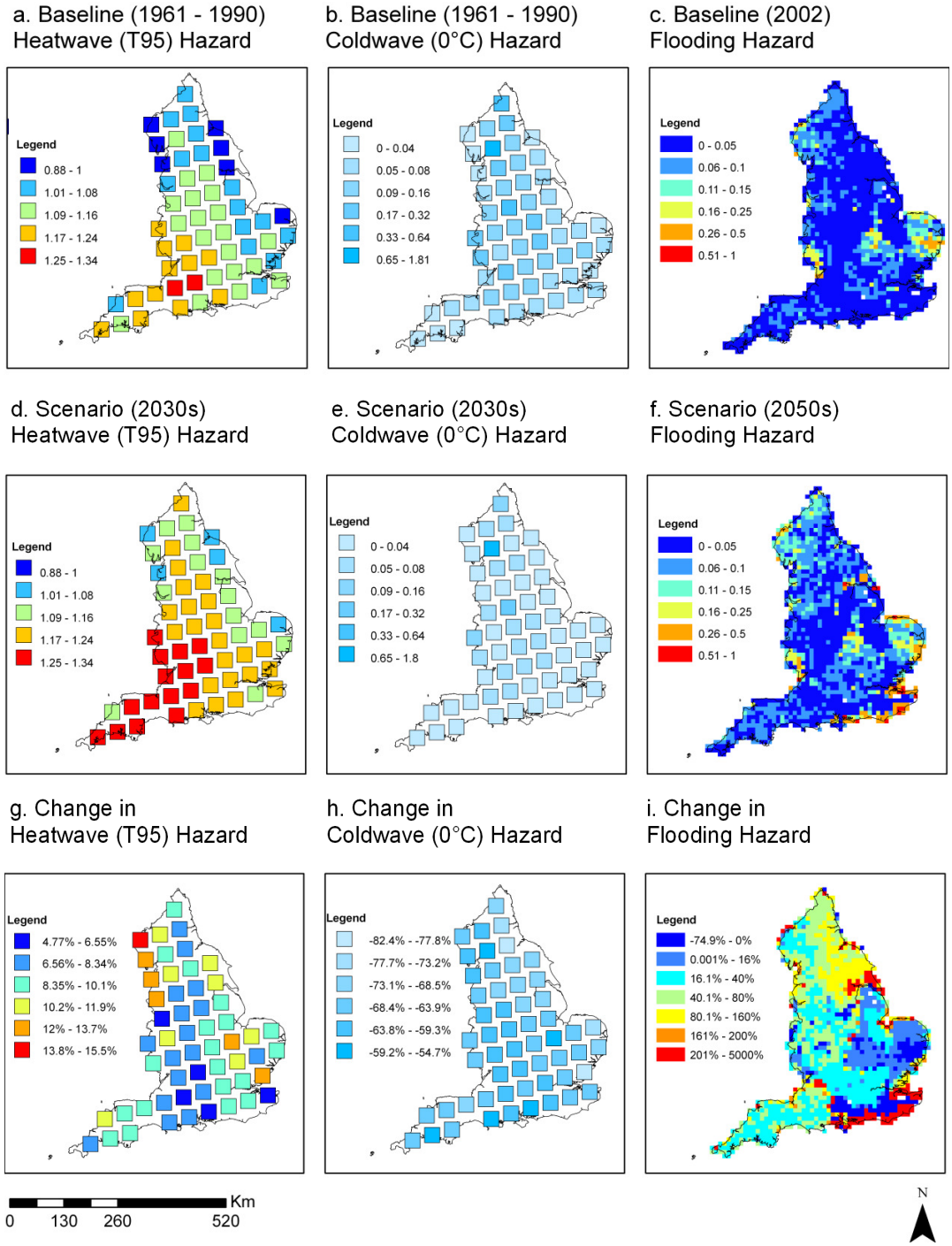

Figure 1.2 Hazard maps for England showing the annual probabilities for the baseline (1961-1990), scenario (2030s/2050s) and percentage change in heatwave hazard (a, d and g) coldwave hazard (b, e and h) and flood hazard (c, f and i). Data for the heatwave and coldwave maps were derived from the UKCP09 Weather Generator (Version 2) under the medium emissions scenario. Heatwaves were defined as events with temperatures at the extreme range (top 5%) of the projected range of prevailing temperatures for the period. Flood maps c and f, and the data derived for map i, were sourced from the UK Government's Foresight Flood and Coastal Defence Project under the high emissions scenario (Environment Agency, 2004). Source: Oven et al. (2012: 21).

In ERY, as in other parts of the country, the risk of **coldwaves** with temperatures at or below freezing is projected to decrease. However, coldwaves may continue to cause disruption and extra pressure for care systems for older people (as recorded in later sections of this report). ERY may need to give attention to how it will execute coldwave plans for health and social care (See: Department of Health 2011). Changes in storm patterns are difficult to predict into the future but could also be disruptive but were not assessed in this project.

While the UKCP09 weather generator results give a broad indication of relative risks of these events in different parts of the country, they do not provide sufficiently precise predictions to be able to anticipate the exact probabilities or return periods of these extreme weather events for the future. Also we tested whether the weather generator produced different extreme temperature predictions for areas within the East Riding of Yorkshire. There was some indication of possible local variability, but for this relatively small geographical area, we were not able to identify significant local variations. Also, as the UKCP projections and the supporting tools, such as the weather generator, are being continually updated, future versions of the projections may be able to give greater local information.

Flood hazard projections based on outputs from the Foresight Flood and Coastal Defence Project 2004 (Environment Agency 2004) are also set to increase in some parts of England. Some areas will experience increased susceptibility to flooding (for example, due the human occupation of flood plains) and sea-level rise, in particular some coastal areas in the South East, the East of England and the Yorkshire and Humber region. ERY has high susceptibility to tidal and fluvial flooding due to low-lying topography, proximity to the Humber Estuary and the presence of several major river systems (Jacobs 2010). The area has a history of flooding such as the 2007 summer floods and the 2011 Goole floods. This study was carried out before the very wet summer of 2012.

We have therefore given particular attention to modelling future flood risk protection in our research in ERY.

1.3 Vulnerability of older people to extreme weather-related hazards

The vulnerability of the older population to weather-related hazards depends on a range of population characteristics, including health status (related to age) and social and economic factors. Older people who are 'vulnerable' are especially affected when extreme weather-related hazards cause disruption to

health and social care systems and their own health may also be affected by the weather. Examples are presented later in this report (section 2).

There are various ways that older people and those caring for them can act to help build resilience to extreme weather hazards. Examples of these are presented in section 2 of this report. Those who are ill or frail are most at risk, so that those in the **oldest age groups** are most likely to be affected. We have generated population projection maps which weight different age groups in the population over 65 years, with highest weights for the oldest groups. The weights are based on NHS formulae for resource allocation, reflecting current estimates of average need to use health services in different age groups (Department of Health 2008).

Population projections from the Office of National Statistics (ONS 2007) show that, compared with other local authorities in England, ERY is among those where the total size of the older population aged 65 years and over will be relatively large and is expected to increase relatively rapidly to produce a comparatively large population of older people (Figure 1.3).

