

# Weather Impacts Assessment

Devon County Council Services

**March 2010**

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**Front cover image: Baggy Point, North Devon**

# Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>V</b>
<b>1 INTRODUCTION.....</b>	<b>1</b>
1.1 The Weather Impacts Assessment .....	1
1.2 Climate Change .....	1
1.3 Context.....	1
1.4 Objectives .....	2
<b>2 METHODOLOGY.....</b>	<b>3</b>
2.1 The Weather Database .....	3
2.2 Service Interviews .....	4
2.3 Gathering Additional Data .....	4
<b>3 DEVON’S WEATHER AND CLIMATE .....</b>	<b>6</b>
3.1 Weather or Climate? .....	6
3.2 Prevailing Conditions .....	6
3.3 Temperature.....	6
3.4 Sunshine .....	7
3.5 Rainfall .....	7
3.6 Snowfall.....	8
3.7 Wind .....	9
<b>4 WEATHER IMPACTS.....</b>	<b>10</b>
4.1 Occurrence of Weather Impacts .....	10
4.2 Location of Weather Impacts .....	12
<b>5 INSURANCE CLAIMS .....</b>	<b>13</b>
<b>6 KEY EVENTS .....</b>	<b>14</b>
6.1 Lying Snow - February 2009 .....	14
6.2 East Devon Flood Event – November 2008.....	17
6.3 Widespread Ice and Snow December 2009 – January 2010 .....	20
<b>7 CONSEQUENCES OF WEATHER FOR DCC .....</b>	<b>24</b>
7.1 Storms.....	24
7.2 Heavy Rain & Flooding .....	25
7.3 Lying Snow & Ice .....	26

7.4	Heatwaves & Drought .....	27
<b>8</b>	<b>PREPAREDNESS .....</b>	<b>29</b>
8.1	Emergency Plans .....	29
8.2	Business Continuity.....	31
8.3	Corporate Risk .....	32
8.4	Adaptation Already Occurring .....	32
<b>9</b>	<b>VULNERABILITIES .....</b>	<b>34</b>
9.1	Children and Young People’s Services .....	34
9.2	Adult and Community Services .....	36
9.3	Chief Executives .....	39
9.4	Corporate Resources .....	40
9.5	Environment, Economy and Culture .....	42
<b>10</b>	<b>CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>44</b>
<b>11</b>	<b>NEXT STEPS.....</b>	<b>46</b>
	<b>ANNEX 1 – RISK ASSESSMENT GUIDANCE .....</b>	<b>47</b>
	<b>REFERENCES .....</b>	<b>48</b>

## Executive Summary

Climate change is projected to bring hotter and drier summers, warmer and wetter winters, higher relative sea levels and more intense storm events. This will have widespread implications for public services and communities in Devon.

This Weather Impacts Assessment (WIA) aims to raise awareness of the importance of planned adaptation to weather under a changing climate amongst officers, senior managers and elected members. It provides a catalyst for further action to ensure Devon County Council's (DCC) services are considering the risk from existing weather and future weather due to climate change within strategies, plans and projects.

Responding to the threats and opportunities of future weather and climate is a challenge. A manageable point at which to begin is to consider how we are affected by existing weather. This WIA raises awareness of DCC's preparedness and areas of vulnerability to extreme weather over the past 10 years by describing how weather affects DCC's services and how they respond.

A search was conducted in journalistic sources to explore the impacts of weather on Devon which revealed 141 reported weather impacts between January 2000 and September 2009. Surface flooding was the most frequently reported weather impact in the county with a higher concentration of these occurring in the south and east. Autumn is the most active season for all types of flood event in Devon whilst spring is the quietest season.

Interviews were undertaken with heads of service to gather additional information about service specific impacts. Weather affects the services provided by every DCC directorate. Two events were most frequently referred to during the interviews – the snowfall of February 2009 and the floods of November 2008. The February snowfall and extended cold period is estimated to have cost DCC £11 million more than a normal winter in road maintenance requirements and the clean up bill for the floods topped £1 million.

Whilst this study has highlighted a small selection of vulnerabilities, generally DCC is resilient to extreme weather because its existing business continuity and emergency planning arrangements function well and there is an overwhelming desire and commitment from staff to maintain service continuity.

There is a high level of awareness amongst staff of how weather can impact the business continuity of DCC services, This is being translated into adaptation action as demonstrated by the range of adaptation that is already occurring.

The next stage is to identify how weather under a future climate could affect the delivery of the Authority's services and plan to minimise these impacts.

# 1 Introduction

## 1.1 The Weather Impacts Assessment

Responding to the threats and opportunities of future weather and climate is a challenge. An understanding is needed of climate projections and their inherent uncertainty, the organisation's acceptance of risk and the sensitivity of decisions to future changes in regulations, society or the economy due to the long time scales that are involved.

A manageable point at which to begin the climate change adaptation journey is to consider how we are affected by existing weather. The purpose of this Weather Impacts Assessment (WIA) is to raise awareness of Devon County Council's (DCC) preparedness and areas of vulnerability to extreme weather over the past 10 years by using empirical evidence.

## 1.2 Climate Change

The Intergovernmental Panel on Climate Change (IPCC) published its Fourth Assessment Report in February 2007. It reported that Earth's climate warmed by 0.74°C over the past century and that 11 of the previous 12 years are the warmest on record. The IPCC concluded that it is very likely that human activities are the main cause through the release of greenhouse gases from the burning of fossil fuels<sup>1</sup>.

For an explanation of climate change see Devon County Council's (DCC) Climate Change Strategy - "[A Warm Response - Our Climate Change Strategy](#)" which was adopted in 2005 and is available on the DCC website and in libraries.

Adapting to climate change needs to occur in parallel with mitigation (reducing carbon dioxide (CO<sub>2</sub>) emissions). Due to the time delay in the climate system between carbon dioxide being emitted and its full impact on the climate coming to fruition the projected change in climate for the next 30 years to 2040 has already been determined. Essential efforts to reduce CO<sub>2</sub> emissions over the coming decades will only begin to be reflected in the behaviour of the climate system beyond 2040.

Broadly, summers are projected to be hotter and drier, and winters are expected to be warmer and wetter. Relative sea levels are likely to continue to rise and storm events may become more intense.

## 1.3 Context

This WIA forms part of the evidence base that is required to produce a Climate Change Adaptation Plan for DCC's services in response to the climate change adaptation strategic objectives of the DCC Climate Change Strategy - "[A Warm Response - Our Climate Change Strategy](#)".

Additionally, the Climate Change Adaptation Plan will satisfy the performance requirements of National Indicator 188 within the Local Government Performance Framework and local indicator LAA3 within the Devon Local Area Agreement.

The Devon Sustainable Community Strategy 2008 - 2018 identifies climate change as a cross-cutting theme and highlights the need to address the challenges of a changing climate and seize its opportunities. Additionally, Climate change is one of the Five Big Challenges within the DCC Strategic Plan 2009 – 2013 which aims to “provide a sustainable future for all”. This will need council services to be resilient to the future climate and the extreme weather it will bring.

Ensuring DCC’s effective adaptation to future climate will result in a service to the people of Devon that suffers less interruption from weather events and will also avoid or reduce the financial costs associated with restoring business operations.

## 1.4 Objectives

This WIA aims to raise awareness of the importance of planned adaptation to climate change amongst officers, senior managers and elected members and provide the catalyst for further action. This will be achieved through:

- Producing a database of the weather events and their consequences that have occurred in Devon over the past ten years.
- Identifying weather events that have invoked a response from a DCC service or that have had an impact upon DCC’s ability to maintain continuity of service.
- Determining the thresholds of different types of extreme weather that have impacted DCC.
- Understanding how vulnerable DCC is to extreme weather.

Whilst some of DCC’s services might be very sensitive to weather, if those services possess a high adaptive capacity (which would include the presence of effective business continuity plans) their vulnerability to weather and climate is likely to be low. See Box 1 for an explanation of these terms.

Understanding DCC’s current vulnerability to weather will help develop strategies and action to deal with the future conditions that climate change is likely to impose.

- **Adaptive Capacity** is the ability of a system to adjust to extremes of weather and a changing climate, to minimise potential damages, to take advantage of opportunities, or to cope with the consequences.
- Climate **Sensitivity** is the degree to which a system would be affected, either adversely or beneficially, by weather and climate-related stimuli.
- Climate **Vulnerability** defines the extent to which a system is susceptible to, or unable to cope with, adverse effects of weather and climate change. It depends not only on a system’s sensitivity but also on its adaptive capacity.

**Box 1: Adaptation jargon**

## 2 Methodology

### 2.1 The Weather Database

In the first instance the archives of local newspapers were searched for weather related stories over the past ten years occurring within the DCC administrative area. It is acknowledged that media may not be a reliable source for gathering facts but the stories do report some of the consequences of weather – the topic of this WIA.

Journalists are likely to report the weather impacts that have caused the most sensationalist stories and therefore the less severe consequences of a particular impact or indeed impacts that had few consequences are unlikely to be found in the media search. Whilst this is a limitation to the methodology, the significant weather events, impacts and consequences should be identifiable. Furthermore, it is not unreasonable to assume that each type of weather impact was under reported by the same proportion. Therefore the relationship between the occurrences of each type of weather impact identified in this study can be considered to be representative of the relationship that has occurred in reality.

The archives that were searched are:

- [Express & Echo](#) (Exeter)
- [Herald Express](#) (South Devon)
- [Western Morning News](#) (Devon and Cornwall)
- [North Devon Journal](#) (North Devon)
- [Mid Devon Gazette](#) (Mid Devon)

The search was extended to the [BBC News](#) and [Times Online](#) if searches within local newspapers returned inadequate results.

The search was originally conducted to find occurrences of the following categories of impact from extreme weather:

- Coastal flooding/sea wall overtopping
- Surface flooding
- River flooding
- Groundwater flooding
- Heatwave/drought
- Wind damage
- Extreme cold/ice/lying snow

Lightning strikes during storms and occurrences of erosion to man-made and natural structures and pollution following floods were added to the list of weather impacts during the media search.

The search revealed that groundwater flooding is not recognised by the media as a unique weather impact, whereas surface, river and coastal flooding are. The occurrences of groundwater flooding, if any, are therefore absorbed into the reports of surface and river flooding.



- **Coastal flooding** results from a combination of high tides, stormy conditions and low pressure.
- **River flooding** occurs when a watercourse cannot cope with the water draining into it from the surrounding land due to heavy rainfall. Land that is already saturated will exacerbate the problem.
- **Surface flooding** occurs when heavy rainfall overwhelms the local drainage capacity.
- **Groundwater flooding** occurs when the water table rises as a result of heavy rain. It is most likely to occur in areas underlain by permeable rocks, called aquifers, which in Devon is mainly in the south east corner.

**Box 2: A description of the common types of flooding**

For each weather impact identified, the causal weather phenomenon and its magnitude were recorded (where reported) along with its consequences and any action taken by the council. The cost to the council was also recorded. However, in many cases only some of this information was available from the media reports.

## 2.2 Service Interviews

A screening exercise was undertaken by email to identify the DCC services that are impacted by extremes of weather. An email proforma was sent to service heads throughout DCC identified from directorate organograms and senior managers. The proforma asked if the particular service was subject to impacts from extreme weather and to what extent the impacts were recorded and monitored.

Semi-structured interviews were scheduled with the council services that reported that they suffered impacts from extreme weather. The purpose of the interviews was threefold:

1. To encourage services to consider how weather affects their operations and the types of responses that are invoked.
2. To understand how significant weather events identified in the Weather Database affected service delivery.
3. To identify service vulnerabilities to existing weather.

The significant weather events within the Weather Database were used where necessary to stimulate discussion with individual council services about the impacts of weather on the service.

## 2.3 Gathering Additional Data

For the majority of weather impacts the magnitude of the weather phenomena were not recorded by the media or DCC services. A small amount of information regarding weather impacts was gleaned from the Authority's insurance claim information.

The Met Office was approached to provide historical weather records but the low resolution of the Met Office's weather stations in Devon proved unsuitable for identifying acute thresholds of rainfall for specific locations.

