Flood Risk to Health and Social Care Infrastructure in Kent and Medway

Spatial Analysis

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Executive Summary

Flooding is a significant risk in Kent and Medway with potential to have a high impact on the Health and Social Care sector. This report summarises the data and findings from an analysis of flood risk to health and social care infrastructure in Kent using the Kent SHAPE Atlas. On license to Kent County Council from Public Health England, the Kent SHAPE Atlas includes data from national datasets on health and social care assets, demographics, local authority boundaries and environmental issues, including air quality and fluvial, tidal and surface water flood risks.

Using the Kent SHAPE Atlas, analysis of flood risk to health and social care services and properties was conducted, including both primary and secondary care assets. Community services such as day care centres and emergency response centres were included, with consideration given to their proximity to other ‘at-risk’ assets. Schools and council offices were also assessed. It is important to note that in this analysis, building outlines (shapes) were used to assess flood risk to the service or asset. In addition, a 10m ‘buffer zone’ was added around each building outline. This allows analysis to take account of all sites in or near an area at flood risk, and to identify those sites that may be at risk from secondary impacts of flooding, such as roads that become impassable preventing access or egress.

Of the 1757 services and assets assessed, 173 (9.7%) were found to be in or near an area of flood risk from rivers and the sea; slightly above the national average assessed by the Environment Agency in 2009. 20 services or assets were also identified as being in or near an area at risk from tidal flooding. Folkestone & Hythe, Swale and Canterbury Districts contain the most health and social care infrastructure in or near an area of flood risk, with 102 assets between them.

The impacts of climate change were not considered in the findings of this report, however other research suggests that the risks from flooding are likely to increase in geographical area and severity under climate change. Therefore, the exposure of health and social care infrastructure in Kent to flood risk is likely to increase in the future.

Results and outputs of this analysis will be used to inform future development of flood plans, emergency response plans, and community plans. In addition, these data and results will aid decision-makers to effectively target their efforts and resources towards the most vulnerable areas of Kent in a way that reflects their unique risk and vulnerability profiles. This work will also allow health and social care providers to assess the risk to their asset(s), and to better incorporate flood risk and climate change into their business and emergency plans.

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1. Context

1.1. Introduction

The 2014 Adaptation Sub-Committee Progress Report indicated that nationally, “between 10 – 14% of emergency service stations and 6 – 8% of hospitals, care homes and surgeries are located in areas that are potentially susceptible to river and coastal flooding”. It is widely known that there is a significant flood risk to Kent, and the county has experienced numerous flooding events over the last few decades. Most notably, the succession of severe weather events over winter 2013/14, which are estimated to have cost public services at least £4.4m. However, there is a need to better understand risk at a local level, and what the impacts of severe flooding may be on vulnerable communities, such as older populations, and key assets upon which the public depend, such as care homes or rest centres in Kent. This is particularly important to Kent County Council — the largest local authority in England, covering an area of 3,500km^2, with a population of 1.5 million — as it has a legal duty of care for residents.

Together with its partners, Kent County Council has produced the Kent Environment Strategy (KES) which aims to strengthen cross-sector partnership working on environmental, health and economic agendas. A key activity within KES is to build the evidence-base across these sectors for action to build resilience to severe weather and climate change. The Council and its Partners have also developed the Kent and Medway Growth and Infrastructure Framework (GIF) 2018 which provides a strategic framework and evidence base for identifying and prioritising future investment across a range of infrastructure, including health and social care services, up to 2031 and visions to 2050. Integrated into both the KES and the GIF is the acknowledgement that Kent’s climate is changing, and that the risks to the county from flooding, already a significant issue in some areas, are likely to get worse with climate change.

1.2. Flood Risk to Health and Social Care Assets

The Health Protection Agency conducted a review in 2012 and made recommendations for public health in the face of climate change. One risk of note was flooding, specifically the detrimental effects that floods can have on healthcare provision and assets. To address flood risk, the HPA suggest:

- Urgently considering development of a cross government flood plan to include health impacts, possibly mirroring the Cold Weather Plan for England (DH, 2011a) or the Heatwave Plan for England (DH, 2011b).
- Better identification of and information on each flood event with effective surveillance and monitoring systems.
- Ensure that hospitals and health centres in flood risk zones are protected from floods, with improved risk assessments, and other activities as described in the Safe Hospitals Project (WHO, 2011).

- Ensure flood defences are maintained to the required defence standard and condition in the long-term. Sustainable planning should be undertaken to ensure that the population living in flood risk zones is reduced (and not increased).
- Support and strengthen the inter-agency Natural Hazards Partnership and its early warning mechanisms, facilitating sharing of tools such as its daily Strategic Hazard Assessments.
- Consider promoting measures to ensure the continuity of the NHS services and health care facilities including elderly care homes during floods to limit the impacts of climate change related risks.

In a recent study reviewing flood preparedness and response in the health sector between 2009-2011, conducted by the WHO Regional Office for Europe Member States, eight countries reported impacts of flooding on health facilities, including the flooding of two hospitals during the 2007 UK floods (WHO, 2013). The review also highlighted issues related to the effects of flooding on health systems, including:

- Increased patient care demand at health care facilities
- Disruption of power supplies and availability of clean water
- Damage to patient record systems
- Disrupted ambulance and outreach services
- Interrupted continuity of care
- Potential hospital or nursing home evacuation

The effects of flooding on healthcare assets, such as care homes, GP surgeries, pharmacies and day care facilities, can be both direct, such as water damage to the site itself; or indirect, such as disruption of access (Meusel and Kirch, 2005). In 2009, the Environment Agency found that 7% of hospitals, 9% of GP surgeries and health centres and 13% of Police, Fire and Ambulance stations are built on floodplains in England (Figure 1). This report also suggests that, as a rule, there should be more services at lower risk across all categories.

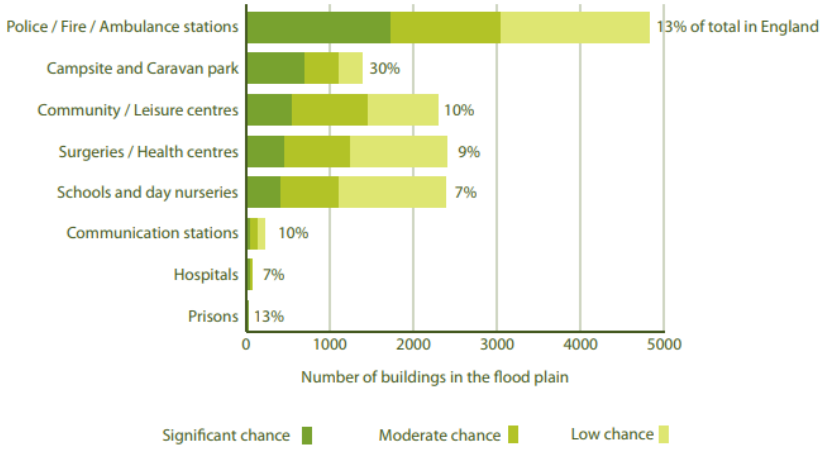

Figure 1: Summary of EA National Assessment of Flood Risk to Assets (2009)

These findings are supported by the Adaptation Sub-Committee Progress Report (2014) which indicated that nationally, "between 10 – 14% of emergency service stations and 6 – 8% of hospitals, care homes and surgeries are located in areas that are potentially susceptible to river and coastal flooding". However, there is still a need to understand flood risk at a local level.