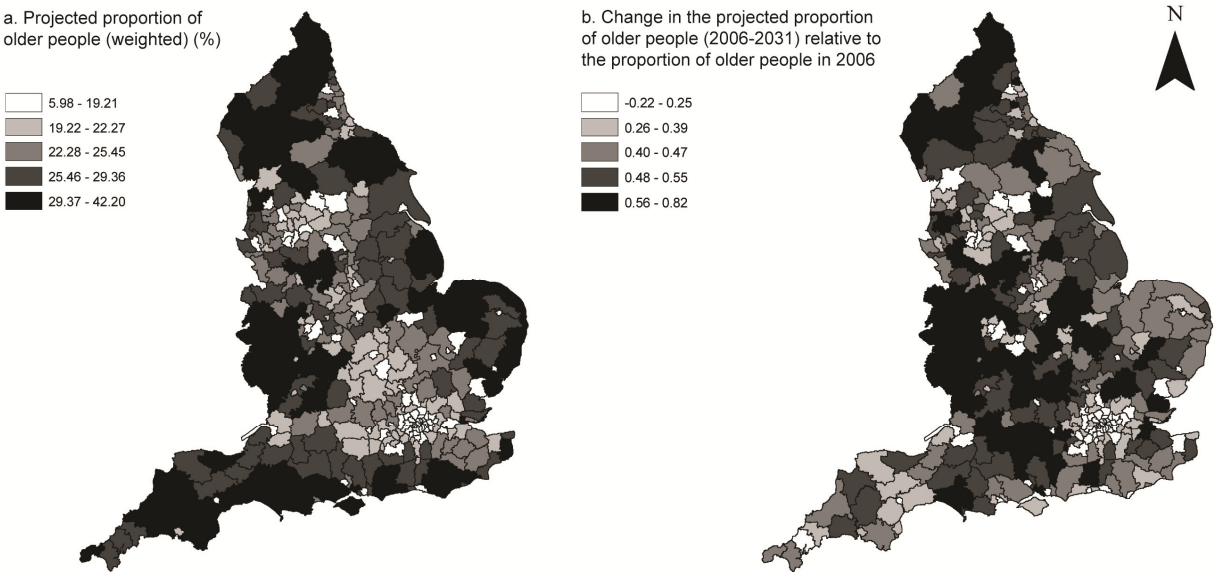

Figure 1.3 Maps of local authority areas in England showing a) the projected and weighted proportion of older people in the population by 2031 and b) the projected change in weighted population of older people (2006-2031) relative to the proportion of older people in 2006. In both examples the older population has been weighted by age-related differences in the likely need to use health care. Analysis based on 2006-subnational population projections by age group at local authority level (ONS 2007). Source: Oven et al. (2012: 22).

Table 1.1 shows information based on projections for total numbers of people aged 65 years and over. As ERY is a large unitary local authority it ranks relatively highly among local authorities in England, in terms of the total numbers of older residents. Also the indicator 'relative change in the number of older people (2006-2031)' shows the number of people aged 65 years and over in the ERY is predicted to almost double between now and 2031 (a rapid growth compared with many other areas). The change in the proportion of people in the age weighted population relative to the total population is less extreme, since the whole population is expected to grow during this period. Growth in the older age groups will be the outcome of inward migration of older people to the area on retirement, as well as aging in place of longer term residents.

Table 1.1 Measures of future growth in older populations (aged 65 years and older) and social dimensions of the population in ERY, ranked in comparison with other local authority areas in England.

Indicator	*Value*	*Rank out of 352 LAs* (1 = highest value)*
Projected population aged 65 years and over in 2031[a]	124,600	3
Relative change in the number people aged 65 years and over (2006-2031)[a]	0.94	35
Relative change in the projected proportion of people aged 65 years and over as a percentage of the total population (weighted) (2006-2031)[a]	0.51	108
IMD rank[b]		232
Proportion of older people that are non-white British[c]	2.19	286

*Analysis undertaken to the level of 352 local authority areas in England (two local authority areas with very small resident populations were excluded) with the exception of the IMD.
[a]2006-based sub-national population projections (ONS 2007)
[b]The Index of Multiple Deprivation (DCLG 2008)
[c]Experimental population estimates by ethnic group for local authority districts and higher administrative areas in England and Wales for 2007 (ONS 2010)

Economic, social and cultural factors can also be important for vulnerability, for example, in terms of risk of fuel poverty, lack of social support and challenges for adapting behaviour to cope with extreme weather. Overall ERY ranks among the more socio-economically privileged areas of the country in terms of the Index of Multiple Deprivation (DCLG 2008), being ranked among the lowest third of authorities on this measure. ERY is also among those local authorities with relatively small proportions of people from minority ethnic groups whose cultural background may be important for their response to extreme weather events (Table 1.1). See also work sponsored by the Joseph Rowntree Foundation (Lindley et

al., 2011) for further examples of local indicators of vulnerability to climate change based on information for the current period.

1.4 Local variation in vulnerability

There is local variation in demographic and socio-economic and cultural characteristics of the older population living in ERY today, which may continue into the future. For example, at small area level (lower super output area level – LSOA) ERY includes some local communities with IMD scores for deprivation which are among the top 2% of small areas nationally[1]. There are also parts of the local authority with local concentrations of ethnic minority groups. This means that it will be important to plan for varying needs in the older population likely to be vulnerable to weather-related hazards.

LSOAs with high proportions of older people are located mainly outside the flood plain. There are exceptions, including the LSOAs adjacent to Hull and in the west of ERY where more than 25% of the population is aged 65 years and over. The most deprived LSOAs tend to fall outside the flood plain, the exception being two LSOAs in the south west of the district, where the proportion of older people in these LSOAs is 15% to 16%. While income deprivation affecting older people is generally low, there are exceptions (mostly outside the flood plain) including a LSOA in the south east of ERY.

Levels of urban development are relatively low compared with other parts of England. Defra (2009) have classified ERY as an area where between 50% and 80% of the population resides in rural census output areas. However, a cluster of LSOAs in the west of ERY are characterised as urban, with a high proportion of older people and relatively high levels of deprivation amongst the older population.

Vulnerability of built infrastructure supporting older people's care is dependent on local conditions and the configuration of local infrastructure as illustrated in Sections 2 and 3 below. We therefore chose some local areas of ERY to examine in detail, as case studies of the different conditions that apply across the local authority. These are described in the following sections of this report.

[1] The most deprived LSOA within ERY is ranked 758 out of 32482 LSOAs nationally.

2. Health and social care systems within the East Riding of Yorkshire: Case study findings and implications for adaptation and resilience planning

Key messages for ERY from discussion with participants in workshops on weather related risks

