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Weather-related costs to Aberdeenshire Council
Interim Report

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Executive Summary

This project was commissioned to help Aberdeenshire Council gain some insight into the costs and benefits of adapting to climate change. This interim report explores the evidence for weather-related expenditure by Aberdeenshire Council over the past five years, and makes recommendations for further phases of work.

Key Findings

- The Scottish climate is changing, and local authorities have an important role in supporting how we adapt to that change. Aberdeenshire Council has embraced this challenge by embedding climate change on their corporate Risk Register It is likely that exposure to weather-related events, and flooding in particular, will increase across communities as a result of climate change
- Different services collect different information on weather-related expenditure
- The absence of data for several services prevents a comprehensive overview across the Council
- Our analysis shows that Aberdeenshire Council incurs financial impacts as a result of extreme weather events. However, the available data can provide a very limited indication of the true costs.
- In addition, investment in responding to severe weather events is reactive rather than proactive, focused on dealing with the aftermath, rather than taking a strategic approach to increasing resilience.

Recommendations

1. A second phase of research is recommended to explore longer term options that address existing and emerging weather related risks.
2. The recording system could be adjusted so that the *cause* of the expenditure is identifiable. This could provide a mechanism for tracking these over time and identifying where costs are increasing, in turn identifying where there is a need for adaptive action.
3. Records could be kept at a whole Council level. This will enable comparisons over time, and identify possible costs that may be increasing so that appropriate action can be taken.

Contents

1. Introduction

The Scottish climate is changing, and local authorities have an important role in supporting how we adapt to that change. Aberdeenshire Council has embraced this challenge by embedding climate change on their corporate Risk Register, which helps them to understand and manage the potential impacts on their operations. In addition, the Climate Change (Scotland) Act 2009 introduced a legal obligation for all public bodies to address climate change through the Public Bodies Climate Change Duties, which includes supporting implementation of the statutory adaptation programme set out in Climate Ready Scotland (Scottish Government, 2014).

Scope of this study

This study explores the evidence for weather-related expenditure by Aberdeenshire Council over the past five years. We recognise that there are significant costs to the wider community, which could be explored in a further phase of the project, should that prove useful.

It was commissioned to help Aberdeenshire Council gain some insight into the costs of adapting to climate change. We began with discussions between Council staff and colleagues from SEPA, Scottish Water and Adaptation Scotland, exploring those operations where the impact of climate change could already be identified, to establish the evidence that was available for analysis. It was agreed that examining recent extreme weather related events had the greatest potential to provide insight into the costs and benefits to the Council and inform delivery of what are known as 'adaptation actions', which are intended to minimise some of the risks identified on their risk register.

1.1 Historic and recent weather trends

Over the past few decades Scotland has become warmer and wetter, with an increase in both total rainfall (especially in winter) and the occurrence of heavy rainfall events. Extreme weather events have always affected communities, but it is now very likely that they will become more frequent and more severe.

Scotland's Climate Change Trends Handbook describes the changes in weather patterns experienced in Scotland over the last century (Sniffer, 2014). Records for Scotland show that temperatures have increased over the last few decades – with the last decade being the warmest ever recorded. Rainfall patterns have changed, with increased rainfall and more, and heavier, downpours; sea-level rise is accelerating; and there have been fewer days with frost and snow cover (Adaptation Scotland, 2015). The maximum temperature has increased for all seasons, with spring seeing the largest rise.

The average length of winter cold spells has reduced by 7.5 days, along with a reduction of days of air and ground frost. Snow cover has also decreased, although this varies considerably from year to year. Average rainfall has increased since 1961, with an annual increase of 27%. While the number of days of rain has not changed significantly, there has been a significant increase in the number of days with heavy rainfall, particularly in winter.

In 2010 Aberdeenshire Council produced a Local Climate Impact Profile (LCLIP). This report identifies the number of extreme weather-related events that have affected a locality in the recent past, and the impacts, consequences and responses to them (Aberdeenshire Council, 2010). The process involves reviewing media reports of extreme weather events and conducting interviews with Council staff, stakeholders and the wider community. The results of the media search (Figure 1) show that instances of frost/ice/snow received the greatest reporting, followed by excessive rainfall and flooding.

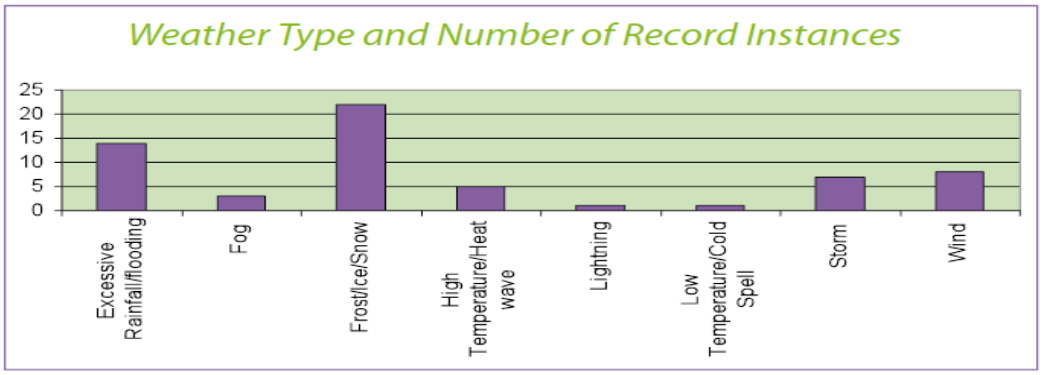

Figure 1 - Results from LCLIP media search - weather type and number of instances