1.3. Current Flood Risk in Kent

Flooding is both a future and current risk to Kent and Medway. According to the Local Flood Risk Management Strategy (2017), there are approximately 64,000 properties estimated to be at risk from coastal and fluvial flooding in Kent. Coastal areas, such as the Romney Marshes, Dartford and Gravesend are at higher risk from tidal flooding; while areas within the floodplains of Kent's 4 main rivers – the Medway, Beult, Stour and Darent – have significant risk of fluvial flooding. Flood defences are in place across these areas to reduce the risk. There are also approximately 24,000 properties estimated to be at risk of flooding from surface water. All areas are at some risk of surface water flooding, but the risk is generally concentrated in urban areas.

The Kent Resilience Forum (KRF), established under the Civil Contingencies Act 2004 and comprised of over 100 Category 1 and 2 emergency responders, including local authorities, emergency services, the military and voluntary groups, has identified flooding as one of the highest risks to Kent and Medway as part of the Kent Community Risk Register (2016). Flooding was identified as 2 of the top 3 highest risks. Figure 2 summarises the current very high, high and medium risks to Kent:

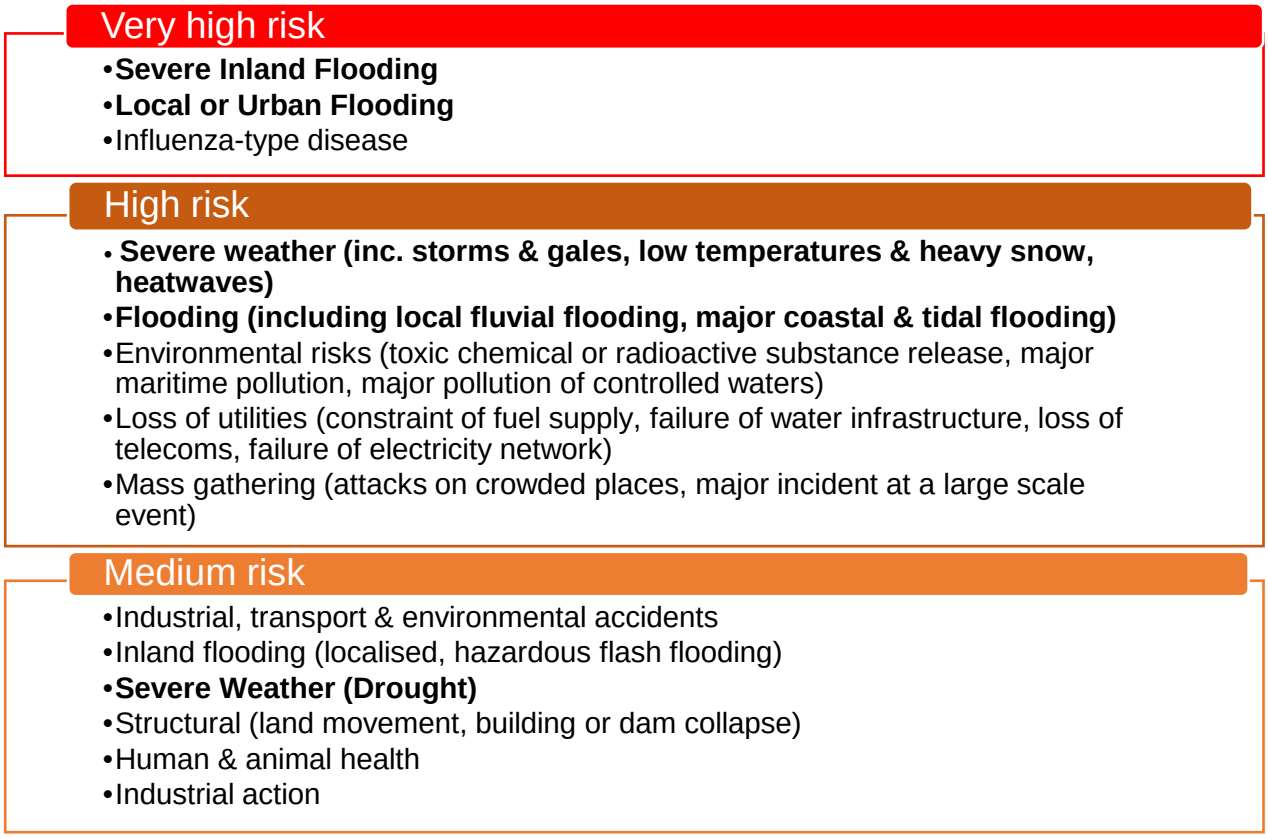

Figure 2: Risks identified in the Kent Community Risk Register (2016)

1.4. Climate Change Risks

Evidence shows that there will be significant implications at global, regional and local levels for socio-economic and natural systems, as well as for the health and wellbeing of populations, from climate change. The UK Climate Change Risk Assessment (CCRA) sets out the risks and opportunities arising for the UK from climate change. According to the most recent CCRA (2017), climate change will have a significant impact on the UK's environment, communities and economy. Risks of flooding and coastal change to communities, businesses and infrastructure was one of the priority risks identifeid in the CCRA 2017.

Additionally, climate change has been shown to have the greatest impact on those who are socially vulnerable, such as those who use health and social care services. Building on these risks and gaps identified on a national and international level, Kent County Council has analysed available data from the Climate Just platform to assess community vulnerability to, and disadvantage from, flooding in Kent. This has helped to identify communities that are most socially vulnerable to the impacts of flooding and climate change. Results of this analysis are presented in a separate report (KCC, 2019).

Climate change is expected to have both positive and negative impacts on Kent, and will result in changes to our environment, with impacts including hotter, drier summers and warmer, wetter winters, which may increase the potential for large scale flooding. However, the impacts of climate change were not considered in this analysis as data required to do so was unavailable. Still, research suggests that the risks from flooding are likely to increase in geographical area and severity under climate change, so the exposure of health and social care infrastructure in Kent to flood risk is likely to increase in the future.

