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Ask for: Andrew Tait
Date: 17 July 2018

Dear Member

KENT FLOOD RISK MANAGEMENT COMMITTEE - MONDAY, 16 JULY 2018

I am now able to enclose, the following presentations to the Kent Flood Risk Management Committee meeting on Monday, 16 July 2018 that were unavailable when the agenda was printed.

Agenda Item No

4 **Presentation by Mark Rogers from the Met Office (Civil Contingencies) on the Met Office early severe weather warning, climate trends and their implications for flood risk (Pages 3 - 32)**

5 **Presentation by the Environment Agency on future flood risks to Kent (Pages 33 - 46)**

6 **Kent and Medway Offsite Reservoir Inundation Emergency Plan (Pages 47 - 56)**

Yours sincerely

Benjamin Watts
General Counsel

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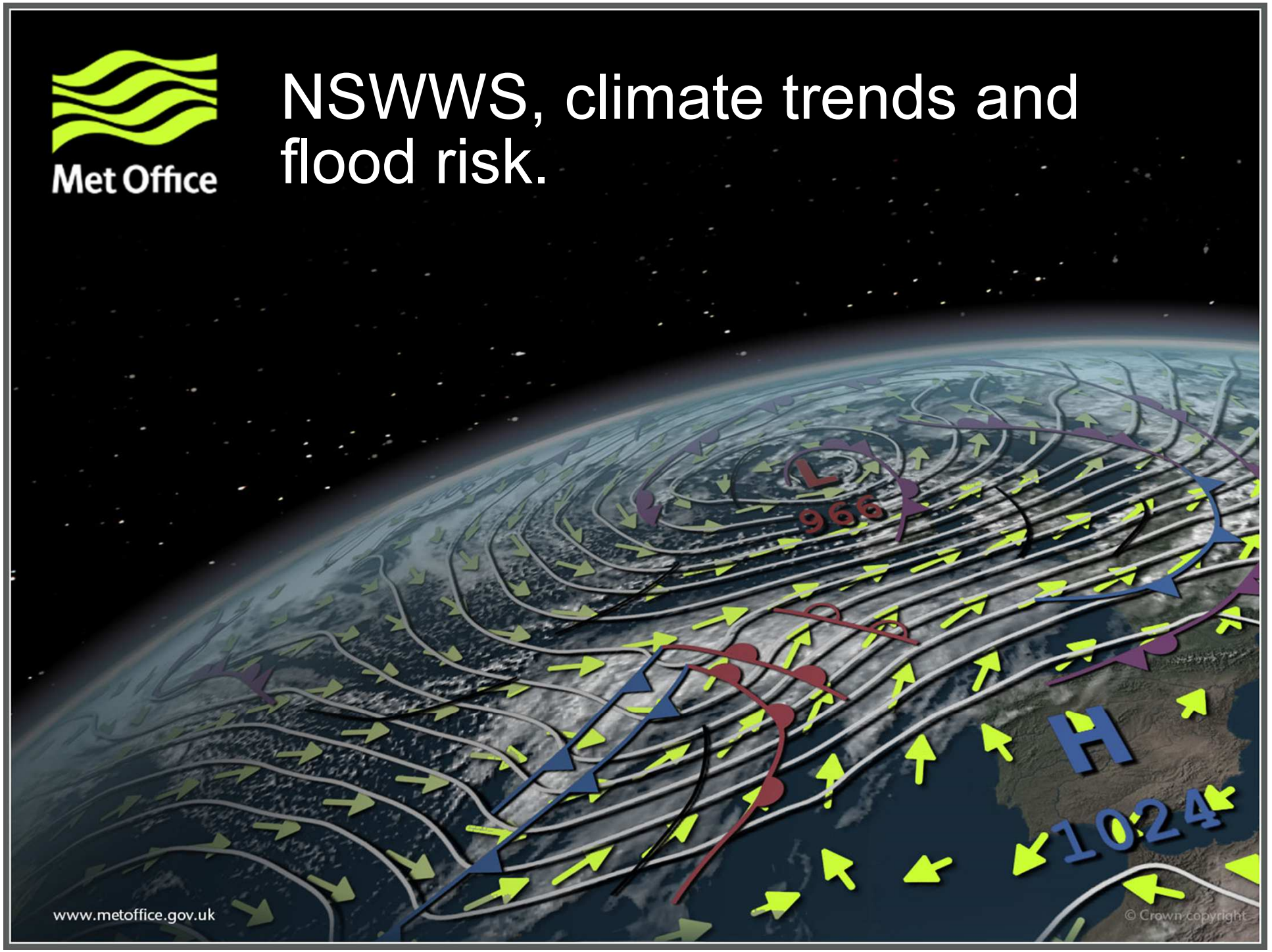
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NSWWS, climate trends and flood risk.
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National Severe Weather Warning Service (NSWWS)
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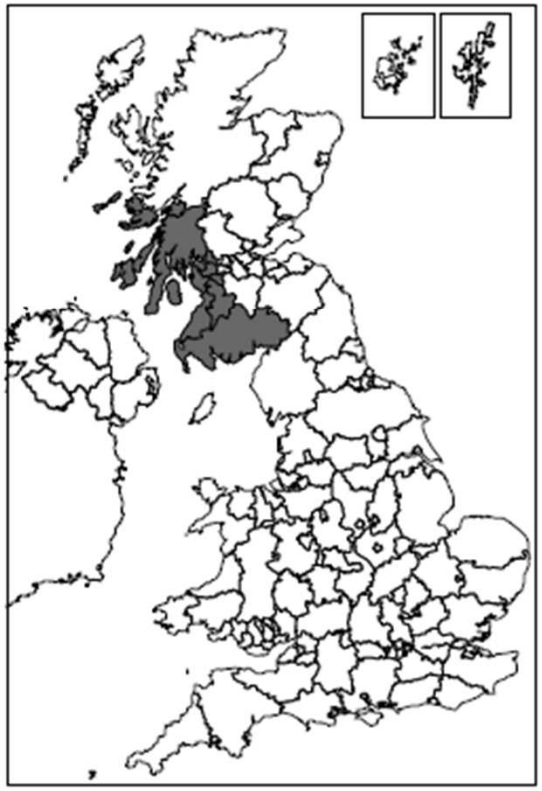
Threshold Based – 1988 to 2011

National Severe Weather Warning Service

FLASH WARNING

Set up as a threshold based warning system. Warnings were issued when the probability of thresholds being met was reached.

For example : 80% confidence of gusts reaching 70 mph or more.



Impact Based – 2011 onwards

	Very Low	Low	Medium	High
Impact and advice applying to ALL SEVERE WEATHER	On the whole, day to day activities not affected but some localised, small scale impacts occur A few transport routes affected.	Some short lived disruption to day to day routines in affected areas Incidents dealt with under‘ business as usual' response by emergency services Some transport routes and travel services affected. Some journeys require longer travel times. .	Injuries with danger to life Disruption to day to day routines and activities. Short-term strain on emergency responder organisations. Transport routes and travel services affected. Longer journey times expected. Some vehicles and passengers stranded. Disruption to some utilities and services. Damage to buildings and property.	Danger to life Prolonged disruption to day to day routines and activities Prolonged strain on emergency responders organisations. Transport routes and travel services affected for a prolonged period. Long travel delays. Vehicles and passengers stranded for long periods. Disruption to utilities and services for a prolonged period. Extensive damage to buildings and property.

What is warned for?

