

Gerald Lacey Memorial Lecture 2020

Flooding in England - Past, Present and Future

ICE Westminster *
Monday 18 May 2020

Background to the Gerald Lacey Memorial Lecture Gerald Lacey was the Professor of Civil Engineering (1915-17, 1928-32, and 1945) and the last British Principal (1945-46) of the University of Roorkee near Delhi. He earned worldwide recognition for his 'regime theory' used for the design of major irrigation canals, and made rich contributions to the field of Stable Channel Flow. For this, he was awarded the Kennedy gold medal in 1930 and the Telford gold medal in 1958. Every year, IWF (formerly ICID-UK) holds a prestigious lecture at the ICE, Westminster by a world authority in the irrigation and drainage development sector.

This lecture commemorates the contribution to irrigation development made by Gerald Lacey, who, through the development of his sediment regime theory, provided the insight and technical guidance that lay behind the successful development of the major irrigation systems throughout the Indian sub-continent.

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\* Due to the COVID-19 pandemic, this meeting was held online

### John Curtin

*Executive Director of Flood and Coastal Risk Management, Environment Agency.*

*John is responsible for the directorate which sets the direction for flood and coastal risk management, manages key stakeholder relationships and gives expert advice to government to help develop and implement flood and coastal erosion risk management policies.*

*During major incidents, John's role is to support the national coordination of the Environment Agency's response and to support their input into Government, including COBR. This was the role John played through the winters of 2013/14, 2015/16 and 2019/20 as the UK faced widespread flooding caused by the largest coastal surge in a generation and the wettest winter in 250 years in 2013/14, the wettest month on record in December in 2015, and many river level records broken this winter.*

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### Abstract

This lecture will provide an overview of the scale of the flood risk in England, touching upon historical flooding and for more recent flood events the impacts, the UK's response and the recovery from them, and looking ahead to the future of flood risk in this country – how do we become a nation ready for, and resilient to, flooding and coastal change?

Recent flood events include the winter of 2013/14, which started with the largest coastal surge in a generation and led to the wettest winter in 250 years. In the winter of 2015/16, Storms Desmond, Eva and Frank brought severe and damaging weather, leaving over 19,000 homes and businesses flooded in the north of England, whilst Environment Agency flood defences protected over 23,000 homes and businesses during the same period. The storms recorded record rainfall and river levels which led to the wettest calendar month on record in December 2015 and new 24 hour and 48 hour rainfall records for the UK.



And - not forgetting this winter – large parts of central and eastern England had twice the normal level of rainfall in October 2019, with central parts of England receiving a month's worth of rainfall in the early part of November.

With saturated catchments and highest ever river levels recorded on several rivers, November saw the most significant impacts in Yorkshire. February 2020 was the wettest February in the UK since records began in 1862

and for the 3 storms that occurred, peak river levels were the highest or second highest on record on 13 rivers. This winter over 4,600 properties flooded. We estimate that our flood risk management schemes have protected 128,100 properties in the same period.

Looking forwards, climate science is telling us that flooding in England is only going to get worse, so we have been developing a new Flood and Coastal Erosion Risk Management Strategy. John will explore what needs to change if we are going to become a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100.

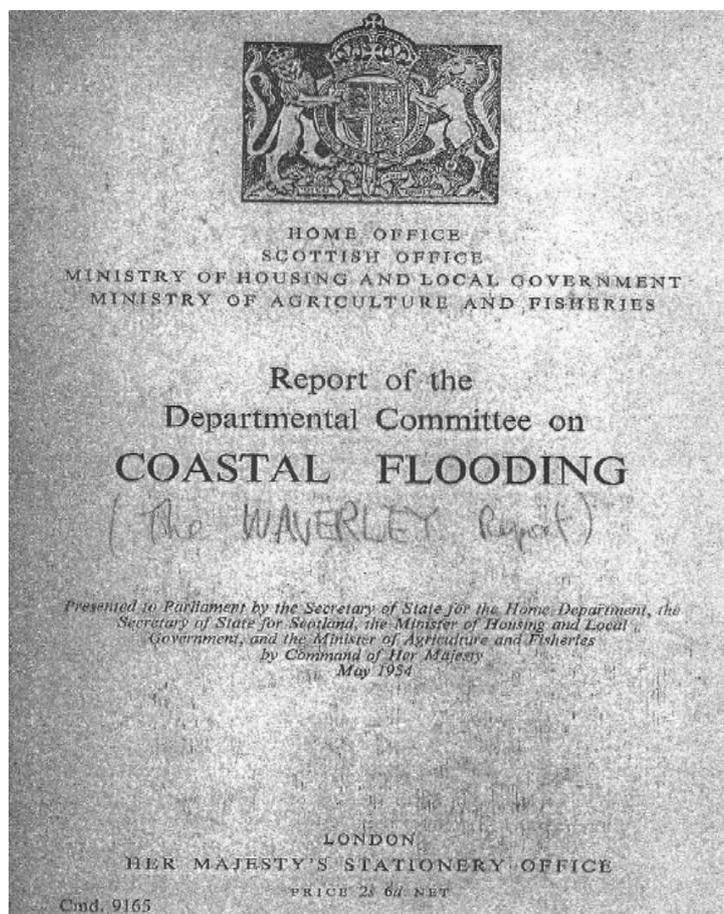
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## The Past