1.5. This report

This report presents analysis of data from the Kent SHAPE (Strategic Health Asset Planning and Evaluation) Atlas, undertaken to improve the understanding of the number and type of health and social care assets vulnerable to flooding in Kent. The purpose of this work is to answer the following questions:

- How many care homes in Kent may be at risk of fluvial or tidal flooding, and to what level of risk?
- What care homes may be at risk of flooding from rivers and the sea, tidal surges or both?
- What is this as a proportion of the total care homes in Kent?
- How many residential care beds may be at risk?
- What is this as a proportion of the total number of residential care beds?
- What client types are cared for by the identified care homes?

2. Methodology

2.1. What is SHAPE?

The SHAPE (Strategic Health Asset Planning and Evaluation) Atlas is an evidence based online mapping application designed and managed by Public Health England to support strategic planning of services and assets across the health economy. It is aimed at professionals in the NHS and Local Authorities who have a role in Public Health or Social Care. The national system links data on public health, primary care and demographics with information on facility locations and healthcare estate performance. As SHAPE is maintained by Public Health England, health data is robust and regularly updated in line with publication of relevant national datasets. The primary aim of SHAPE is to facilitate scenario planning and options appraisal in support of Sustainability and Transformation Partnerships (STPs).

2.2. The Kent SHAPE Atlas

The Kent SHAPE Atlas contains data from KCC Public Health and Health & Social Care teams, which provides a more accurate snapshot of Kent's population, services and assets. In addition to location data (street address and latitude/longitude co-ordinates), the Kent SHAPE Atlas contains a large amount of data on each site in the database, including the type of site, primary (and secondary) client groups cared for, number of care beds and the owner/operator of the site. There is also data on other services provided in the same location (such as care homes that also provide day care facilities).

The Kent SHAPE Atlas includes Environment Agency data on risk of flooding from rivers and the sea, updated in December 2018. The Environment Agency classifications of flood risk is shown in Figure 3. When calculating the risk of flooding, the effects of flood defences in the area have been accounted for and flood risk scores adjusted accordingly. It is important to note that while defences reduce the risks from certain types of flooding, they do not eliminate the chance of flooding as defences can be overtopped or fail.

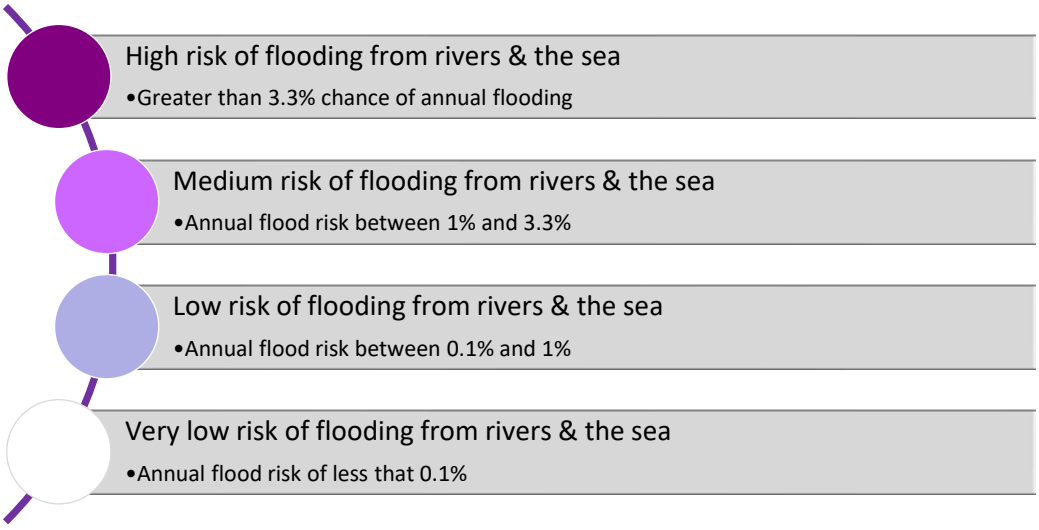

Figure 3: EA flood risk classifications

Another additional data layer added to the Kent SHAPE Atlas is tidal flood risk. This was added following the 2013 East Coast Tidal Surge in order to allow better understanding of the potential risks to Kent Health and Social Care sites in the event of a flood resulting primarily from the actions of a high tide or storm surge. Tidal flood risk is assessed differently from risk of flooding from rivers and the sea in this analysis as the high – very low rating scale is not available. Risk from tidal flooding is much lower than risk from fluvial and coastal (river and sea) flooding, and the tidal surge event used to model the data layer on the Kent SHAPE Atlas carries the same risk level as a 1 in 1000-year flood (very low).

The key benefit of using the Kent SHAPE Atlas for this analysis is that the application enables accurate comparison of flood risk and the location of services and assets in Kent. The Kent SHAPE Atlas overlays and compares flood risk and site data so assessments can be made about which assets are at which level of flood risk quickly and easily.

In this analysis, building outlines were used. Each building was given a 10m buffer zone which allows for improved planning for both direct and indirect impacts of flooding, as well as increased awareness of general flood risk. For example, while a building itself might not be in an area at risk from flooding, flooding nearby may affect key access or egress routes which could impact how aid is provided or residents evacuated, if needed. Tidal flood risk has simply been assessed on whether it is present at or near (within 10m) of a location. Figure 4 shows an example of how an asset in a flood risk area is visualised on the Kent SHAPE Atlas and shows the added benefit of including a buffer zone.

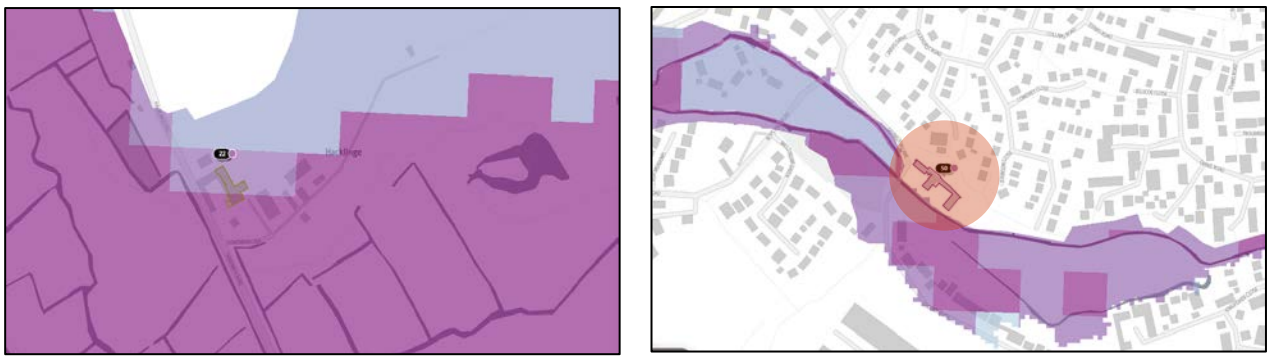

Figure 4: Examples of care homes in (left) and near (right) a flood zone

2.3. Scope and Limitations of the Data and Analysis

For the purposes of this report, the term ‘flood risk’ or ‘at risk’ refer to the presence of flood risk within the 10m buffer zone around sites on the Kent SHAPE Atlas, or to flood risk that directly overlaps a site. It should be noted that the presence of flood risk does not guarantee that a property will be flooded at any given time, and the absence of risk does not guarantee that a property will not be affected by flooding. The Environment Agency has published guidance on using the Risk of Flooding from Rivers and the Sea dataset (EA, 2018).

