

**Open Report on behalf of Pete Moore, Executive Director of Finance and Public Protection**

Report to:	<b>Flood and Drainage Management Scrutiny Committee</b>
Date:	<b>29 May 2015</b>
Subject:	<b>Emergency Evacuation Route Signage</b>

**Summary:**

Flood risk management remains a high priority for Lincolnshire County Council within two of its Commissioning Strategies 'Protecting the Public' and 'Protecting and Sustaining the Environment'.

Severe coastal flooding is the largest natural threat to Lincolnshire. Whilst the threat brings uncertainty in forecasts of expected water levels, timescales, overtopping or breaches of defences, and of flood extent, this 'low likelihood' but 'high impact' severe weather event may be forecast up to 5 days in advance (although confidence increases the nearer the event) allowing for a range of preventative responses.

Preventative evacuation before the onset of coastal flooding has the potential to save lives but it can be costly in time, money and credibility. Success will depend on the combination of 'available time' and 'required time', with the effectiveness of measures such as communication, traffic management and decision-making being critical.

National and local evacuation planning assumptions indicate that 10% of the population 'at risk' may refuse to evacuate (and may require rescue at a later stage), and up to 15% may require physical assistance from authorities to leave their homes and/or for transport and temporary shelter. This may equate to as many as 15,000 persons in Lincolnshire during a 'most likely' scenario of multiple breaches during a 1:200 event. Providing this evacuation assistance and support will overwhelm local resources.

Every effort would therefore be required to encourage the remaining 85% of 'at risk' population to 'self-evacuate', using their own transport and finding their own alternative shelter or accommodation with friends or relatives.

A study commissioned by DEFRA examining the 'effective use of roads in Lincolnshire & North Norfolk to evacuate people' modelled the time required to safely evacuate coastal residents as between 21 and 30 hours. The study recommended that a managed evacuation strategy using pre-specified routes would perform better than allowing people to follow their own routes, and that information on routes to follow is critical to efficiency of procedures. In particular

this includes route signage.

A number of options for managing evacuation traffic have been explored by resilience partners (in particular LCC Highways, emergency planners, and Lincolnshire Police), including the deployment of personnel to direct traffic, temporary, permanent and electronic signage. Planners used the roads study to identify 12 optimum evacuation routes (largely based on the winter maintenance routes).

The deployment of official personnel to direct traffic will be essential at a number of major junctions, but reliance on personnel alone would be resource intensive, may expose them in isolated areas and direct them away from other emergency activity such as flood warning and assisting the vulnerable.

Therefore, and for public and responder safety and most effective use of responding resources, planners recommend the use of emergency evacuation route signage on all 12 identified routes, with a preference for permanent signage as being relatively cost effective and reinforcing community resilience.

#### **Actions Required:**

In advance of a decision paper being presented to the Executive on 7<sup>th</sup> July 2015, the Scrutiny Committee is asked to consider and support the proposal that the County Council (as Highways Authority) invests in the pre-production, installation and maintenance of signage along pre-identified evacuation routes on a permanent basis, in order to facilitate a safe and effective self-evacuation strategy that maximises public and responder safety whilst allowing most efficient use and prioritisation of responding resources during a coastal flood emergency.

- Permanent evacuation route signage is both reasonable and proportionate to public and responder safety in the context of the coastal flood threat
- Signage would make a significant contribution to safely achieving a key multi-agency operational strategy of 'removing people from danger' in advance of coastal flooding
- Evacuation route signage would be particularly effective in areas with a high transient or tourist populations (including non-English speaking)
- Opportunities for procuring and despatching temporary signage immediately before onset of flooding will be limited
- The recommendation presents a relatively cost effective solution
- The Secretary of State for Transport pre-authorized the use of specific symbol based, non-prescribed signs for this purpose immediately following the Tidal Surge of December 2013
- Permanent signage reinforces public awareness and acceptance of the routes
- Evacuation signage is consistent with wider coastal flood communications campaigns in Lincolnshire, reinforcing public education of the risk and strengthening community resilience