Rain

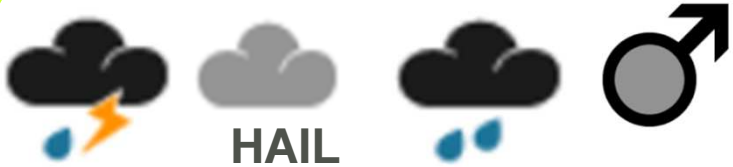
Wind

Snow

Ice

Fog

Lightning



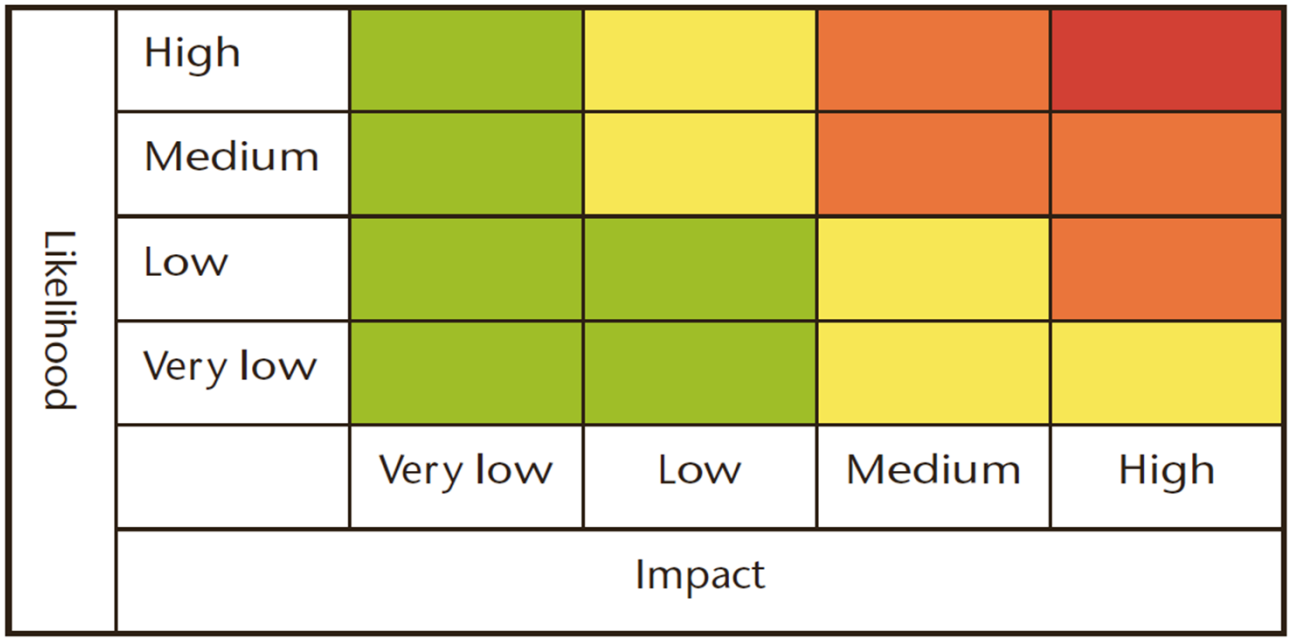
Thunderstorm

Warnings can be issued out to 7 days ahead

Impact Matrix

Likelihood and Impact are plotted onto a Weather Impact Matrix

Likelihood of impacts occurring

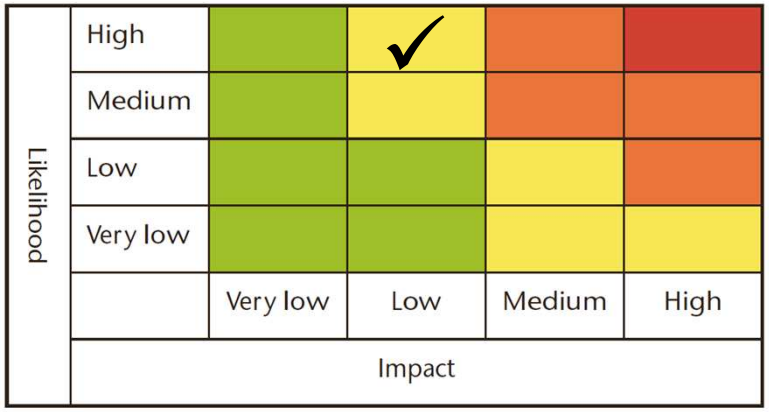


Level of impacts Expected

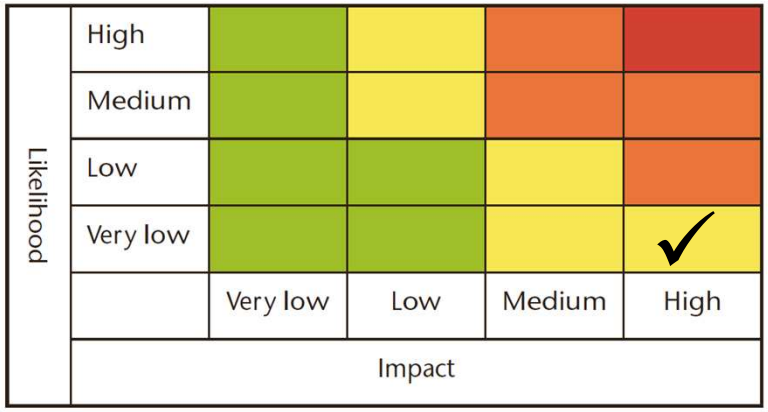
Plotting the Likelihood against the Impact allocates the warning a colour. The location of the tick in the box is the important element NOT the colour!

Locate the tick!

It is very important that you look to see where the tick is on the matrix. Yellows are not all the same!



Low impacts – no major issues?



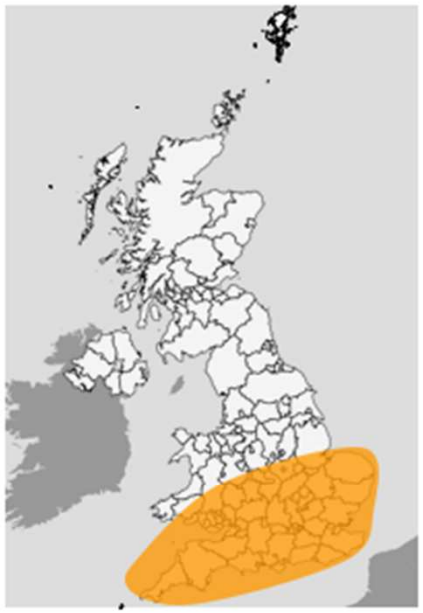
High impacts – risk to life?

Example Warning

Met Office — National Severe Weather Warning Service

Amber warning
Rain

Between
02:00 Tue 24 Apr 2018 and
12:00 Tue 24 Apr 2018



Further heavy rain expected through Tuesday.

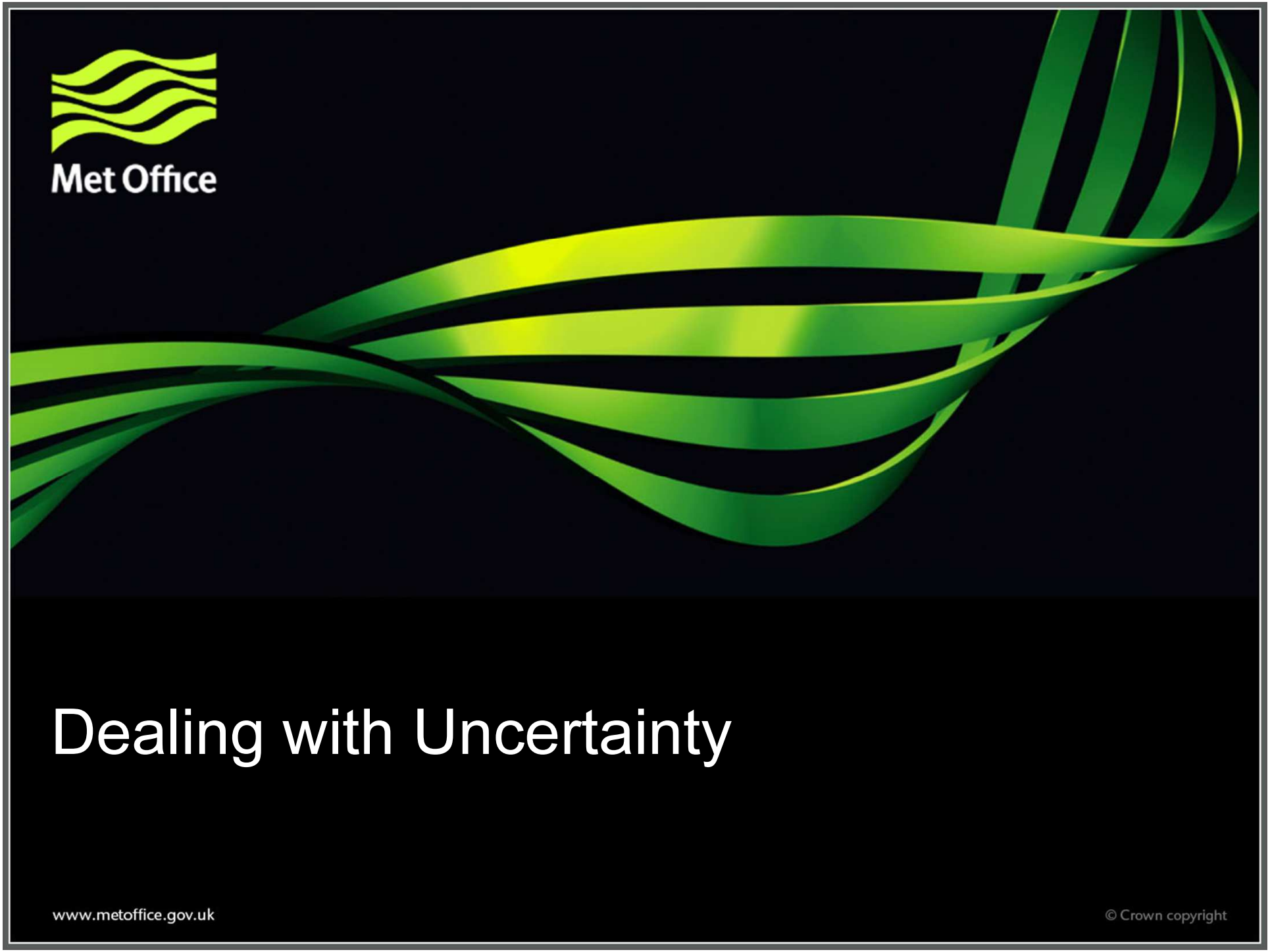
What to expect

- Homes and businesses are likely to be flooded, causing damage to some buildings
- Fast flowing or deep floodwater is likely, causing danger to life
- Delays and some cancellations to train and bus services are likely
- Spray and flooding probably leading to difficult driving conditions and some road closures
- A good chance some communities cut off by flooded roads
- Power cuts and loss of other services to some homes and businesses likely

Further details

An area of low pressure will move across central parts of the UK bringing areas of heavy rain across southern parts of England and Wales giving 40-50 mm quite widely, but locally as much as 60-70 mm, falling onto already saturated ground.

Issued at 12:49 Sun, 22 Apr 2018
For enquiries regarding this warning please contact the Met Office Weather Desk Phone: 03709000100
E-mail: enquiries@metoffice.gov.uk
Visit: www.metoffice.gov.uk/premium/hazardmanager



Dealing with Uncertainty

Level of Certainty

The Met Office Chief Forecaster monitors other information in addition to that from the UK, including USA, Germany, Japan, and France.

Model output similar leads to certainty 

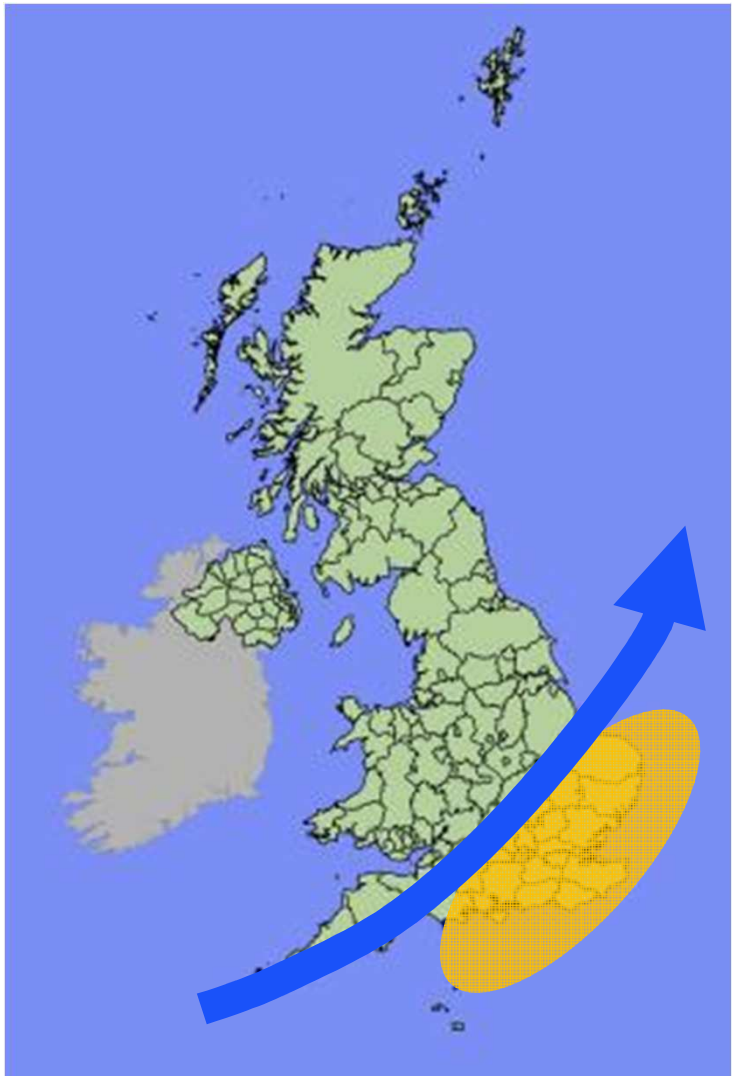
Model output different leads to uncertainty 

If necessary the Chief Forecaster can adjust the UK model to bring it into line with other information.