There are some gaps in the data as the Kent SHAPE atlas only holds data on sites where Kent residents are accessing services. As Medway is a Unitary Authority, services in Medway are controlled independently of services in Kent. This analysis includes data on 77 care homes and 3-day care sites in the Medway Unitary Authority area but does not include data on other site types assessed for the rest of Kent.

While the data on the Kent SHAPE Atlas is regularly updated – and when possible, new data added, such as the number of occupied and available beds – this analysis represents a snapshot of flood risk to the health and social care infrastructure in Kent at the time of data extraction. With changes to assets and flood management measures, overall risk may increase or decrease.

3. Flood Risk to Health and Social Care Infrastructure in Kent

3.1. Findings of analysis of risk of flooding from rivers and sea

3.1.1. Summary of findings for Kent

Of 1757 health and social care services and assets assessed, 173 (9.85%) are at or near some level of flood risk from rivers and the sea. Of the 173 services potentially at risk, 39 may be at a high risk of flooding; 46 are in or near areas of medium risk; 61 may be at low risk and 27 are at or near very low risk of flooding.

This analysis suggests that the overall risk of flooding to assets in Kent is slightly above the national average for surgeries, health centres, schools and day nurseries as assessed by the Environment Agency in 2009.

Tables 1 and 2 below summarise the assessed flood risk from rivers and the sea by service/asset type and the number of services at each level of risk.

Group	Service/Asset Type	Total #	% of all infrastructure assessed	# at flood risk	% at flood risk	% of total at flood risk
Accommodation	Care home	638	36.92	54	8.46	31.21
	Children's residential	5	0.29	0	0.00	0.00
	Extra care	21	1.22	2	9.52	1.16
Community (Day care)	Learning disability	90	5.21	12	13.33	6.94
	Older people	60	3.47	15	25.00	8.67
	Physical disability	12	0.69	3	25.00	1.73
	No speciality	1	0.06	0	0.00	0.00
Local Authorities	District, Borough & Unitary Councils	13	0.75	0	0.00	0.00
	Kent County Council	25	1.45	4	16.00	2.31
Education	Primary school*	450	25.61	34	7.56	19.65
	Secondary school	97	5.52	4	4.12	2.31
	Special school	22	1.25	0	0	0
Emergency response	Rest centre	323	18.69	45	13.93	26.01
Total		**1757****	**100%**	**173**	**9.85%**	**100%**

* Schools data available for analysis did not differentiate between primary and infants' schools in Kent, so data for primary schools may include some infants' schools as well.

** In some locations, more than one service is delivered from the same building, so the 1757 assessed assets are delivered from 1674 locations in Kent. This duplication within the number of assets assessed is primarily due to schools also functioning as rest centres outside of their primary function.

Table 1: Summary of infrastructure assessed in this analysis

Flood risk level	No. of Services/ Assets at Risk	Percentage	Care Homes	Day Care	Schools	Rest Centres	Other
High risk	39	22.54%	10	9	9	10	1
Medium risk	46	26.59%	11	7	13	12	3
Low risk	61	35.26%	21	9	14	16	1
Very low risk	27	15.61%	12	5	2	7	1
Total	**173**	**100%**	**54**	**30**	**38**	**45**	**6**

Table 2: Flood risk to all services and assets in Kent

Services and assets at risk are not evenly distributed across Kent – of the 173 assets at risk, 102 (58.96%) are in just three districts – Folkestone & Hythe (47), Swale (28) and Canterbury (27). Canterbury is the only district with more than 10 sites at high risk of flooding, whereas Folkestone & Hythe and Swale have few or no sites at high risk, but more sites at low risk.

Table 3 breaks down the sites at risk in each district.

	Flood Risk					
District	High Risk	Medium Risk	Low Risk	Very low Risk	Total at Risk	% of Total at Risk
Ashford	2	0	7	0	**9**	**5.20**
Canterbury	13	8	5	1	**27**	**15.61**
Dartford	0	1	1	4	**6**	**3.47**
Dover	7	1	12	0	**20**	**11.56**
Gravesham	0	0	1	0	**1**	**0.58**
Maidstone	2	5	1	0	**8**	**4.62**
Medway	0	1	0	0	**1**	**0.58**
Sevenoaks	3	2	0	0	**5**	**2.89**
Folkestone & Hythe	7	9	10	21	**47**	**27.17**
Swale	0	7	20	1	**28**	**16.18**
Thanet	0	0	1	0	**1**	**0.58**
Tonbridge & Malling	5	9	3	0	**17**	**9.83**
Tunbridge Wells	0	3	0	0	**3**	**1.73**
Total	**39**	**46**	**61**	**27**	**173**	**100%**

Table 3: Flood risk to all services and assets by district

3.1.2. Care homes & care beds at risk

Of the 173 services in Kent identified as having some level of flood risk, 54 (31.21%) are care homes. 8.46% of the total care homes located in Kent have some level of flood risk from rivers and the sea: 10 at high risk, 11 at medium risk, 21 at low risk, and 12 at very low risk.

Care homes assessed for this analysis range in size from large, purpose-built centres with up to 100 beds, to smaller facilities located in residential housing where there may be only 2-3 beds. 1,203 (7.56%) of 15,929 care beds may be at some risk of flooding from rivers and the sea. Of those beds that may be at risk, 278 at high flood risk, 382 at medium risk, 355 at low risk, and 188 at very low risk. This differs slightly from the breakdown of risk by care

home in that most care beds that may be at risk fall into the medium risk category, suggesting that the homes identified in this category are larger in size than those in the low risk category.

A breakdown of care homes and care beds by risk level is shown in Table 4.