The LCLIP also explored references to the main impacts of the extreme weather events (Figure 2). The largest impact discussed in the media was disruption to processes, followed by changes in use of facilities and services. The LCLIP focuses on reports in the media and thus does not represent a comprehensive or quantitative analysis of the impacts of extreme weather events in the region. It does however identify the issues that appear to have caused the greatest disruption or concern in the community.

Among the most significant weather events in the recent past was the flooding in November 2009. Three separate flooding events occurred on the 2nd, 13th and 28th, the first of which was the worst, resulting in several rivers bursting their banks after extensive rainfall. The ground was already saturated from an earlier event, resulting in extensive flooding. Over 200 properties suffered flood damage, including approximately 30 businesses. Several bridges were also damaged (three severely), roads and embankments washed out, and landslips triggered. Recreational facilities were damaged including footpaths, play areas, fences and access roads, with severe impacts on the Hill of Haugh/Nordic Ski Centre Huntly, Minerwell Park Stonehaven and parts of the Formartine and Buchan Way.

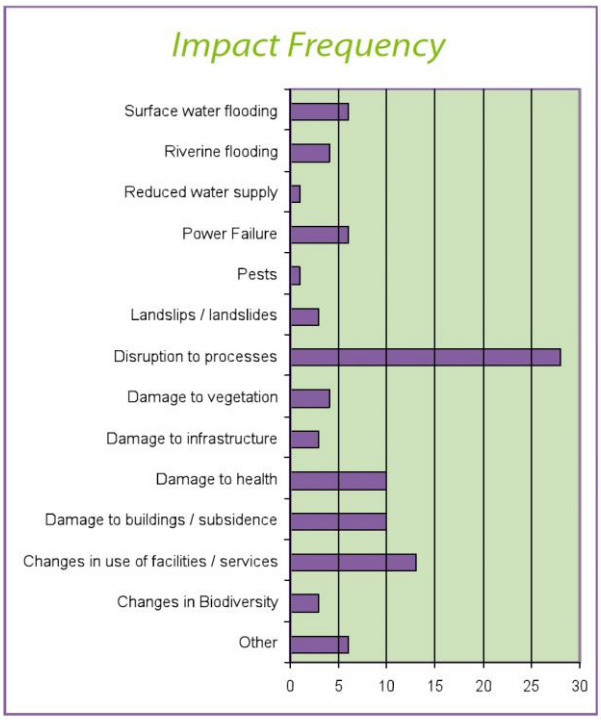

Figure 2 - Results from LCLIP report - impact frequency

Stonehaven and **Huntly** were worst affected, with evacuation required from a large number of properties, including specialist housing units for vulnerable people. Extensive flooding of Stonehaven Town Centre was caused by the River Carron overtopping its banks. In Huntly the River Deveron overtopped, flooding adjacent houses in the Meadows area.

1.2 Climate projections

The UK has produced comprehensive projections of future climates (UKCP09), further details of which can be found in Jenkins et *al*. (2009). These projections show a moderate decrease in summer precipitation for the East of Scotland by the 2050s with a projected decrease in precipitation of between 10 and 15% in most areas. The projected change in winter precipitation (for the same assumptions) shows an expected increase of 20% in most parts of the region, although a small area in the central massif is expected to experience a decrease. Over a longer period of time there is some confidence these changes will intensify.

Temperatures are also expected to change, with the summer average expected to increase by around 3 degrees by the 2050s, and that for winter by 1 - 3 degrees (most of the area is projected to experience an increase of 2 degrees).

Should these changes be realised, particularly the increase in winter rainfall, there would be important consequences for Aberdeenshire. It is likely that the frequency and intensity of extreme events will increase, so flooding is likely to remain an important consideration. On the positive side, projected increases in winter temperature may reduce private energy costs and the burden on Council's winter maintenance budget.

1.3 Climate risk register

Following the LCLIP project in 2010/11, the Council developed a Climate Change Risk Register, identifying 18 risks relating to flooding, disruption to infrastructure, drought, forest fires and landslides. The risk register is reviewed every six months and the outcome of the most recent assessment is summarised in Table 1. The table shows the inherent risk, which is a combination of the likelihood of an event occurring and its potential impact. It also shows residual risk – that is, the potential impact after the Council has identified mitigating action. On this basis, the most important climate risk to the Council would be damage to infrastructure as a result of natural or man-made disasters. Loss of buildings, personal property and businesses continues to be a significant risk, along with damage to road surfaces from climatic impacts other than flooding and the psychological impacts of adverse events, among others.