- Resilience planners recently reinforced support for signage during a review of coastal flood operational planning post the Tidal Surge of 2013

## 1. Background

### The Coastal Flood Risk

Severe coastal flooding is a 'tier one risk' to UK national security and the largest natural threat to Lincolnshire (see the Lincolnshire Resilience Forum's Community Risk Register; available at [www.lincolnshireprepared.co.uk](http://www.lincolnshireprepared.co.uk)). This 'low likelihood' but 'high impact' severe weather event may be forecast up to 5 days in advance (although confidence on the likelihood increases the nearer to the event) allowing for a range of preventative response options.

The threat of coastal flooding brings uncertainty in forecasts of expected water levels, timescales, overtopping or breaches of defences and flood extent. The impacts will include disruption to infrastructure, essential services and public health. Flooding affecting properties and parts of communities, damage to buildings/structures is possible, with danger to life due to fast flowing/deep water. Power and water supply disruption will affect areas outside the actual flood extent. Delays in restoring power and water supplies will impact living conditions on non-evacuees. Recovery will be a long process. Affected housing (whether evacuated or not) may not be habitable for a period of time.

Evacuation has the potential to save lives but it can be costly with respect to time, money and credibility (evacuating people before the onset of flooding has been a consistent recommendation since the report into the 'Great Storm' of 1953). Success depends on the combination of 'available time' (period between detection of threat and onset of flooding) and 'required time' (based on strategy and local circumstances). It may be achieved by targeted or prioritised evacuation (e.g. prioritising households within particularly high risk, low lying areas vulnerable to overtopping, or 'vulnerable premises' or known 'vulnerable people'), or by a full-scale preventative evacuation.

In some areas where even if severe flooding occurs, flood water may be shallow and slow moving and it may be appropriate for persons to shelter on upper floors of sturdy buildings within the area at risk (where these are available) until flood water recedes or rescue by suitably trained persons is possible.

There are a higher number than average of elderly people living with health and mobility challenges, and other 'vulnerable persons' living in these at risk coastal communities. There are also a number of 'vulnerable premises' including health and social care settings, schools, child day care, children's home, single storey dwellings and the largest concentration of caravans in Europe (economic experts from Sheffield Hallam University found that around 6,600 people were living in caravans or chalets along the coast, of whom 40 per cent were 'in effect full-time East Lindsey residents and should really be counted as such' (reported to East Lindsey District Council in 2011).

Due to all these factors it is thought probable that where adequate time is available for persons to leave the most at risk areas before the flooding occurs, the threat to human life (both the resident population and emergency services who would need to provide rescue or support for those remaining in a flooded area), will be reduced by evacuation when compared with the risk of remaining within the area at risk. This judgement may be affected by the presence of weather conditions, which make travel extremely hazardous such as serious snow or ice conditions on roads, the depth and flow of flood waters and the nature of dwellings (e.g. number of storeys) and availability of sturdy 'shelters' within the area.

There will remain important decisions based on confidence in the forecast, resources and infrastructure. The effectiveness of measures such as communication, traffic management and decision-making is critical. To be clear, evacuation will not be an automatic decision. Whilst it may be considered, there may simply not be enough time to achieve it or confidence in the level of threat until it's too late.

### **Evacuation Planning Assumptions**

In total, there are approximately **41,713 residential properties** at risk from a 'most likely multiple breach scenario' in a 1:200 annual chance event. This may equate to as many as between **22,823** people (in a 'reasonable worse-case' scenario from overtopping during a 1:1000 annual chance event) to **104,282** people (in a 'most likely' scenario following multiple breaches during a 1:200 annual chance event) being affected.

