London’s Experience

Completely Lifted from a
Presentation to the
New York Panel on Climate Change

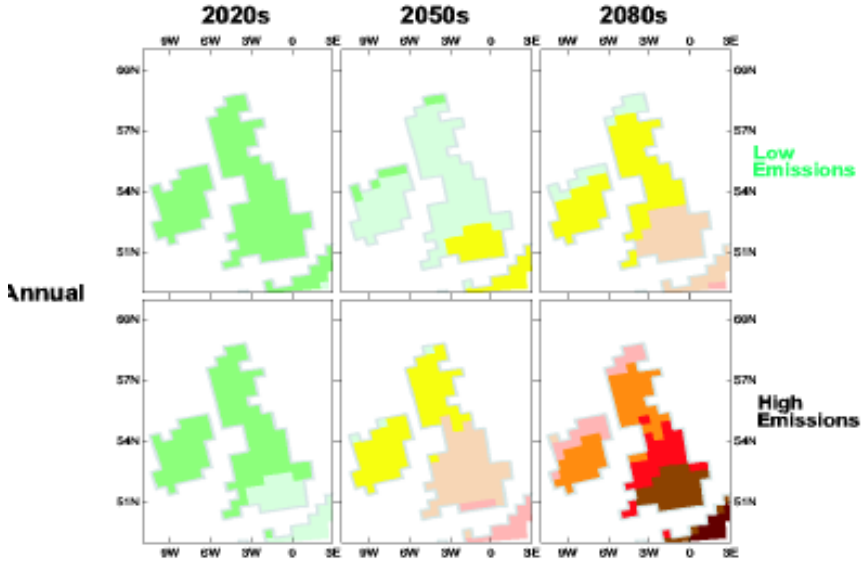
Preparing London for inevitable climate change

The Mayor's draft climate change adaptation strategy

Alex Nickson, Strategy Manager : Climate Change Adaptation and Water

GREATER**LONDON**AUTHORITY

Warmer, wetter winters and hotter, drier summers



Summer temperatures

Summer 2050's (high emissions)