## 3 Devon's Weather and Climate

### 3.1 Weather or Climate?

Weather and climate are distinctly separate. Weather is a description of the environmental phenomena that occur at a particular moment in time, i.e. the temperature, cloud cover or rainfall that is seen from a glance through the kitchen window.

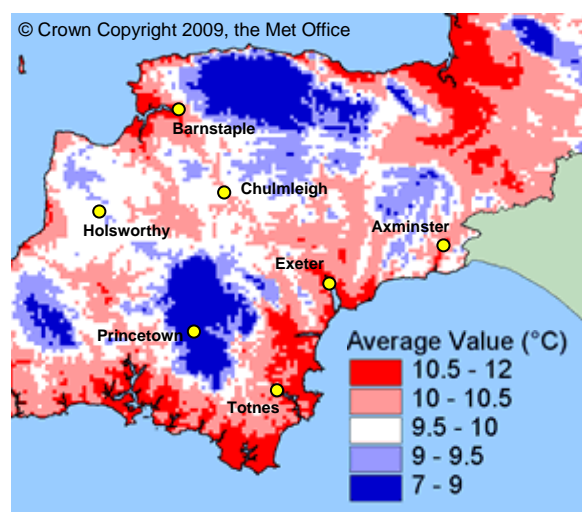
Climate is a representation of average weather over longer periods of time. The timescale used by the United Nation's Intergovernmental Panel on Climate Change to describe a region's climate is 30 years<sup>2</sup>.

This WIA considers the effects of weather now and in the recent past. It does not consider the effects of future climate.

### 3.2 Prevailing Conditions

The South West Peninsula is the warmest area in Britain being thrust well forward into the mild rain-bearing winds of the Atlantic. This oceanic location produces a warm temperate humid climate with only occasional frost that is tempered throughout the year by the influence of the sea. Such extreme Atlantic coastal areas are defined by Tansley<sup>3</sup> as having "low summer and high winter temperatures, moderate precipitation and below average sunshine for their latitude".

### 3.3 Temperature<sup>4</sup>



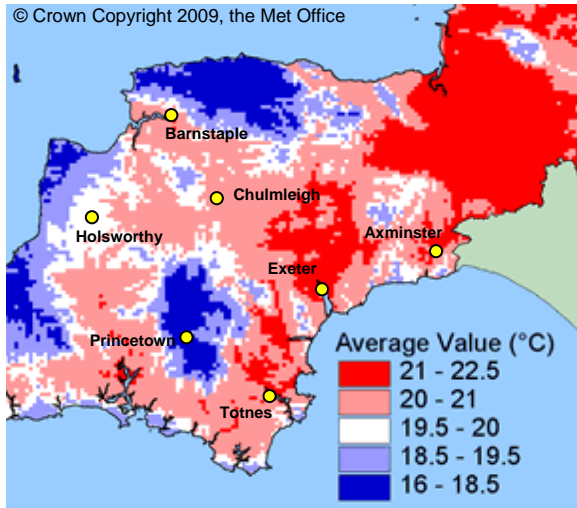
**Figure 1: Devon's annual average temperature (1971 – 2000)**

The seas surrounding the south west peninsula are the warmest of the UK with a mean annual temperature of between 11 and 12°C. The south west prevailing winds travel over the sea before coming ashore which helps maintain onshore air temperatures close to this in coastal areas.

Inland, the mean temperature decreases with height. For example, Princetown at an altitude of 414m on Dartmoor has an annual mean temperature of just 8°C (Figure 1).

Due to Devon's proximity to the sea the range of seasonal temperature is less than in most other parts of the UK.

The seas are at their coldest between February and March and so generally February is the coldest month in Devon with mean minimum temperatures falling to around 1.5°C inland. Very low temperatures are usually prevented due to Devon's proximity to the sea but away from the shoreline temperatures well below freezing have been recorded, such as -15.0°C at Exeter Airport on 24<sup>th</sup> January 1958.



**Figure 2: Devon's average July maximum temperature (1971 - 2000)**

The average maximum temperature in Teignmouth is 20.6°C<sup>5</sup> which occurs in July and is slightly lower than the 22.5°C enjoyed by the Home Counties. In July the Exe, Teign and Dart valleys on Devon's south coast are some of the County's warmest locations (Figure 2).

Extreme high temperatures are rare and occur when south easterly winds bring hot air from mainland Europe and are accompanied by sunshine. The highest temperature recorded in Devon reached 35.4°C at Saunton Sands on 3rd August 1990.

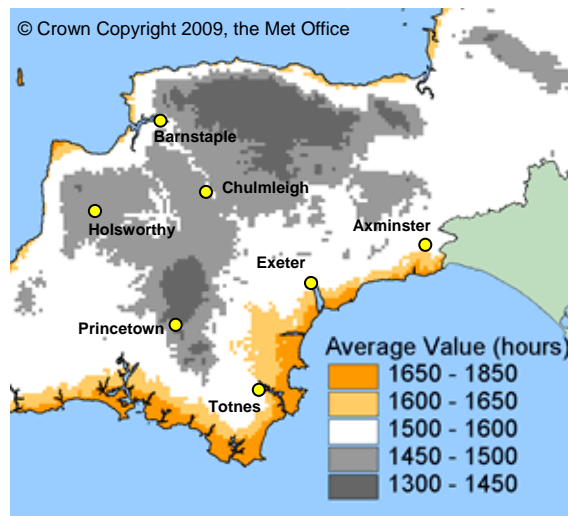
There are up to 23 days a year with air frost in coastal areas rising to between 47 and 78 on Dartmoor and Exmoor<sup>6</sup>. The warmth of the sea following summer usually prevents coastal autumn frosts.

The occurrence of frosts can be relatively high in certain locations.

### 3.4 Sunshine<sup>7</sup>

Coastal areas in the south-west have average annual sunshine totals above 1600 hours. Whilst this is more favourable than many areas in the UK it is not as high as the southeast coast where almost 1850 hours can be expected in Eastbourne<sup>8</sup>.

Inland in Devon the annual sunshine totals are between 1300 and 1600 hours (Figure 3).



**Figure 3: Devon's annual average hours of sunshine (1971 - 2000)**

### 3.5 Rainfall<sup>9</sup>

The highest rainfall is in December and January when the sea is still warm enough to ensure high levels of air humidity and the Atlantic depressions are most active. April to July is the driest period when the sea is relatively cool.

Coastal areas have 900 - 1,000mm annually, but up to double this amount falls on Dartmoor and Exmoor (Figure 4). Areas sheltering in the lee of high ground receive less such as 800mm near Exeter. In comparison, the driest parts of eastern England receive around 500mm and over 4,000mm falls in the western Scottish highlands.

Monthly rainfall is also highly variable between years. Most months of the year have recorded totals below 20mm in coastal districts but, for example, at Plymouth, every month has had more than 100mm at some point in time.

The south west peninsula is subject to rare, but very heavy, rainfall events lasting from five to 15 hours. The Lynmouth storm on 15<sup>th</sup> August 1952 was one of these, when one weather station on Exmoor recorded 228mm in 12 hours.

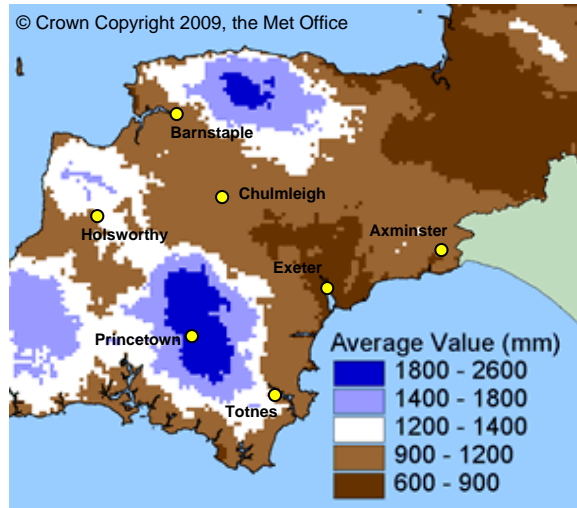


Figure 4: Devon's annual average rainfall (1971 - 2000)

### 3.6 Snowfall<sup>10</sup>

On average, the number of days with falling snow is less than 10 per winter on the coast and 8-15 days is common inland. In upland areas more than 25 days per year are possible.

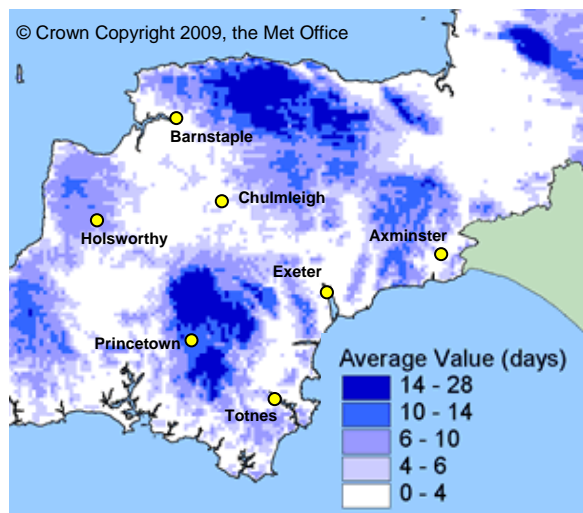


Figure 5: Devon's annual average days with lying snow (1971 - 2000)

Lying snow is not frequent and in lowland areas about a third of years do not record any. Coastal areas can expect less than three days per year on average. This increases to five-10 days per year further inland and Dartmoor and Exmoor have more than 20 (Figure 5). This is still relatively low compared with Balmoral, Aberdeenshire, which has about 60 days with snow lying on average.

Despite being the mildest region of the British Isles, the south-west peninsula has experienced some of the most severe blizzards to affect the UK. If cold easterly winds from Europe meet a slow-moving Atlantic depression off

south-west England then persistent snowfall accompanied by high winds is possible. On the 18<sup>th</sup> February 1978 fine snow accompanied by 25 knot winds at temperatures as low as -2°C deposited 50cm of snow in inland Devon and over 90cm on Dartmoor and Exmoor.

### 3.7 Wind<sup>11</sup>

The south west of England experiences average wind speeds that are only bettered by western Scotland. Mean speeds and gusts are strongest in the winter. Speeds are lower inland but Exmoor and Dartmoor are likely to experience speeds similar to those on the coast.

The most frequent and strongest winds come from between the south and north-west. In spring, winds from the north-east are common due to the high pressure over Scandinavia at this time of year. Calm winds with no preferred direction occur less than 6% of the time in the coastal districts. This increases to about 15% of the total time in inland areas which is relatively low in comparison to central England that expects light winds for 25% of the time.

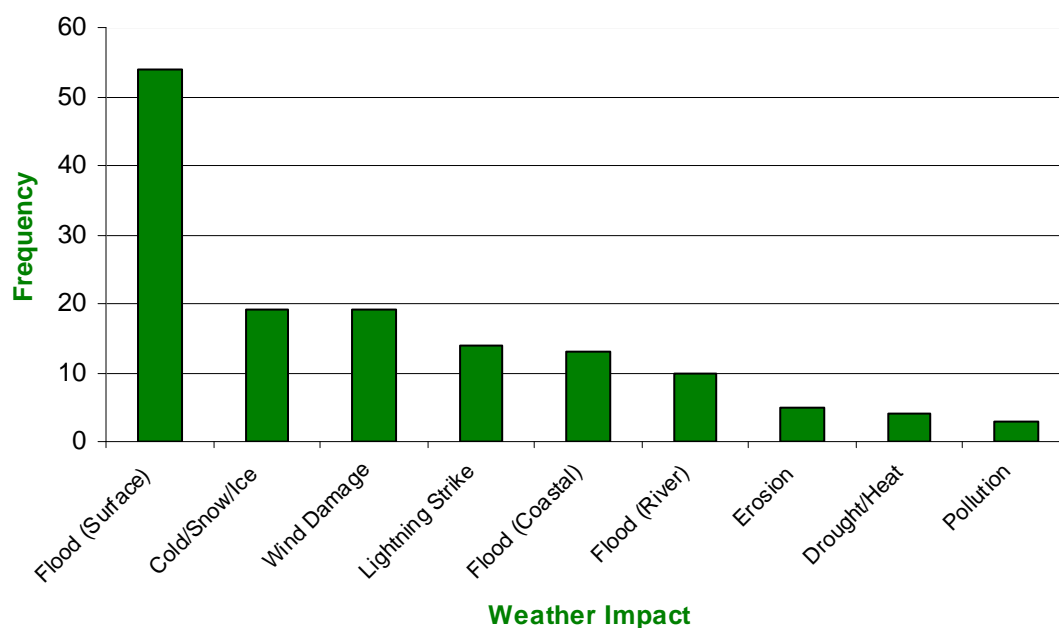
The highest gusts recorded during the period from 1971 to 2000 in Devon were during the 25<sup>th</sup> January 1990. This included 84 knots at Plymouth and 74 knots at Exeter Airport (hurricane force 12 on the Beaufort scale). The maximum hourly mean speed was 60 knots at Plymouth (violent storm force 11 on the Beaufort scale) which caused widespread damage to buildings and overturned vehicles.