	Care Homes (Total: 638)			Care Beds (Total: 15,929)		
Flood risk level	**No. at risk**	**% at risk**	**% of total at risk**	**No. at risk**	**% at risk**	**% of total at risk**
High	10	18.52	1.57	278	22.31	1.75
Medium	11	20.37	1.72	382	30.66	2.40
Low	21	38.89	3.29	355	28.49	2.23
Very low	12	22.22	1.88	188	15.09	1.18
Total	**54**	**100%**	**8.46%**	**1203**	**100%**	**7.82%**

Table 4: Flood risk to care homes and care beds in Kent

Flood risk is unevenly distributed across the four primary client groups. Across all four client groups, most assets are in an area of low or very low risk – 33 of the 54 care homes that may be at flood risk. Care homes providing services primarily for older people are the largest proportion of care homes in Kent and have the highest number of sites at risk. However, by percentage of total sites by client group, 14.29% of the care homes that provide services to people with physical disabilities are at some level of flood risk.

By far the largest number of beds that may be affected by flooding are in assets whose primary clients are older people. The total number of beds in older people's homes that may be at flood risk is 926, most of which (329) may be at medium risk. There are, however, 219 older peoples care beds that may be at high risk. This gives an average of 36.5 beds at risk in each of the 6 older peoples care homes identified as being in or near an area of high flood risk.

Table 5 shows a breakdown of flood risk to care homes and care beds by client group.

	Learning Disability (Total Care Homes: 262)			Mental Health (Total Care Homes: 34)			Older People (Total Care Homes: 321)			Physical Disability (Total Care Homes: 21)		
Flood risk level	# at risk	% at risk	% of total	# at risk	% at risk	% of total	# at risk	% at risk	% of total	# at risk	% at risk	% of total
High	3	12.50	1.15	0	0	0	6	24	1.87	1	33.33	4.76
Medium	4	16.67	1.53	1	50	2.94	6	24	1.87	0	0	0
Low	10	41.67	3.82	1	50	2.94	10	40	3.12	0	0	0
Very Low	7	29.17	2.67	0	0	0	3	12	0.93	2	66.67	9.52
Total	**24**	**100**	**9.16**	**2**	**100%**	**5.88**	**25**	**100%**	**7.79%**	**3**	**100**	**14.29%**
	Learning Disability (Total Care Beds: 2,195)			**Mental Health (Total Care Beds: 492)**			**Older People (Total Care Beds: 12,747)**			**Physical Disability (Total Care Beds: 495)**		
Flood risk level	# at risk	% at risk	% of total	# at risk	% at risk	% of total	# at risk	% at risk	% of total	# at risk	% at risk	% of total
High	35	15.70	1.59	0	0.00	0.00	219	35.53	1.72	24	38.10	4.85
Medium	27	20.35	1.23	26	61.90	5.28	329	23.65	2.58	0	0.00	0.00
Low	65	37.79	2.96	16	38.10	3.25	274	29.59	2.15	0	0.00	0.00
Very Low	45	26.16	2.05	0	0.00	0.00	104	11.23	0.82	39	61.90	7.88
Total	**172**	**100**	**4.87**	**42**	**100**	**5.28**	**926**	**100**	**5.11**	**63**	**100**	**12.73**

Table 5: Flood risk to care homes (top) and care beds (bottom) by client group

On a district level, Folkestone & Hythe District has the highest number of care homes (22) that may be at some level of flood risk. Most (11) of the care homes that may be at risk in Folkestone & Hythe are in or near an area of very low flood risk. Swale has 9 care homes at or near areas of flood risk, but these are also mostly at low risk. Dover has the most care homes (3) at high risk of flooding. There are three districts where no care homes are at flood risk – Dartford, Maidstone and Tunbridge Wells.

The number of beds assessed as being in or near an area of flood risk by district closely mirrors the data for care homes, with Folkestone & Hythe district having the highest total number of beds (313) at risk (mostly at very low risk), followed by Swale (202 beds, mostly low risk). Dover has the highest number of beds that may be at high risk of any district (92 beds in 3 homes). There are some differences between the two sets of data, however, due to differences in the size of care homes in each district. Tonbridge & Malling only has 4 care homes at or near an area of flood risk, but they are relatively large with a total of 199 beds. Although Sevenoaks only has two homes at risk, this represents 57 beds, the second highest number of beds at high risk in any district.

Table 6 shows a breakdown of flood risk to care homes and care beds at by district.

	Care Homes at Risk						Care Beds at Risk					
District	**High Risk**	**Medium Risk**	**Low Risk**	**Very low Risk**	**Total at Risk**	**% of sites at risk**	**High Risk**	**Medium Risk**	**Low Risk**	**Very low Risk**	**Total at Risk**	**% of sites at risk**
Ashford	1	0	3	0	**4**	**7.41**	50	0	29	0	**79**	**6.57**
Canterbury	1	2	1	0	**4**	**7.41**	56	21	60	0	**137**	**11.39**
Dartford	0	0	0	0	**0**	**0**	0	0	0	0	**0**	**0.00**
Dover	3	0	3	0	**6**	**11.11**	92	0	56	0	**148**	**12.30**
Gravesham	0	0	1	0	**1**	**1.85**	0	0	2	0	**2**	**0.17**
Maidstone	0	0	0	0	**0**	**0**	0	0	0	0	**0**	**0.00**
Medway	0	1	0	0	**1**	**1.85**	0	61	0	0	**61**	**5.07**
Sevenoaks	2	0	0	0	**2**	**3.70**	57	0	0	0	**57**	**4.74**
Folkestone & Hythe	2	3	6	11	**21**	**38.89**	13	31	85	184	**313**	**26.02**
Swale	0	2	6	1	**9**	**16.67**	0	80	118	4	**202**	**16.79**
Thanet	0	0	1	0	**1**	**1.85**	0	0	5	0	**5**	**0.42**
Tonbridge & Malling	1	3	0	0	**4**	**7.41**	10	189	0	0	**199**	**16.54**
Tunbridge Wells	0	0	0	0	**0**	**0**	0	0	0	0	**0**	**0.00**
Total	**10**	**11**	**21**	**12**	**54**	**100%**	**278**	**382**	**355**	**188**	**1203**	**100**

Table 6: Flood risk to care homes and care beds by district

3.1.3. Day Care

Adult day care facilities are non-residential centres that support a range of social and medical needs for people with specific chronic conditions (e.g. dementia), the elderly population and disabled adults. These services also provide transitional care and short-term rehabilitation following hospital discharge. Individuals with mental or cognitive impairment,

mobility impairment, sensory impairment; who are temporarily or permanently ill; supported by the health or local authority; or older and elderly people use these services.