- +3ºC
- - 30-40% rainfall

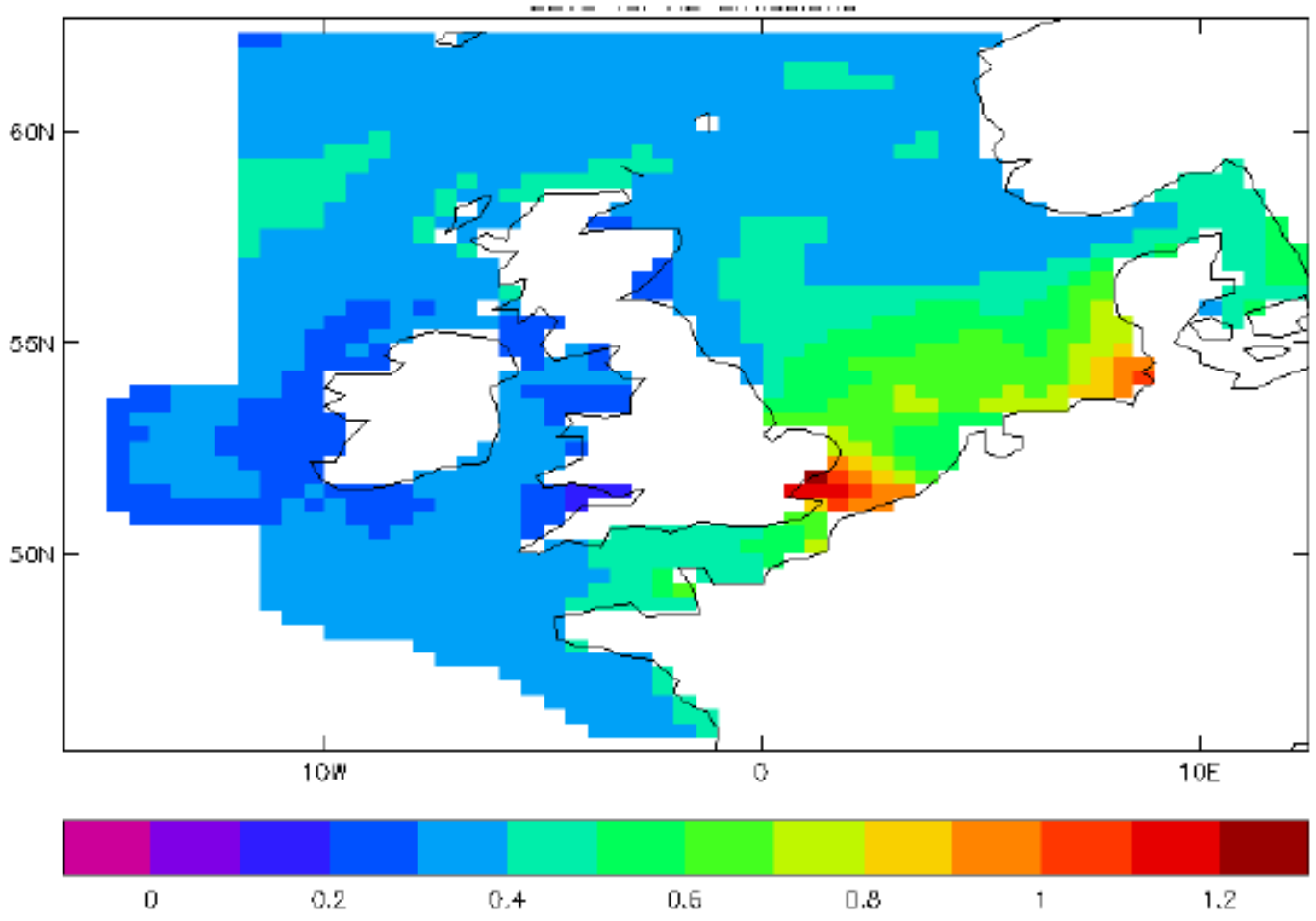
Winter 2050's (high emissions)