## 4 Weather Impacts

### 4.1 Occurrence of Weather Impacts

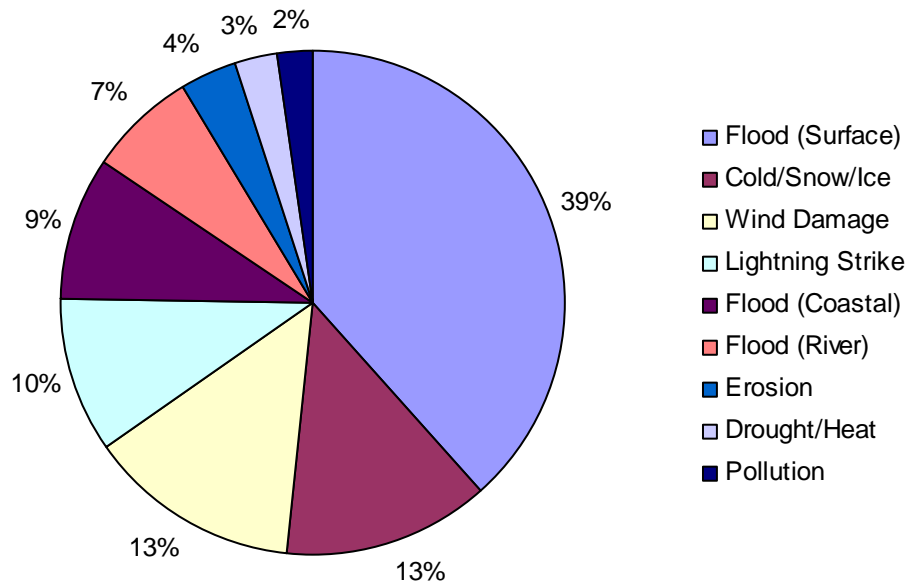
The media search and insurance information revealed 141 reported weather impacts between January 2000 and September 2009. In reality many more impacts will have occurred as this is only the number considered worthy of reporting by the media. Furthermore, multiple occurrences of the same impact type that occurred within a small geographical area at the same time have been counted as only one impact based upon the discretion of the author.

Surface flooding was the most frequently reported weather impact in the county. Extreme cold, snow and ice came joint second with wind damage (Figure 6). Drought/heat, erosion and pollution are the three least common weather impacts. However, these events tend to be less damaging to people, property and equipment and less visible and hence may be underreported in this study due to the methodology used.



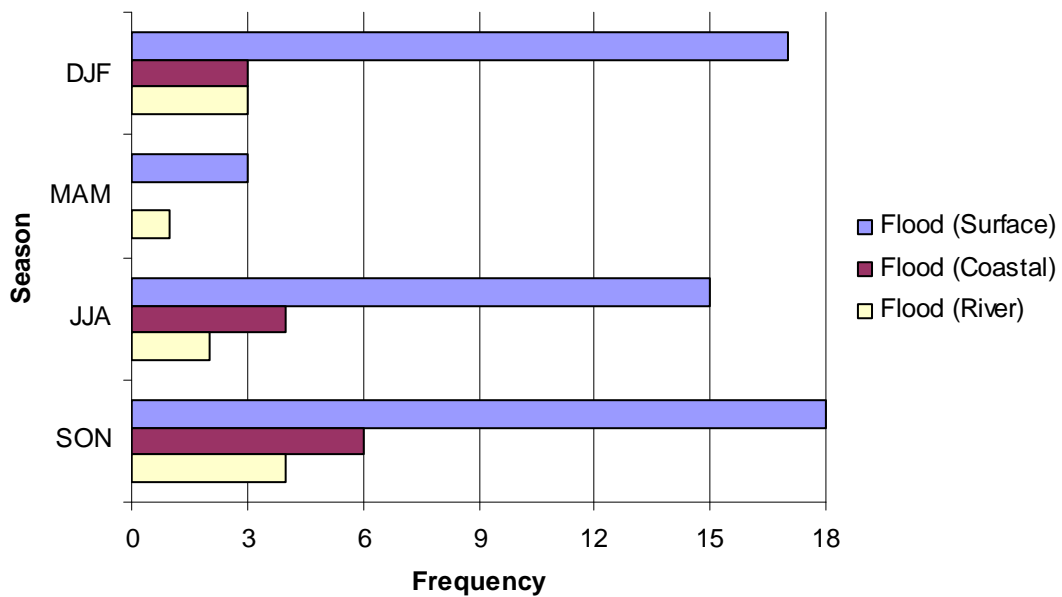
**Figure 6: Frequency with which weather impacts in Devon were reported in local and national press between January 2000 and September 2009.**

Figure 7 demonstrates that the three types of flooding are responsible for 55% of the weather related impacts reported in Devon. Interestingly, lightning strikes constitute 10% but this phenomenon is likely to be over reported due to its unique nature and often dramatic consequences.



**Figure 7: Percentage spread of weather impacts reported in local and national press between January 2000 and September 2009.**

Autumn is the most active season for all types of flood event in Devon – a total of 28 was found in the media search. Winter and summer experience a similar number of flooding events (23 and 21 respectively). Spring is the quietest season for flood events with only four events reported in the media between January 2000 and September 2009 (See Figure 8).



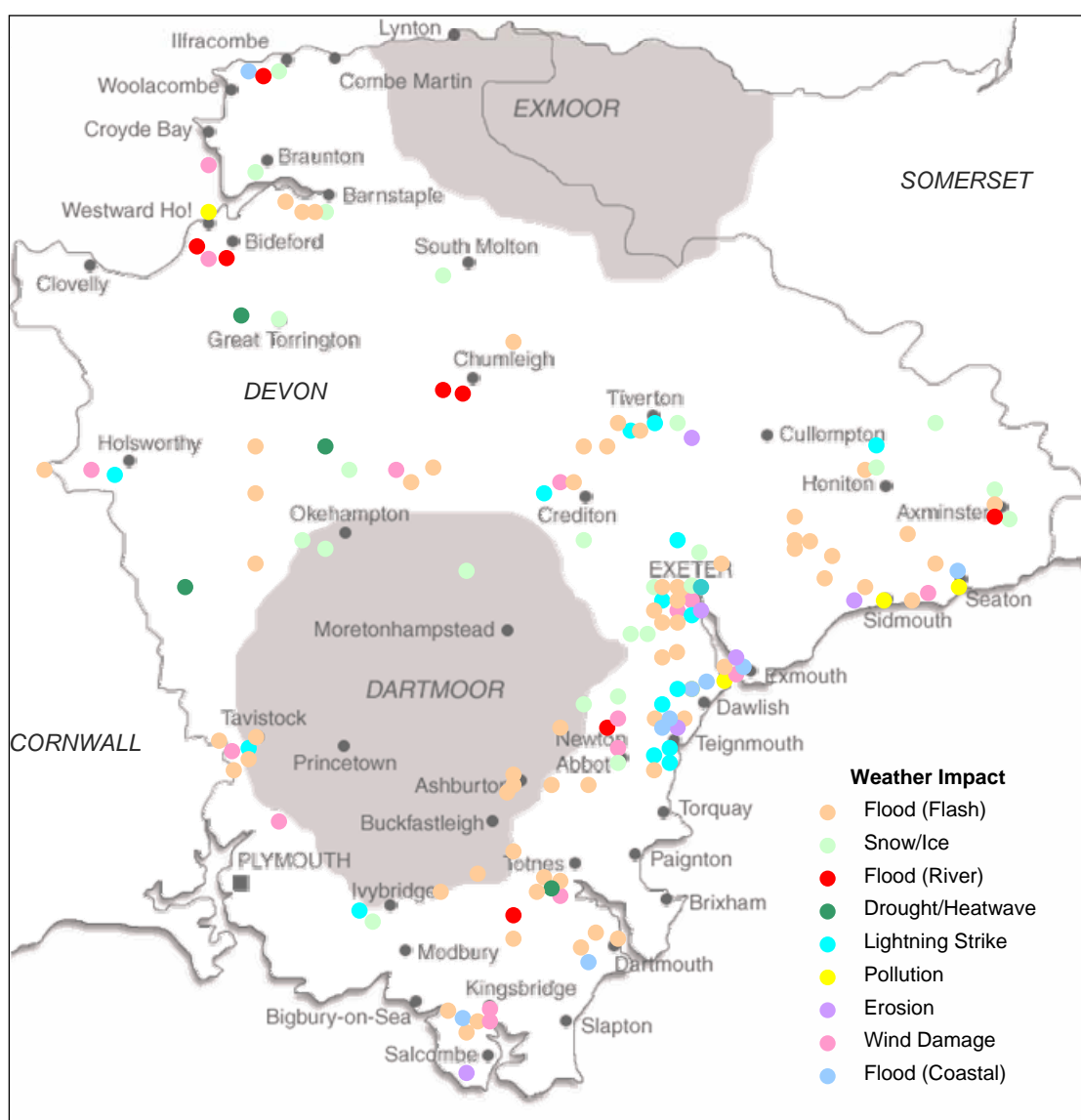
**Figure 8: Seasonal frequency of occurrences of flooding in Devon as reported by local and national press between January 2000 and September 2009.**



## 4.2 Location of Weather Impacts

Figure 9 shows the geographical distribution of weather impacts across Devon. Predictably the impacts occur predominantly in the areas of population and appear to be proportional to the size of the population centre. A concentration of surface flooding occurs in the south and east of the county and Teignmouth and Dawlish appear susceptible to lightning strikes.

Interestingly, it is only the periphery of Dartmoor that is represented within the reports of weather impacts. This may be because the population density of Dartmoor is too low for a weather event to cause impacts that are significant enough for local media to report them but it may also be because the populations on Dartmoor are resilient to the full range of the extremes of weather they receive so frequently.



**Figure 9: Geographical distribution of the weather impacts identified through the media trawl and analysis of DCC insurance claims**

## 5 Insurance Claims

Prior to 2008 DCC only insured its property against fire, lightning, explosion & aircraft damage because the cost of additional cover was too great. A competitive tender was performed as part of the renewal process in 2008 and DCC was able to obtain increased cover at favourable terms for flood, snow and storm damage.

In the past five years DCC has made 22 weather related insurance claims (21 of which were for damage to school property) which have totalled over £0.25 million. The most significant contribution to this is the floods of 2008 (Table 1). Not all weather related damage is claimed for on insurance due to the potential increase in premiums. For example, the County Farm Estate suffers storm damage throughout the year of which very little is claimed for but remedial works are implemented through the repair and maintenance budget.

	2005	2006	2007	2008	2009 <sup>†</sup>
<b>Flood</b>				£154,599	-
<b>Snow</b>				-	£12,500*
<b>Storm</b>				£45,226	£2,864
<b>Lightning</b>	£14,324	£31,265		£4,539	£2,848
<b>Total</b>	<b>£14,323</b>	<b>£31,265</b>		<b>£204,364</b>	<b>£18,212</b>

**Table 1: DCC insurance claims 2005 – 2009**

\*Pending at November 2009. <sup>†</sup>As of November 2009.