Dealing with uncertainty - example

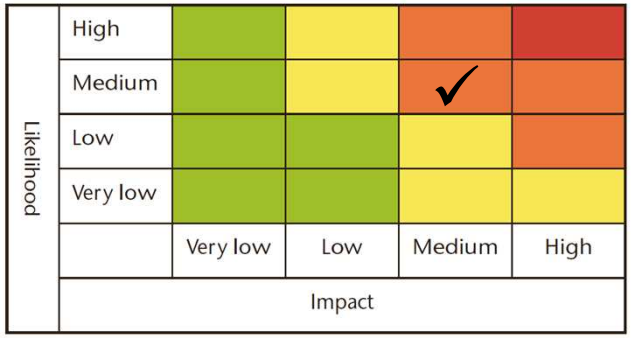
Here the model is suggesting that the track of the low pressure will be across central Southern England with the strongest winds across SE England.

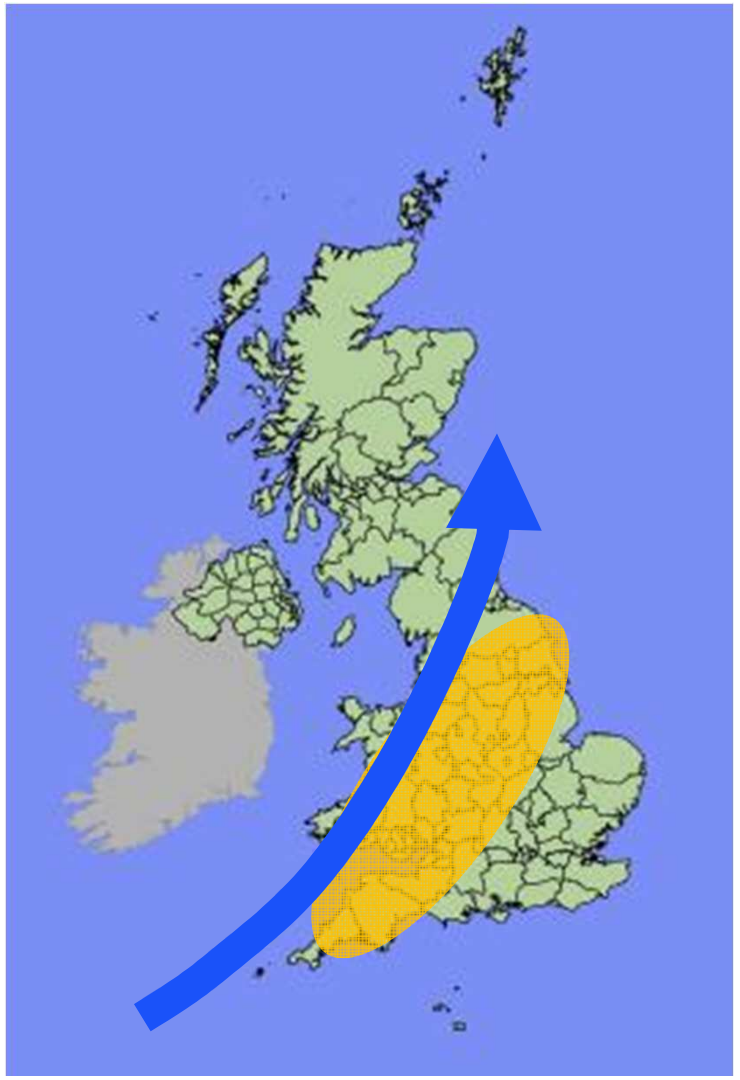
Likelihood					
	High				
	Medium			✓	
	Low				
	Very low				
		Very low	Low	Medium	High
		Impact			



Dealing with uncertainty - example

However, this model is suggesting a track further northwest across Wales and northern England with the strongest winds across western and into northern England.

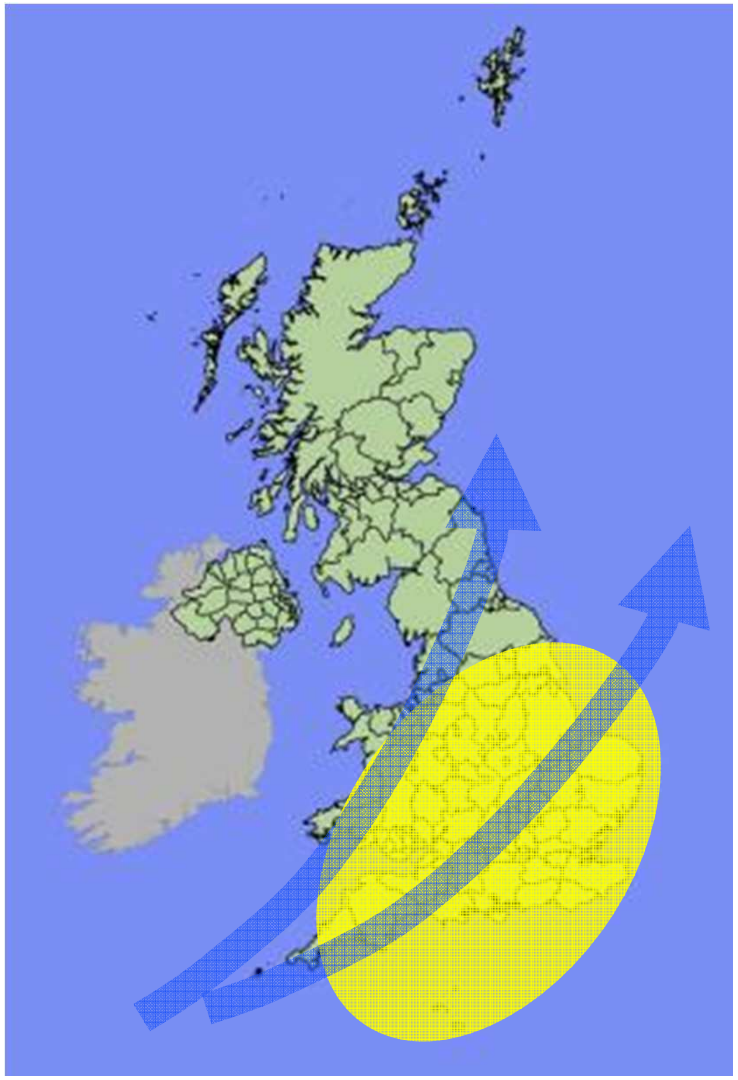




Dealing with uncertainty - example

Due to the uncertainty around the track a larger area may be covered by the warning with a lower likelihood.

Likelihood					
	High				
	Medium				
	Low			✓	
	Very low				
		Very low	Low	Medium	High
	Impact				




Met Office
Assessing Risk
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Assessing the Risk

Location

Rural

Urban

Coastal

Assessing the Risk

Current conditions

Assessing the Risk

Time of year

Assessing the Risk

Time of day / day of week


Met Office
Flood Guidance Statement
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Flood Risk

Flood Guidance Statement

10:30hrs Saturday 12 May 2018

FLOODFORECASTINGCENTRE

a working partnership between Environment Agency | Met Office

Saturday	Sunday	Monday	Tuesday	Wednesday
12 May 2018 10:30-23:59	13 May 2018	14 May 2018	15 May 2018	16 May 2018
Trend since last FGS				
Steady →	Steady →	Increased ↑	Increased ↑	Increased ↑

Severe coastal flooding impacts are probable on Monday and Tuesday in parts of the south of England. Severe river and surface water flooding impacts are possible on Monday and Tuesday. See end of FGS for 6-10 day forecast.