- +1.5 - 2 3ºC
- + 25-30% rainfall

UK Climate Impacts Programme

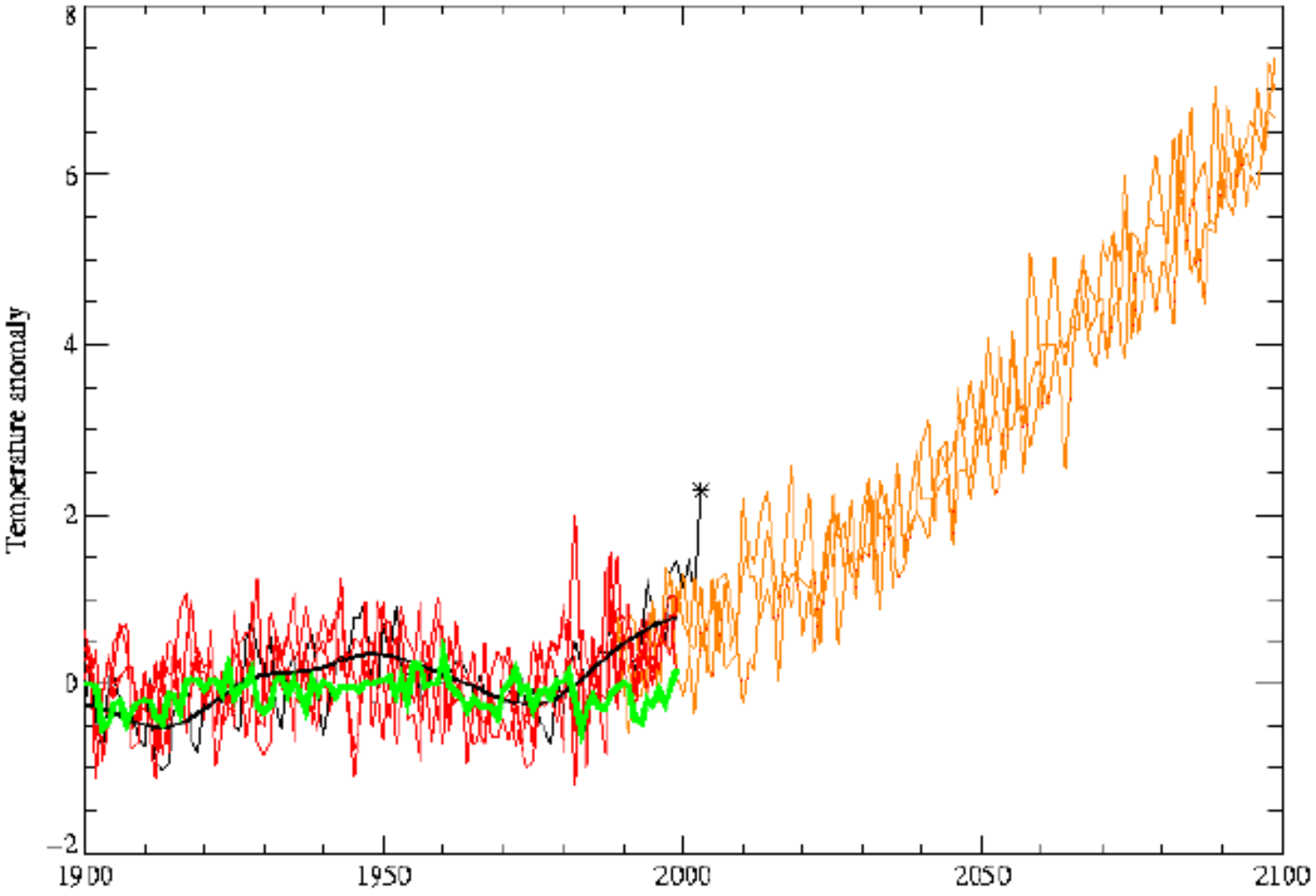
GREATERLONDONAUTHORITY

More extreme weather : tidal surges



GREATERLONDONAUTHORITY

More extreme weather : heatwaves



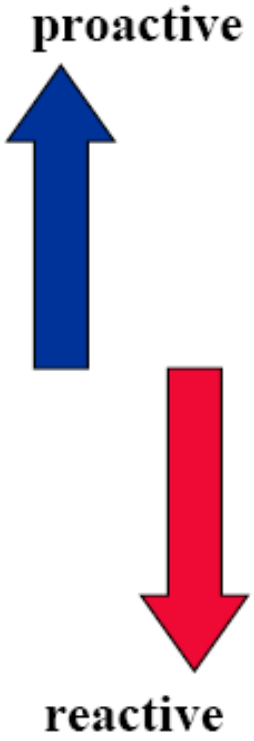
GREATERLONDONAUTHORITY

What does the Adaptation Strategy do ?

- It meets the 'climate change duty' in the GLA Act
- It employs a risk-based assessment to identify the strategic climate risks for London

  Risk = Probability x Consequence x Vulnerability
- It establishes a baseline for today and analyses how these risk may change
- It provides a framework for assessing and prioritising action
- Lays the foundation for a dynamic process

When to adapt and how much to adapt to ?



- Prevention
  - Structural measures, land use planning, mitigation
- Preparedness
  - Vulnerability assessments, public awareness, insurance, budget allowance
- Response
  - Contingency plans
- Recovery
  - Support for those who cannot 'self rescue'

Discussion Questions

A) What is an 'acceptable level of risk' ? Who determines it and how are the public engaged in it's determination / communication ?

B) Can we develop adaptation pathways (as TE2100 does for sea level rise) for temperature and drought ?

C) How can we demonstrate the cost-benefits of adaptation actions / pathways ? What level of return period/s should we use in cost benefit analyses ?