- Development of adaptation to weather related risks and building resilience is a complex task, requiring a cross-sectoral perspective, so it is important to involve and consult with the different agencies and constituencies concerned in order to build up a good knowledge base.
- Emergency response planning activity is closely related to adaptation and resilience planning, though some aspects of adaptation extend beyond crisis response and it will be useful to think about adaptation as a way to develop preparedness over the longer term.
- Planning may be best taken forward in future through Joint Strategic Needs Assessment and Health and Wellbeing Board, and will also benefit from knowledge exchange and capacity building at the local level of particular communities as well as across the whole local authority.
- It may be difficult to engage with participants on adaptation issues if the discussion is focused on 'climate change'. However, preparedness for extreme weather events in future (particularly future flooding risks) can usefully draw on shared experience of recent extreme weather events in ERY.
- It may be helpful to engage different participants using (anonymised) case studies of individual experiences as well as more systematic information for whole populations. Also we found that use of local maps helped to make discussions about adaptation more 'realistic' and engaging for participants.
- Disruption of health and social care for older people is most problematic when it extends over a lengthy period (which has been especially the case during coldwaves and flooding events). Although coldwaves are projected to become less common in future, lack of adaption to cold weather can make older populations very vulnerable when they do occur.
- Disruptions to communications links through road and public transport networks and to electrical power supplies are often the most problematic aspects of extreme weather events.
- Resilience and adaptation planning may require explicit proposals for organized, rather than *ad hoc* measures such as: maintaining and developing 'at risk registers'; access to vehicles suited to such conditions; reorganization of home care services so that if extreme weather disrupts normal services, carers visit older people living near them rather than their routine clients. This may become more challenging as trends towards personalisation make the system more fragmented and economic pressures bear down on service providers.
- There is considerable potential resilience among local communities of older people, and more could be done to develop this, though they need strong and well co-ordinated local authority engagement, and it must be borne in mind that not all older individuals are in a position to take action on this issue themselves.
- We demonstrated ways that local as well as more central intelligence may be collected on parts of the built infrastructure that may need to be prioritised for adaptation in future (discussed in more depth in section 3).

The aims of the case study research were to:

i. develop, and test ways to collect information from service providers and older people and engage these groups in discussions around climate change;
ii. explore how infrastructure and service providers might be made more resilient to extreme weather events;
iii. explore how individuals and communities can take action to help maintain health and social care service delivery during extreme weather events.

The research focused on two areas in ERY, which we will call 'Port-Town' and 'Rural Coastal Area'. The latter is a large rural area that has 'Town-by-Sea' as the main settlement and a number of smaller villages. The research included a rapid appraisal of discussions with key informants and this report summarises the views of the participants we spoke to, however, this was not a survey representing the whole community. Initially we held discussions with representatives from organizations responsible for health and social care services and supporting infrastructures across ERY (section 2.1). This helped us to identify two case study areas with varying local conditions to hold further in-depth discussions (sections 2.2 to 2.4).

Ethical issues were carefully considered including how to sensitively approach potentially vulnerable older people and how to discuss possibly sensitive concerns about change and extreme weather events. The research was approved by through the appropriate research governance procedures. We have used pseudonyms for places to protect confidentiality in this document.

The anonymised quotes we include in the report illustrate individual experiences. These help us to see how extreme weather has impacted on different people and what might be good approaches to adaptation through local action. These illustrations of individual experience may help to inform local adaptation and resilience planning.

Further details of the methods are available from the authors of this report.

2.1 Discussion at local authority level to select case study localities in East Riding

In June 2011 the BIOPICCC project held a cross-sectoral meeting with representatives from various agencies in the local authority area with responsibility for delivering health and social care, climate

change planning and emergency response. Appendix 1 summarises the role types of people invited to this meeting.

The following key issues were raised during this group discussion and are relevant to future planning in ERY:

1. Conditions in ERY present significant challenges for both health and social care delivery, and emergency planning during extreme weather events. It is important to plan for climate change across large, sparsely populated rural areas, as well as in urban settings.
2. Road access is particularly important to formal and informal networks of care.
3. A particular characteristic of the ageing population in ERY is the large numbers of retirees moving to the area from elsewhere. They are particularly attracted to coastal and rural areas of ERY. This creates challenges for health and social care planning and delivery both now and in the future.
4. Planning for and responding to emergencies is challenging due to the plurality of providers involved in local service delivery.
5. Strategic planning across geographical and organisational boundaries was emphasised as a key area for development in order to make older people's health and social care more resilient to climate change.
6. Climate change adaptation should be integrated into the planning of older people's future health and social care through Joint Needs Assessment, the Health and Wellbeing Board, and the Humber Local Resilience Forum.
7. Parish councils were identified as having an important role in local level resilience planning, and ongoing liaison across sectors and levels of administration is important. The move towards greater personalisation of Adult Social Care presents both challenges and opportunities for resilience building.
8. The local authority has less control over the social care workforce and emergency/contingency planning is more complex as a result. However, personalisation could lead to a more localised workforce that is better placed to ensure continuity of care during extreme weather.

Working from base maps of the local authority (Figure 2.1), participants identified possible local areas (wards/parishes) suitable for local level consultation. The areas selected have high concentrations of older people (and/or are projected to have high concentrations in the future) and are susceptible to extreme weather events, in particular flooding.

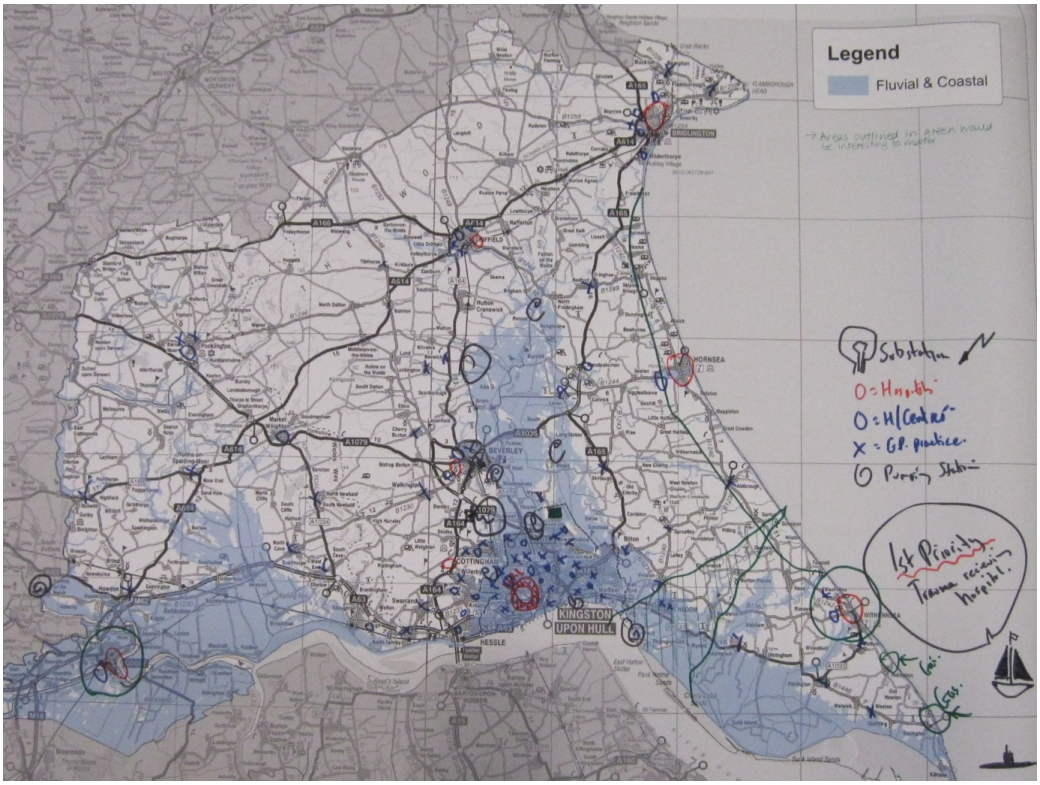

Figure 2.1 Identifying key health and social care infrastructures at the local authority level.

Participants suggested that the research team select case study sites which capture the characteristics of the local authority. The following categories emerged:

- coastal settlements (with large numbers of retiring in-migrants), e.g. Withernsea, Roos, Aldborough;
- larger market/port towns, e.g. Market Weighton, Driffield, Beverley, Goole;
- rural areas with isolated villages, e.g. Warter Burnaby, Huggate.