DCC receives a couple of compensation requests each year from residents suggesting DCC's liability for damage to their property from flooding from the highway. However DCC can not be held responsible for the weather and hence liability is normally denied.

Claims from members of the public suggesting DCC's liability for injury or damage caused by a highway defect amount to approximately £500k each year, but it is difficult to separate the effect of individual extreme weather events from damage caused by the effects of weather over extended periods and general wear and tear from traffic using the highway.

## 6 Key Events

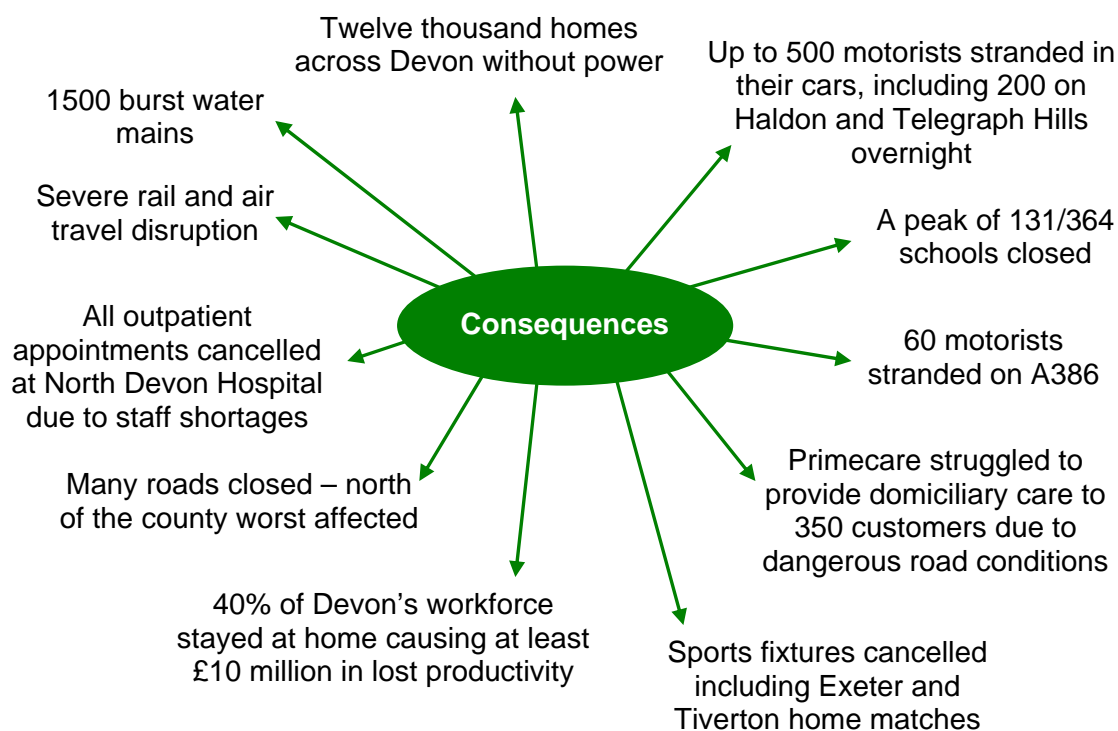
During the most recent five years of weather events recorded within the Weather Database there appears to have been a number of weather impacts that had more significant impacts than others in terms of geographical, media and temporal extent and the response from DCC and its partners. These are:

- |                                 |                              |
|---------------------------------|------------------------------|
| 1. Lying snow and ice           | December 2009 – January 2010 |
| 2. Lying snow                   | February 2009                |
| 3. Surface and river flooding   | November 2008                |
| 4. River and surface flooding   | Summer 2007                  |
| 5. Surface and coastal flooding | Autumn 2006                  |

The consequences and the response from DCC of the snow of February 2009 and the flooding of November 2008 are described below. The snow and ice event of December 2009 – January 2010 occurred after the research for this WIA was completed. A less detailed description of the consequences of this event is available at Section 6.3. The methodology was unable to obtain sufficient information about DCC's response to the flooding of summer 2007 and autumn 2006 for further description to be useful.

### 6.1 Lying Snow - February 2009

The most widespread snow since February 1991 fell across the UK between the 1<sup>st</sup> and 6<sup>th</sup> February 2009. Most of Devon was affected and over 21cm was recorded at Dunkeswell and 19cm at Haytor on the morning of the 6<sup>th</sup> February<sup>12</sup>. The consequences of this event for Devon are shown in Figure 10.



**Figure 10: Consequences for Devon of the lying snow during early February 2009, as reported by the media**

In response to these consequences DCC implemented a range of measures to ensure key services continued to be delivered and emergency situations were addressed.

### Emergency Response

The 200 vehicles trapped in deep snow on Haldon and Telegraph Hills (Figure 11) triggered a Major Incident to be declared and relevant emergency plans of the Devon, Cornwall and Isles of Scilly Local Resilience Forum members to be implemented, including the DCC Adverse Weather Plan. The Emergency Planning Service facilitated the opening of a rest centre at Chudleigh Town Hall for stranded motorists, staffed by social care services and local partners. An additional rest centre was opened at Exeter Racecourse by Police. The Emergency Planning Service represented DCC at the multi-agency Silver control that was established to coordinate the emergency response, and activated County resources in response to requests from Silver.



**Figure 11: Cars trapped in snow overnight on Haldon Hill, February 2009**

Corporate Communications provided three staff members during this emergency, one attended the Chudleigh Rest Centre to co-ordinate media attention during the event to ensure people's privacy was not compromised, another staffed the Press Office and a third was stationed in the Highways Operations Control Centre.

Many DCC services experienced staff shortages during the few days of snowfall because staff found it difficult to get to their work locations. DCC's Corporate Business Continuity Plan identifies the option of reallocating staff to services that have been identified as critical in the event that significant staff shortages are experienced.

## Adult and Community Services

The providers of meals to those residents in receipt of domiciliary care are contracted to try all realistic ways of delivering to clients. Four wheel drive vehicles were rented in some situations. In some locations the snow was too bad for the meal providers to travel. In these circumstances the **Care Direct Plus** (CDP) team contacted family, friends and local service providers such as pub landlords and owners of local shops to help get meals to vulnerable people. Communities responded brilliantly.

Some staff members couldn't get to the CDP office in Exmouth so they reported to their local health services near their homes to help in anyway they could. This system occurs across the full range of health and social services in Devon meaning that staffing issues during a severe weather event are usually overcome through good will and flexibility.

Staff shortages were experienced by the **Primary Community Care** teams predominantly because staff had to stay at home to look after children due to school closures. No significant issues arose, however. The service has a database of people in receipt of a Care Plan which allows vulnerable people in particular communities to be contacted or their details passed on to the emergency services.

The **Emergency Duty Team** needed to attend a resident's home on the edge of Dartmoor. Luckily the staff member's private vehicle was a four wheel drive and so was able to rescue a doctor who had become stuck in the snow whilst attempting to attend the same location. Four wheel drive vehicles were at a premium during this period.

## Chief Executives

DCC Committee meetings were cancelled due to the inability of Members to travel safely to County Hall. This caused decisions to be delayed and was the first time **Committee Services** was forced to cancel committee meetings due to severe weather since 1978.

## Environment, Economy and Culture

The **Highway Management Group** deployed the 'white-out fleet' comprised of snow ploughs and gritters to clear snow on roads in North and West Devon. Eighty four gritter lorries spread 1000 tonnes of salt on Devon's roads in 24 hours. Approximately 4000 tonnes of salt more than a 'normal' winter were spread during the winter of 2008/09 and the maintenance bill for roads damaged by the cold weather was £11 million more than a normal winter.

**Bridges and Structures** investigated a landslip caused by the snow that caused the closure of the Tiverton to Cullompton road.

Moretonhampstead library closed due to staff shortages and the mobile libraries were unable to travel due to the dangerous conditions. Lynton, Chulmleigh, Chagford and Tiverton **libraries** were also closed.

The **Highways Operations Control Centre** (HOCC) was triple staffed to deal with the number of incidents occurring across Devon. Twelve DCC staff members are

trained in the operation of the HOCC so that in the event of illness or adverse weather desired staffing levels should be maintained.

### Children and Young People's Services

Some school transport services were cancelled meaning that children were unable to travel to school. By default this meant that there was little point some schools opening. Other **schools** closed due to concern for children's welfare in the treacherous conditions or due to heating system failure. Schools advised DCC when they decide to close and this information was advertised by **Corporate Communications** on the DCC website and on BBC Radio Devon. School closure information was cascaded to transport providers and catering services. Parents were encouraged to check the DCC website and providers of extended school services attempted to contact the service users directly.

The Learning and Development Partnership's **Early Years** conference was cancelled, which needed to be rescheduled at additional cost.

The Learning and Schools **14 – 19 Partnership** had to cancel the North Devon Learning Fair due to difficult travelling conditions. Schools were contacted and advised not to travel.

The day shift staff at the **Atkinson Unit** (a secure unit for children and young people) slept at the centre overnight so that they were already on site to take over from the night shift staff the next morning.

## 6.2 East Devon Flood Event – November 2008

Early in the morning on the 30<sup>th</sup> October 2008 the Otter valley experienced a hailstorm followed by a large amount of rainfall. Approximately 25cm of hail was accompanied by 187mm of rainfall in 27 hours over an area no more than three square miles. The return period of the rainfall event alone has been calculated as more than 200 years<sup>13</sup>.

The volume of water running off the valley slopes caused flash flooding and swelled the River Otter. This, combined with the hailstones blocking drainage ditches, caused the Otter to burst its banks. The run-off carried the hailstones to the lowest locations in the area causing banks of up to 1.2m deep hail to accumulate. Flooding reached depths of 1.5m<sup>14</sup>. The consequences of this event are shown in Figures 12 and 13.

In response to these consequences DCC implemented a range of measures to ensure key services continued to be delivered and emergency situations were addressed.

### Emergency Response

The disruption caused by the flooding triggered a Major Incident to be declared. Relevant emergency plans of the Devon, Cornwall and Isles of Scilly Local Resilience Forum members were implemented. The Emergency Planning Service led the County Council's response to the incident, which included opening a rest centre

for displaced people in Ottery St Mary at the King's School. An unofficial Rest Centre was opened by the Red Cross at Feniton Sports and Social Club.

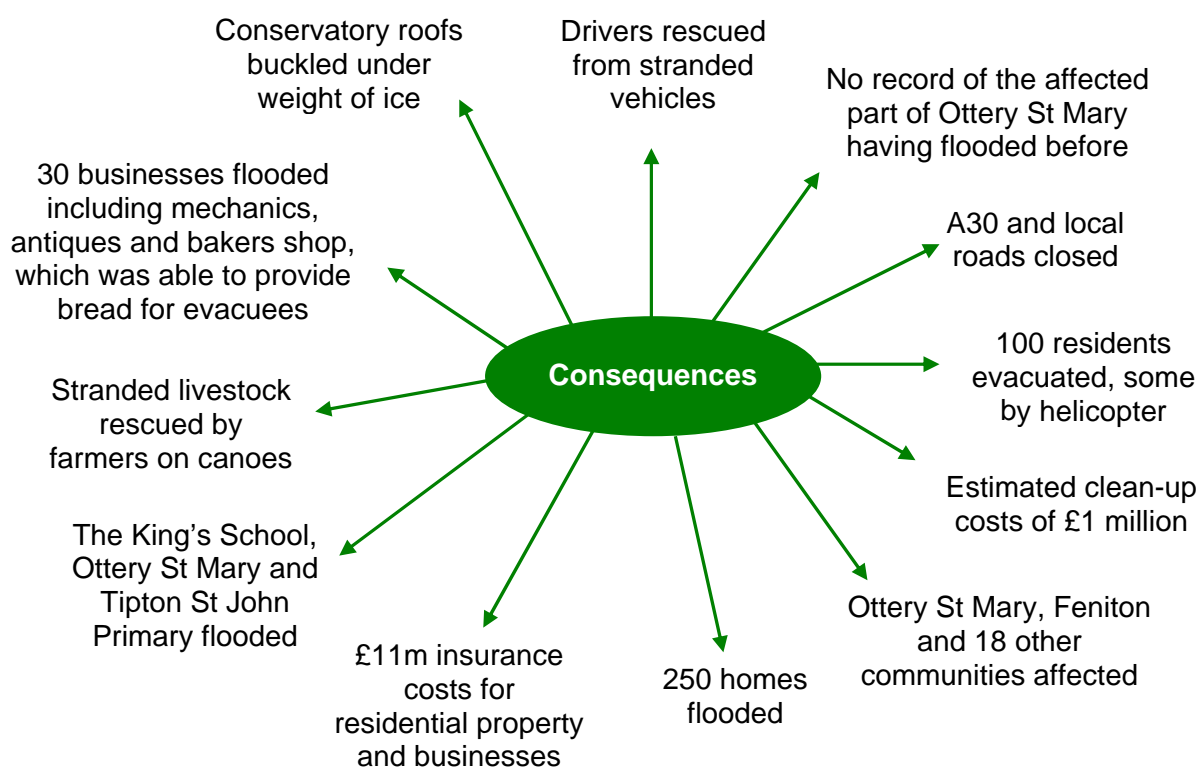


Figure 12: Consequences of the flooding during early November 2008, as reported by the media

### Adult and Community Services

**Community nurses and social workers** found it difficult to travel to appointments with people needing care in the affected area. Appointments of a non-critical nature were rescheduled and the emergency services were asked to make contact with people for whom there was concern.