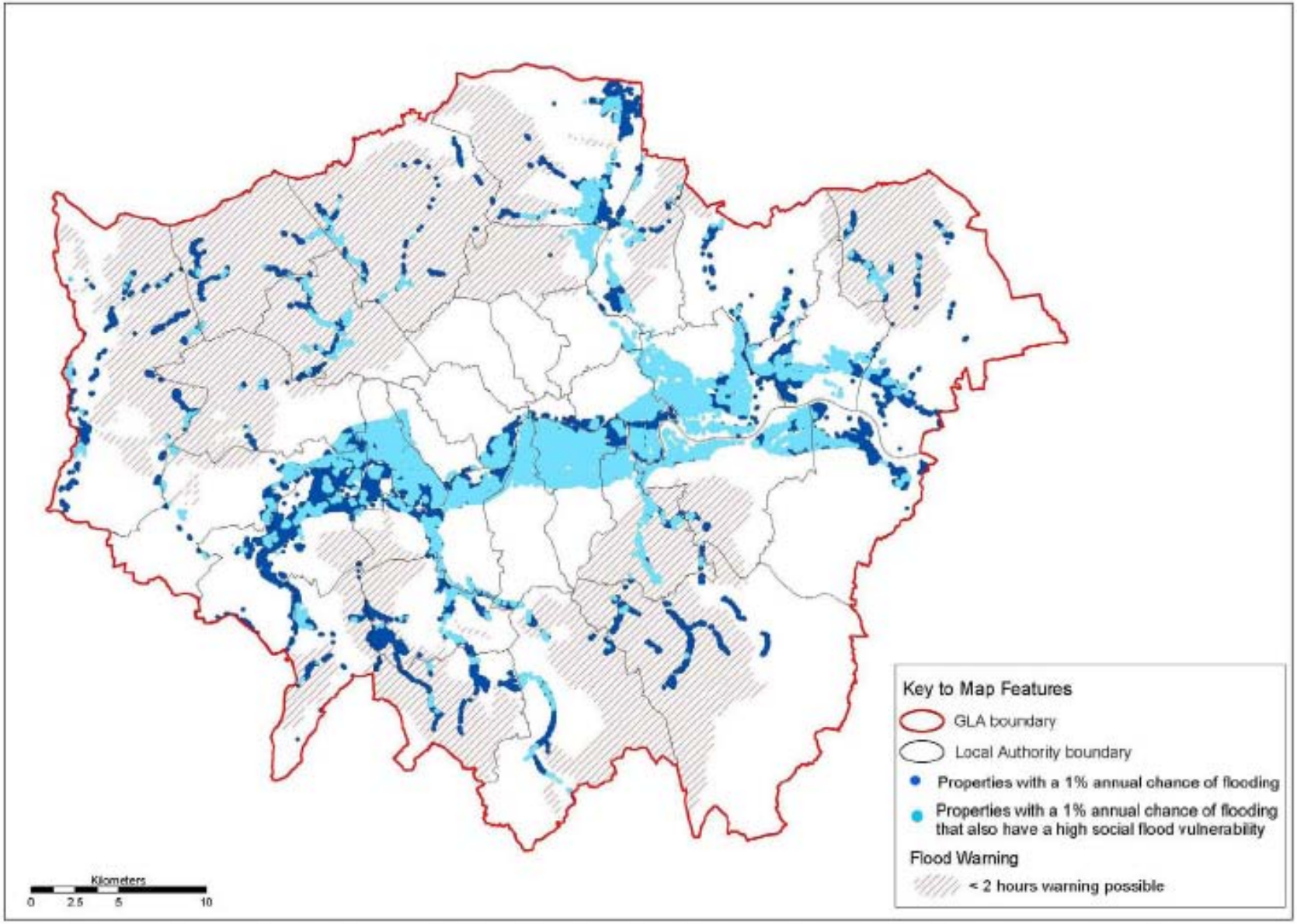
D) What are the 'triggers' for switching adaptation pathways ? Who determines when a trigger point has been achieved, or how much lead in time to allow for it ?