For the purpose of mass evacuation, transportation and shelter planning, the following assumptions are made;

- Between 10-20% of population at risk of flooding may refuse to leave (and may later require assistance once isolated by flood waters)
- Up to 15% of the population (e.g. up to 15,642 people) willing to evacuate may require physical assistance from the authorities to evacuate, and/or with transport and shelter. Helping protect these people will be a priority for responders but may quickly overwhelm local resources
- We have limited shelter infrastructure within the county, but with the assistance of neighbouring counties, may be able to shelter up to 15,000 people

Public communication effort will therefore be necessarily concentrated on **encouraging 85% of population at risk to 'self-evacuate'**, to use their own transport and to seek their own alternative shelter with friends, relatives, etc.

*(Please note: these assumptions can only ever be indicative and must be refined on the basis of dynamic threat / hazard assessments completed at the time by Met Office, Environment Agency (EA) and other flood risk authorities)*

## Using the roads of Lincolnshire for self-evacuation

To investigate the effective use of roads for evacuation in Lincolnshire and North Norfolk, DEFRA commissioned a study by flood risk management consultants from the UK (HR Wallingford) and Holland (HKV), together with University of Leeds, Institute for Transport Studies.

The study had three main objectives;

1. Analyse how the capacity of the roads in Lincolnshire and North Norfolk would restrict the free flow of traffic in the event of a major evacuation from the coast
2. Develop proposals for the improved management of evacuation including evacuation routes and signage
3. Develop maps for these recommendations

The study used traffic modelling for mass evacuation based 1:200 and 1:1000 annual chance flood events, identifying the optimum routes, traffic management strategies, congestion points and support service (e.g. fuel, roadside assistance, medical first aid) deployments.

An additional, and complementary, study (using the same methodology and modelling) into the 'Mass evacuation during a surge flood in Humberside: the effective use of roads in the Humber LRF to evacuate people' was published in March 2013 and examined some of the cross border issues to our North.

Together, the studies conclude:

- A managed evacuation strategy, using specific routes performs better than allowing people to follow their own or familiar routes
- Information on routes to follow during evacuation is critical to the efficiency of evacuation procedures; in particular this includes signage
- Route signage is critical in areas with high % transient or tourist populations
- Effective traffic management reduces the time needed for evacuation
- Without traffic management, around 30% of evacuees could well still be on the road network at the point of high tide
- With effective traffic management in place, between **21 and 30 hours** is required to safely evacuate threatened communities in Lincolnshire (**48 hours** is required to safely evacuate threatened communities in the Humber)
- People may be moved to 'first safe exits' within 18 hours, population may then disperse reducing impact on network

As a result of this study we have identified **12 optimum evacuation routes** in Lincolnshire directing people from affected communities within potential coastal flood zones to 'safe exit points'. These routes are largely based on the existing winter maintenance routes (see attached maps).

The road study recommended public education of evacuation routes and procedures for warning and informing the public during an evacuation itself.

## Evacuation Route Signage

Road signage is a common way of routing the public during an evacuation in countries such as the United States; however these may take many forms. The deployment of official personnel to direct traffic, temporary, permanent and electronic signs have all been used during evacuations to route the traffic and will all have their advantages and disadvantages.

The deployment of temporary signage to route traffic during an evacuation will depend on whether there is enough time and personnel available prior to the need to begin evacuation. In the case of the East Coast, this may depend upon the quality and lead-time of the forecast. However, in reality the lead time, which has been modelled as being required to evacuate people from the flood zone, may mean the possibilities for the deployment of signage immediately before an evacuation will be limited.

The use of official personnel to direct traffic (in addition to either temporary or permanent signage) is, in most cases, more likely to lead to drivers following suggested routes than by using signs on their own. Although this may reinforce the signed messages and should be considered for major junction points where routing of cars is critical, it will depend on the availability of personnel (which may direct them away from other emergency activities such as flood warning and assisting the vulnerable) and will of course require people to be exposed within an area. As the modelling for the east Coast suggested that maintaining the exit routes is critical to the effectiveness of an evacuation, this is where emergency personnel should be best deployed to manage the traffic.