There is some flood risk to day care sites across Kent, with 30 sites (18.4%) potentially at risk of flooding. It is important to note that some of these day care services are co-located in properties that primarily deliver residential care or extra care services in addition to having day care service users. For the purposes of this analysis, day care has been assessed separately to care home provision. There also is one day care facility that can act as a rest centre, and one day care location where two services are provided (by different organisations). One location providing day care in addition to having another function may be at high risk, three at medium, one at low risk and one at very low risk of flooding from rivers and the sea.

15 (25%) day care services catering primarily to older people have some risk of flooding from rivers & the sea, compared to 12 learning disability services (13.33%) and 3 physical disability services. In total across all day care services, 18.4% are at some flood risk. Learning Disability as a client group has the greatest number of services at or near high and medium flood risk. There are 4 older peoples' day care services assessed at high risk of flooding and 3 at medium risk. All three physical disability services have been assessed as being at low or very low risk.

Table 7 gives the breakdown of sites that may be at risk of flooding by primary client group.

	Learning Disability (Total Sites: 90)			Older People (Total Sites: 60)			Physical Disability (Total Sites: 12)		
Flood risk level	**No. at risk**	**% of at risk**	**% of total**	**No. at risk**	**% of at risk**	**% of total**	**No. at risk**	**% of at risk**	**% of total**
High	5	41.67%	5.56%	4	26.67%	6.67%	0	0%	0%
Medium	4	33.33%	4.44%	3	20%	5%	0	0%	0%
Low	1	8.33%	1.11%	6	40%	10%	2	66.67%	16.67%
Very low	2	16.67%	2.22%	2	13.33%	3.33%	1	33.33%	8.33%
Total at risk*	**12**	**100%**	**13.33%**	**15**	**100%**	**25%**	**3**	**100%**	**25%**

*1 day care site does not cater to a specific client group, but is not at flood risk so is not included in the table above.

Table 7: Flood risk to day care services by client type

Day care services at risk are concentrated in three districts across Kent. Overall, Folkestone & Hythe District contains the highest number (8) of day care services that may be affected by flooding. Dover, where there are 5 sites at risk, has the highest number of services that are at high risk of flooding (3). Canterbury only has 3-day care services at risk, but two are at high risk. Whereas, all 4 services in Swale have a low risk of flooding.

Table 8 shows a breakdown of the flood risk to day care services by District.

District	High Risk	Medium Risk	Low Risk	Very low Risk	Total at Risk	% of sites at risk
Ashford	0	0	1	0	**1**	**3.33**
Canterbury	2	1	0	0	**3**	**10.00**
Dartford	0	0	1	2	**3**	**10.00**
Dover	3	0	2	0	**5**	**16.67**
Gravesham	0	0	0	0	**0**	**0.00**
Maidstone	0	2	0	0	**2**	**6.67**
Medway	0	0	0	0	**0**	**0.00**
Sevenoaks	1	0	0	0	**1**	**3.33**
Folkestone & Hythe	1	3	1	3	**8**	**26.67**
Swale	0	0	4	0	**4**	**13.33**
Thanet	0	0	0	0	**0**	**0.00**
Tonbridge & Malling	2	0	0	0	**2**	**6.67**
Tunbridge Wells	0	1	0	0	**1**	**3.33**
Total	**9**	**7**	**9**	**5**	**30**	**100**

Table 8: Flood risk to day care services by District

3.1.4. Schools

38 schools may be at flood risk, representing 6.68% of the total schools in Kent, close to the national average of 7% for schools and day nurseries (EA, 2009). In Kent, there are more schools at high or medium risk (3.87%, 22) than at low or very low risk (2.81%, 16), as shown in Table 9.

Of the schools that may be at flood risk, the majority are primary schools (34), with only 4 secondary schools at risk. None of Kent's 22 special schools are at flood risk. All 9 schools that may be at high risk of flooding from rivers and the sea are primary schools.

	All schools (Total Sites: 569)			Secondary Schools (Total Sites: 97)			Primary Schools (Total Sites: 450)		
Flood risk level	**No. at risk**	**% of at risk**	**% of total**	**No. at risk**	**% of at risk**	**% of total**	**No. at risk**	**% of at risk**	**% of total**
High	9	23.68	1.58	0	0	0	9	23.68	2
Medium	13	34.21	2.28	3	7.89	3.09	10	26.32	2.22
Low	14	36.84	2.46	1	2.63	1.03	13	34.21	2.89
Very low	2	5.26	0.35	0	0	0	2	5.26	0.44
Total at risk	**38**	**100%**	**6.68%**	**4**	**10.53%**	**4.12%**	**34**	**89.47%**	**7.56%**

Table 9: Flood risk to schools by type in Kent

Five Districts in Kent have most of the schools at flood risk. Canterbury and Swale have 8 schools at flood risk, but that Canterbury has the most schools that may be at high risk of flooding. Maidstone and Folkestone & Hythe have two schools at high risk, while the district of Tonbridge & Malling has 7 schools at risk, but only 1 at high risk of flooding.

A breakdown of risk to schools by district is shown in Table 10.

District	High Risk	Medium Risk	Low Risk	Very low Risk	Total at Risk	% of schools at risk
Ashford	0	0	0	0	**0**	**0.00**
Canterbury	4	1	3	0	**8**	**21.05**
Dartford	0	0	0	1	**1**	**2.63**
Dover	0	0	2	0	**2**	**5.26**
Gravesham	0	0	0	0	**0**	**0.00**
Maidstone	2	2	0	0	**4**	**10.53**
Medway	0	0	0	0	**0**	**0.00**
Sevenoaks	0	2	0	0	**2**	**5.26**
Folkestone & Hythe	2	1	2	1	**6**	**15.79**
Swale	0	3	5	0	**8**	**21.05**
Thanet	0	0	0	0	**0**	**0.00**
Tonbridge & Malling	1	4	2	0	**7**	**18.42**
Tunbridge Wells	0	0	0	0	**0**	**0.00**
Total	**9**	**13**	**14**	**2**	**38**	**100**

Table 10: Flood risk to schools by District

3.1.5. Rest Centres

A rest centre is set up to provide temporary accommodation for people who have been affected by an emergency and is intended to provide basic care for a short period while the incident is dealt with (KELSI, 2019). Kent has 323 sites that can be used as rest centres to provide shelter and care for up to 120,000 residents if needed. These include schools, community centres, village and church halls and sports centres. Rest centres in Kent range in size from very small, able to accommodate 12 people, to the very large – the Kent Showground is the largest designated rest centre in Kent and can provide temporary accommodation for up to 6000 people, if needed. Use of rest centres is dependent on the scale of the emergency and the needs of the local community, so not all sites may be used as rest centres for all emergencies.