How is London vulnerable to CC ?

- Flooding
- Overheating
- Water resources
- Air Quality
- Subsidence and heave
- Wind storms
- Global climate events

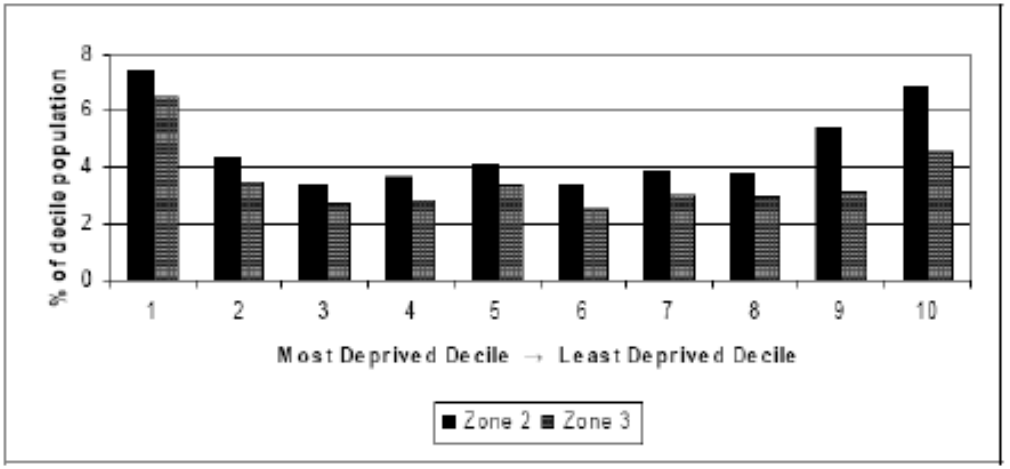
Health

- London has existing significant health inequalities which will increase under CC
- CC will affect people's health through :
  - indirect impacts on the wider determinants of health
  - direct impacts on their health
  - direct effects on delivery of health services
- Rising temperatures will reduce winter fuel poverty but create summer 'cool' poverty
- Poor air quality episodes may reduce in winter, but increase in summer
- Extensive health infrastructure is located in the floodplain and also frequently overheats in current summers

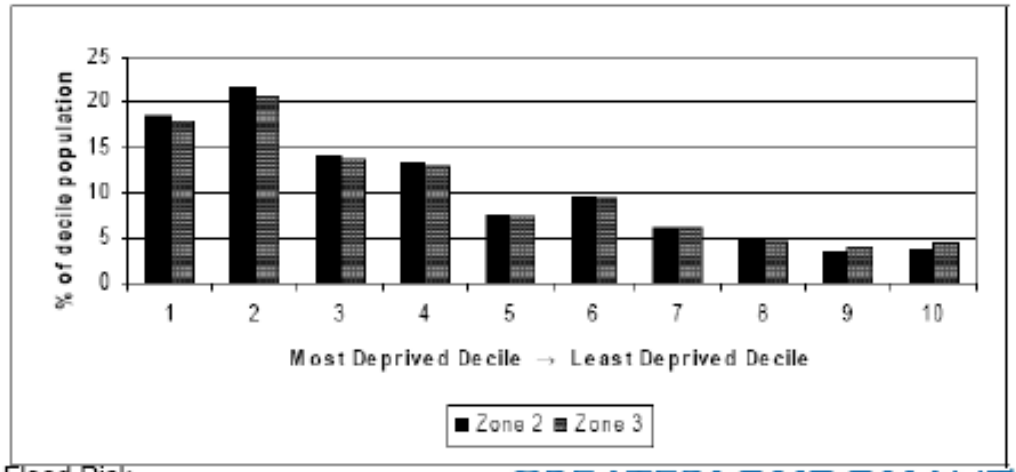

Key to Map Features
GLA boundary
Local Authority boundary
Properties with a 1% annual chance of flooding
Properties with a 1% annual chance of flooding that also have a high social flood vulnerability
Flood Warning
< 2 hours warning possible
Kilometers
0
2.5
5
10