Currently, any temporary road signage (including electronic or 'variable' signs) would need to be procured and dispatched immediately prior to any evacuation to aid the process. This has been considered as an alternative to permanent route signage, but would prove costly in time (and may not be achievable before onset of flooding), finance and resources. It also introduces something unfamiliar on the roads, which may prove distressing and confusing in a high-pressured evacuation scenario.

There are two options for permanent signs: i) stickers to be used as patches on existing direction signs, and ii) flip-style signs, hinged horizontally to allow the signage to be revealed when top half is released (dropped down).

Following consultation with relevant Executive Councillors, the *preferred option* for permanent signage is through 'flip signs'. They are not designed to frighten anyone or deter tourism from the area, but rather to encourage and facilitate 85% of the coastal population to self-evacuate, and to provide those people with the quickest route to safety that can offer them support should they run into any problems. These signs can be 'activated' either seasonally (e.g during winter months), or as part of early responses to forecast storm conditions likely to lead to coastal flooding.

Any permanent (or temporary) signs will be used for **'outward' routes only**. Additional signs could be used to indicate when evacuees are in a place of safety,

but public messaging would encourage them to carry on to a final destination as opposed to stopping where the signage ends, as this could lead to traffic build-up in the threatened area.

As a result of consultation between LCC Highways and Department for Transport, the Secretary of State for Transport has given authorisation for the 'placing at suitable sites' of prescribed signs 'authorised sign A' conforming to size, colour and character (see attached).

LCC Technical Services have created a series of detailed maps of the main 12 routes identified for potential signing (based on the HR Wallingford study) recommending signage profiles for each route. As a result it is estimated that there will be a 206 signs required in total, averaging 17 signs per route. The estimated cost of producing and erecting these signs is between **£105,000** (for stickers) and **£107,000** (for 'flip-signs', with dynamic activation costing an estimated additional **£2,000** per occasion).

### **Alternatives considered**

- No traffic management strategy to support evacuation: leaving members of the public to find their own routes away from evacuation zones (without traffic management, around 30% of evacuees could still be on the road network at the point of high tide).
- Evacuation traffic management strategy without signage: could be undermined by the availability of sufficient personnel, danger to personnel in exposed locations, resource intensive detracting from other emergency duties.
- Alternative signage provision at higher cost (e.g. temporary signs to be procured and deployed immediately ahead of onset of flooding (time and cost constraints), introduces something new and unexpected to the public during high-pressure scenario.

## **2. Conclusion**

Emergency evacuation is part of one of the key operational strategies ('removing people from danger') for responding to coastal flooding in Lincolnshire. Lincolnshire County Council and Lincolnshire Police have lead responsibilities for the planning and management of evacuation strategies and participated in the road study.

The study has demonstrated that a managed evacuation strategy, using specific routes performs better than allowing people to follow their own or familiar routes, and that information on routes to follow during evacuation is critical to the efficiency of evacuation procedures; in particular this includes signage. Route signage is critical in areas with high % transient or tourist populations.

A number of options for managing evacuation traffic have been explored by resilience partners (in particular LCC Highways, emergency planners, and Lincolnshire Police) including the deployment of personnel to direct traffic,

temporary, permanent and electronic signage. Planners used the roads study to identify 12 optimum evacuation routes (largely based on the winter maintenance routes).

The deployment of official personnel to direct traffic will be essential at a number of major junctions, but reliance on personnel alone would be resource intensive, may expose them in isolated areas and direct them away from other emergency activity such as flood warning and assisting the vulnerable.

Therefore, and for public and responder safety and most effective use of responding resources, planners recommend the use of emergency evacuation route signage on all 12 identified routes, with a preference for permanent signage as being relatively cost effective and reinforcing community resilience.

### **3. Consultation**

#### **a) Consultation with lead Government Departments, neighbouring areas and local flood risk managers**

Additional comments have been sought from neighbouring areas likely to be affected by similar evacuation challenges, together with Department for Communities & Local Government (DCLG), Cabinet Office (Civil Contingencies Secretariat) and Department for Environment, Fisheries & Rural Affairs (DEFRA). Letters of reply (Humber Local Resilience Forum and Norfolk County Council) and support ("*all three government departments welcome your proposals*" – see *appendix G*) are included in appendices.