Table 1: Aberdeenshire council climate risk register 2015 (summarised)

Risk	Inherent risk	Residual risk
Road Network flooding	12	6
Risk of infection/ pollution of potable water inc flood waters/storm overflow polluting drinking water	9	3
Loss of buildings, personal property and businesses.	12	6
Damage to infrastructure	12	9
Damage to road surface on major routes from climatic impacts other than flooding	12	6
Psychological impact of adverse event	9	6
Extreme weather disrupting electricity, gas, telecommunication infrastructure, street lighting and traffic signals	9	6
Extreme winter temperature, increasing electricity/ gas demand for heating	9	4
Increase in crime	4	2
Properties become too high risk	6	3
Forest and moorland Fires	8	3
Water Shortage	6	4
Human Health	6	4
Livestock/ Vegetation	3	2
Financial Implication (Increase in cost of living)	3	2
Landslides	8	6
Inadequate sewer and drainage systems including sceptic tanks	6	4

1.4 Flood Risk

The Scottish Environment Protection Agency (SEPA) produces information on the main sources of flooding and associated impacts identified through the National Flood Risk Assessment (NFRA)[1]. They have identified 23 areas at the greatest risk to the impacts of flooding within Aberdeen City and Aberdeenshire (Figure 33). The NFRA has identified approximately 13,000 residential properties and 3,600 non-residential properties at risk in this district. Surface water run-off and rivers are

[1] http://www.sepa.org.uk/environment/water/flooding/flood-risk-management/national-flood-risk-assessment/

identified as the main sources of concern and coastal flood risk is not considered to be significant (SEPA 2015).

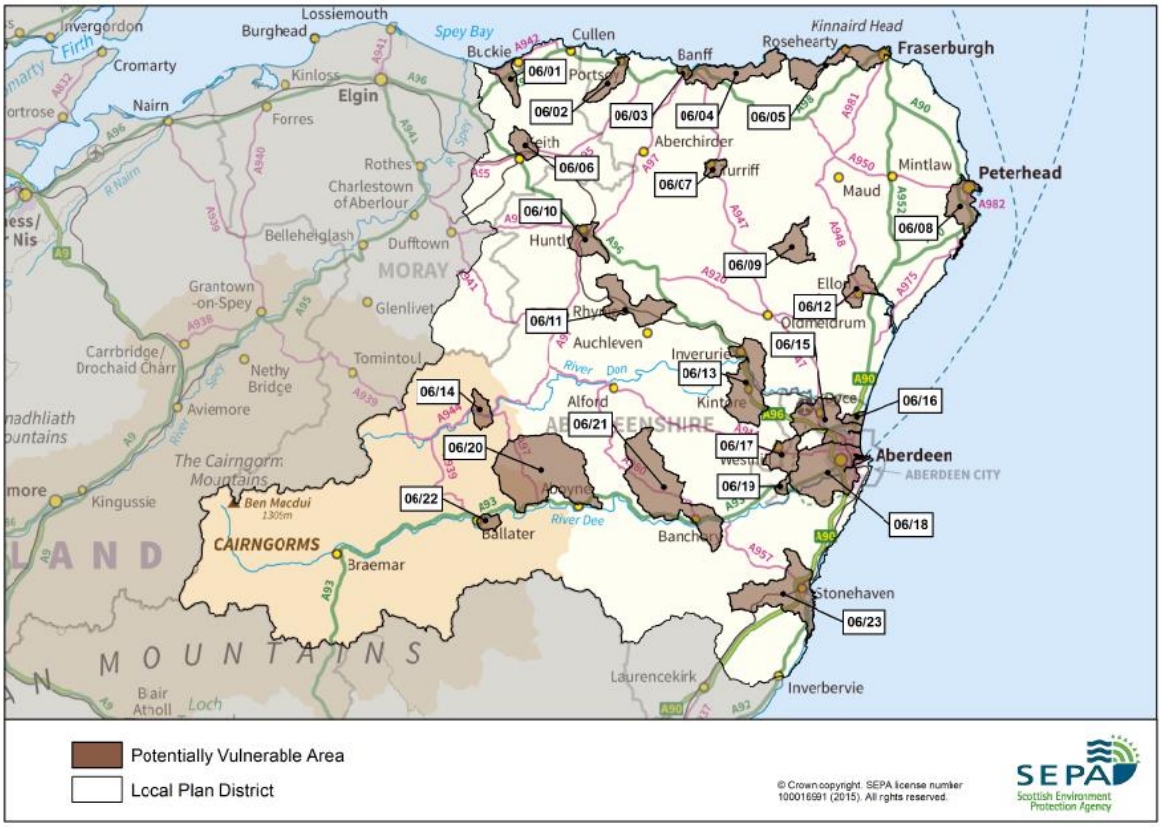

Figure 3 - Potentially Vulnerable Areas in the North East of Scotland

2. Methodology and available data

A primary aim of this study was to help the Council gain some insight into the costs of adapting to climate change. Identifying the extent of current activity was a first priority, and we began by holding wide-ranging discussions with staff. Direct contact was made with at least one representative from each of the Services listed previously, which helped us to understand how they currently respond to weather events and how that activity might be recorded. We retrieved valuable qualitative information, but quantitative data proved to be more challenging:

- data was not available for all years. In some cases reasonably detailed data was only available for one year, making temporal comparisons challenging;
- services do not routinely identify weather-related expenditure, so while there is an awareness that some costs are caused by weather, these have not been recorded and no trend can therefore be established;
- not all services were able to provide a response to our inquiries within the timescale. The authors are aware that a number of costs are missing: e.g. tree clearance from storm damage, and disruption to waste collection services.

We were however able to draw some meaningful conclusions from the available material.

3. Expenditure in 'normal' years and 'extreme' years

Two main types of expenditure were identified during the course of this study.

1. Weather related expenditure in years where no major weather 'event' occurred – 'normal' years. This type of expenditure is routine and absorbed into the everyday running of the Council. This has the potential to provide a useful baseline, although it is possible that that these expenses are increasing gradually and may become significant when aggregated across the Council.
2. Weather-related expenditure in 'extreme' years. These are years when there was one or more identifiable and memorable event that resulted in significant extra costs to the Council. These costs are often more easily identified and better recorded, sometimes to support a claim for support from the Scottish Government under the Bellwin Scheme of Emergency Financial Assistance to Local Authorities ('Bellwin' hereafter, see Box 1).

4. Council Services affected

Through informal discussions with Council staff and study of materials they were able to provide, we can now outline the main services within Aberdeenshire Council affected by weather-related events, and the ways in which the weather currently impacts on their functions.

Property and Facilities Management
The Property and Facilities Management service has responsibility for building and construction projects; management of the industrial/commercial property portfolio, and the repair and maintenance of council properties, including schools, libraries, sports facilities and care homes. This service is affected when properties under its care are damaged or affected by weather events.

Protective Services and Waste Management
Protective Services and Waste Management are primarily affected when their services such as waste collection are disrupted due to adverse weather conditions or flooding. The main source of disruption is domestic bin collection, where collections are delayed or cancelled and must be completed on other days, resulting in overtime and increased labour costs for the Council. This service also covers environmental health, where there are potential impacts through the risk, for example, of contamination and disease of water supplies. They are responsible for regulating private water supplies, which can be affected during periods of lower rainfall by reduced water availability and the potential deterioration in water quality. There is also a risk of contamination during heavy winter rainfall.

Roads and Landscape Services
Roads and Landscape Services suffer significant impacts. Routine salting of roads in winter is a considerable annual cost. When flooding occurs, damage and disruption to road networks, bridges and pathways can occur. Landslides in particular are a significant source of expenditure. Because of the scale of roads and bridges, costs can be extensive. Disruption has an impact, in turn, on transport, particularly in this large rural authority. While private operators deliver the majority of transport provision, the council is responsible for services such as school buses and social care.

This service also has responsibility for flooding and coastal protection. They routinely monitor areas that flood and identify priorities for action. They are responsible for planning major and minor flood

alleviation schemes, as well as emergency response. Flooding and coastal protection also deal with general enquiries from the public and respond to flood events. As this is such an important component of the Roads and Landscape Service, we refer to it as a standalone Service for the remainder of the report.

Planning and Building Standards

Planning and Building Standards must consider flood risk for future development. They are also responsible for the coastal path network in Aberdeenshire, which suffers regular erosion and landslides requiring remedial action, often at considerable cost.

Housing

Housing is affected through the need for extra maintenance or repairs, and evacuation of Council homes during flooding. They are also indirectly affected when private homes are flooded and the Council has some responsibility to provide emergency accommodation. Maintenance and repairs include the replacement of guttering following heavy rainfall, or damage caused by freezing and then thawing. Evidence of adaptation on a small scale was found in reports that wider gutters are now being installed to prevent future blockages.

The Bellwin Scheme

The Bellwin Scheme of Emergency Financial Assistance to Local Authorities is for emergency works sufficient to make things safe and preserve life etc. It is not designed to replace or repair capital assets. "The purpose of the scheme is not to put right all the ill effects resulting from an emergency incident but to provide a degree of financial protection to both local authorities and their local council taxpayers as a result of having to deal with an emergency situation over and above what could reasonably have been budgeted for (0.2% of their total net revenue budget)" (Scottish Government 2013). The scheme addresses revenue and uninsurable expenditure incurred from a two-month period following the incident.