45 (13.93%) rest centres are at or near an area of flood risk with 10 at high flood risk and 12 at medium risk. These figures suggest that, depending on the location and type of emergency, there may issues encountered when attempting to open some rest centres in the event of flooding.

The centres assessed at the highest level of risk also have the largest capacities (4,160 total in high risk), which may cause issues depending the type and magnitude of event requiring their use. Although the largest number of rest centres appears to be in the low risk category, there is a disproportionate amount of capacity at the higher risk levels – 22.22% of centres have been assessed as high risk, but this equates to 34.88% of the total at risk capacity.

Table 11 gives a breakdown flood risk to rest centres and capacity.

Flood Risk	Rest Centres			Capacity of Rest Centres		
	Sites At risk	% of at-risk sites	% of total Rest Centres	Capacity	% of at-risk capacity	% of total capacity
High	10	22.22%	3.10%	4,160	34.88%	3.46%
Medium	12	26.67%	3.72%	2,045	17.15%	1.70%
Low	16	35.56%	4.95%	3,990	33.46%	3.32%
Very low	7	15.56%	2.17%	1,730	14.51%	1.44%
Total	**45**	**100.00%**	**13.93%**	**11,925**	**100.00%**	**9.92%**

Table 11: Flood risk to rest centres in Kent

The District with the highest level of risk to its rest centres is Canterbury, with 11 rest centres at risk and 9 of which at high or medium risk of flooding from rivers and the sea, significantly more than any other district. Folkestone & Hythe (10 centres) and Dover (7 centres) also have notable risk to their rest centres.

Although there is only one rest centre that may be at high risk in Tonbridge & Malling, it's capacity (1520) is more than all 9 rest centres at high and medium risk in Canterbury put together (1495), and there are an additional 3 centres (650 capacity) in Tonbridge & Malling that may be at medium risk of flooding. By total capacity of centres, Folkestone & Hythe is the most at risk district, but many of the centres in Folkestone & Hythe are at very low risk.

Table 12 gives a breakdown of the number of rest centres and capacities assessed at each level of risk by district.

	High Risk		Medium Risk		Low Risk		Very low Risk		Total at Risk	
District	Centres	Capacity	Centres	Capacity	Centres	Capacity	Centres	Capacity	Centres	Capacity
Ashford	1	1000	0	0	2	460	0	0	3	1460
Canterbury	5	700	4	795	1	150	1	50	11	1695
Dartford	0	0	1	50	0	0	0	0	1	50
Dover	1	90	1	150	5	910	0	0	7	1150
Gravesham	0	0	0	0	0	0	0	0	0	0
Maidstone	0	0	1	150	1	220	0	0	2	370
Medway	0	0	0	0	0	0	0	0	0	0
Sevenoaks	0	0	0	0	0	0	0	0	0	0
Folkestone & Hythe	2	850	1	130	1	300	6	1680	10	2960
Swale	0	0	0	0	5	1750	0	0	5	1750
Thanet	0	0	0	0	0	0	0	0	0	0
Tonbridge & Malling	1	1520	3	650	1	200	0	0	5	2370
Tunbridge Wells	0	0	1	120	0	0	0	0	1	120
Total	**10**	**4160**	**12**	**2045**	**16**	**3990**	**7**	**1730**	**45**	**11925**

Table 12: Flood risk to rest centres by District

3.1.6. Extra Care services

Extra care housing is for single people or couples aged 55 and over who have long-term deteriorating health conditions or mild disabilities, who need care during the night or whose needs may quickly change. To be eligible, patients must have a social care need, physical or learning disability or mental health illness and be registered for council housing with their local council. Extra care accommodation can be provided or owned by the local council, a housing association, charities or by a private company. Patients rent or buy the purpose-built apartments within the complex. These services help to maintain patient's independence while still providing on-site care and support from staff. The facility usually has skilled and specially trained care worker teams which are on site twenty-four hours a day, along with on-site nurses, with the scheme manager being the person in charge.

There are 2 Extra Care properties have some risk of flooding from rivers and the sea in Kent, which represents 9.52% of the total Extra Care properties. Both properties are in or near areas of medium flood risk, one located in Swale and one in Folkestone & Hythe. The property in Swale is primarily an older people facility, while the property in Folkestone & Hythe works primarily with those with learning difficulties.

3.1.7. Office and administrative locations

Of 38 office locations, 4 are at some risk of flooding from rivers and the sea. All 4 of those properties are owned and operated by Kent County Council and one at each level of flood risk.

Table 13 shows the assessed risk to the 4 properties.

Flood Risk Level	No. of Sites	Office Location
High risk	1	Whitstable
Medium risk	1	Sittingbourne
Low risk	1	Ashford
Very low risk	1	Dartford
Total	4	

Table 13: Flood risk to office locations in Kent

3.2. Findings of analysis of risk of tidal flooding

In addition to those properties identified as at risk of flooding from rivers and the sea, there are some properties in Kent that our analysis suggests may be at risk from tidal flooding.

19 locations, delivering 20 services, have a risk of tidal flooding either within the 10m buffer zone or to the building.

Rest centres are the most at risk group of sites from tidal flooding, with 7 sites that may be at risk, of which 5 may have risk to the building. One of these rest centres is the same location as the one secondary school at risk. There are 5 care homes at risk from tidal flooding, of

which two may have flood risk to the building itself. There are also 5 primary schools that may be at risk, with three of those potentially having risk to the building.

Table 14 shows the number of services at risk from tidal flooding.

	Service type				
	Care home	Day care	Primary school	Secondary school	Rest centre
Building	2	2	3	1	5
Buffer	3	0	2	0	2
Total	**5**	**2**	**5**	**1**	**7**

Table 14: Tidal flood risk in Kent

There is significant overlap between sites at risk from tidal flooding and those at risk of flooding from rivers and the sea. 16 sites are at risk from both tidal flooding and flooding from rivers and the sea. In most cases (12), risk of flooding from rivers and the sea is low. Only one location (a primary school) has both high risk of flooding from rivers and the sea and tidal flood risk present, and tidal flood risk is to the buffer zone, and not to the building. 4 sites at risk from tidal flooding do not have any risk of flooding from rivers and the sea present at their locations.

Table 15 shows the breakdown of the risk of flooding from rivers and the sea and tidal flood risk.