Flood Risk

Specific Areas of Concern map 3: Monday 14th and Tuesday 15th May 2018

RISK AREA **C**
Impact **SEVERE**
Likelihood **MEDIUM**

Source **Coastal/Tidal**
Likely duration **2 Days**

Impacts mainly around the Monday evening and Tuesday morning high tides

RISK AREA **D**
Impact **SEVERE**
Likelihood **LOW**

Source **River Surface**
Likely duration **2 Days**

Impacts most likely in urban areas and on rapidly responding rivers

RISK AREA **E**
Impact **SIGNIFICANT**
Likelihood **MEDIUM**

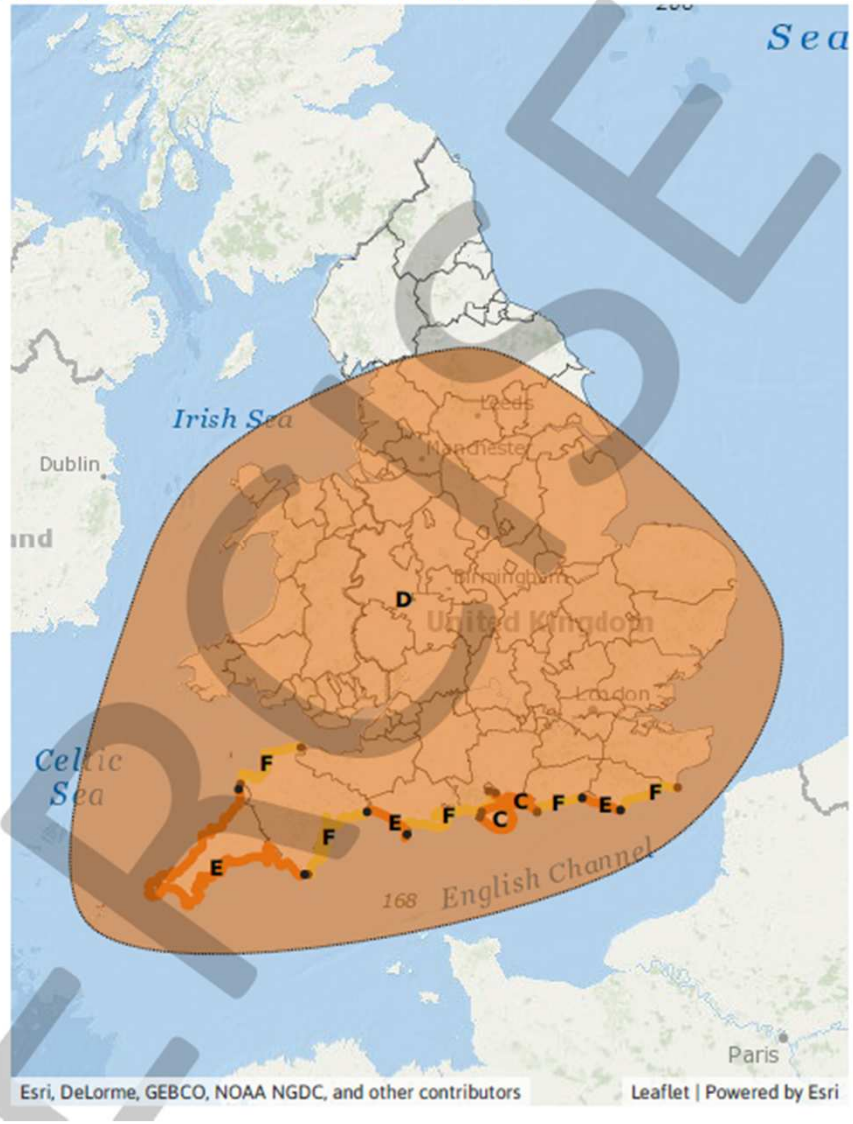
Source **Coastal/Tidal**
Likely duration **2 Days**

Impacts most likely around the Monday evening and Tuesday morning high tide

RISK AREA **F**
Impact **SIGNIFICANT**
Likelihood **LOW**

Source **Coastal/Tidal**
Likely duration **2 Days**

Impacts mainly around the Monday evening and Tuesday morning high tide

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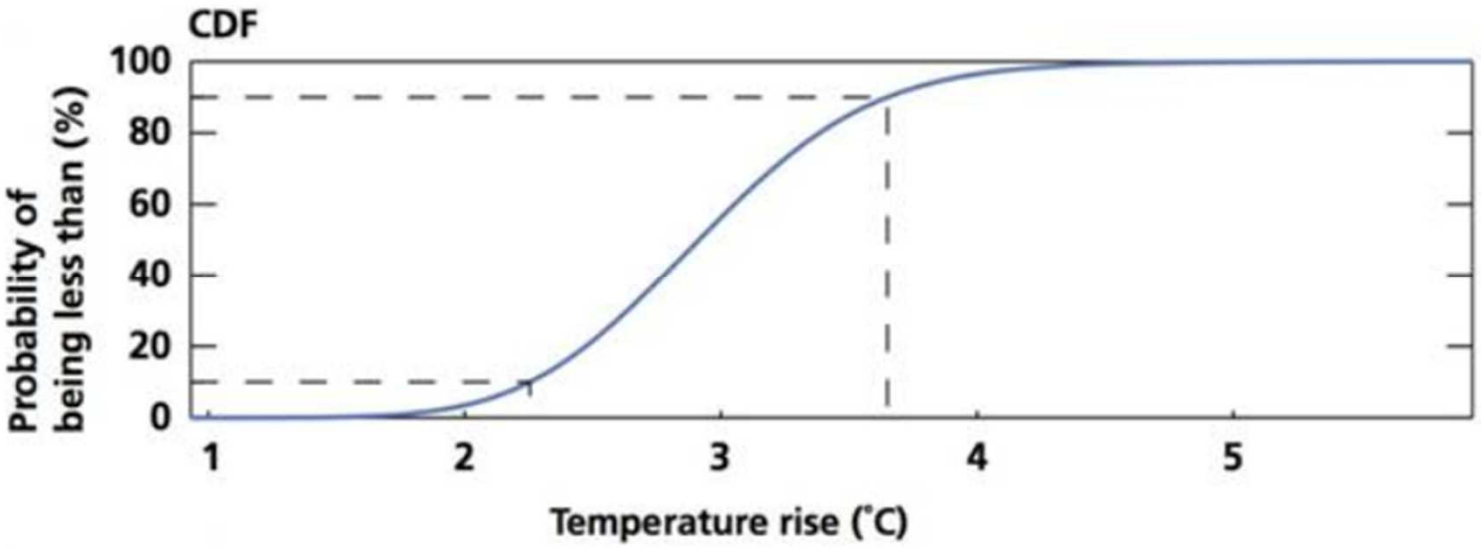
Probability



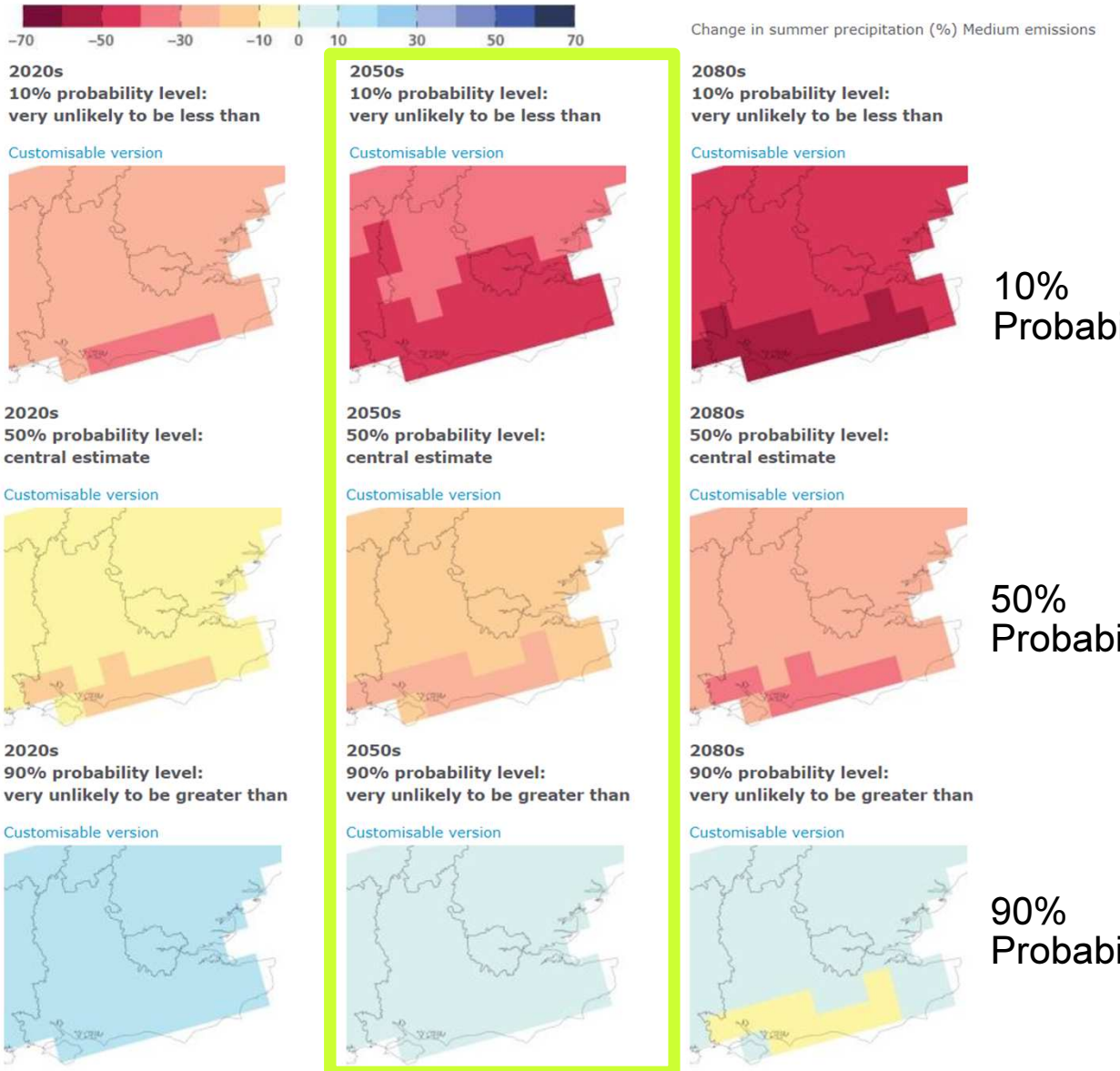
At the 10% probability level, only 10% of the climate model runs fall **at or below** that level, at the 90% probability level, only 10% of the climate model runs fall **at or above** that level.