Before being eligible for grant, an individual local authority is required to have incurred expenditure resulting from emergency incidents, which exceeds the local authority's threshold level within a financial year. The Finance Department collates information on behalf of Council, reviews and submits as necessary. Costs are borne by services in the first instance. There are strict rules on the costs that are eligible, and those for which claims cannot be made include:

- capital expenditure
- normal wages for workers whether they are diverted from their normal work or otherwise
- longer term works of repair or restoration
- any element of betterment, e.g. repairs to roads or buildings
- any amounts in respect of specific works on flood defence or coast protection that will be compensated by the Scottish Government's Environment and Rural Affairs Department by means of specific grant, and
- any capital expenditure which is of a long term or preventative nature and not therefore connected with the immediate action to safeguard life or property following an emergency incident.

Box 1 - The Bellwin Scheme[2]

4.1 Costs across all years

Figure 4 illustrates the expenditure by each service in addressing weather-related events, based on the information available. As outlined above, the data obtained is very piecemeal so these figures can only be indicative, and likely to be an under-estimation of the total costs. Expenditure eligible for the Bellwin scheme is included.

Although the proportion of costs varies to a certain extent year by year, Roads and Landscape Services are consistently highest. Flooding and coastal protection make up only a small proportion of the costs, but this is because much of the damage caused by flooding is dealt with in the affected services, such as Roads and Landscape Services. The flooding and coastal protection costs are made up of staff and contractors' time responding to flooding enquiries and emergencies, clearing up after flooding events, and updating plans with lessons learned. Small-scale flood protection would be also

[2] Bellwin guidance notes for claims http://www.gov.scot/Topics/Government/local-government/17999/Bellwin/Bellwin-Scheme-Guidance

included here, but not the major flood alleviation schemes such as in Huntly and Stonehaven (discussed below).

It is unfortunate that it is not possible to present a more comprehensive picture of all types of costs. The proportions of costs in Figure 4 only represent the data that were available, rather than all weather-related expenditure across departments. The dominance of Roads and Landscape Services may simply be due to the fact that that the Service was able to provide relatively comprehensive data. Notwithstanding, the expenditure in roads and landscape services does appear to be much larger than any other Service, and is explored in more detail below. Adaptation to climate change is a very complex issue and further thought could be given to how best staff can be supported in learning how it might impact on their current operations.

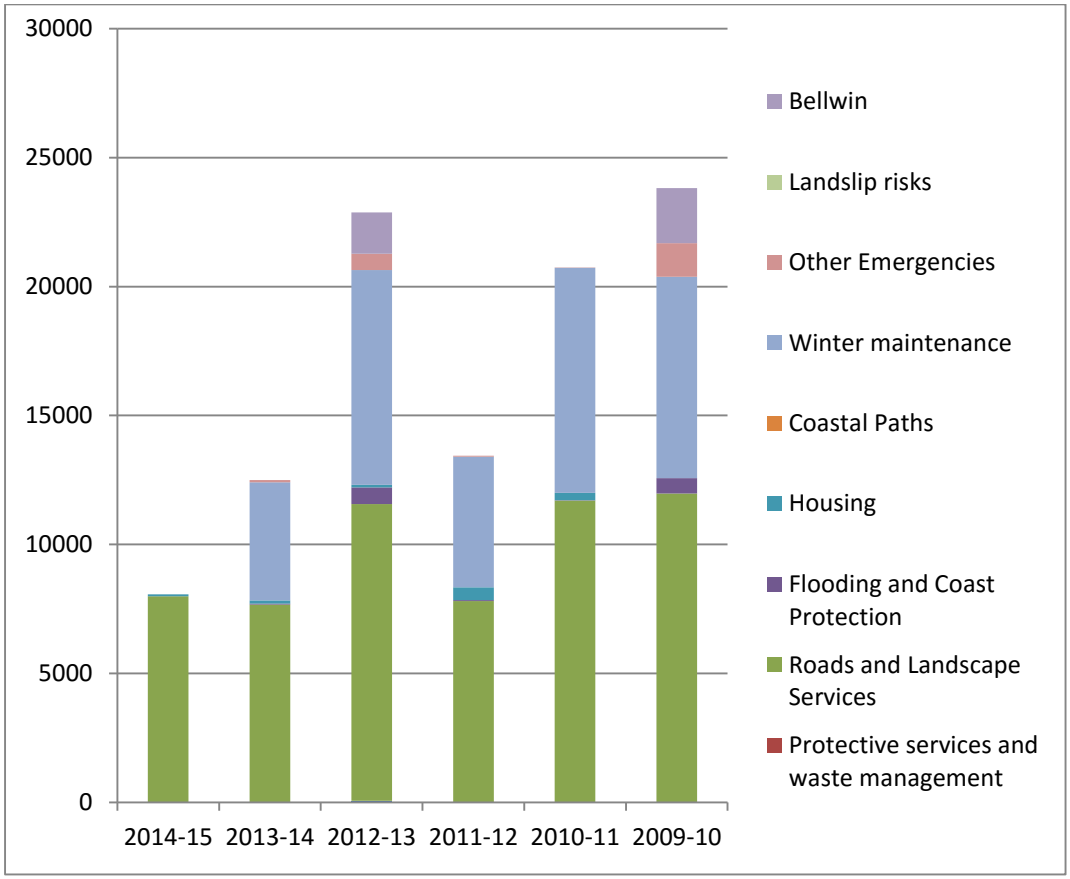

Figure 4 - Expenditure by Service across years

Breaking down the costs within Roads and Landscape Services, Figure 5 shows that the greatest expenditure is on winter salting. For 2009/10 and 2012/13 bridge loss due to flooding events was also significant. The values for 24-hour response provision, minor flood protection works, gully emptying, road drainage and culvert maintenance represent the allocated budget for each year, not necessarily what was spent, as this information is not routinely recorded.