For the purposes of the local level consultation, we selected two localities for more in-depth research. These localities are referred to by the pseudonyms: 'Town-by-Sea' (and surrounding isolated communities in 'Rural Coastal Area'); and 'Port-Town'. These illustrated most of the settlement types identified above (coastal towns/isolated villages); are susceptible to extreme weather hazards; and represent a variety of social and organisational settings/characteristics.

2.2 Local case studies: perceptions of extreme weather events and climate change in 'Port-Town' and 'Rural Coastal Area'

The older people we spoke to have a range of perceptions and experiences of climate change and extreme weather events (reported in this section). In section 2.3 we discuss their views on how extreme weather can impact the health and social care services older people rely upon.

Views about climate change

A common view among the older people interviewed was that the weather is changing. However, in some cases there was scepticism about whether these changes could be attributed to anthropogenic causes or not:

> *"The weather's going crazy. What exactly we can do about that now it's probably all too late, if indeed it is all caused by what we're doing at the present time, i.e. from the start of the Industrial Revolution, presumably. This is when things started to go or is it just a natural, you know, how on earth do you find the answer to that?"*
> Older resident, Rural Coastal Area

Other participants seemed to reject the notion of a changing climate. The following quote is from an older man who seemed less concerned about climate change, though he had limited mobility and was potentially vulnerable to extreme weather events

> *"You know environmentally, generally it's the same. It basically just plods on. It just plods on."*
> Older resident, 'Port-Town'

In contrast, a significant minority subscribed to the view that climate change was occurring and likely to become more significant in the future. For example, we spoke to an active older woman who is a carer and had been evacuated from her home during an extreme weather event. She commented that:

> *"It's quite worrying really but what do you do? I mean you see everybody's suffering from it now. I think it's, you know, the way the weather's altering all the time, you know…we don't seem to get the seasons do we, you know."*
> Older person, Rural Coastal Area

Experiences of extreme weather events

Most of the participants had experienced extreme weather. This related to the floods of 2007 in 'Rural Coastal Area' and some localised flooding in 'Port-Town' in 2011. In addition, all participants regarded the winters of 2009/10 and 2010/11 as prolonged extreme weather events. As indicated above, the nature of past experiences of extreme weather events tended to shape people's views about such events in the future. For example, an older lady commented that:

> "[I]*t is so stressful every time you get a really lot of rain now like yesterday for instance…the other night we had a downpour and where I parked the car it was all like flooded, but you see before we had the flood initially, you know, the big flood in 2007, five years ago, I never used to worry when I used to see all this water... I used to think oh well, you know, it'll go… Because you see it's just a worry all the time and in* ['Rural Village', in Rural Coastal Area] *I don't think they've done anything, you know, to stop this if it happens again."*
> Older resident, Rural Coastal Area

A different older lady living in one of the villages in Rural Coastal Area also felt more vulnerable following the previous winters.

> *Interviewer: Do you see yourself as vulnerable in relation to the weather?*
> *Interviewee: Yes I do now. I didn't but I do now yes. Yes I do. I dreaded this winter to be honest. So I must have felt vulnerable.*
> Older resident, Rural Coastal Area

In summary, the awareness of extreme weather events among the participants is strongly related to recent experience of weather related hazards. It may help when engaging local communities in local adaptation plans to draw on the experiences of local people and be sensitive to their perceptions of the nature of weather related hazards.

2.3 Local experiences of how extreme weather impacts on health and social care systems and supporting infrastructures

This section considers the impact of extreme weather events in terms of both short and long term disruptions to older people and the services they rely upon and how these challenge the continuity of care.

Flooding events tend to produce short term disruptions for most of the older population. However, for those people whose homes are flooded these are long term disruptions and involve lengthy periods of reconstruction. Box 2.1 presents some of the experiences participants described.

Apart from the older people evacuated from their homes due to flooding, all of the older people we spoke to considered the ice and snow from the prolonged cold spells in 2009/10 and 2010/11 to have caused the greatest disruption to health and social care. Hazards due to heat and strong winds were reported to be less disruptive. This can in part be attributed to the study taking place shortly after these extreme winters. However, older people discussed weather events from as far back as the 1950s. The impact of coldwaves was primarily attributed to the extended period of time the disruption lasted, the

large area disrupted (most of the East Riding) and the fear of falling on slippery ice and snow on un-cleared paths. This shows that hazards due to extreme weather events require not only short-term emergency responses but also preparedness for longer-term disruptions to services.

Box 2.1 Examples of disruptions caused by floods

An older female carer, in her early 70s, living in a village in Rural Coastal Area was evacuated with her husband from her home. They lived in a mobile home for five months while their bungalow was made habitable. Despite the considerable disruption the couple managed to maintain their health and well-being during this period. However, the female carer indicated that this was not the case for all older people in the area:

"…I mean it's so sad because I had two lovely neighbours who were quite elderly, you know, and it really, really affected them. And they didn't come back here…They ended up, both of them, in a residential home. You know, they've died since because they were in their '80s but, oh they were so traumatised, you know.

Well you see they'd lived in these bungalows for years and years and they had to get out, you know. At first they were with relatives but, one of them in particular…she was so upset, she didn't want to go so her family did what they could, and well they made a really good job of repairing everything in the bungalow, even though it was council, because she didn't want to go. And when we, I used to come more or less every day to check to see if she was alright because she was still living here, next door but one day…she was crying and saying that she couldn't see anybody. Well I said 'no because everybody's gone', you know, moved, but they'll be back I said but we were in the motor home at the time.

And because you see they'd lived here a long time and she was put in a residential home and then, it was really, really sad, you know, what happened because the elderly ones who really, well I mean we're not young but they really took it really badly."

Service providers also felt that the snow and ice caused the most disruption to older people, many of whom were housebound for a number of weeks. The main roads were cleared by the council but not the side roads or pavements and older people were often worried that they might fall and injure themselves. Some disruption and delays to health and social care services was reported but this mainly occurred in the more remote villages outside 'Port-Town' and in 'Town-by-Sea' and 'Rural Coastal Area'. Domiciliary care teams covered for each other when colleagues were unable to reach the older people they cared for routinely. A local older people's advocacy group agreed with these findings, regarding the snow as the most disruptive event they had experienced. Box 2.2 provides an account of how disruptions from the snow can have consequences for both the formal and informal provision of care.

Box 2.2 Example of extreme weather disruptions on informal care

An example of service disruption comes from an older female carer, 73 years old living in a large village in Rural Coastal Area. Her son has a mental health condition and lives approximately five miles away in another village in the same area. The cold winters impacted on the delivery of care to her son in two ways. Firstly, through requiring extra help to provide care:

"…because I didn't drive for two or three weeks. Where I live there's a slope going down onto the main road. It wasn't gritted. There was no grit in the grit box. One of my neighbours actually skidded onto the main road but luckily she was OK …I got the bus or [my daughter] *would pick me up after work you know that sort of thing. I know it was for about 3 weeks. It seemed unending."*

Being able to rely on close family, who also assisted in taking her shopping ensured continuity of informal care to her son during this period, although the weather meant there was more time spent delivering the same level of care.

Secondly, the weather impacted on the delivery of care through the provision of mental health services by mental health nurses. These specialist services are located approximately 20 miles away and tend to be more susceptible to extreme weather events in rural areas due to the larger catchments they serve than for example, district nurses.