The proposal has also been supported by the Lincolnshire Flood & Water Management Strategy Group at its meeting of 26 February 2015 (*minutes are available from Environment Agency*)

#### **b) Policy Proofing Actions Required**

##### **Equality Act 2010**

An Impact Analysis has been completed in respect of Equality Act 2010 'protected characteristics' and consideration given to the impact of this decision on people who may be vulnerable on account of disability. These same considerations are applicable in respect of first (non-English) language:

- The proposed signs comply with size, colour and characteristics authorised by DfT and are based on symbols and lettering only (making it easier to understand for people with learning difficulties and non-English speaking persons)
- A comprehensive communications strategy establishing emergency evacuation routes, the meaning and purpose of signage, will be required and made available in multiple languages and media



There are no other expected impacts in relation to all other persons with 'protected characteristics' (as defined by the Equality Act, 2010)

### Child Poverty Strategy

The Strategy has been taken into account in this instance and while there are no direct impacts the provision of emergency signage is expected to have a beneficial impact on the economy of Lincoln and the wider county and will therefore contribute to addressing economic poverty generally and therefore that of children.

### Joint Strategic Needs Analysis and Joint Health and Well-being Strategy

Consideration has been given to the JSNA and JHWS and as can be seen the proposals have significant benefits for both the health and wellbeing of people in the County.

### 4. Appendices

These are listed below and attached at the back of the report	
Appendix A	HR Wallingford: East Coast Flooding: 'The effective use of roads in Lincolnshire and Norfolk to evacuate people' – 'Summary' and 'Information and signage provided during evacuation sections' (only)
Appendix B	Authorisation for signage from Department for Transport
Appendix C	PDF maps of proposed emergency evacuation routes
Appendix D	PDF example of single route with signage locations
Appendix E	Costings section – permanent signage ('stickers' and 'flip-signs')
Appendix F	Proposed communications strategy
Appendix G	Letter of support from Department of Communities & Local Government (DCLG) – representing views of Cabinet Office (Civil Contingencies Secretariat) and Department for Environment Food & Rural Affairs (DEFRA) dated 27 March 2015
Appendix H	Letter from Humber Local Resilience Forum dated 17 February 2015
Appendix I	Letter from Norfolk County Council dated 26 March 2015

### 5. Background Papers

The following background papers as defined in the Local Government Act 1972 were relied upon in the writing of this report.

Document title	Where the document can be viewed
HR Wallingford: East Coast Flooding: The effective use of roads in Lincolnshire and Norfolk to evacuate people	This document is a 22 KB sized electronic file (including all maps). Full electronic copies on are available on CD disc – please contact Head of Emergency Planning & Business Continuity. A summarised version of relevant sections is attached at <b>Appendix A</b>

Mass evacuation during a surge flood in Humberside: the effective use of roads in the Humber LRF to evacuate people' (HR Wallingford, 2013)	For electronic copies (only) – please contact Head of Emergency Planning & Business Continuity. This document is 'owned' by the Humber & S. Yorks LRF
The response of vulnerable people to coastal inundation in Lincolnshire: A needs and actions analysis (Shaw, D. Scully, J. Hart, T, 2011)	For paper and electronic copies – please contact Head of Emergency Planning & Business Continuity
'The Caravan Communities of the Lincolnshire Coast' (Sheffield Hallam University report to East Lindsey District Council, 2011)	Reported to East Lindsey District Council and available via Sheffield Hallam University as a download on; <a href="http://www.shu.ac.uk/research/caravan-communities-lincolnshire-coast.pdf">www.shu.ac.uk/research/caravan-communities-lincolnshire-coast.pdf</a>
Community Risk Register (published by Lincolnshire Resilience Forum)	This document is only available as a 'download' on the LRF website; <a href="http://www.lincolnshireprepared.co.uk">www.lincolnshireprepared.co.uk</a>

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