It is possible that a changing climate may present an opportunity for reduced costs through fewer frost and snow days and warmer temperatures, thus reducing the need for winter salting.

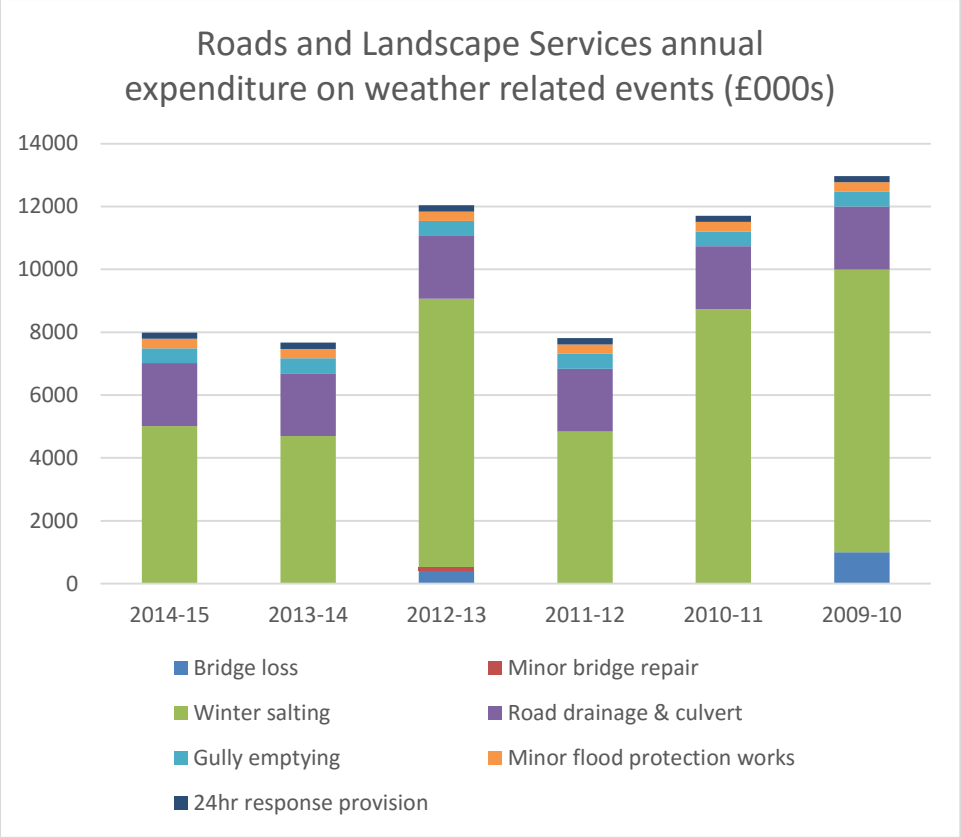

Figure 5 – Roads and Landscape Services annual expenditure on weather related events (£000s)

4.2 Bellwin claim

In 2009/10, a Bellwin claim was submitted, as the flooding events in November 2009 caused extensive damage and the costs incurred reached the 0.2% qualifying threshold for the scheme.

The total eligible expenditure in 2009/10 came to £2.14 million. The composition of the expenditure is illustrated in Figure 6, which highlights the dominance of roads and bridges and to a smaller extent, landslips, in the expenses incurred in that year. These were primarily as a result of the November 2009 floods, which particularly affected Huntly and Stonehaven. Other types of costs included path reinstatement, coastal protection and restoring amenity areas. Relatively minor costs were incurred for the repair of boardwalks, footways and footpaths, domestic property, a harbour, drainage systems and shelters, although it is important to remember the strict qualifying criteria that restrict eligible costs.