"not being able to come and see [my son] *when they should. You know that sort of thing because they were slowed down even if they could get through."*

Extreme weather events tend to slow the provision of care down leading to a backlog of patients to see. This in turn can have implications on informal caring relationships.

"…he got agitated...I was hoping that somebody would come along and reassure me."

Whilst this older carer did get support and advice over the phone, her son's condition meant that he needed face-to-face care. Disruption to formal care provision placed considerable additional stress on the informal provision of care.

The ways in which older people were disrupted by the ice and snow varied greatly depending on their need for services and mobility but the main problems were experienced by frail older people, carers (formal and informal) and other service providers moving between and within urban and rural areas. A particular issue cited by most respondents was the lack of gritting of side roads and, in particular, pavements. Older people and service providers indicated that the size of the local authority area is particularly challenging for the Council given the cost and practicalities of gritting the whole area. Nevertheless, some informants felt more could be done to maintain access to places such as sheltered housing schemes, and to maintain bus routes.

> *"I think the council should recognise the needs of the people... here it's a sheltered accommodation. No gritting whatsoever. Those people are on the bus route and…, all bus roads should be gritted. These people have difficulty going out. Some haven't been out while the snow's been here because of the lack of gritting. Even the supply of gritting to get other people to do it. There's nothing there."*
> Older person, Rural Coastal Area.

Being confined at home during bad weather can lead to a sense of social isolation:

> *"… the old people was that pleased to see somebody because they couldn't get out; you couldn't get away from them* [laughs]*. But it just made you understand, you know, how vulnerable* [they are] *when they are old."*
> Older carer, Rural Coastal Area.

Frontline service providers also commented on the lack of gritting of side roads and pavements as a problem for older people who were unable to get out leading to social isolation. A key issue for older people was the fear of falling which might exacerbate health conditions or create mobility problems. There is also a lack of clarity about responsibilities and potential liabilities for those making the effort to clear paths:

> *"Well I don't know what the rules and regulations are, because at one time it was if you don't and someone slips and hurts themselves you are liable. So that's frightened a lot of people."*
> Older resident, 'Port-Town'.

> *"There's been a thing on now about streets asking for grit boxes. East Riding is one of the worst suppliers. Equip people with grit and ask people to do their own. Some areas in the country have got them, have got them so you can do your own. It's very bad. There's no supply and no grit boxes. I'm sure people would go out and grit."*
> Older resident, 'Port-Town'.

The issue of gritting of paths and roads seems significant for resilience planning. A number of older people we interviewed indicated that even though major transportation routes were largely kept open it was of not much use to those older people who felt unable to leave their homes, located on more minor routes. This is particularly significant in 'Rural Coastal Area' as some of the villages are poorly connected to the main bus network (although those villages on the main road to and from 'Town-by-Sea' are reasonably well served). Bus services were also reported to be vulnerable to the snow.
Given that the closest major hospital services are located a minimum of an hour away by bus from 'Town-by-Sea' disruption of road traffic and public transport networks was considered to be very important for access to health care during extreme weather events. In future more may need to be done, not only to enhance provision of road gritting series, but also to reassure residents that if they are willing and able to do so, they are entitled to clear snow and grit pathways themselves.

2.4 Planning for extreme weather: implications for adaptation and resilience planning in future

Service providers who work closely with older people noted that older people have considerable life experience, are level headed and are often more resilient than other people may think. However, older

people do not always know who to contact if they find themselves housebound due to severe weather and in need of assistance. Older people are not always aware of local parish emergency plans or the contingency plans their care teams have in place. In some cases older people did not know if their carers would be able to reach them during periods of extreme weather. Some of the service providers felt that older people should be better informed during extreme weather events and that the radio and television are the best ways of conveying information. Participants from a local older people's advocacy group agreed that a large proportion of older people can look after themselves and are very pragmatic when it comes to dealing with disruptive weather. For them a key requirement is for information on service disruption to be communicated via the telephone, radio and/or television. Others may not be able to be so self-reliant and will need more support.

In 'Town-by-Sea' participants from group discussions reported that people migrating to the area to retire do not have family and friends living close by. However, the local community is conscious of this and welcomes new people to the area. There are a number of groups and activities to get involved in that newcomers are encouraged to join. These appear to be very important in terms of sustaining health and well-being. Also making connections between these informal support networks is important for future resilience planning.

In 'Town-by-Sea' participants remembered the chaotic situation due to flooding in 2007. On that occasion, the police did not know where to take people (i.e. to the designated rest centre). Some people did not know where their relatives had been taken. In general older people indicated that there was a lack of coordination and information. However, it was reported that people in the locality (both frontline service providers and older people) and in the ERY have learnt from this experience. It had made local people think more about emergency planning and people reported being much better prepared than in the past, with a local system of wardens and new contingency plans now in place. This example raises questions about the need for leadership and coordination during extreme weather events and ongoing review of emergency planning.

An example from one of the larger villages in Rural Coastal Area highlights the importance of having wardens in neighbourhoods and communities.

> *"We have a gentleman that is paid by the parish council that walks round sweeping. He notices anything odd and deals with that or would inform somebody...and he sort of knows everybody and, you know, he would soon know if something wasn't quite right."*

Older person, Rural Coastal Area.

In this village there were also strong social ties across the community with friends and neighbours providing support and assistance to those caring for older people. In many areas local people and businesses also coordinated activity. For example, in another village in 'Rural Coastal Area' there is a concentration of older people living in bungalows. These older people struggled to get out during the prolonged cold spells. However, the local shop contacted the local warden to see if the older people needed any supplies and invited them to ring up with orders for home delivery. In a different village in the area a local garage with retail functions performed an important role as a rural service hub during the recent cold spells.

> *"Luckily in this village we've got a really good, like a mini-supermarket but it sells everything. And it's a garage as well and there's a post office. You know, so if you, like when it was really bad snow, the year before last, you just used to go there."*
> Older resident, Rural Coastal Area

Medicines were also delivered to the garage during this period for carers and volunteers to pick up and distribute to residents in the village. In addition, local residents had developed their own contingencies to cope with disruptions caused by extreme weather events, illustrated by this comment from a participant who was an informal carer:

> *"…we have a small generator, I have candles on standby anyway. And I also have, this sounds so extreme but oh my god, I have a small gas cooker with a canister."*
> Older resident, Rural Coastal Area.

These kinds of actions by local residents are important in maintaining continuity in health and social care provision for frail older people and they highlight the importance of identifying and supporting informal networks of care to build resilience to extreme weather events and to support a community based model of care:

> *"If they want care in the community they've got to back it up with proper care …They've pushed and pushed that people will get better in their own homes...I care for my son but there's lots of people with nobody isn't there. How do they get on? They never speak about it in the teams cause they're not allowed to obviously. But I know they are stretched. If they* [the statutory agencies] *want care in the community, they have to put in proper care… I think you know if things break down weather wise and people can't get in, to me they've lost a vital part of their care."*
> Older carer, 'Port-Town'.

Participants (including older people, informal carers and service providers) identified the importance of effective referrals from hospitals to social services for patients that are being discharged. A number of people have experienced disruptions and limited back up care in 'normal' times, highlighting the potential for further disruption during extreme weather events.