Hail damaged a group of social housing bungalows in Ottery St Mary to the extent that they were no longer fit for occupation. The **Learning Disability Commissioning Service** found temporary accommodation for the residents in local bed and breakfasts. In this instance the residents were relatively mobile but had they been less able bodied there would have been significant costs to DCC for the use of accessible hotel rooms.

### Chief Executives

The travelling fairground in Ottery St Mary was subject to flooding which meant that the community needed to find a temporary location to shelter from the conditions. The **County Community Strategy Officers** arranged for mothers and children to be moved on to various locations in East Devon whilst the fathers were allowed to stay behind in an attempt to rescue the fairground equipment.

## Environment, Economy and Culture

Trees and other debris were removed from roads, gullies and bridges by **South West Highways** and **Bridges and Structures** undertook inspections of bridges where increased scour might have undermined them. Repairs had to be made to washed out roads and drains. The clean up and repair operation is estimated to have cost DCC between £500k and £1 million.



Figure 13: Flooding in the Otter valley November 2008

## Children and Young People's Services

The homes of foster carers in the area were flooded. The **Children in Care** service checked on their welfare and the children were able to stay with the carers during the evacuation.

Tipton St John Primary School was flooded and was temporarily relocated to the village hall. Mud was still being cleared from the site at the end of November 2008. The **ScoMIS IT** service installed a wireless connection between the village hall and the school site so that access to network resources could be maintained.

The responsibility for assessing whether a school shuts rests ultimately with the head teacher in consultation with the Chair of Governors. Each year there are a number of



closures, usually relating to utilities failures, which pose a health and safety risk. In adverse or freak weather conditions (e.g. localised flooding) head teachers must assess not only levels of risk to pupils and staff, but also whether a viable number of staff will be able to travel to the school. A school could therefore be as much affected by conditions in staff members' home locations as by the conditions at the school location. Once the decision has been made the school notifies DCC which posts school closure notices on the DCC website and distributes them to local media outlets including BBC Radio Devon on a daily basis via **Corporate Communications**.

### 6.3 Widespread Ice and Snow December 2009 – January 2010

This weather event occurred after the research for this Weather Impacts Assessment had been completed. Due to the weather event's temporal and geographical scale a brief description of its impacts and responses from DCC are described below, as discussed at the Severe Weather Crisis Management Team De-Brief in February 2010. Lessons learned from this event are being considered by the County Emergency Planning Service.

#### The Event

Between the 17<sup>th</sup> December 2009 and 15<sup>th</sup> January 2010 the UK experienced the most widespread and prolonged spell of low temperatures and snowfall across the country since the winter of 1981/82<sup>15</sup>.

On December 23<sup>rd</sup>, rain falling on freezing surfaces in counties bordering the English Channel, including Devon, formed sheet ice and caused many accidents. Two people died in Cornwall after a bus overturned on sheet ice. The freezing conditions continued into the New Year with widespread ice causing treacherous conditions on roads and pavements, resulting in a spate of accidents and falls.

By 7<sup>th</sup> January, the UK was covered by lying snow, almost without exception, to significant depths in many areas. Fourteen centimetres of snow was recorded across East and Mid Devon. With daytime temperatures often failing to rise above freezing, little thawing occurred so fresh snowfalls added to previous accumulations. There were further snowfalls in south-west England and south Wales on the 12<sup>th</sup>, while on the 13<sup>th</sup>, these became more widespread to bring renewed disruption to roads, rail and air travel. It was only by Friday 15<sup>th</sup> that the thaw was well under way.

The south-west in particular experienced a hard frost on the evening of the 7<sup>th</sup> January with Exeter recording -13.6 °C, the coldest on record (previous record -13.1 °C on 2 January 1979). The canal basin and parts of the River Exe froze over in Exeter (Figure 14). On the evening of the 6<sup>th</sup> January Okehampton reached -9.4°C.

Maximum daytime temperature recorded on the 7<sup>th</sup> January at Chivenor was -5.7°C. This is the coldest on record (previous record -3.7 °C on 12 January 1987).

The consequences of this event are shown in Figure 15.



Figure 14: The canal basin frozen over at Exeter Quay, 8<sup>th</sup> January 2010

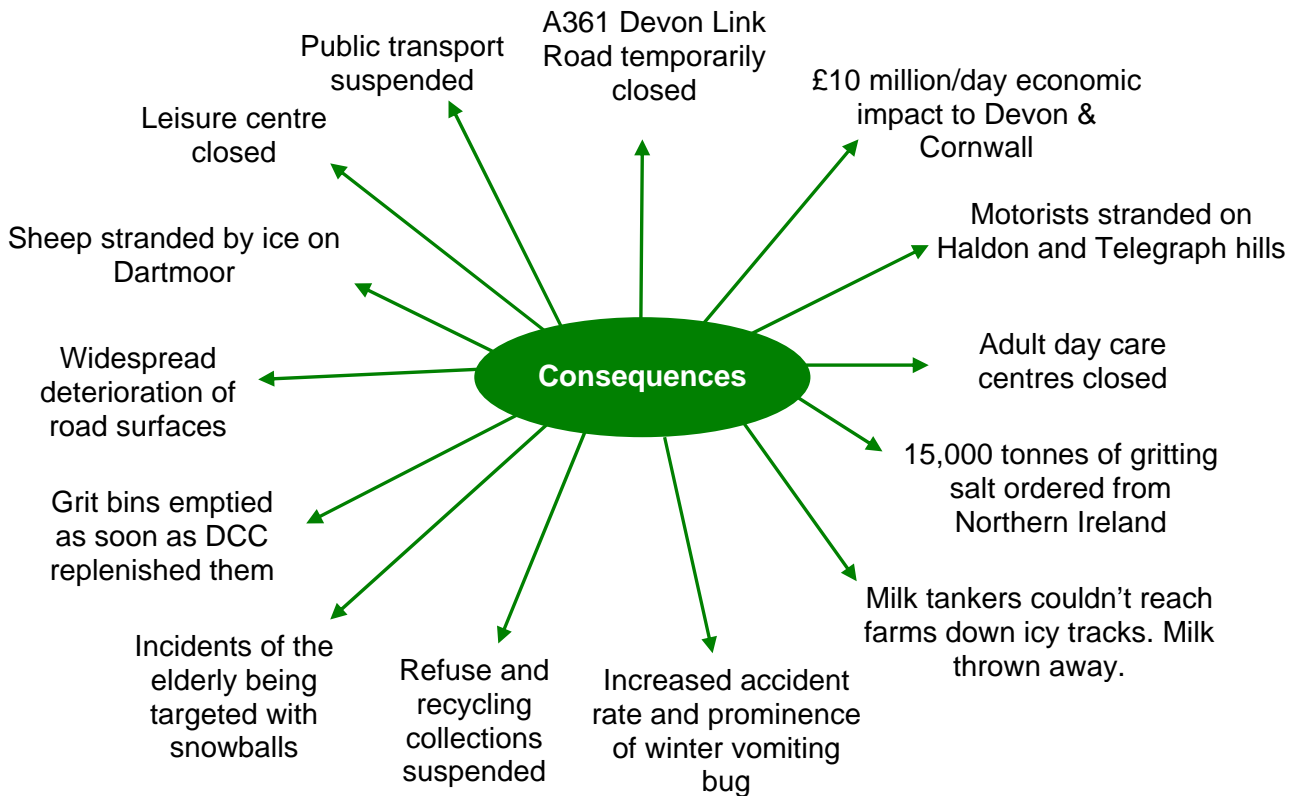


Figure 15: Consequences of the widespread ice and snow during December and January 2009/10, as reported by the media

## Environment, Economy and Culture

The Highway Management Group used the same amount of salt during the first half of the winter as would have been expected to have been used during one and a half 'normal' winters. Despite Devon's salt supplies remaining high the Authority was requested by Government to reduce salting by up to 50% to conserve supplies in the event that other areas experienced shortages. From the 7<sup>th</sup> January salting was restricted to 1700 miles of highway – a 25% reduction. The Emergency Services were content with this decision and were confident that the occurrence of ice off of the primary salting network could be dealt with.

Reports were received of community grit bins being emptied as soon as they had been filled; this gave the illusion that DCC was not replenishing supplies, which prompted complaints and press coverage.

Compliments were received from the Exeter business community on how effectively the Authority had salted the pavements in the city centre.

## Children and Young People's Services

Staff and children in rural areas found it difficult to travel to schools and some schools had no means of clearing access roads to their own property or clearing their own grounds. This did not enable safe access to property by school transport services. Children and Young People's Services directly commissioned treatment of critical areas in secondary schools in order to improve access for those needing to take examinations. School Transport was cancelled for two full days during the week of the 4<sup>th</sup> January due to extensive ice.

On the worst affected day 198 schools (54% of the total) were closed, of which 27 were secondary.

In a post-event survey, over 50% of primary schools believed the Authority had performed well in supporting schools to enable staff and pupils to arrive safely.

## Adult and Community Services

Care Direct Plus co-ordinated staff living in remote communities that were snowbound to deal with remote clients who needed assistance.

The provision of four wheel drive vehicles worked well, but some staff needed to use their own vehicles to access clients. The present arrangement for the provision of four wheel drive vehicles is with a voluntary organisation which is not a resilient system.

## Corporate Resources

Unprecedented demand for the DCC website by the public caused operational problems for IT.

The Citrix Access Gateway server capacity was increased from 300 to 500 users to allow for the increase in the number of staff working from home and wanting to access the DCC IT network.

## 7 Consequences of Weather for DCC

Below are described additional general consequences of weather for DCC that were not specifically related to either the Haldon Hill snow event, the flooding in East Devon or the widespread ice and snow of winter 2009/10.

### 7.1 Storms

High winds impact the stability of motorcyclists, cyclists and towed vehicles. **Road Safety** distributes education material to raise awareness of this and reminders to all road users are placed on the Variable Message Signage by the **Highways Operations Control Centre**. An increase in incidents involving these vulnerable road users and an increase in tree related incidents inevitably still occurs during storms to which the **Traffic Managers Unit** responds.

Maintenance or construction works on the highways can be delayed by severe weather. If the weather event is more frequent than a 'one in ten' year event then the contractor is liable for incurred costs, but if the event is less frequent then DCC will compensate the contractor. It is the responsibility of the contractor to demonstrate the weather event was less frequent than 'one in ten'.

Time extensions are provided to companies implementing DCC building contracts if they can prove that a weather event was 'exceptionally inclement'.

**Enterprise and Skills** try to help locations affected by storms by promoting activities to tourists that are relevant to the conditions. Indoor attractions are promoted during extended stormy periods, as is mud prone mountain biking. The grounding of the MSC Napoli off Branscombe in 2007 proved useful in increasing trade in local pubs and cafés by encouraging tourists to view the wreckage.