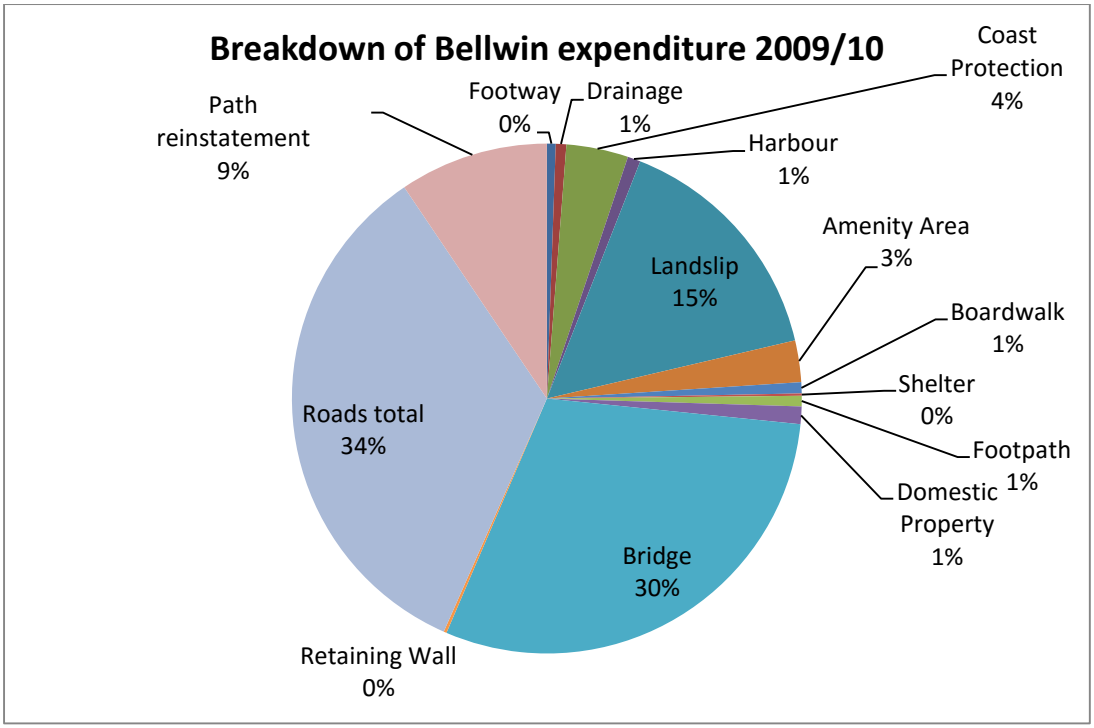

Figure 6 - Breakdown of Bellwin expenditure 2009/10

5. Impacts on and interactions with the wider region and community

In addition to the Council's own statutory and operational role, it works closely with partners and stakeholders who may also be affected by weather-related events in a changing climate change.

Examples include government bodies such as SEPA, Scottish Water and the NHS, commercial service providers such as transport companies, along with private businesses and individuals. The Council is considered to be the primary source of support in an emergency situation, so while it makes sense to start there, it is important to understand their links with the wider community.

It is well known that flooding can be very stressful and individuals may experience varying levels of psychological distress, at times requiring medical intervention. Apart from the distress to the individuals and their families, this poses a real cost to the NHS.

Examples of the relationship with the community can be seen through the Council's responsibility for housing private home-owners whose properties had been flooded. On the other hand when council-run school buses are not able to operate due to bad weather, there is potential for significant savings, estimated by one source to be in the order of £100 000 per day, that can be reallocated to other essential services. These types of interactions highlight the critical role of the Council in the wider regional network and the importance of considering the broader picture of activity.

6. Existing action

The significant flooding in Huntly and Stonehaven in 2009 repeated a pattern in earlier years. This prompted a decision to develop two major flood alleviation schemes to address the long-term risk. (see Box 2). Once these are in place, it is anticipated that they will reduce the impact, and hence

also the costs, from such flooding events. Lessons were also learned regarding the nature of the Council's response, as well as the importance of communities recognising where they could take preventative action.

In a survey of public concerns regarding the Council's response to the events in 2009, the following issues were raised (not in any order of importance):

- Insufficient sandbags
- Apparent lack of knowledge of drainage systems
- Level of ditch cleaning and gully emptying
- Lack of dredging of watercourses
- Capacity of drainage systems in new developments
- Landslips
- Lack of awareness of emergency procedures and contact numbers
- Lack of public awareness of how to respond
- Lack of clarity of role of Councillors and Community Councils
- Praise for a job well done given the limit of available resources
- Need for better warning systems and communication with public and businesses
- Need to promote concept of self-help and being prepared
- Need access to larger pumps

Five particular issues were identified for review by the Council, namely:

(i) communications, particularly the need to raise public awareness about flooding and keep those affected updated on actions;
(ii) the provision of improved flood warning information;
(iii) the provision of advice on sandbag availability:
(iv) the development of a better understanding of emergency procedures by all those involved; and
(v) ensuring corporate communications are advised at the earliest possible time during a major event

(Information from Report to Scrutiny and Audit Committee – 26 May 2010)

These issues highlight the importance of clear transparent communication at all stages from anticipatory action through to actions during an event. These findings are in common with other reviews of flooding (and indeed other types of disasters in general), e.g. The Pitt Review (Pitt 2008) and Environment Agency (2007). As the climate changes and extreme events become more frequent, it is critical that communities are empowered to take appropriate action themselves, rather than relying only assistance from agencies. The role of the Council, as much as removing or reducing the risk physically through flood defences for example, is also to ensure that communities and individuals have the information they need to help themselves.