All of the care homes in ERY have contingency plans in place. These provide details about what to do and who to contact in the event of an emergency. Networks of care provided by district nurses, carer support services and domiciliary care all provide very important services for older people in both areas. In 'Port-Town' representatives of local advocacy groups highlighted that neighbourhood care teams of district nurses and social services work well together. Frontline workers agreed that they worked together in partnerships more than in the past and that further pooling of resources across sectors and agencies would strengthen resilience planning. For example, it was suggested that the costs of buying 4x4 vehicles, which were important for service delivery in rural areas, should be shared among agencies. In addition, an inventory of local resources was identified as a useful tool in building local knowledge about the resilience of areas. Following the 2007 floods troughs have been dug out in the area that will take large volumes of excess water. In addition, rock salt has also been stockpiled in preparation for future bad winters.

Much of the discussion in this section points to the importance of local capacity and knowledge helping to build the resilience of local communities. With limited knowledge about local areas it will be difficult to draw on local capacity at the time of an emergency. Exchanges with local communities to build local knowledge and capacity is one way of enhancing the resilience and preparedness of an area.

> *"We've been talking here about people in their own homes getting cared for. Well it is right across the town. You can't say that they are in this street or that street. They are throughout the town and quite often the next door neighbour might not even know that there is one person on their own there that is vulnerable. If they're talking to their next door neighbour then no problem but that is not always the case…The unknown people is the difficult issue...It's the unknowns."*
> Older volunteer, Port-Town

As discussed above, participants' views about disruptions to health and social care delivery were shaped by recent extreme winters, which largely impacted on mobility within and beyond the case study areas. Less emphasis was placed on the electricity, gas, water and telecommunications infrastructures in the interviews, with participants reporting that these were, in general, less likely to be disrupted during

extreme weather events. (We note that private sector landlords are less likely to have installed gas heating and appliances.) However, these infrastructures were identified as being essential to health and social care services and for keeping older people safe, warm and informed. In particular, the electricity supply is significant for equipment used to provide medical care for older people such as hoists, oxygen supplies and for refrigerating medicines. Given that the frequency and intensity of flood events is likely to increase in the future, these essential infrastructures may become more vulnerable to extreme weather.

Local coordination of adaptation strategies varies and extra effort may need to be concentrated in some places. Also local experiences could be shared to disseminate ideas about good practice. There may need to be more attention paid to helping communities and individuals to take action themselves to be better prepared and adapted to extreme weather events (though this will not be feasible for all older individuals).

3. Developing approaches toward mapping and modelling built infrastructure supporting older people's care

Key messages for ERY from work to model networks of built infrastructure

- Participatory mapping had identified a range of types of built infrastructure that were important for support of older people's health and social care; these include a range of buildings and facilities, not limited to NHS/Local Authority properties. They will include domestic dwellings, in the rented as well as the owner occupied sectors.
- Built infrastructure extends beyond buildings – the utilities and transport networks linking buildings are essential to their function. These networks can in principle be modelled as whole systems of nodes and links using engineering models. They seem particularly relevant since electricity supply and road transport networks were identified as critical in several consultative workshops.
- In some cases, during extreme weather events certain buildings take on new functions to act as central parts of the network to ensure resilience.
- We have reviewed information available to carry out network modelling, concentrating especially on key infrastructure (water, electricity, gas) networks, for which the chosen models are designed. However, while some information is available, it is not sufficient allow us to run the models across the networks.
- Resilience planning may involve weighing up alternative adaptation strategies (e.g. flood-proofing electricity substations vs. installation of emergency generators to supply key buildings for older people's care during weather related emergencies involving loss of power).
- The difficulties encountered in terms of gathering the breadth and resolution of data required to run the models brings into question the feasibility of achieving this through the limited resources available on a relatively short-term research project. However, the work indicates potential for future development, with collaboration between ERY and utility suppliers, to better understand how key utilities like electricity are delivered to end nodes such as health and social care facilities and possible future adaptation strategies to ensure continuity of supply.
- This project is part of a wider research programme on Adaptation and Resilience to Climate Change, including other studies which have examined adaptation of transport networks, and of hospital buildings. Our findings suggest that these might also have relevance for ERY.

BIOPICCC is especially concerned with how to adapt built infrastructure to make it more resilient to the effects of a changing climate. As we saw in the previous section, built infrastructure is part of a wider system. Human organization and resilience is also very important and may need to be adapted in future. In this section we focus further on findings from our research on how built infrastructure plays an important part in supporting older people's care and what might be suitable approaches to building up data to inform infrastructure adaptation.

3.1 Mapping the range of services that older people use in 'Port-Town' and 'Rural Coastal Area'

We asked local participants to identify infrastructure that is especially important in their locality. Working with maps and structured questions we undertook a number of 'participatory mapping' exercises in the case study areas with older people and service providers. Participatory mapping is designed to enable informants to become directly involved in deciding what information is important to record (Pain, 2004), while researchers take on the role of facilitator/observer, learning about local conditions and the reality on the ground (Williams and Dunn, 2003).

Examples of types of infrastructure are: health and social care services; care homes; pharmacies; shops; and emergency services. A summary list of services for 'Port-Town' is included in Table 3.1. Figure 3.1 shows an example participatory map including the location of some of these services.

In feedback discussions about our results it was noted that domestic dwellings in both the rented and owner occupied sector may need to be adapted to be more resilient to future climate change. Issues likely to arise will include the affordability of adaptation for home owners and the motivation of both owner occupiers and private landlords to invest in adaptation of the housing stock. There are also issues for plans for building new homes.

Table 3.1 Important services for older people identified in 'Port-Town' through participatory mapping (lists of individual buildings in these categories were provided and these could be located on maps that can be linked to other information relevant to assessing extreme weather risk and vulnerability

Health and social care facilities:
GP Surgeries
Local hospital and ambulance station
Day care centres for older people with conditions such as dementia
Centres coordinating home care services
'Medi-bus' services
Care homes
Pharmacies
Retail services:
Local post office and retail outlets for essentials
Emergency and highways services etc:
Fire and police stations
ERY Council offices and Highways depots
Community centres used as 'rest centres' during extreme weather events which may force residents to leave their homes

Figure 3.1 An example participatory map of 'Port-Town' produced during a discussion with frontline service providers.

3.2 Steps towards engineering models of infrastructure (including utilities) providing services to key buildings in 'Port-Town'

The BIOPICCC project also aims to explore the potential to use engineering models to examine the networks of infrastructure that support services for older people's care and how they may be affected by disruption due to extreme weather events. In ERY we have concentrated especially on collecting information to allow modelling of the vulnerability of the electricity network to flooding hazards, as explained below.

We have built up our knowledge of the network based on the concept of *nodes* and *links*. **Nodes** are points where a process happens (such as water being pumped) or where two or more utilities join

together. For example, electricity supplies link to other utilities in nodes such as a water pumping stations. **Links** are the connections between these nodes where utilities flow, such as a water pipe or an electricity cable.

Our model has developed as the project progressed. We initially sought to collect the following information:

- Where are the important nodes located? (Information required to estimate the flood risk at each node.)
- How do the nodes work? (Information required on, for example, capacity, storage, production, max flows.)
- How are the nodes connected? (Information required to understand the links between nodes and how they feed into the network.)
- Which areas are served by these nodes: Required to understand when a node fails, which places will be without the service (electricity, water, gas) and will be affected by this failure.
- How do networks work individually and together? E.g. How does the electricity network supply electricity to the other networks?