		Risk of flooding from rivers & the sea				
		High	Medium	Low	Very low	None
Tidal flood risk	**Building**	0	3	8	0	2
	Buffer	1	0	4	0	2

Table 15: crossover between EA RoFRS and Tidal flood risk

4. Conclusions

The results presented in this report from the analysis of the data downloaded from Kent SHAPE Atlas in March 2019 has found that Kent has 173 properties delivering care services or housing office functions that may be liable to some degree of flooding. This is 8.46% of all assessed locations across Kent. Key figures are:

- Overall: 173/1757 potentially at risk of flooding from rivers and the sea
- Care Homes: 54/638 potentially at risk
- Day Care: 27/160 potentially at risk
- Extra Care: 2/21 potentially at risk
- Children's Residential: none at risk
- Rest centres: 45/323 potentially at risk
- Primary Schools: 34/450 potentially at risk
- Secondary Schools: 4/67 potentially at risk
- Office & administrative locations: 4/38 potentially at risk
- Tidal flood risk: 20 services, 19 sites potentially at risk across all categories

Kent is slightly above national trends for percentage of health and social care infrastructure that are at some risk of flooding from rivers and the sea. Sites that may be at risk are concentrated in coastal districts of Kent, particularly Folkestone & Hythe, Dover and Canterbury. There are fewer sites in the non-coastal districts likely to be at high levels of flood risk, however, districts with large rivers also have risk– notably Ashford, Sevenoaks and Tonbridge & Malling.

Flood risk data used and assessed in this report reflects the data available through the Kent SHAPE Atlas in March 2019 and does not consider the impacts of climate change. While these impacts are uncertain, they are generally accepted to increase the severity of severe weather events, including increased winter rainfall, increased severity of flooding, and contributing to sea level rise. These impacts are likely to increase the severity of flood risk to those properties at risk and may mean that additional properties not identified in this analysis would also be at risk of flooding from rivers and the sea in the future.

5. Recommendations

Further work should look to identify and better understand the risks to the locations and services identified as being in or near areas of high flood risk. This should incorporate an element of 'ground truthing' where flood risk is checked directly on the Environment Agency flood risk website to ensure accuracy of Kent SHAPE Atlas results, and to better understand whether risk is likely to be directly to the property or to the 'buffer zone' and may be obstructing access. Further data from public health and flood risk services for relevant sites should also be gathered and considered as part of the in-depth assessment. Some of this additional data may be available through the Kent SHAPE Atlas, including bed occupancy rates. Examples of potential data could be:

- What is their main client group?
- How many beds do they have?
- What is their current and 'normal' level of bed occupancy?
- When was their last CQC/other relevant body inspection?
- What is the quality of care (from last inspection)?
- How appropriate are/were any plans in place?
- Is there any history of flooding at that location?
- What (if any) adaptation has taken place or is planned?

Additional information on the office location(s) at high and medium risk should also be considered as part of this additional work to better understand the risks should that office be flooded. This information could consider what services are delivered from that location and what the impacts of a significant flood would be on service delivery and record keeping?

In addition, data from this report should be assessed in conjunction with the data from the accompanying Community Vulnerability Assessment report (KCC, 2019) to better understand risks at more local levels. Work should identify the key vulnerabilities to the specific communities along with the potential risk to the facilities located in that area. This could help inform the development and review of Multi-Agency Flood Plans to ensure that the differing characteristics of communities within the district are considered when planning for flood events.

In addition, this data may also be useful in emergency planning to assess the number of residents at risk and plan resources accordingly. Data on the number of care beds at flood risk helps to better understand not just the number of sites, but the number of residents that may be affected by a flood. The number of care beds in Kent's care homes varies between 3 and 101, and flooding in a larger care home may therefore require a higher degree of preparedness than in a smaller home. As such, the inclusion of care home and other site level data available through the Kent SHAPE Atlas and this report may help with allocation of resources and prioritisation in the event of an emergency.

References

Committee on Climate Change (2016). *UK Climate Change Risk Assessment 2017 Synthesis Report*. Online: www.theccc.org.uk/uk-climate-change-risk-assessment-2017/synthesis-report. (accessed 18/06/2018).

Environment Agency (2009) *Flooding in England: National Assessment of Flood Risk.* Environment Agency, UK. https://www.gov.uk/government/publications/flooding-in-england-national-assessment-of-flood-risk (accessed 02/07/2019)

Environment Agency flood risk map: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Environment Agency (2009) *Investing for the future: Flood and coastal risk management in England. A long-term investment strategy*. Environment Agency, UK

Environment Agency (2018). Risk of Flooding from Rivers and the Sea Product Description. https://parallel.co.uk/rofrs/resources/RoFRS_Product_Description_vs1_8.pdf [last accessed 16/05/2019].

Intergovernmental Panel on Climate Change, (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Core writing team: Pachauri, R.K. & Meyer, L.A. (eds). IPCC, Geneva, Switzerland. 151pp. Available online at http://www.ipcc.ch/report/ar5/syr/ [Last accessed 13/08/2018].

KELSI, Rest Centres webpage (2019). https://www.kelsi.org.uk/school-management/maintenance-and-operations/emergency-planning/rest-centres [last accessed 08/04/19].

Kent County Council (2016). *Kent Environment Strategy: A strategy for Environment, Health & Economy*. Available online at: http://www.kent.gov.uk/about-the-council/information-and-data/Facts-and-figures-about-Kent/environmental-policies/kent-environment-strategy [last accessed 13/08/2018]

Kent County Council (2017): *Kent Local Flood Risk Management Strategy*. Available online at https://www.kent.gov.uk/__data/assets/pdf_file/0010/79453/Local-Flood-Risk-Management-Strategy-2017-2023.pdf [last accessed 15/05/19].

Kent County Council (2018): *Kent and Medway Growth and Infrastructure Framework.* Available online at: http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/growth-and-infrastructure-framework-gif [last accessed 13/08/2018]

Kent County Council (2019): *'Community Flood Vulnerability and Disadvantage in Kent and Medway.'* Online: www.kent.gov.uk.

Kent Resilience Forum (2016). *Kent Community Risk Register.* Online: http://www.kentprepared.org.uk/page1.aspx?p=13&t=1 (accessed 18/07/2018).

Kent SHAPE Atlas: https://shapeatlas.net/place/kent

Meusel, D. and Kirch, W. (2005) *Lessons to be learned from the 2002 floods in Dresden, Germany*. In: Kirch W, Menne B, Bertollini R, (eds). *Extreme weather events and public health responses*. Berlin, Springer.

Stanke, C., Kovats, S., Heaviside, C. & Murray, V (2012). *Health effects of flooding and adaptation to climate change.* In Vardoulakis, S. & Heaviside, C. (eds), *Health Effects of Climate Change in the UK 2012: Current evidence, recommendations and research gaps* (pp. 137-158). Oxfordshire: Health Protection Agency.

WHO, Menne, B. & Murray, V. (Eds) (2013). *Floods in the WHO European Region: health effects and their prevention. World Health Organization*. Copenhagen.

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