### Floods of 1953

#### Waverley Report (May 1954)

‘For 100 years there have been progressive increases both in the highest levels reached in exceptional storms and in the frequencies with which such levels occur.’



## The Present – a decade of flooding

### Scale of the challenge in England –National Risk Register

It is estimated that about 1 in 6 people in the UK are at risk of flooding.

The table below shows the approximate numbers of properties in England that are affected by flooding from rivers, coastal flooding, surface water flooding and groundwater flooding.

| Approximate Numbers of Properties affected by Flooding |                     |                                 |                                       |                                   |                                                        |
|--------------------------------------------------------|---------------------|---------------------------------|---------------------------------------|-----------------------------------|--------------------------------------------------------|
| Not susceptible to flooding                            | At risk of flooding | At risk of groundwater flooding | At risk of river and coastal flooding | At risk of surface water flooding | At risk from river, coastal and surface water flooding |
| 23 million                                             | 5.2 million         | 200,000                         | 2.7 million                           | 3 million                         | 660,000                                                |

### Winter Floods of 2013/14

2013/14 saw the wettest winter for 250 years, as illustrated by some statistics shown in the table below.

| December 2013                                        | January 2014                                                                  | February 2014                                                                   |
|------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>Most serious</b> tidal surge for <b>60</b> years. | <b>1.4 million</b> properties protected by Environment Agency flood defences. | <b>Thousands</b> of homes and businesses protected by temporary flood defences. |
| <b>155</b> severe flood warnings issued.             | <b>50</b> closures of the Thames barrier.                                     | <b>Largest</b> pumping operation ever in England.                               |
| <b>11,000</b> properties flooded.                    | <b>4,500</b> staff involved.                                                  | <b>2,500 km<sup>2</sup></b> of farmland protected.                              |

**December 2013** saw the most serious tidal surge in 60 years on the East Coast, causing extensive flooding, major coastal erosion and helicopters delivering supplies to communities cut off by the flood waters. We should never underestimate the mental impact of such flooding on people and communities.

**12 storms caused major floods in the winter of 2013/14**, because they all came one after the other. If they had struck one at a time, EA estimate they could have better coped with the situation. To illustrate the severity of these storms, a similar event in Japan would have set off tsunami warnings.

The flooding resulted in the inundation of the majority of the Somerset Levels and saw the main railway line to Cornwall and West Devon at Dawlish severed for several weeks.

**The Thames Barrier** more than proved its efficacy on 6 December 2013, when it protected London from the highest tide since the barrier was completed in 1984. There were 50 closures during that winter - over one quarter of all closures since the barrier was completed.

### Winter Floods of 2015/16

The winter of 2015/16 saw the arrival of Storms Desmond, Eva and Frank. Storm Frank was the most severe, and strong enough to disturb the path of the atmospheric river (intense moisture transport).

The north of England floods from 5 December 2015 to 6 January 2016, are illustrated by some statistics shown in the table below.

| North of England Floods: 5 December 2015 to 6 January 2016                              |                                                                                     |                                                                    |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Record Rainfall</b><br>December was the wettest month ever recorded. *               | <b>Highest 24-hour rainfall</b><br>341.1 mm - Honister Pass, Cumbria.               | <b>14 Catchments</b><br>Experienced their highest ever river flow. |
| <b>Properties Protected</b><br>12,500 during storm Desmond.<br>10,900 during storm Eva. | <b>Properties flooded **</b><br>About 13,000 households.<br>About 4,000 businesses. | <b>Over 350 Communities</b><br>Visited by flood support officers.  |
| <b>92</b><br>Severe flood warnings issued.                                              | <b>2,300 metres</b><br>of temporary barriers used to protect communities.           | <b>Around 650</b><br>Flood risk assets needing repair.             |

\* Met Office data. \*\*Department for Communities and Local Government data.