'Demand nodes' are points, or groups of points, where commodities such as power are consumed to allow the provision of health and social care. As explained above (section 3.1), through interviews, focus groups, and participatory mapping, we compiled a list of important facilities in 'Port-Town' for the well being of older people during extreme weather events. By mapping these points, we then examined likely **supply routes** for utilities (using the nodes and links outlined above).

The infrastructure model is intended for use in situations where normal conditions have been affected by weather-related hazards. Floods within the UK are a major concern, and this is reflected also as a key problem in the area of 'Port-Town'. When an area floods, different parts of the infrastructure are susceptible to different kinds of risk. This could be, for example, an 'extreme' flood brought on by heavy rain.

Furthermore, and also as a consequence of flooding, the normal pattern of consumption may change. For example, certain demand nodes might be situated in areas where there is a high risk of flooding and thus older people might need to be evacuated from those areas. This decreases the need to supply key

resources (water, electricity etc) to evacuated areas. However, it increases the need in areas and buildings not normally used to deliver care that are receiving evacuees and might suddenly require extra resources. One of the novel aspects of the infrastructure model is its capacity to deal with such situations during the restoration of services to normal conditions. Essentially, demand nodes can be 'tuned' to allow more resources to flow to areas where the cost of failure is greatest (this is illustrated in Figure 3.2).

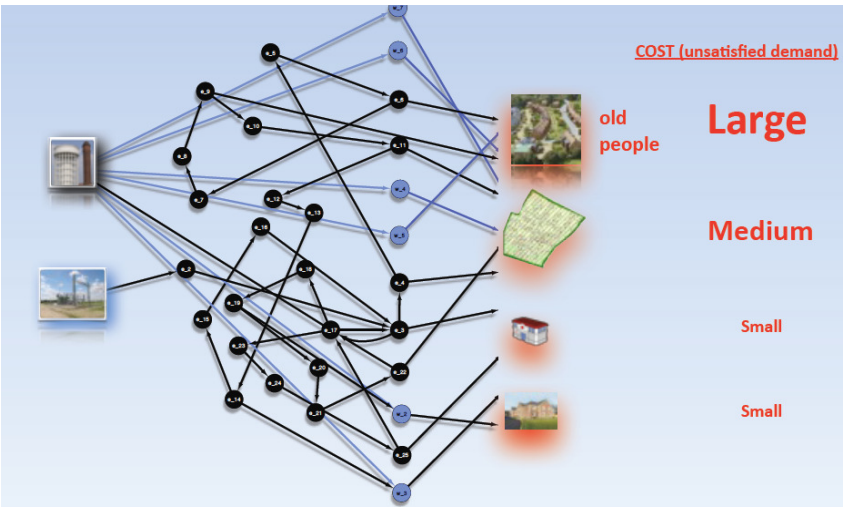

Figure 3.2 Demand nodes can be 'tuned' to allow more resources to flow their way by including larger 'cost' parameters in the model.

3.3 Availability of information needed to model utility networks

As explained below, based on data we have collected, we can estimate which utility nodes can supply the main demand nodes that are important for older people's care. It is assumed to be most useful to model the electricity network, based on information gathered in the research. (In Section 2 we reported that electricity 'power cuts' have been mentioned as disruptive events occurring in the past and also electricity has been referred to as an important utility that people cannot do without).

Electricity

Northern Powergrid supplied the as-built drawings for the electricity network in 'Port-Town'. Based on the connections shown on these drawings, we can be reasonably sure of how the electricity network is connected in 'Port-Town'. We have identified most substations in 'Port-Town' from Ordnance Survey maps (this is illustrated in Figure 3.3). We can then assess the risk of flood related power failure based on the location of each substation in relation to flood-prone areas.

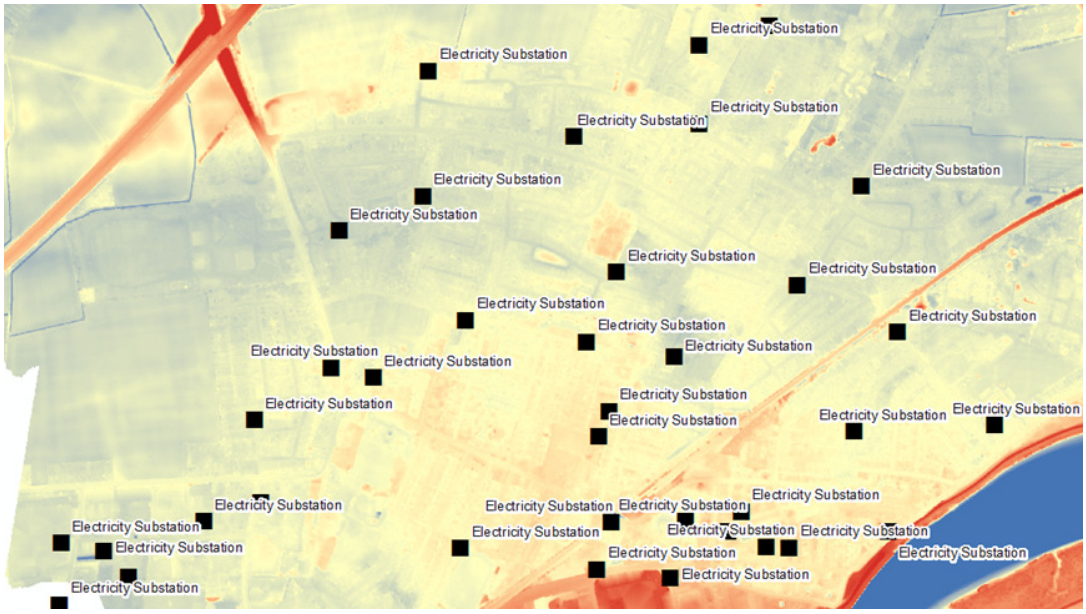

Figure 3.3 An example of electricity sub-station locations in 'Port Town'

We have had to estimate the groups of 'demand nodes' (houses, hospitals, other facilities) supplied by each substation (see Figure 3.4). Although this is not ideal and would need to be confirmed prior to modelling to ensure the engineering judgements are correct, we suggest this network and location of demand nodes are useful starting points for starting to envisage how to understand the vulnerability to floods of the electricity system and services depending on it.

Figure 3.4 An example of a flood zone, electricity substations and demand nodes in 'Port Town'.

Our models are provisional and for illustrative purposes only. We caution against using them as representing the real situation, for planning purposes, because we have not been able to confirm all of the data.

Wastewater and water supply

The full wastewater network was supplied by Yorkshire Water.

In discussion with the local Water Supply Operations Team of Yorkshire Water, we suggest the **water supply network** is resilient in 'Port-Town' and therefore, we have not modelled the water supply system. The network is resilient for the following reasons. First, both the main supply and secondary (backup) water treatment works are located outside 'Port-Town' and are therefore not in the flood risk zone used in the research. Conversations with Yorkshire Water have informed us that no water supply pumping stations are located in 'Port-Town' which means the water supply network within the town does not rely on the electricity network. Finally, as the water supply areas are set up in a resilient way; if water fails in one area of 'Port-Town', the supply can be moved from another area with no reliance on the local electricity supply.