Flooding - baseline

Fluvial flood risk



Tidal flood risk



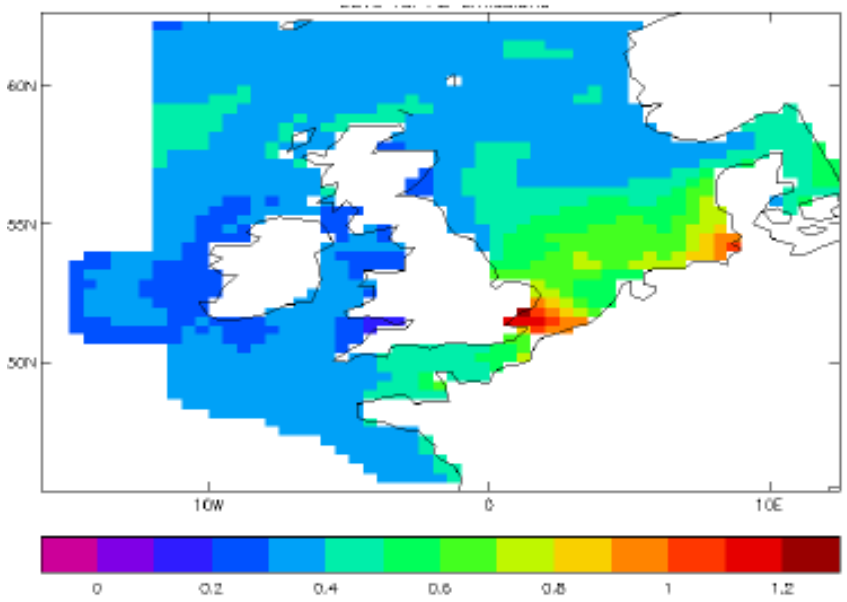
Source : Environment Agency (2006),
Addressing environmental inequalities : Flood Risk

GREATERLONDONAUTHORITY

Flooding - baseline

Social infrastructure	Total in London	Number in Flood Zone 3
Schools	3049	441 (14%)
Hospitals	111	10 (9%)
Gypsy & traveller sites	35	10 (29%)
Civil infrastructure		
Police stations	169	46 (27%)
Fire stations	111	20 (18%)
Ambulance stations	63	9 (19%)
Prisons	8	1 (Belmarsh)
Railway Stations	324	49 (15%)
London Underground Stations (inc DLR)	291	75 (26%)
Bus Depots	84	25 (29%)
Airports	2	1 (City Airport)
Borough Emergency Centres	Awaiting data	

Flooding – climate impact



- Tidal
  - sea level rise + 94cms
  - Extreme scenario +200cms
  - Increase in frequency and intensity of surges (+70cms)

Fluvial peak flows

- Thames: +40% by 2080's,
- Tributaries:

  +40% by 2080's

Surface water

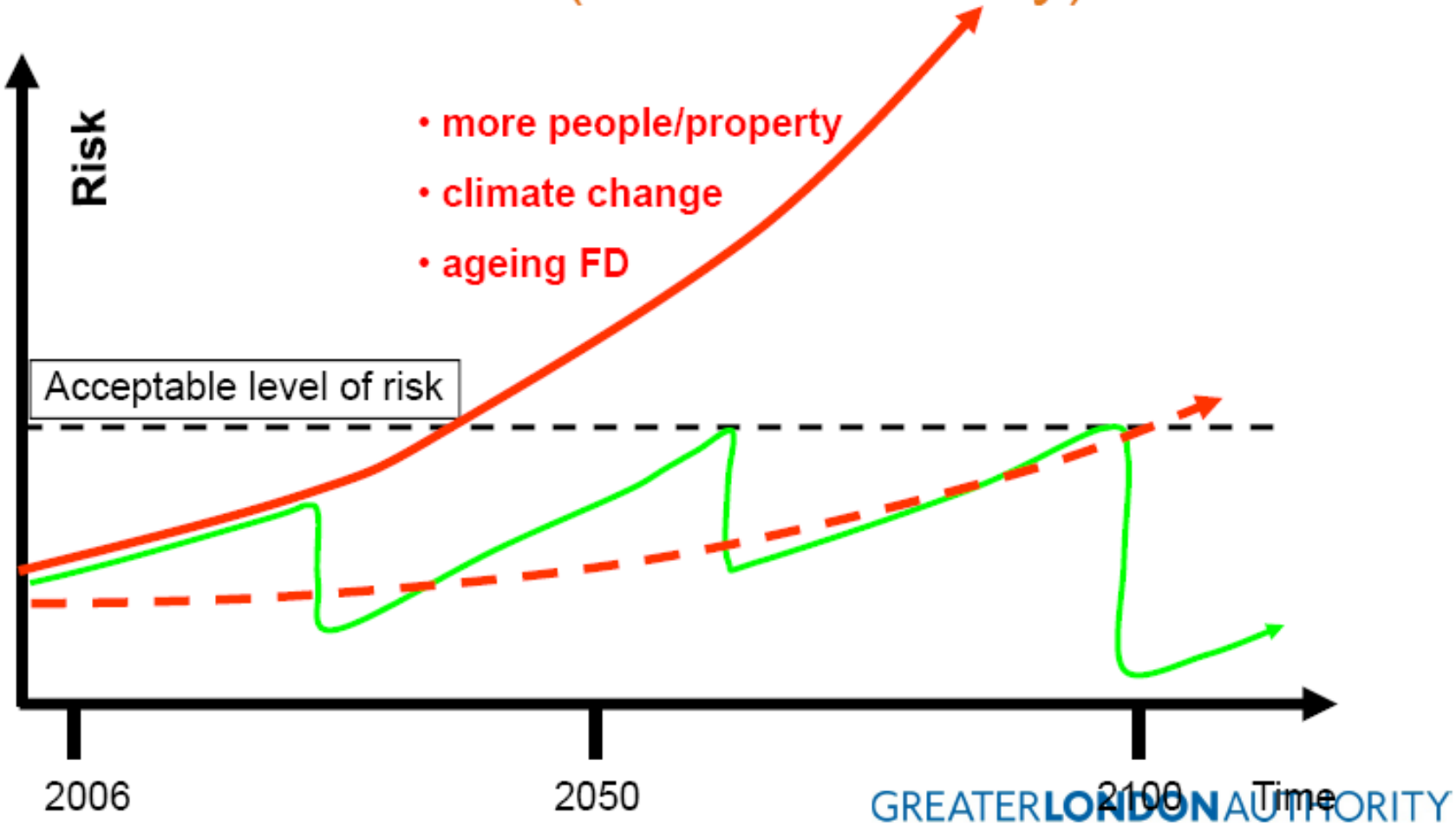
- 30% more winter rainfall
- More intense rainfall events (eg 20 July 2007)