## December 2015 record breakers

- 24-hour rainfall record for Honister Pass, Cumbria - 341.4 mm.
- New 48-hour rainfall record for Thirlmere - 405.0 mm.
- Wettest calendar month on record.
- Largest ever flows recorded on English rivers (around 1,700 m<sup>3</sup>/s in Eden, Lune and Tyne).
- Soil Moisture Deficit <= 10 mm in most areas of England.

## Warning and Informing 2015/16

|                                                             |             |
|-------------------------------------------------------------|-------------|
| Total number of <b>Flood Warnings</b> issued by FWD.        | 529         |
| Total number of <b>Severe Flood Warnings</b> issued by FWD. | 92          |
| Total number of <b>Messages</b> sent, issued by FWD.        | 860,961     |
| Total number of <b>Visits</b> to live flood warning map.    | 7.2 million |



### FLOOD WARNING

FLOODING IS EXPECTED. IMMEDIATE ACTION REQUIRED.

## Winter 2019/20 Flooding

### Significant recent flood events

| Year    | Flood event                         | Properties flooded | Properties protected |
|---------|-------------------------------------|--------------------|----------------------|
| 2019/20 | Yorkshire and Storms Ciara & Dennis | 4,633              | 128,141              |
| 2015/16 | North of England Floods             | 17,000             | 23,400               |
| 2013/14 | Winter Floods (Dec '13 to May '14)  | 11,000             | 1.4 million          |
| 2012    | 2012 Floods (Mar to Dec)            | 7,900              | Approx.200,000       |
| 2007    | Summer Floods                       | 55,000             | Approx.100,000       |

### Flood Service Summary - February 2020



|                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Warning Messages Sent</b><br>Phone: <b>1,400,000</b> Email: <b>564,600</b> SMS: <b>537,500</b>                | <b>Visits to GOV.UK Flood Information Service</b><br>Users: <b>3,111,486</b> New Users: <b>2,857,677</b> Pageviews: <b>30,087,582</b>                                                                                                                                                                                                                                  |
| <b>Registrations to the Flood Warning System</b><br>Home: <b>11,822</b> Business: <b>1,042</b>                   | <b>Live feedback received on FIS GOV.UK</b><br><b>Satisfied: 68% Dissatisfied: 29% No opinion: 3%</b>                                                                                                                                                                                                                                                                  |
| <b>Number of calls to the Floodline Recorded Message Service</b><br>RMS: <b>21,117</b> Call centre: <b>6,646</b> | <b>Feedback - 27/02/2020, 12:31:54</b><br><b>Very satisfied</b> ... Good linkage to nearby areas, etc. Trend chart and areas that offer prediction services is very valuable. Very clear when data was last updated, etc. Would be nice to have a slightly larger timeline option, e.g. past week and slightly further forward predictions (if the data is available). |

## The Future – my personal view on the three leadership challenges to creating a flood resilient nation

### Challenge 1: Adaptation is not a failure ...

#### Currently, Mitigation is the Political Strategy

- **Future increases in extreme hourly rainfall intensity** By 2020, extreme hourly rainfall intensity associated with an event that typically occurs once every two years, increases by **25%**.
- As the population grows, we are more likely to see the number of properties built on the flood plain almost **double by 2065**.
- Summer temperatures could be up to **5.4 °C hotter by 2070**, while winters could be up to **4.2 °C warmer**.
- Wetter winters: there could be up to **35% more precipitation in winter**.
- Drier summers: Average summer rainfall could decrease by up to **47% by 2070**.
- About **1.8 million** homes are at risk of coastal flooding and erosion in England.
- **0.4 to 1 metre** sea level rise predicted by **2100**, and a coast continuing to change.
- **5.2 million** homes and businesses in England are at risk of flooding, with numbers rising over future decades.

### Challenge 2: The social & infrastructure resilience balance (or the myth of protection)

**Developed Economies** are generally characterised by having Community Resilience **greater than** Infrastructure resilience.

In **Developing Economies**, on the other hand, Community resilience is generally **less than** Infrastructure Resilience.

**What is this nation's balance between resistance and resilience?**

### Challenge 3: Breaking the crisis cycle

- The current National Flood and Coastal Erosion Risk Management (FCERM) strategy up to 2100 was published in May 2011.
- Climate resilient plans.
- Today's growth in infrastructure - resilience in tomorrow's climate?
- A nation ready to respond and adapt to flooding and coastal change.

And finally .....



Reported by  
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