Gas

We were unable to find evidence of interaction between the gas network and electricity network, as the gas network provider was not in a position to supply the information needed. As we have not been provided the gas network, we are unsure how the gas network functions or where are the nodes and links relating to gas supply. We assume that the gas network is resilient to flooding, based on two factors: there is no evidence that local electricity input affects the gas supply and there were no reports from discussions with our key informants considered in Section 2 to suggest that gas had failed in past flooding or coldwave events. Not all private homes will rely on gas supplies, especially those in the private rented sector.

In order that engineering models can be effectively applied, they must be used in the context of appropriate local knowledge. Therefore, the generation of realistic scenarios requires information that reflects the actual infrastructure in a given locality. Only then can the risk of damage of essential infrastructure assets (e.g., electricity substation, water treatment plant, water pumping station) for a particular hazard scenario (e.g., flood) be realistically estimated, and knowledge of the effects of this

damage on commodities supplied to important nodes in terms of the delivery of care gauged. We have summarized the kind of data that is required in order to achieve this and have also highlighted its availability in ERY. Table 3.2 highlights that we are still missing a number of key values that our model requires in order to run. Although we could estimate these values, the outputs would probably be unrealistic and imprecise.

Table 3.2 Summary of data collection/data required for 'Port-Town'

Infrastructure Type	*Variable/parameter in model*	*Are data available?*	*Were data supplied to the researchers?*	*Who has supplied data? Who can provide data?*	*Notes*
Electricity					
	Supply point	Yes	Yes	Northern Powergrid (NP)	
	Links between nodes	Yes	Yes	NP	
	Areas served by nodes	Yes	Estimated – needs to be confirmed.	NP	Uncertain – cannot be used for recommendations using this method.
	Max flow	Yes	No	NP	Required to produce a realistic model. Cannot model without this data.
	Max capacity	Yes	No	NP	
	Max storage (generator fuel)	Yes	Can be estimated – will need to be confirmed.	NP	Uncertain – cannot be used for recommendations using this method.
	Max production (generators)	Yes	Can be estimated – will need to be confirmed.	NP	Uncertain – cannot be used for recommendations using this method.
	Demand required	Yes	Can be estimated – will need to be confirmed.	NP	Uncertain – cannot be used for recommendations using this method.
	Usual stored volume (fuel for generators)		No	NP	
	Production coefficient		No		
	Cost of flow (links)		No		
	Cost of storage		No		
	Cost of production		No		
	Penalty for unsatisfied demand		No – set by prioritising demands		
Water					
	Supply point	Yes	Yes	Yorkshire Water (YW)	Both primary source and backup but both are located outside Goole and therefore not included in flood risk.

	Links between nodes	Yes	Can be estimated – will need to be confirmed.	YW	Uncertain – cannot be used for recommendations using this method.
	Areas served by nodes		Can be estimated – will need to be confirmed.	YW	Uncertain – cannot be used for recommendations using this method.
	Max flow (in water pipes)	Yes	No	YW	Required to produce a realistic model. Cannot model without this data.
	Max capacity (at wtw, pumping stations, etc)		No	YW	Required to produce a realistic model. Cannot model without this data.
	Max storage (at wtw, water tower)	Yes	No*	YW	
	*Usual stored volume		Yes	YW	Uncertain but could be used to set max.
	Max production	Yes	No	YW	
	Demand required	Yes	Estimated – need to be confirmed.	YW	Uncertain – cannot be used for recommendations using this method.
	Production coefficient		No		
	Cost of flow (links)		No		
	Cost of storage		No		
	Cost of production		No		
	Penalty for unsatisfied demand		No – set by prioritising demands		
Wastewater				YW	
	Supply point		Yes (end point for treatment)		
	Links between nodes		Yes		
	Areas served by transmission nodes		Can be estimated – will need to be confirmed.		
	Max flow		Can be estimated – will need to be confirmed.		
	Max capacity		No		
	Max storage		No		
	Max production		No		

	Demand required		Can be estimated – will need to be confirmed.		
	Usual stored volume		No		
	Production coefficient		No		
	Cost of flow (links)		No		
	Cost of storage		No		
	Cost of production		No		
	Penalty for unsatisfied demand		No – set by prioritising demands		
Gas					Gas is supplied to Goole but the network has not been provided. Unsure where nodes are.
	Supply point		No		
	Links between nodes		No		
	Areas served by transmission nodes		No		
	Max flow		No		
	Max capacity		No		
	Max storage		No		
	Max production		No		
	Demand required		No		
	Usual stored volume		No		
	Production coefficient		No		
	Cost of flow (links)		No		
	Cost of storage		No		
	Cost of production		No		
	Penalty for unsatisfied demand		No		
Demand points			Yes		Participatory mapping (Section 3.1) provided us with health and social care demand points.

3.4 Concluding comments on the scope for future developments

This section shows how we have developed engineering models to examine parts of the utility system are crucial for the built infrastructure supporting older people's care. We show the kinds of information needed to develop these models. Not all parts of the model can be constructed realistically because some of the key information was not available to the Universities, however, we have preliminary results to demonstrate the potential of these models. We expect that in future this kind of modelling might be adopted by utility companies or local authorities to examine the performance of utilities during extreme weather events. There is scope to apply this kind of modelling to evaluate alternative adaptation solutions that will make the system more resilient in the face of extreme weather.

More generally in this report we have argued that future risks related to extreme weather events, such as flooding are projected to increase due to climate change and that demand for health and social care in the older population will grow. It will be important, especially in areas like ERY to plan adaptation and resilience in a coordinated way, engaging a range of partners and including a whole- system approach to adaptation of the built infrastructure. This report provides some information and examples that can inform adaptation planning at different scales and illustrates some of the methods that ERY may plan to apply in future in light of climate change scenarios.

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Appendix – Strategic level organogram

<table>
<tr><th>Local Government</th><th>NHS Trusts</th></tr>
<tr><td>

Adult Social Care (leads in the following areas: social work, residential care, day care, domiciliary care, telecare, personalisation, learning and physical disabilities, and mental health)
Emergency and resilience planning
Spatial planning/development control
Infrastructure planning
Climate change adaptation
Neighbourhood management
Community services (e.g. CVS liaison and leisure facilities)

</td><td>
Acute Trust

General acute inpatient services
Geriatric inpatient care
Inpatient dementia and mental health Care
Accident and emergency
NHS estates

Community Trust (where applicable)

Mental Health Trust
</td></tr>
<tr><td colspan="2">
Coordinating Bodies

Local Strategic Partnership
Local Resilience Forum
Sustainability Forums

Clinical Commissioning Groups and Health and Wellbeing Boards

Public health intelligence
Joint planning and commissioning
Community care representative
GP representative

</td></tr>
<tr><th>Utilities</th><th>Emergency Services</th></tr>
<tr><td>

Water company
Electricity company
Gas company
Telecommunications

</td><td>

Fire and Rescue Service
Police Force
Ambulance Service

</td></tr>
<tr><th>Independent Care Sector</th><th>Other</th></tr>
<tr><td>
Community and Voluntary Sector

Age UK
WRVS
CVS
Older people’s forum
Carers’ advisory groups
Alzheimer’s Society
‘Other’ local user-led groups
Older people’s charter groups
British Red Cross

Private Care Providers

Private care companies
Care homes
Care in the community schemes

</td><td>
Inspection and Regulation

Environment Agency
Care Quality Commission

Transport

Rail service providers
Network Rail
Local bus companies
Dial-a-ride schemes

Advocacy and Brokerage Groups

Health-Watch

Social Housing Corporation/Major Housing Associations
</td></tr>
</table>