Summer Precipitation (UKCP09)

Medium Emissions

↓ 20-30%

↑ 0-10%

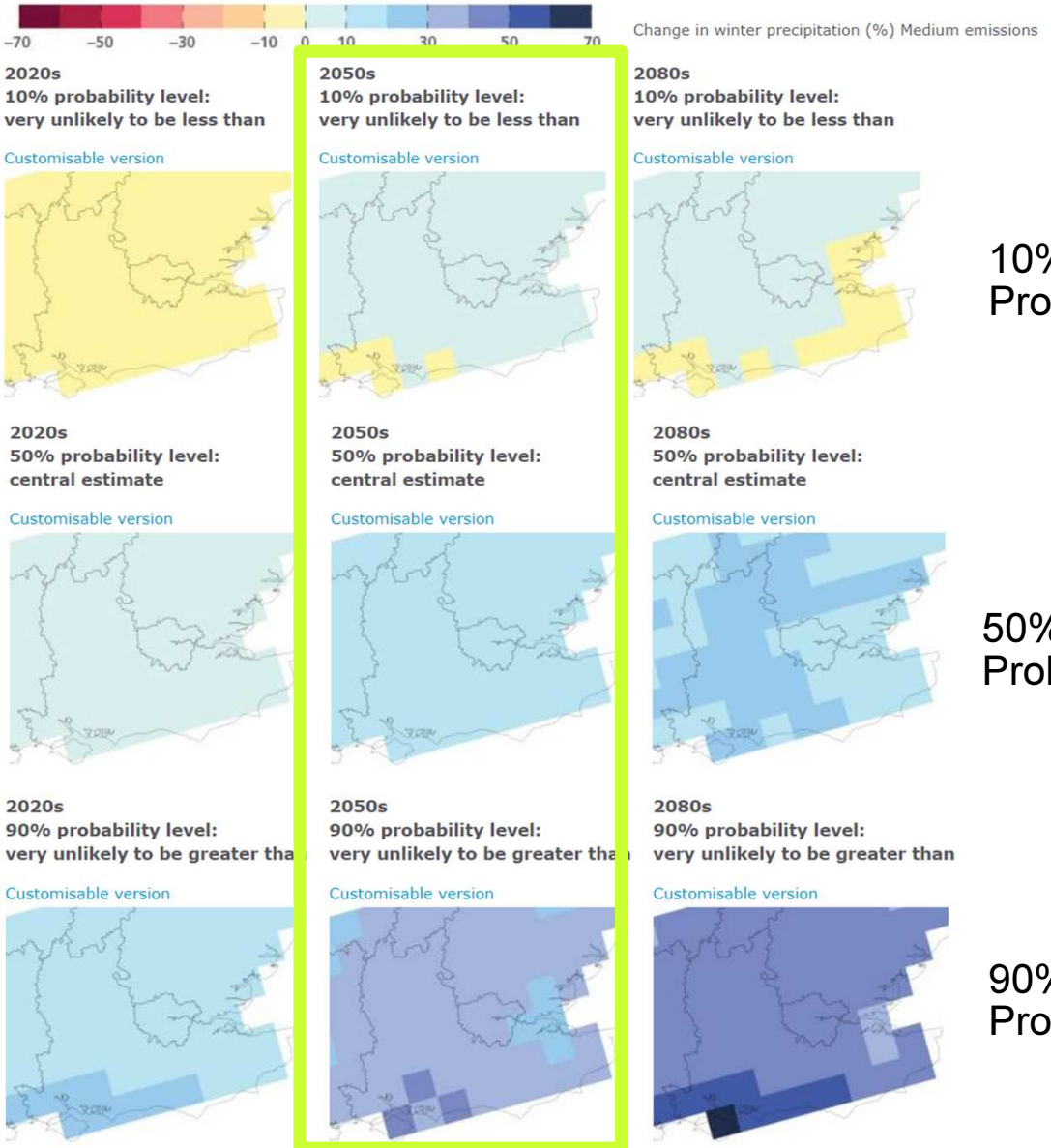


Winter Precipitation (UKCP09)

Medium Emissions

↑ 0-10%

↑ 30-40%



Summer Convection

We found that summers are likely to become drier overall by 2100, in a warming climate. But our results suggest that when it does rain, it will be heavier in short outbreaks. In particular, intense rainfall with the potential to cause serious flash flooding could become a more common occurrence.

Dr Elizabeth Kendon, Senior Climate Scientist at Met Office Hadley Centre

Winter Rainfall

In 2017, the Met Office published new innovative research which found that for England and Wales there is a 1 in 3 chance of a new monthly rainfall record in at least one region each winter.

Met Office records show that since 1910 there have been 17 record breaking rainfall months or seasons – with 9 of them since 2000.

Summary

Climate change impacts on rainfall are complex and uncertain.

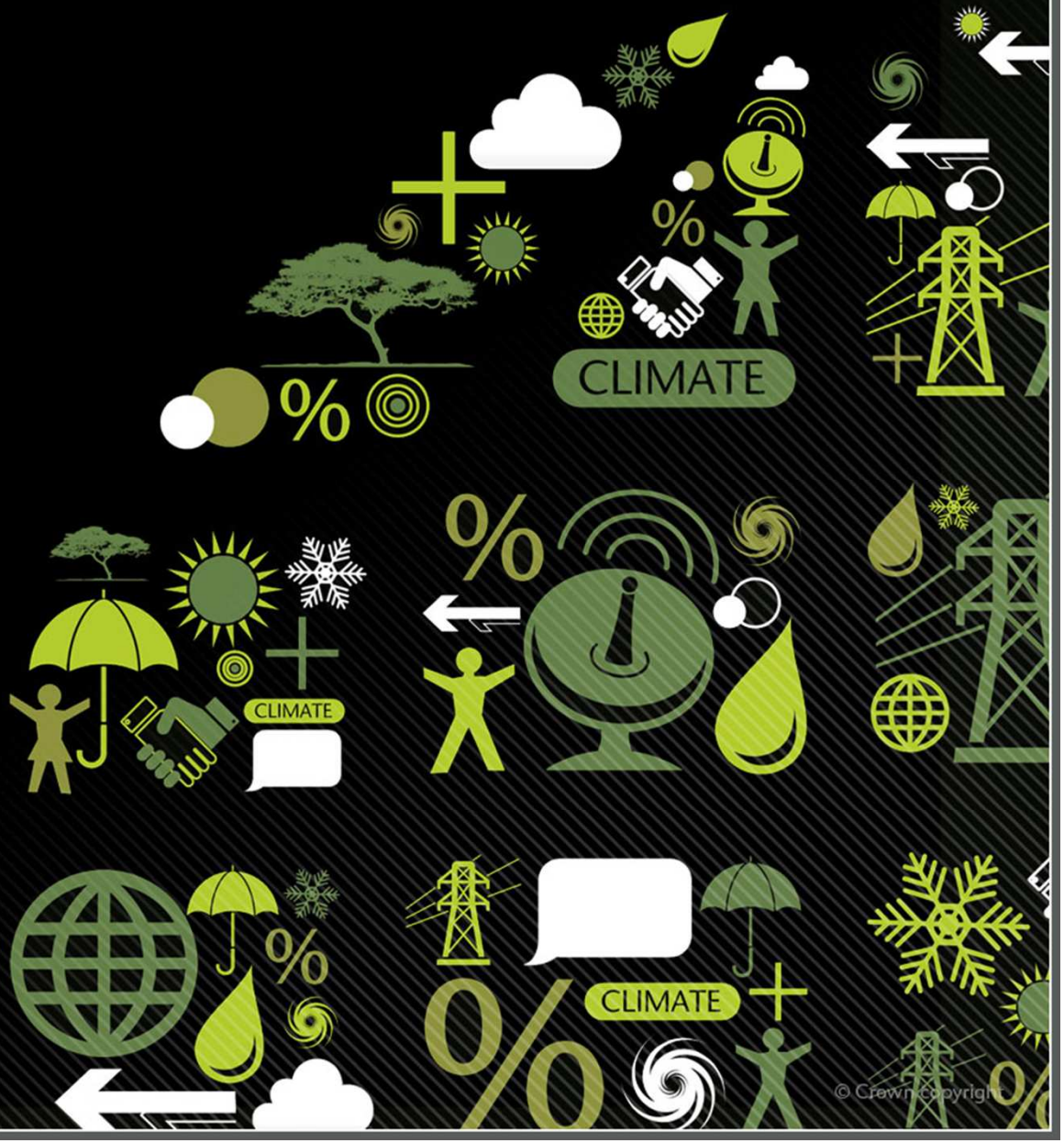
The risk of surface water flooding could increase as we see more intense summer rainfall.

The risk of river and groundwater flooding could increase as we see increased winter rainfall.

However, due to uncertainty, a risk management approach is needed.

N.B. UKCP18 available in November!

Questions and Answers



www.metoffice.gov.uk

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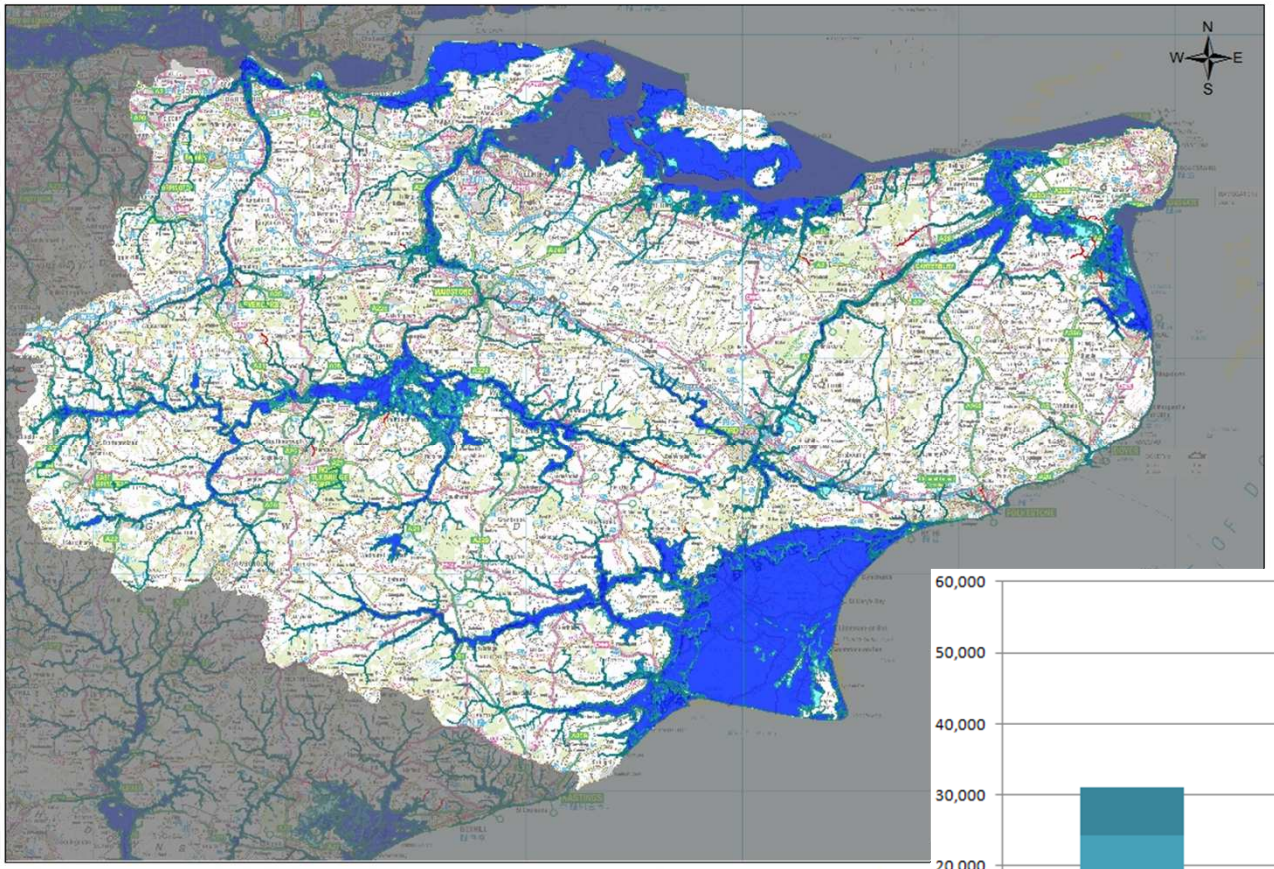
Flood risk in Kent