The **ScoMIS IT** service provides IT support to the 550 schools in Devon, Plymouth and Torbay and may need to attend infrastructure damaged by weather to restore network access. The Customer Service Centre will be advised of the situation in case telephone enquiries are received from schools. If the ScoMIS team are unable to travel to particular locations the IT managers of near by secondary schools would be asked to help restore connectivity at primary schools. When a significant delay is expected in restoring connectivity teaching staff can be given access to the systems from home or data can re-located to the school rather than being held centrally for the duration of the outage.

In addition to school closures, childcare providers may also need to close their premises. In this instance parents are likely to contact the **Early Years** service for details of alternative childcare in their area to avoid having to take a day off work. The same childcare situation occurs when extra-curricular clubs and activities have to be cancelled.

**Devon Discovery's** outdoor learning programmes for school children across Devon may have to be curtailed or postponed to a later date in consideration of a risk assessment of staff and children's safety, particularly if conditions are so poor that emergency services would struggle to attend the location quickly. An alternative activity in a more sheltered location may be offered to the school group if appropriate.

## 7.2 Heavy Rain & Flooding

**Public Rights of Way** may need to close or divert routes due to damaged bridges, fallen trees and increased erosion of river banks and undercutting of cliffs from swelled rivers and more violent seas. Path surfaces in the lower reaches of the Otter valley are increasingly subject to erosion due to an increase in the mobility of the river's meanders in recent years. The Jurassic Coast is also particularly affected by drought and wet weather which causes the South West Coast Path to be diverted when damage has occurred. Wardens assess situations individually to determine the correct action, as described within the Rights of Way Improvement Plan. Re-opening paths as quickly as possible is paramount to minimise the damage to local tourism businesses.

In addition to the problems encountered by the DCC **domiciliary and respite care services** attending the homes of people in receipt of care described in Section 6, other DCC care services also suffer interruptions to their normal service during weather events. Residential homes can experience staff shortages as can day centres, which might choose to close if conditions are considered too dangerous for users of the centre to travel.

All of the DCC residential, domiciliary and respite services have Adverse Weather Plans and none of the services consider themselves vulnerable to weather due to the high adaptive capacity and professionalism demonstrated by staff. Furthermore, residents can contact **Care Direct Plus** (itself resilient to extreme weather due to it being spread across three sites in Devon) by telephone during office hours if problems occur and the Community Alarms Service is available to people already in receipt of domiciliary care if they experience problems outside of working hours. **Residential care services** might ask staff to volunteer to stay at a home overnight so that they will definitely be available to start the next day's shift. Alternatively, health care staff living locally that can't travel to their normal work location might be asked to help out at residential and day care centres or visit vulnerable people that are known in to be in the vicinity. In the event that a day care centre closes the regular users will be contacted to ensure their welfare. If a residential home is damaged by flooding the residents can usually be transferred to alternative accommodation as DCC residential homes are evenly spaced across the County.

The **Sensory Service** may have a critical situation where a client needs to be visited at home for a wide range of reasons e.g. due to equipment essential for daily living having broken down. Members of staff regularly travel through minor flooding and have historically always been able to find a way to visit clients during the more severe events. Staff are issued with the 'Devon Drivers' Handbook' and only travel if they feel confident to do so.

**Trading Standards** might need to travel to attend a petroleum or explosives spillage. In the event that staff members are unable to get through due to flooding or other blockages the emergency services will make the area safe for later inspection by the team.

A storm event on the 5<sup>th</sup> September 2008 triggered hundreds of calls to DCC's **Customer Service Centre** (CSC) to report over 130 flooding incidents across the County. If total call volumes increase by more than 10%, CSC staff members are asked to work overtime on a voluntary basis but even with additional staff calls inevitably take longer to be answered than the public may be used to. Pre-recorded

messages will be placed on the phone system requesting that non-urgent callers hang up and try again later.

Flooding and other weather events may affect the accommodation of children in care or care leavers. DCC Residential Homes are developing Business Continuity Plans for this occurrence and private residential homes also have plans in place. Depending on the circumstances action might involve moving children to other homes or placing them temporarily in foster care.

The **Safeguarding of Children** service needs to respond immediately to reports of children at risk. Historically there have not been any problems in doing so during weather events but the situation could occur where routes are blocked. Recently a four wheel drive vehicle has been made available to the service during emergencies.

### 7.3 Lying Snow & Ice

Snow and ice causes problems for the **Transportation Co-ordination Service** to provide passenger transport to school children, adults and children with disabilities, the elderly and those without transport in rural communities. Services can be cancelled for safety issues or in response to school closures. Drivers are issued with the DCC Drivers' Handbook for Transport Contracts/Passenger Vehicles, to ensure they know their responsibilities with regard to the safety of passengers, and school pupils are issued with the DCC Code of Conduct which reminds parents that in the event of snow or a storm they are responsible for their children until the bus has arrived at the bus stop. Flooding, unless widespread, does not cause such significant problems with vehicle operation as routes regularly deal with diversions due to road works.

Snow on the roads does not generally cause an increase in road traffic incidents as road users generally slow down. Black ice, however, does increase incidents as road users obviously can't see it.

Road space booking requests from utility contractors for maintenance works increase during cold weather due to burst pipes and this has to be scheduled to minimise the impact of highway closures and diversions on highway users.

A modern, well constructed road should not suffer damage from freeze-thaw cycles but many of Devon's roads have evolved over many years having started out life as stone tracks. Freeze-thaw cycles will cause damage to roads, such as pot holes, especially on roads that are already nearing the end of their life. The road can be sealed from water for up to ten years by applying a surface dressing but this can only be done during dry weather and when warm weather is expected for three months afterwards. The wet summer of 2009 meant that the **Highway Management Group** wasn't able to implement as much surface dressing as was scheduled. See Box 3 for further details. Once a road or pavement defect is reported to DCC, the Highway Management Group has between 24 hours and 7 days (depending on the class of road) to repair the defect before negligence by DCC can be claimed as causing an incident.

DCC **residential homes** can be difficult to heat during cold spells. If this is a significant problem then free standing heaters can be brought in or residents can be transferred temporarily to other homes in either public or private ownership.

**Schools** with pre-fabricated buildings are advised to evacuate these structures on a temporary basis when snow has accumulated on their roofs.

The **Gypsy, Roma and Traveller Achievement Service** is required to visit newly established camps within three days to signpost service users to educational, medical and social care provision. Under snow or icy conditions a four wheel drive vehicle would be made available for these visits to occur.

### Road Construction

Warmer temperatures accelerate the ageing of asphalt roads due to a reaction between bitumen and oxygen. Additionally, a noticeable change in rainfall patterns over the past couple of decades has reduced the ability of bitumen to adhere to the aggregate in the road structure.

Higher ambient temperatures and wetter conditions also accelerate the upward migration of tar bound layers which can break through overlying bitumen layers. This leads to lower skid resistance and surface deformation. These softened surfaces are even more problematic when exposed to higher temperatures.

Furthermore, warmer weather also makes asphalt less stiff. This means that the road is less able to cope with traffic which in turn places more stress on the supporting substrata. Where drainage is overwhelmed the substrata themselves are also weakened. Some estimates suggest that for a 1°C rise in ambient temperature the asphalt layers will need to increase in thickness by more than 25mm to have the ability to carry the same level of traffic.

In Devon, many of the roads have been built up over the decades since they were first laid down as stone tracks. These “evolved roads” have variable and widely different construction. Evolved roads were not constructed to cope with the environmental conditions in which they are increasingly immersed, e.g., sustained higher temperatures and wetter winters and it is therefore these road types that cause the greatest problems.

#### Box 3: Impact of weather and climate on DCC's highways

## 7.4 Heatwaves & Drought

Roads are busier during the evening during warm weather as residents and visitors make the most of the opportunity for recreation. Drink driving frequency also increases during warm weather and a greater number of motorcyclists use the highway without leathers meaning that the fatality rate of motorcyclists increases. The **Road Safety Team** raises awareness of these issues via the web, hard copy publications and the variable message signage across the County.

Roads have become sticky in the past due to high summer temperatures. When this has occurred sand has been used to temporarily treat the road surface. Complaints received from the public about the length of grasses on roadside verges and weeds in kerb stones and pavements increases during extended periods of hot, wet



weather. Verges are cut 6 times each year during the growing season and weeds are sprayed annually. Periods of hot, dry weather prevent grass and weeds from growing quite as rapidly and complaints are not generally received.

DCC **residential homes** can become warm during hot spells. The usual response is to bring in portable air conditioners but the financial costs of doing this can be significant.

Portable fans and chillers are used in corporate buildings during extended periods of hot weather on an ad-hoc basis. Other arrangements such as altering flexi-time arrangements, so that work can be undertaken in the cool of the day, and allowing short trousers to be worn in the workplace have been implemented in the past.

**IT** server rooms have also used additional temporary air conditioning during hot spells. IT business continuity plans exist for the occurrence of accommodation being damaged.

No schools have ever overheated to the point of closure. Local decisions might be made about installing temporary cooling but DCC is not aware of this occurring.

One of the four outdoor activity centres operated by **Devon Discovery** gets its water supply from a borehole and another filters water from a river. Both sites have experienced issues with low water levels but this has not yet impacted service users. A new filtration system was installed 3 years ago which allows lower river levels to still feed the site.

## 8 Preparedness

### 8.1 Emergency Plans

#### Local Resilience Forums

The Civil Contingencies Act 2004 requires local authorities as Category 1 responders to prepare and maintain emergency plans to prevent emergencies, mitigate their effects and to take other action in the event of an emergency. Plans can be specific to particular events (e.g. flooding at a particular location) or generic plans, which plan a response to a wide range of possible scenarios.

Multi-agency plans are those where plans are maintained by more than one Category 1 responder acting jointly. Usually one agency will take the lead and will consult with and will obtain approval from other agencies before the plan is issued. An example of a multi-agency plan in Devon is the Combined Agencies Emergency Response Protocol which provides the principles upon which emergency response is based within the geographical area covered by the [Devon, Cornwall and Isles of Scilly Local Resilience Forum](#) (LRF). The LRF is where Category 1 responders meet quarterly, including the emergency services, local authorities, Government agencies and Health organisations.

The LRF prepares the [Community Risk Register](#) (CRR) which provides a comprehensive listing of threats, hazards and risks in the LRF area, together with a risk rating. This informs the preparation of contingency plans by the LRF. Weather related risks for the LRF area identified within the CRR, together with their current rating, are displayed in Table 2.

Code	Threat	Risk Rating
SW001	Storms and gales	Medium
SW002	Low temperatures and heavy snow	Medium
SW004	Heatwave	Low
SW005	Flooding: Major coastal/tidal	Very High
SW006	Flooding: Major fluvial (river)	Very High
SW007	Flooding: Localised fluvial flooding	Very High
SW010	Flooding: Localised - other sources	Medium
SW008	Drought	Medium
SW009	Forest, heath or gorse Fire	High

**Table 2: Weather related risks in the Devon, Cornwall and Isles of Scilly Community Risk Register**

## Devon County Council

DCC is involved in the immediate response to an emergency where there are significant human or environmental concerns, and will gradually assume a greater responsibility once the immediate response by the emergency services is finished and there is a focus on recovery.

DCC has staff available and trained to work in the immediate response phase and will undertake the management and staffing of Rest Centres and Humanitarian Assistance Centres. We also assist the Police at Evacuation Assembly Points, Survivor Reception Centres and Friends and Family Reception Centres (see Box 3). In all these roles the Voluntary Sector offers valuable support.

### Rest Centres

Rest Centres are set up in response to an evacuation, where there is no immediate possibility of people returning to their own homes. The primary function of a Rest Centre is to provide shelter, refreshments, emotional support, and to assist evacuees to return to their own homes, or on to temporary accommodation arranged by the District Council. Rest Centres are staffed by volunteers from the County Council's Social Care Services and the Voluntary Agencies. A Rest Centre will open for a maximum of 72 hours.

### Evacuation Assembly Points

These will be set up and managed by the Police to gather together those people requiring evacuation to the Emergency Rest Centres, or who need transport out of the area being evacuated. The Police are assisted by Social Care volunteers and Voluntary Agencies, who offer social care and support.