Implementing these suggestions could result in reduced losses from future flooding events. Although it is not possible to compare events directly, it is worth noting that flooding did occur in these areas in 2012 and the financial costs borne by the Council were not as great as those in 2009. Further analysis would be required to determine whether this reflects changes in practice both by the Council and agencies, as well as the affected communities.

The Huntly Flood Alleviation Scheme

The low-lying Meadows area in Huntly has experienced several significant flood events, with many residential and commercial properties experiencing damage. The area was flooded in September 1995, April 2000, October and November 2002, and most recently September and November 2009.The Council looked into different options for addressing the flood risk of the Huntly area, which included:

- managed retreat
- upstream storage
- demountable defences
- raised defences
- increased culvert capacity
- local storage

Detailed modelling showed that a combination of raised defences on the River Deveron, increasing the capacity of selected culverts on the Ittingston and Meadow Burns and the provision of storage on the Meadow Burn are the most effective methods of providing flood risk management improvements for the community of Huntly (Aberdeenshire Council 2011) The proposed works will raise the standard of protection of property flooding from the 10% (1 in 10) annual chance event to the 0.5% (1 in 200) annual chance event. This recognises that the statistical distribution of extreme events is likely to change as a result of climate change, and what previously may have been a 1 in 200 year event may become a 1 in 50 year event, for example. While it is difficult to gauge changes in return periods, estimates suggest that winter rainfall events are likely to become more frequent, with mixed evidence for the direction of change for extreme summer rainfall events (Sanderson 2010).

Allowing for more frequent return periods in planning for climate change is an important adaptation tool, although this must be balanced with economic and social considerations.

Stonehaven Flood Alleviation Scheme

Major flooding events over the last century have had a significant impact on local residences and businesses within the lower reach of the River Carron, Stonehaven. They have occurred in Stonehaven over many years, most recently 1988, 1995, 2001, 2002, 2007, 2009 and 2012, requiring the evacuation of nearby residents, and causing considerable damage.

The proposed flood alleviation scheme includes the construction of defence walls and raising or modifying bridges along the River Carron. Self-raising barriers may also be installed in sensitive areas (JBA Consulting 2013)

Construction is expected to begin in January 2017, and the cost is currently expected to be around £15m.

Box 2 - Huntly and Stonehaven Flood Alleviation Schemes

7. Conclusions and Recommendations

Our analysis shows that Aberdeenshire Council incurs financial impacts as a result of extreme weather events. However, the available data can provide a very limited indication of the true costs. In addition, investment in responding to severe weather events is reactive rather than proactive, focused on dealing with the aftermath, rather than taking a strategic approach to increasing resilience.

While there is a general understanding within certain services of the damage, disruption and associated expense that major weather-related events can cause, there is no comprehensive overview of how these relate to a routine baseline across the Council. This is primarily the result of how expenditure is recorded within individual services, and across the Council as a whole. As a result, it is very difficult to determine the full extent to which weather is causing disruption and expense. This makes it almost impossible to establish the most appropriate adaptation action.

Different services collect different information on weather-related expenditure within the Council. In many cases the reason for the expenditure is not provided, so it is not possible to determine why costs are incurred. While the disruption and costs associated with major events are relatively clearly understood, there may be other issues that are gradually increasing in cost to the Council but are not currently being identified. While we can only speculate here what these may be, they could relate to increasing maintenance costs on the housing stock, changes to the incidences of new groundwater abstractions, or even the direct and indirect staff costs associated with dealing with an extreme event. Indirect staff costs may relate to the tasks that are not completed or delayed due to staff being redirected from their routine roles to deal with emergencies, for example.

While the development of the major flood alleviation schemes in Huntly and Stonehaven are important and will ideally reduce the future impact of flooding in those areas, the underlying driver for action was their vulnerability to extreme events. It is likely that exposure to flooding will increase across communities as a result of climate change, meaning that continued collaboration within the Council and with partners such as SEPA, in monitoring areas at future risk of flooding is very important.
The social and economic costs of recent events present a very compelling case for a proactive approach to increasing resilience. Based on these results, we recommend that:

4. the recording system be adjusted so that the *cause* of the expenditure is also identifiable. This could provide a mechanism for tracking these over time and identifying where costs are increasing, in turn identifying where there is a need for adaptive action. The benefits of a more co-ordinated approach across the Council include would support more strategic planning – collation is currently applied only in the event of an application under the Bellwin Scheme;
5. once the above recommendation of enabling greater traceability of expenditure has been implemented, records are kept at a whole Council level. This will enable comparisons over time to be made, and identification of possible costs that may be increasing so that appropriate action can be taken. Each service appears to have a budget to deal with a range of expenditures with no clear incentive for minimisation.

We believe implementation would provide a greater overview of the cost to the Council of weather related events and a base on which to build greater resilience to the effects of a changing climate.

8. Next steps

A second phase of research is suggested, with the aim of exploring longer term options to address existing and emerging weather-related risks, using innovative approaches to decision-making under uncertainty. The weather impacts and risks of to be studied will be decided upon together with relevant Council staff.

9. Acknowledgements

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