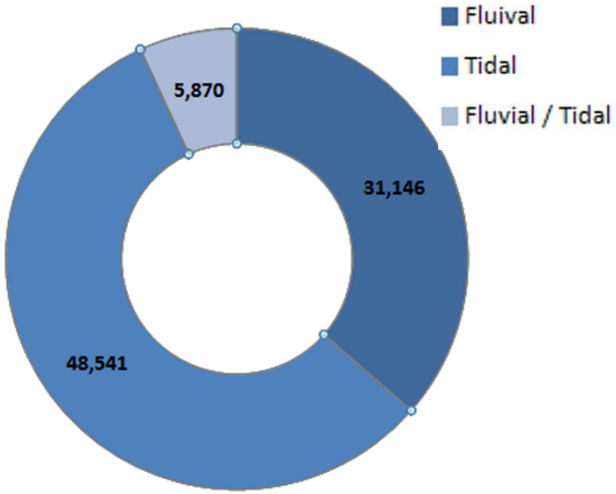
Environment Agency

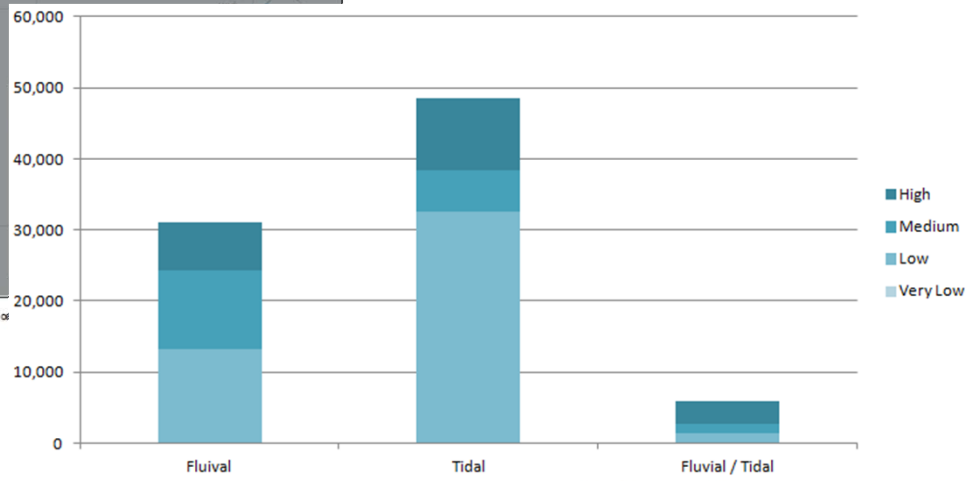
Flood risk in Kent

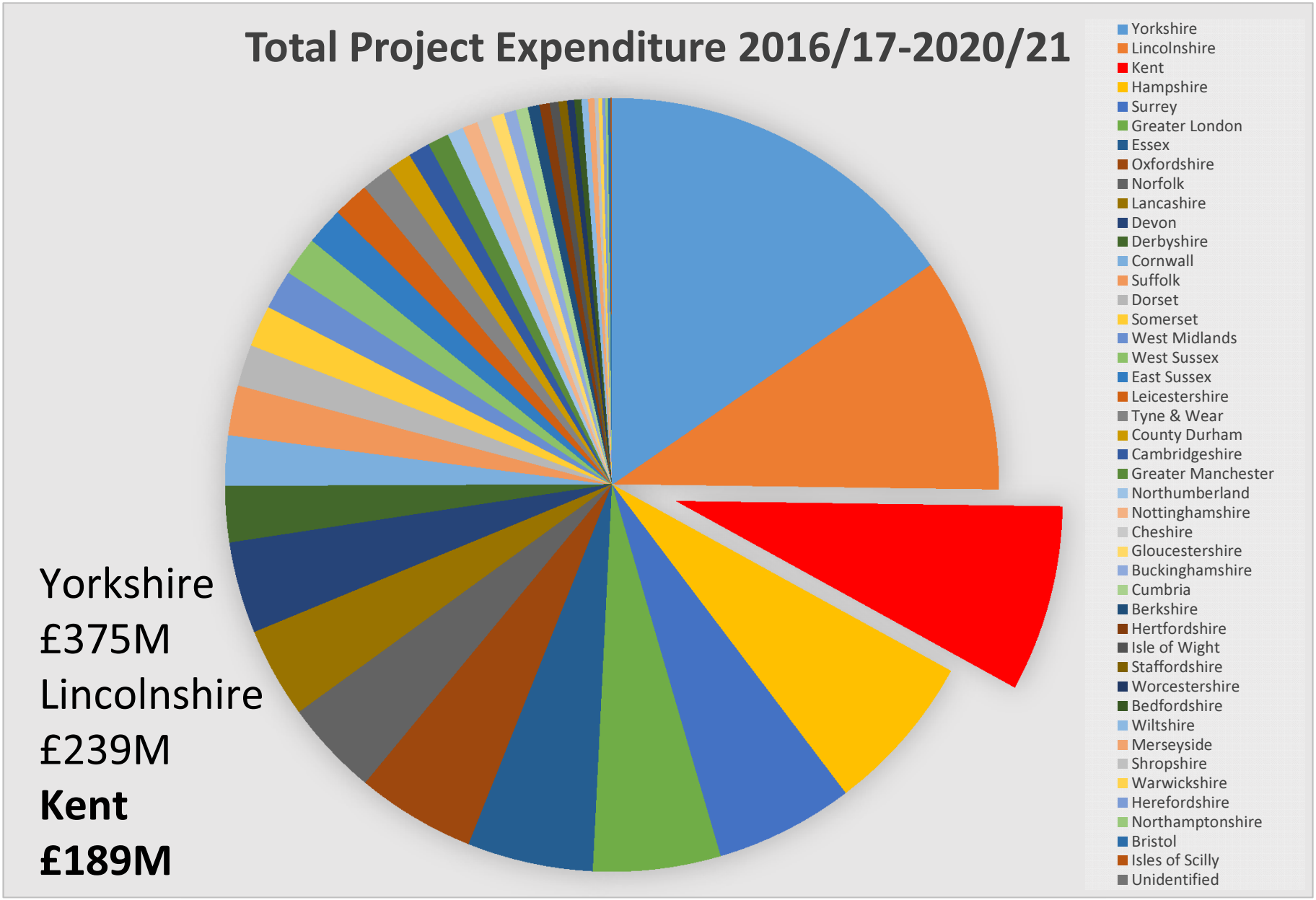
- In Kent currently 85,557 homes and businesses at risk of flooding from rivers and the sea



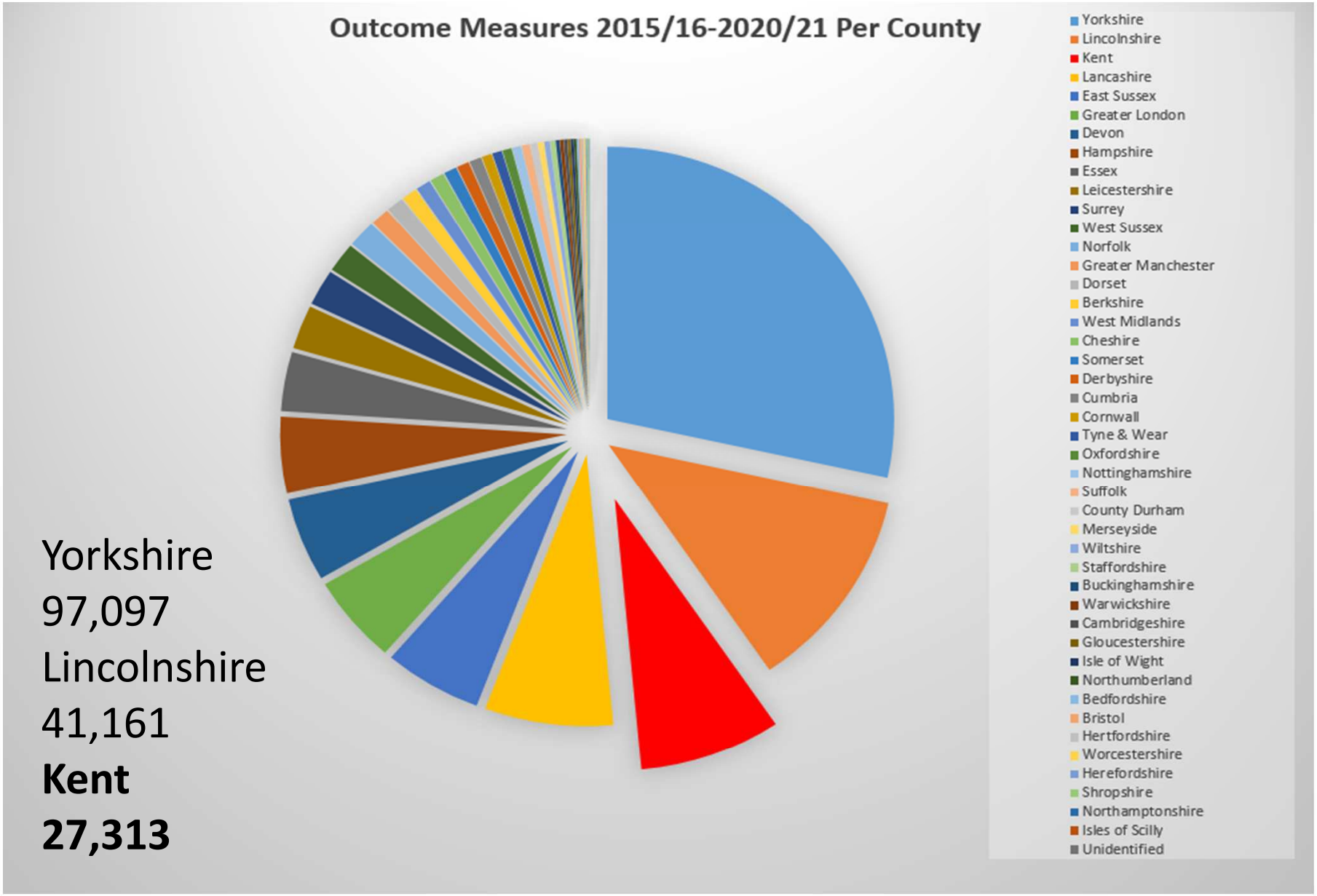
Number of properties at risk of tidal/fluvial flooding in Kent