### Survivor and Friends and Family Reception Centres

In the event of a major disaster, the Police are responsible for establishing and managing these centres and will allocate a Family Liaison Officer to the families of the deceased. The Crisis Support Team, consisting of volunteers from Social Care, Health and related agencies (inc. voluntary sector) will assist the Police in these centres, providing additional emotional support to those people who find themselves in need of professional support. Longer term support would be provided by the Health community.

### Humanitarian Assistance Centre

Humanitarian Assistance Centres (HAC) provide professional advice that is coordinated, consistent and clear, that meets individuals' needs and is offered in a sensitive and compassionate manner. The HAC will act as a 'one stop shop' for survivors, families and those affected by a particular disaster. Led by the local Authority, the HAC is intended to be a multi-agency operated facility that avoids duplication of effort. Generally, a HAC will not open until the other centres, which are set up in the immediate aftermath of an emergency, close.

#### Box 3: Types of assistance provided by joint agencies in response to an emergency

DCC has a generic [Emergency Response Plan](#) which describes how DCC would respond to a wide range of possible emergencies and it supports a suite of plans which relate to specific emergencies. In an emergency DCC has a significant role that includes:

- Support to the emergency services
- Provision of support services to affected communities
- Recovery and return to normality of the community
- Recovery and return to normality of council services
- Maintenance of normal services to the unaffected parts of the community

The full list of specific emergency plans prepared by DCC, joint local authorities, emergency services and other supporting organisations are available [online](#). With particular regard to weather, the following emergency plans are operational:

- [Devon Flood Warning and Response Plan](#) (in process of being updated) covers arrangements for flood warnings and joint response for specific areas of Devon, Plymouth and Torbay which could be threatened by flooding.
- [Devon County Council Coastal Pollution Plan](#) contains details of DCC's response to a major maritime incident which causes pollution on Devon's beaches.
- [Adverse Weather Plan](#) identifies accommodation to be utilised as rest centres for people trapped in vehicles in severe weather conditions, including snow and heatwaves.
- [Heatwave Plan for England](#) enhances resilience in the event of a heatwave.

## 8.2 Business Continuity

DCC's business continuity plans are complementary to, and could be invoked at the same times as, the Emergency Response Plan. The plans are an additional requirement of the Civil Contingencies Act and are developed, compiled, exercised and maintained in readiness to enable the Authority to continue to deliver its critical services to an acceptable level. It is the responsibility of all managers to promote and embed a business continuity management culture within the Authority to ensure that it becomes part of DCC's core values and management systems.

Three organisational tiers of business continuity planning exist. The [Corporate Business Continuity Plan](#) defines how the strategic issues of an incident would be addressed and managed by a central Crisis Management Team. [Tactical level plans](#) exist for each major site (County Hall Campus, Barnstaple Civic Centre and Great Moor House) and there are also separate plans for known high risk specific hazards (Influenza Pandemic). These plans address business disruption, interruption or loss from the initial response until normal operations are resumed. Specifically they allocate roles and responsibilities and provide guidance for dealing with external agencies, suppliers and the emergency services. At the operational level there are a range of [Critical Services' Plans](#) covering those services across the Authority's directorates where loss of delivery would endanger the safety or welfare of the public, or would seriously affect DCC's finances or its ability to comply with legislation.

### 8.3 Corporate Risk

DCC's Corporate Risk Management Group (CRMG), which includes senior representatives from each Directorate, has a pivotal role in implementing DCC's [Risk Management Policy](#). Directorate Management Teams own Directorate Risk Registers. The significant strategic risks identified within each Directorate are presented to CRMG for inclusion in the Corporate Risk Register (CRR) together with any active mitigating controls. The CRR is owned by the Corporate Leadership Team.

DCC's Audit Committee receives quarterly progress reports from CRMG to monitor the effectiveness of risk management within the Authority. The Audit Commission spoke to the Audit Committee in December 2009 about its observations on risk management within DCC. It identified consistency as a problem but is encouraged that steps are being taken to ensure that the approach is more consistent and transparent.

Table 3 identifies the weather and climate related risks detailed within the Corporate Risk Register.

Code	Risk	Inherent Risk
CRR15	Disruption to DCC services (business continuity)	Medium
CRR16	Failure to reduce DCC's CO <sub>2</sub> emissions and demonstrate community leadership on mitigation and future preparedness	Medium
CRR17	Flooding - Surface water run-off, coastal flooding, river flooding and ground water flooding.	High
CRR18	Extreme Weather - Heavy rainfall, high winds, snowfall, hail and ice. (excludes flooding)	Medium

**Table 3: Weather and climate related risks in DCC's Corporate Risk Register**

### 8.4 Adaptation Already Occurring

The information gathered from the interviews with heads of service has reinforced the expectation that adaptation to weather and climate is a continuous process that has been ongoing within DCC.

Small but significant increases in annual average temperature and autumn rainfall have caused a range of maintenance issues with Devon's roads. In 1999 DCC was the first Authority to change its highway construction and maintenance specifications to help with the adaptation to a changed & changing climate. The **County Scientific Unit**, part of the Highway Management Group, has implemented changes to road construction and maintenance contracts in response to the UKCIP02 UK climate projections to deal with increased temperature and rainfall up to 2080 (a realistic life expectancy for drainage systems). The more recent UKCIP09 data set does not suggest future changes in climate that are significantly different to those projected by UKCIP02. The County Scientific Unit is working with suppliers of gully grids to ensure designs allow leaf debris to pass into the gully rather than blocking them.

Severe weather, such as ice, snow and flooding can deteriorate the carriageway and hamper the summer maintenance schedules. Following the severe winter of 2008/09 and the wet summer of 2009, the severe damage evident on the road network has been identified by the **Highway Management Group** as a corporate risk to DCC within the Corporate Risk Register as part of risk 'CRR18 – Extreme Weather'. An emergency inspection regime to identify and repair potholes caused by the freezing temperatures during winter 2008/09 and early 2010 has been launched.

Following the East Devon Flood Event the Environment Agency (EA) and its partners on the East Devon Flood Recovery Group, including the **Highway Management Group** at DCC, are working with farmers in East Devon to reduce the risk of flooding to homes and business. The EA has demonstrated that land management in the Otter catchment contributed to high levels of run-off due to soil compaction, which inevitably leads to flooding. Farmers have been working with the EA to improve land management and are now using subsoilers to break up soil after a harvest. This benefits the farmer because minimising run-off also minimises the loss of expensive fertilizer. Additionally, CCTV surveys of storm water pipes in Feniton revealed that some of them were partially blocked. As a result of the findings, East Devon District Council and DCC have already done some clearance work and have also contacted the owners of any private pipe-work to discuss making improvements.

In response to recent severe weather events, **Children and Young People's Services Business Strategy** has setup a system to record the number of school days lost across Devon due to bad weather forcing schools to temporarily close.

Following the flooding of Kenton Primary School in May 2008 flood boards have been installed by **Norfolk Property Services** and **Teignbridge District Council** has increased the frequency of gully cleaning. A report was commissioned by **CYPS Strategic Planning** to identify long term solutions to reduce the likelihood of school flooding in the future. Information provided by the Environment Agency was used to recommend the redesign of an underground culvert to cope with future water discharges from the catchment, with consideration of climate change. Every school that sits within a flood zone designated by the Environment Agency is registered with Flood Warnings Direct.

Buckridge Farm at Torbryan, part of the **County Farms Estate**, also flooded during May 2008. Investigations into the cause of the flooding identified a spring that had emerged due to the high water table on the hillslope above the farm house. Norfolk Property Services installed a 150mm diameter land drain to satisfy insurance requirements which now pipes the spring water into the main drainage system for the site and should be capable of coping with a 1:100 year rainfall event.

**Devon Discovery** operates four residential, outdoor learning centres for children and young people. One of these centres obtains its water supply from a river, which is filtered before use. Following the warm spell of summer 2006 the river level dropped to a new low causing the concentration of pollutants in the water to increase, which the existing filtration system could not handle. The filtration system was upgraded to cope with lower water levels in the river.

## 9 Vulnerabilities

Listed below are DCC's vulnerabilities to extreme weather that have been identified during the process of preparing this Weather Impacts Assessment. An assessment of residual risk (risk taking into consideration the existing mitigating controls in operation) has been performed for each vulnerability using the methodology outlined in DCC's Risk Management Policy. A description of the scoring categories of risk likelihood and risk impact can be viewed at Annex 1.

### 9.1 Children and Young People's Services

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
CYPS 1	Communicating school transport cancellations	School transport can be cancelled due to extreme weather affecting the highway network or causing a school closure. Naturally, complaints are received from parents when they haven't been notified that a transport service has been cancelled. This carries the risk of children being left at the road side, subsequent impacts to the economy through a loss in business productivity due to parents staying at home to perform childcare and a reputational risk for DCC.	Operational	Education Transport Service	Anne Whiteley	<ol style="list-style-type: none"> <li>1. Business continuity plan operational but needs reiterating to schools and transport providers</li> <li>2. DCC Drivers' Handbook details procedures in case of extreme weather</li> <li>3. Code of Conduct issued to each pupil lists procedures for extreme weather</li> <li>4. School closures are published on the DCC website and broadcast on BBC Radio Devon</li> <li>5. County Council Resilience Group Severe Winter Weather Action Plan (R7) – Explore using SMS to inform school communities when a school is closed.</li> </ol>	5	2	M

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
CYPS 2	Atkinson Unit ventilation	The air conditioning system at the Atkinson Unit is no longer sufficient for summer temperatures causing the internal environment to become uncomfortable. Doors and windows need to be kept closed to protect the children and others.	Operational	Atkinson Unit	Anne Whiteley	1. Norfolk Property Services has been commissioned to design a new ventilation system	3	1	L
CYPS 3	Devon Discovery Centres	Due to the recent wet summers causing outdoor children's activities to be cancelled, schools are not rebooking for subsequent visits to the Centres. The service operates on a commercial basis and this could impact its future viability.	Financial	LDP – Devon Discovery	Anne Whiteley	1. Revenue is being monitored closely	3	1	L
CYPS 4	Maintaining staffing levels	Maintaining staff levels for critical services during a severe weather event is made more difficult by school closures because DCC staff have to return home to care for their children (community care teams have highlighted this in particular). A shortage of staff could disrupt critical services and cause neglect or deaths and associated reputational impacts.	Operational	CYPS Business Strategies	Anne Whiteley	<ol style="list-style-type: none"> <li>1. Business continuity plans are being developed for DCC services identified as critical. All ACS services have a business continuity plan.</li> <li>2. County Council Resilience Group Severe Winter Weather Action Plan (R9) – Confirm that schools have resilience plans in place.</li> <li>3. County Council Resilience Group Severe Winter Weather Action Plan (R10) – Review potential to clear road and pathways up to school gates.</li> </ol>	3	4	H



## 9.2 Adult and Community Services

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
ACS 1	Adult residential care home temperatures	Davey Court care home, Exmouth, reports that a high internal summer temperature is already an issue. Summer temperature, and maintaining a comfortable winter temperature, could be an issue in other homes not identified in this study. Financial costs of temporary air conditioning in summer and longer operating periods for heating during an extreme winter can be significant. Furthermore, the use of carbon intensive air conditioning and heating systems will have additional financial implications for DCC within the national Carbon Reduction Commitment Energy Efficiency Scheme.	Financial	In-House Social Care Provision for Older People	Jennie Stephens	1. Mail shot sent to DCC and external providers of residential care homes each May to remind them of the need to start forward planning for excessive summer temperatures - such as creating cool rooms, opening windows/doors, drinking water and eating salads, wearing the right clothes and limiting movement.	3	1	L

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
ACS 2	Consideration of the needs of vulnerable residents during an emergency who are not in receipt of a Care Plan - particularly those with a sensory impairment.	Some populations are vulnerable to severe weather events but are not detailed on the CareFirst database because they are able to live independently and are therefore not in receipt of a Care Plan. This situation applies to Devon residents with a sensory impairment who may not be as aware of an emergency occurring as other residents, and the emergency services may not be aware of their location due to their absence from CareFirst. They may suffer unnecessary discomfort or neglect if a severe weather event were to affect their locality.	Operational	Strategic Property and Emergency Planning	Jennie Stephens	<ol style="list-style-type: none"> <li>1. Self help leaflets in GP surgeries and libraries.</li> <li>2. Joint Health &amp; Social Care multi media press releases titled 'Looking after Yourself'.</li> <li>3. Local Resilience Forum's Vulnerable Persons Plan identifies all Agencies with information on vulnerable people - out of hours test of Vulnerable Person Data by geographical area planned for 2010/11.</li> </ol>	3	3	M
ACS 3	Shortage of 4x4 vehicles	There are several occasions each year when social services have been unable to get access to a 4x4 from the Devon and Cornwall 4x4 Response Team (voluntary) and then rely on good will of staff to use their own 4x4 vehicles which they are not obligated to own or provide for business use. If staff vehicles are not available or the number of staff with such vehicles decreases over time (likely due to the escalating costs of operating such vehicles) there is a risk of a safeguarding incident that could result in deaths, deliberate harm, neglect or abuse of vulnerable people leading to reputational risk in national press.	Operational	Strategic Property and Emergency Planning	Jennie Stephens	<ol style="list-style-type: none"> <li>1. Devon and Cornwall 4x4 Response Team (voluntary) has a Service Level Agreement with Devon and Cornwall Police</li> <li>2. County Council Resilience Group Severe Winter Weather Action Plan (R8) – Identify a pool of 4x4 vehicles to use during severe weather in addition to the Devon &amp; Cornwall 4x4 Response Team.</li> <li>3. Some external domiciliary care providers have now bought 4x4 vehicles.</li> </ol>	5	4	VH

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
ACS 4	More effective identification of vulnerable people in receipt of care	There are currently no links between the databases that hold information about service users in receipt of Care Plans from the NHS led services and the database used by DCC's Adult and Community Services to record its service users' Care Plans (an exception to this is North Devon). This requires more than one database to be queried to identify vulnerable people in the vicinity of an emergency event, which relies on multiple staff members being available. Whilst this system works, there is an opportunity to identify vulnerable service users more quickly and efficiently by linking these databases, which could ultimately save lives.	Strategic	Integrated Health and Social Care	Jennie Stephens	<ol style="list-style-type: none"> <li>1. NHS and ACS information is shared in North Devon</li> <li>2. NHS Devon has plans to begin using electronic record systems. This will allow information to be shared between the NHS and ACS in the future.</li> </ol>	4	3	H

### 9.3 Chief Executives

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
CE 1	Communication for Emergencies	<p>Three staff members from Corporate Communications are required during emergency events to provide expertise at the HOCC, rest centre and press office. Historically, staff members were on salaried standby but due to financial pressures this is now changing to a good will basis. Therefore, Communications staff may not be available to assist with emergencies when needed and relationships with the public and media could suffer.</p>	Operational	Corporate Communications	Phil Norrey		2	2	L

## 9.4 Corporate Resources

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
CR1	Customer Service Centre telephone call answering priority	The volume of calls from the public to the Customer Service Centre (CSC) regarding an emergency can prevent routine calls being answered, some of which could be regarding child or adult safeguarding. Vulnerable people disassociated from the physical weather event could therefore be at risk from death, deliberate harm, neglect or abuse. Furthermore, it is unclear within many DCC Business Continuity Plans whether the telephone calls from business units that are non-operational due to the severe weather will also be diverted to the CSC. This would increase the number of calls to the CSC which will enhance this risk. The Weather Database suggests that weather events that affect large areas of Devon occur approximately on an annual basis.	Operational	Customer Service Centre	Heather Barnes	<ol style="list-style-type: none"> <li>1. An increase in call volumes of 10% will trigger requests to ask staff to work overtime in order to answer more calls.</li> <li>2. Discussions have started at CLT level to determine which services' calls will be given answering priority.</li> <li>3. Public could contact Emergency Services if call isn't answered.</li> <li>4. County Council Resilience Group Severe Winter Weather Action Plan (R20) – Review the role of the CSC in supporting other departments in an emergency.</li> </ol>	2	4	M

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
CR 2	Flood risk status of corporate property	It has not been determined whether any corporate buildings sit within the 1:100 or 1:1000 flood plain. Business continuity plans may therefore be inadequate and an unforeseen service interruption due to flooding could occur which would cause potentially unnecessary expenditure on clean up costs and inconvenience to service users.	Operational	Property and Business Transformation Unit	Heather Barnes	<ol style="list-style-type: none"> <li>1. Business continuity plans are being developed for all critical services</li> <li>2. When a change of use is proposed for a corporate building a flood risk assessment is performed</li> </ol>	1	2	L

## 9.5 Environment, Economy and Culture

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
EEC 1	Stone arch bridges	Some of the stone arch bridges built across Devon's rivers during the 19 <sup>th</sup> century are no longer able to cope with heavy precipitation events. The bridge structure impedes the flow of river water which, combined with land use in the catchment, causes roads and property to flood. This is occurring a few times each year.	Operational	Bridges and Structures	Chris McCarthy	<ol style="list-style-type: none"> <li>1. Bridges vulnerable to being damaged by high river flows are being identified and either monitored more closely or being assessed for any necessary protection work.</li> <li>2. A database of retaining walls supporting the highway and an inspection routine has been established.</li> </ol>	5	2	M
EEC 2	Damage to public rights of way	An opportunity exists to setup a process for sharing Environment Agency GIS flood data between authorities in Devon to make the identification of damaged rights of way quicker. This would enable more efficient and effective targeting of resources to implement remedial works. Closed paths affect local tourism income and attract local media attention.	Operational	Public Rights of Way	Chris McCarthy	<ol style="list-style-type: none"> <li>1. An effective working partnership exists between DCC and the Environment Agency</li> </ol>	3	2	L

ID	Title	Description	Type	Service	Owner	Existing Mitigating Controls	L	I	Rating (L x I)
EEC 3	Accelerating deterioration of highways	<p>The gradual warming of mean air temperatures and changes to rainfall patterns over the past few decades is causing more rapid ageing of asphalt roads, a lower ability of bitumen to adhere to aggregate and an accelerated rate of upward migration of tar layers in the road structure.</p> <p>These processes culminate in lower skid resistance, more rapid road surface deformation and increased stress on the supporting substrata which reduces the life of a road (For further information see Box 3). This is an ongoing process which is ultimately increasing maintenance requirements and costs.</p> <p>This has been a contributing factor to the damage caused to Devon's roads by the cold winters of 2008/09 and 2009/10 which received significant media attention.</p> <p>In addition to maintenance costs, a greater incidence of damage across the highway network will result in DCC being subject to more frequent public liability claims.</p>	Operational	Highway Management Group	Chris McCarthy	<ol style="list-style-type: none"> <li>The specification of compounds used to repair roads has been adapted for the changing weather conditions which the roads are increasingly subjected to.</li> <li>A budget is allocated for the payment of liability claims. An insurance policy exists for the event of a significant claim.</li> </ol>	5	4	VH



## 10 Conclusions and Recommendations

The WIA process has been used to identify the range of weather events that have hit Devon over the past ten years (flooding has been the most prolific) and describe how severe weather events in the recent past and gradual changes in weather have affected the services provided by DCC. Whilst this study has highlighted a small selection of vulnerabilities, which have been risk assessed (Section 9), generally DCC is resilient to extreme weather because its existing business continuity and emergency planning arrangements function well.

DCC and its partners on the Devon, Cornwall and Isles of Scilly Local Resilience forum have demonstrated that they respond effectively to extreme weather events. This is demonstrated by letters and emails received by the Authority from business leaders and local residents thanking the various response agencies for their efforts during the winter of 2008/09<sup>16</sup>.

There is a high level of awareness amongst staff of how weather can impact the business continuity of DCC services, perhaps in part due to the recent snow and flooding events. This is being translated into adaptation action as demonstrated by the range of adaptation that is already occurring. Furthermore, 'extreme weather' and 'disruption to DCC services' are listed in the Corporate Risk Register and are therefore identified as strategic risks to the Authority. However, these risks are absent from directorate risk registers (an exception to this is Environment, Economy and Culture which lists extreme weather).

This, combined with an overwhelming desire and commitment from staff to maintain service continuity, a wealth of technical knowledge and operational experience suggests that DCC has high capacity to adapt effectively to changing weather and future climate.

Due to the complex range of weather phenomena that combine to cause an impact, and the lack of recording of weather events by most DCC services, this study has been unable to identify specific thresholds of weather that will trigger the vulnerabilities identified. This is not a significant issue, however, as it can be assumed that the frequency with which weather events currently occur is likely to increase (except snowfall) under future climate change scenarios.

### Recommendation 1

It is recommended that extreme weather and associated disruption to directorate services is included within each directorate risk register as an operational risk. Specifically, it is recommended that business continuity plans are reviewed for their effectiveness, or in some cases developed, for when services are disrupted due to the inability of staff to travel around the county on business. Thirty of the 55 services interviewed in this study identified an inability to travel around Devon as being an issue for them during severe weather for which there are limited arrangements – decisions are made on an ad hoc basis when the situation arises. Some service business continuity plans do consider the loss of vehicular access to premises, including clients' premises, but not necessarily for all likely eventualities.

**Recommendation 2**

To monitor the effectiveness of business continuity arrangements and to enhance DCC's understanding of the impacts and true cost of severe weather on its services, it is recommended that the potential to develop a centralised process based around existing risk management protocols to record the impacts of weather on DCC's services is explored. The information collected could be considered by Directorate Management Teams and periodically reported to the Corporate Risk Management Group to inform the development of business continuity planning.

**Recommendation 3**

The risk scores of the vulnerabilities to current weather described in Section 9 should be discussed by the Corporate Risk Management Group and amended with regard to other organisational risks. Where appropriate, the vulnerabilities identified in Section 9 should be integrated into Directorate Risk Registers and the most effective ways of controlling them should be determined by Directorate Management Teams.

## 11 Next Steps

The next stage of DCC's work on adapting to climate change is to identify how future climate and weather could affect the delivery of the Authority's services and its priorities. Any significant vulnerabilities or opportunities that are identified will be risk assessed and recorded within the Authority's existing risk management registers. Appropriate risk management responses will be identified and implemented.

It is also necessary to inform the Devon Strategic Partnership of this WIA process and to engage the body in the identification and awareness raising of climate change risks to Devon's communities. This will complement the work of the Devon Futures Group.

## Annex 1 – Risk Assessment Guidance

This guidance on assessing risk is taken from the DCC Risk Management Policy and was used to assess risk within this study.

Assessment of Impact / Severity					
		Financial	Reputation	Stakeholders	Customers
1	Negligible	£0-25,000	Contained within the individual service area	Affects only 1 group of stakeholders	Minimal impact or service disruption to customers. Contained within service area
2	Minor	£25,000-£100K	Affects significant number of the service areas but with transient impact	Affects more than 1 group of stakeholders	Minor impact to customers and customer dissatisfaction. Limited service disruption
3	Moderate	£100K- £1m	Receives significant attention from within the organisation with potential to reach the public domain	Affects 2- 3 groups of stakeholders	Moderate impact to customers and customer dissatisfaction. Moderate service disruption
4	Major	£1m - £5m	Receives local press attention with immediate but not sustained impact	Affects 4-5 groups of stakeholders	Significant service disruption and customer opposition. Threat of legal action
5	Catastrophic	>£5m	Receives national / international attention with potential for persisting impact	Affects more than 5 groups of stakeholders	Major service disruption. Significant customer opposition. Legal action. Long term public memory

Assessment of Likelihood (in 5 year time frame)	
1	Very unlikely Unlikely to occur but not impossible
2	Possible Less likely to occur than not to occur
3	Possible/Probable Equally as likely to occur as not to occur
4	Probably More likely to occur than not to occur
5	Very likely Very likely though not certain to occur

Risk score category (as used in the Corporate Risk Register):

1 – 7	Low
8 – 11	Medium
12 – 19	High
20 – 25	Very High

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