Environment Agency

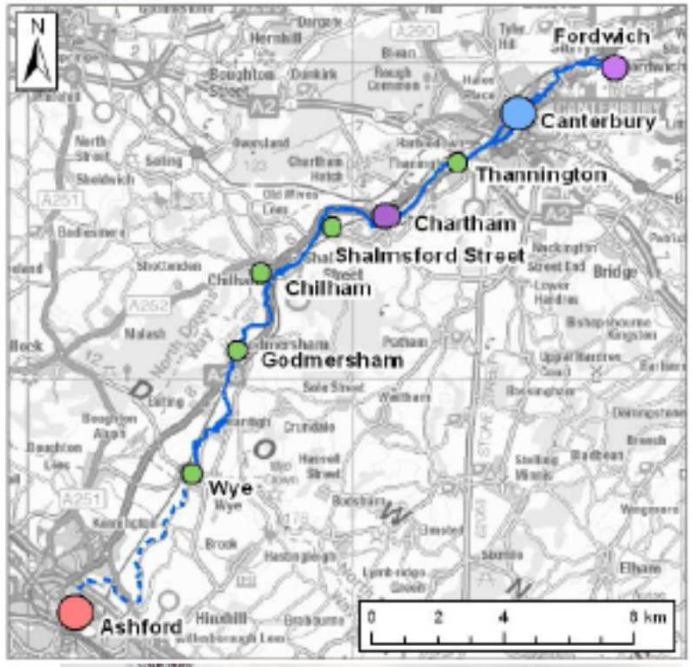


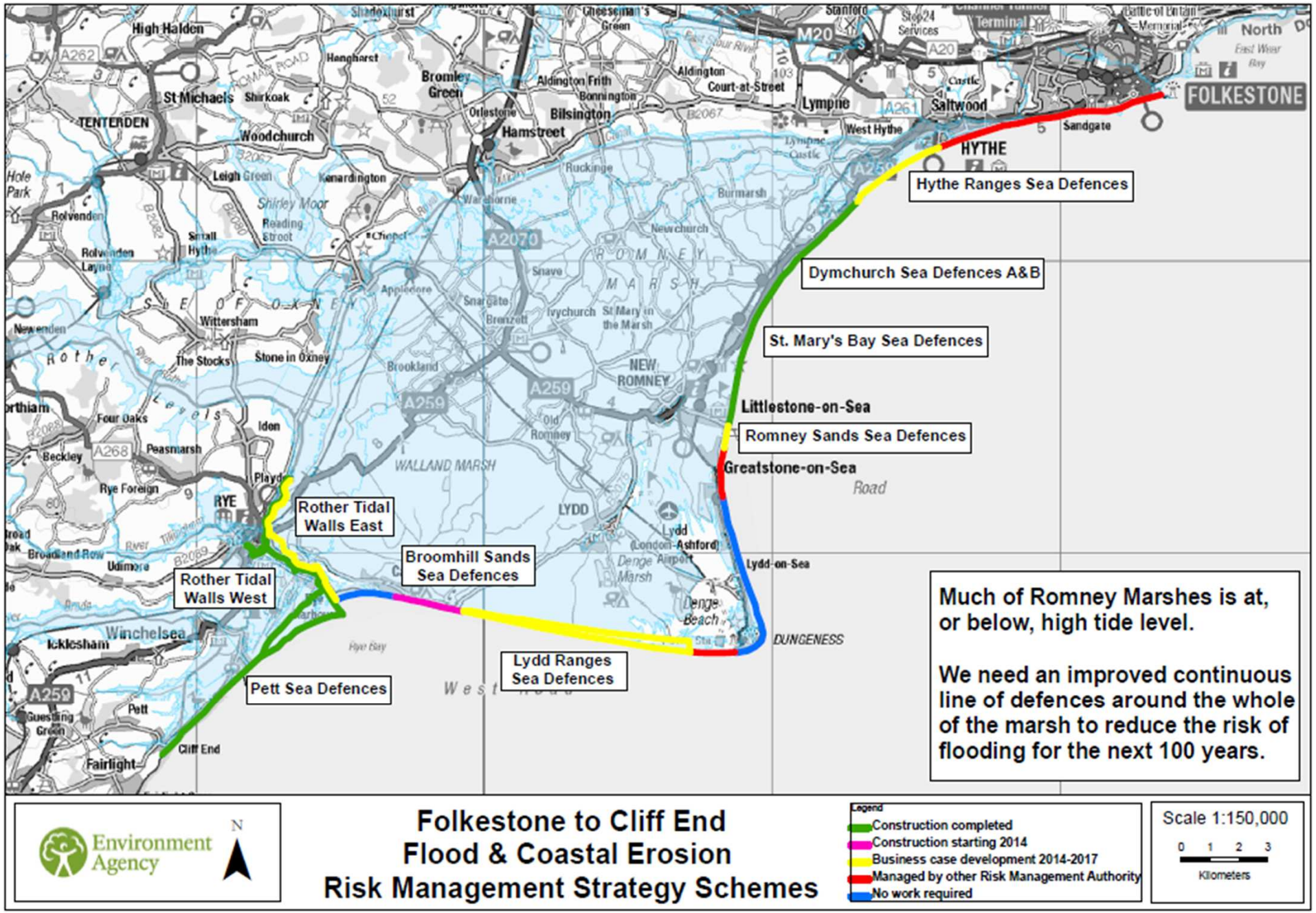
Environment Agency

Great Stour FAS

- Reduce risk of flooding from Great Stour to communities between Wye & Ashford
- Detailed Appraisal Stage completion 2019
- Current Business Case based on storage delivers:
  - 492 properties / 84 businesses
  - Cost £16M
  - Benefit Cost Ratio 13:1
  - Economic Benefits £199M
  - PF Score 81%
  - £2.7M External Funding Required
- Current Programme:
  - Full Business Case & Detailed Design

    Contract Award 2021
    - Build Completion 2023





Middle Medway Flood Resilience scheme

- Working with 8 Parish Councils in the Middle Medway
- £7,500 funding per property for Property Flood Resilience (PFR) measures topped up by Southern RFCC Levy funding
- PFR measures installed to 28 homes in Dec 2017
- PFR surveys completed on 247 homes with further installations planned for Autumn 2018
- Investigations underway for community resilience measures such as small walls and embankments to protect clusters of properties not suitable for PFR

Environment Agency

Natural Flood Management – Defra Pilot Project

- ✓ Match funding from FRAMES (EU Funding)
- ✓ SERT leading - coordinator in post – Dean Morrison
- ✓ Project Board established to approve spend
- ✓ Pilot projects eg Bedgebury with Forest Enterprise
- ✓ 15 Landowners have expressed interest so far
- ✓ Each project will be evaluated against a range of Defra criteria

Environment Agency

Leigh Expansion and Hildenborough Embankments Scheme

- Project Benefits:
  - 1,500+ properties better protected
  - 200 businesses better protected
  - Unlocking economic growth

- Flood storage level 28.05 to 29.00m (AOD)
  - 5.5m m^3 to circa 9m m^3
  - Minimal upstream impact on landowners
  - Widespread benefits in Hildenborough

Environment Agency

Unlocking business and growth benefits

As well as better protecting 200 businesses, the scheme also aims to:

- Unlock new opportunities for residential and commercial development
- Create new habitats and leisure/recreation opportunities

Total scheme cost = £15.7m

Key funding sources:
EA GiA - £10.1m
South East LEP - £2.3m
Kent County Council - £2.6m
Tonbridge & Malling BC - £575K

The SELEP business case sets out that the scheme will enable:

- 100 homes completed by 2023 (1,480 new homes completed by 2031)
- 50 direct jobs created and safeguarded by 2023
- 100 associated jobs created by 2023 (1,400 new jobs created on unlocked employment sites by 2031)*
- 0.75ha of new employment land by 2023 (Over 13ha of new employment land in use by 2031)*

Environment Agency

Partnership contributions are essential in unlocking Government funding

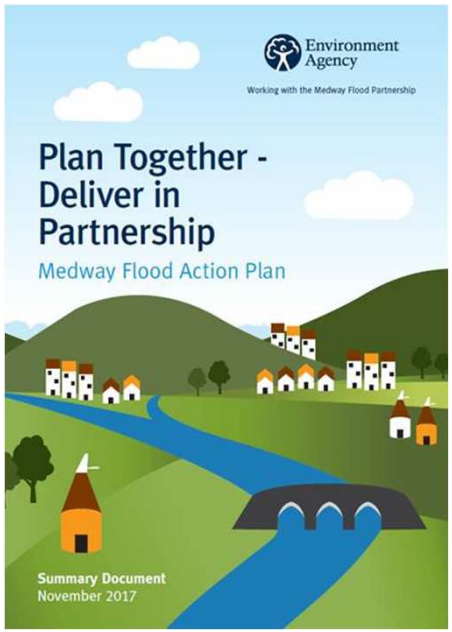
Scheme	Homes and business benefitting	Government allocation	Partnership contribution required
Increase capacity of Leigh + Hildenborough embankments	1,475 properties	£10.1 million	£5.5 million (£2.6m - KCC £575k - TMBC £2.3m - SELEP)

Without partnership contributions, this government funding would be lost.

Environment Agency

Partnership working is the key to success and innovation

The Medway Flood Partnership brings together the wide variety of work that needs to be done by partners and communities to help manage the risk of flooding.



Community resilience and awareness

Natural flood management

Infrastructure resilience

Regular maintenance

Roads and bridges

Property level resilience

Review governance

Preparing for flooding

Channel and ditch management

Invest in traditional defences

Integrated Medway flood action plan

Environment Agency

Key points

- Kent is a big winner for government investment in capital projects
- To unlock government funding for FCRM projects, we need partnership funding
- Partnership working is key to success and innovation
- Incorporating Natural Flood Management into schemes can help to deliver more, wider benefits

Environment Agency

Thank you

Environment Agency

To: Kent Flood Risk Management Committee – 16th July 2018

From: Tony Hills, Chair of Kent Flood Risk Management Committee

Subject: Kent and Medway Offsite Reservoir Inundation Emergency Plan

Classification: Unrestricted

Summary: To brief Kent Flood Risk Management Committee on the recently re-published Kent and Medway Offsite Reservoir Inundation Emergency Plan and contribute any additional matters arising from debate by the Committee

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1. Background

1.1 The Kent and Medway Offsite Reservoir Inundation Emergency Plan addresses planning for, response to, and recovery from offsite reservoir inundation emergencies occurring within, or impacting upon, the administrative boundaries of Kent and Medway. The plan incorporates technical data on 60 individual reservoirs.

1.2 The plan was written in compliance with relevant legislation and guidance including The Civil Contingencies Act 2004, The Reservoirs Act 1975 (as amended by the Water Act 2003), The Flood and Water Management Act 2010 and Framework for Reservoir Inundation Preparedness Planning (Cabinet Office: October 2009).

2. Plan aim, testing and validation

2.1 The aim of the plan is to provide clear definitions of the roles, responsibilities and actions for responding agencies at the pre-planning, response and recovery stages of a reservoir emergency, encompassing:

- Outlining key principles of pre-planning for a reservoir inundation emergency;
- Describing the actions of the first responders on the scene and/or to receive the incident notification;
- Providing a response escalation procedure to cover actions from the initial alert through to stand-down and post-incident recovery;
- Setting-out the multi-agency co-ordination and control arrangements at each level of response;
- Specifying the manner in which warnings may be communicated to the public and partner agencies in an accessible and consistent fashion;
- Providing contact details to facilitate an efficient call-out of resources; and
- Outlining key principles of recovery for a reservoir inundation emergency.

2.2 The draft plan was tested and validated on 29 November 2017 at Exercise Tethys, a multi-agency event hosted by Kent Fire and Rescue Service and utilising a realistic yet challenging reservoir dam breach scenario.

3. Publication and next steps

3.1 A public version of the plan can be found on the emergency planning page of the Kent.gov website, while a technical, and protectively marked, version is held on Resilience Direct, the government's secure resilience platform.

3.2 The plan is a living document and will be updated as new reservoirs are commissioned or existing reservoirs modified or decommissioned. Further, the planning assumptions informing the plan will be pro-actively tested using forthcoming emergency planning training and exercise events.

4. Recommendations

4.1 That Members:

- Note the publication of the updated Kent and Medway Offsite Reservoir Inundation Emergency Plan; and
- Contribute any additional matters arising from debate by the Committee to the future evolution of the plan.

Tony Harwood, Resilience and Emergency Planning Manager, Growth Environment and Transport tel. 03000 413 386 e-mail tony.harwood@kent.gov.uk

Background documents: The Kent and Medway Offsite Reservoir Inundation Emergency Plan

Kent and Medway Offsite Reservoir Inundation Emergency Plan

Context

Framework for Reservoir Inundation Preparedness Planning (Cabinet Office: October 2009)

- This guidance confirms upper tier / single tier local authority responsibility for co-ordination of Off- Site reservoir inundation Emergency Planning within their administrative boundaries.

- Upper tier / single tier local authorities have legal requirement to operate a Generic Off-Site plan.

Context

Type of Dam Breach:

A complete collapse of a dam wall and a sudden inundation of water: If a complete collapse occurs without warning or is forecast, available inundation velocity details and maps (potentially combined with the predicted period of time until collapse) will indicate how much time is available to evacuate downstream properties.

A slow onset reservoir emergency: In a slow onset emergency, i.e. where water is escaping as the result of an uncontrolled or emergency draw-down. The dam will continue to be monitored to assess the risk of a major failure.

Kent County Council kent.gov.uk

Context

Dam Break Analysis:

“Sunny day” Breach: This would occur in dry weather conditions, suggesting the breach is not a result of increased flows into the reservoir. Downstream conditions are normal

“Rainy day” Breach: The describes a dam failure during a flood event, suggesting the breach may be the result of the increased flows entering the reservoir. Downstream conditions could already be experiencing high flows and flooding

Context

Consequences of Reservoir Inundation Emergency:

- Deaths and/or injuries amongst population caught in flood wave;
- Flooding, structural damage or total destruction of a number of properties;
- The severing and/or inundation of key parts of the local transport infrastructure, including arterial roads, bridges and railway lines. Closures of key parts of the transport network, such as major arterial roads and bridges linking different areas could compromise the ability of key agencies to respond and deploy their resources where these are needed; and
- The severing and/or inundation of key parts of the local utility infrastructure (electricity, gas, water and telecommunications).

Kent County Council kent.gov.uk

Context

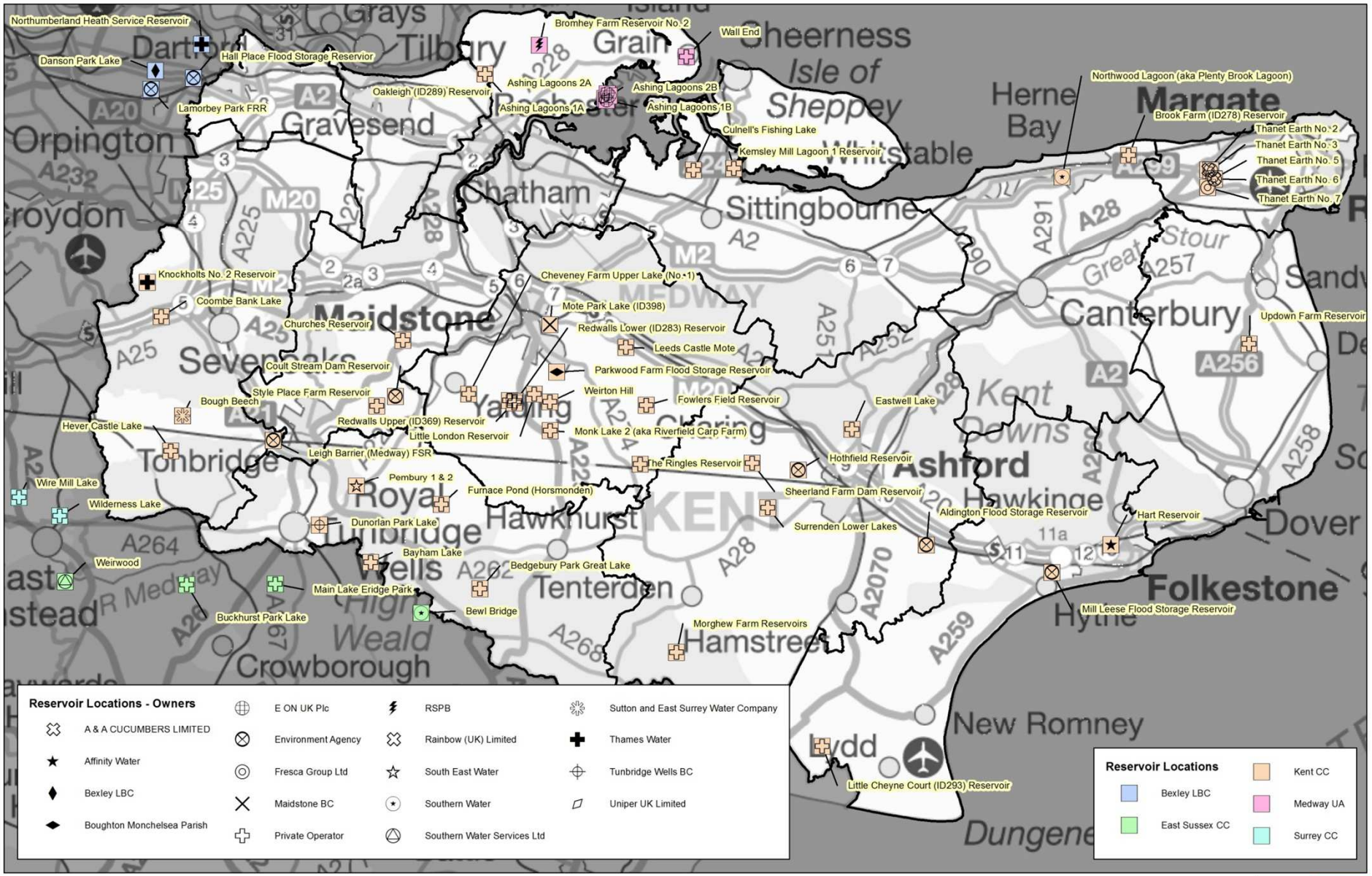
How many ‘Large Raised Reservoirs’ with capacity above 10,000m³ in Kent?

- **44** located within administrative county of Kent;
- **6** located within the Medway Council area; and
- **10** located within neighbouring local authority areas but could impact Kent.

TOTAL: 60 SITES

Kent County Council
kent.gov.uk

‘Large Raised Reservoirs’ with capacity above 10,000m³



Produced by the KCC GIS Team

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Context

Post-script:

- Reservoir Inundation Emergency Plan compliments Kent Resilience Forum Pan Kent Flood Plan, Local Multi-agency Flood Plans and KCC Flood Response Plan;
- Exercise Tethys tested and validated Reservoir Inundation Emergency Plan; and
- Kent Resilience Forum Severe Weather Group (formerly KRF Pan Kent Flood Group) provides multi-agency forum for reservoir inundation planning activity in Kent.
- **Questions?**