GREATERLONDONAUTHORITY

Flooding - analysis

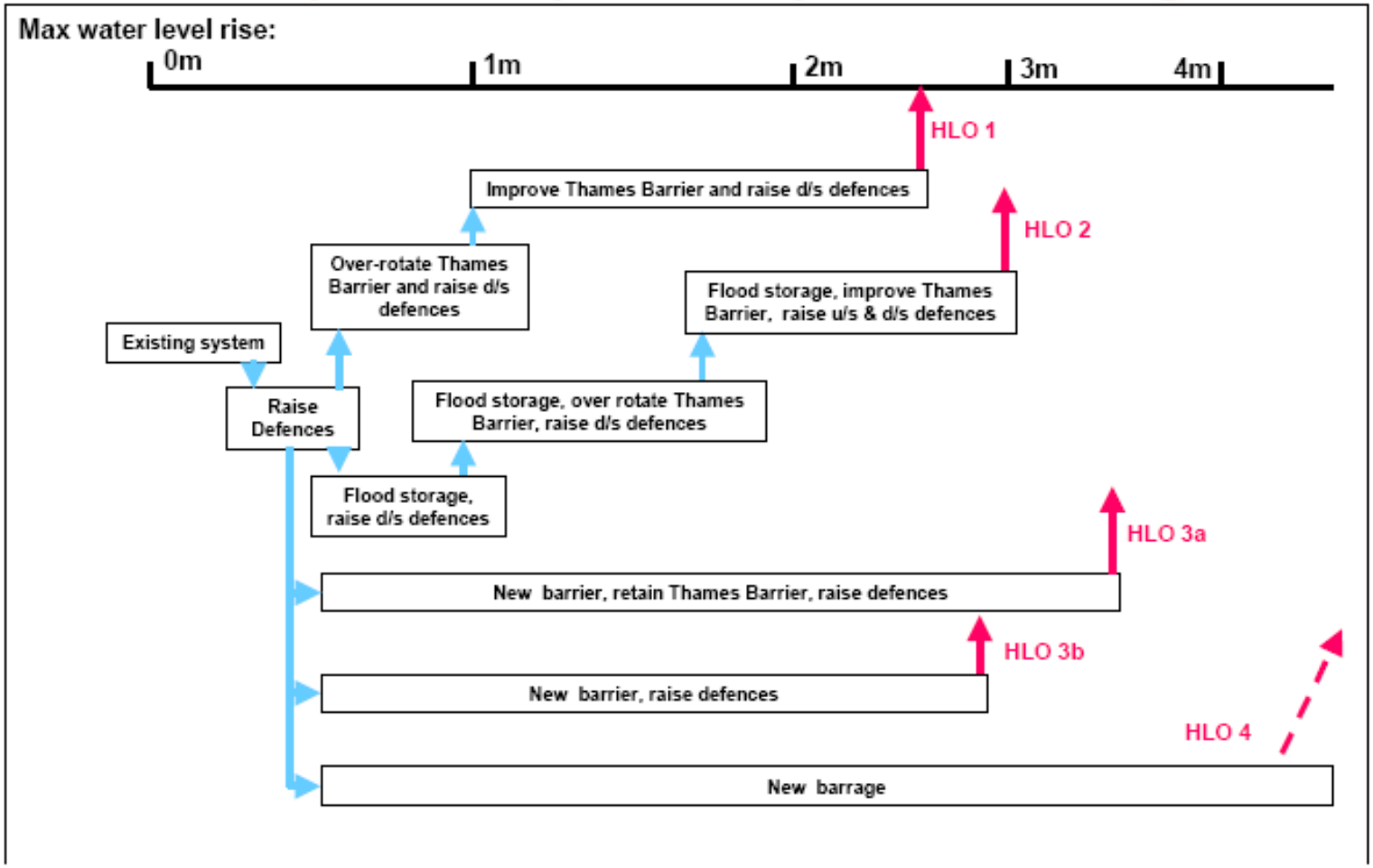
- TIDAL flooding is the highest consequence, lowest probability climate risk for London. London is (currently) well defended, but this standard of defence is decreasing. A £16m future flood risk management options study (TE2100) is underway
- FLUVIAL flooding is a significant risk. 100,000 homes have low standards of protection, little warning time and few management options. Currently, the risk analysis is patchy and un-coordinated and few funds are committed to managing the increasing risk
- SURFACE water flooding is not well understood. The risk has not been mapped, is less predictable than tidal, or fluvial flood risk, but could be the biggest flood risk to London. The management options will be expensive and difficult to implement (covered by Water Strategy)

Flexible response to managing increasing risks (and uncertainty)

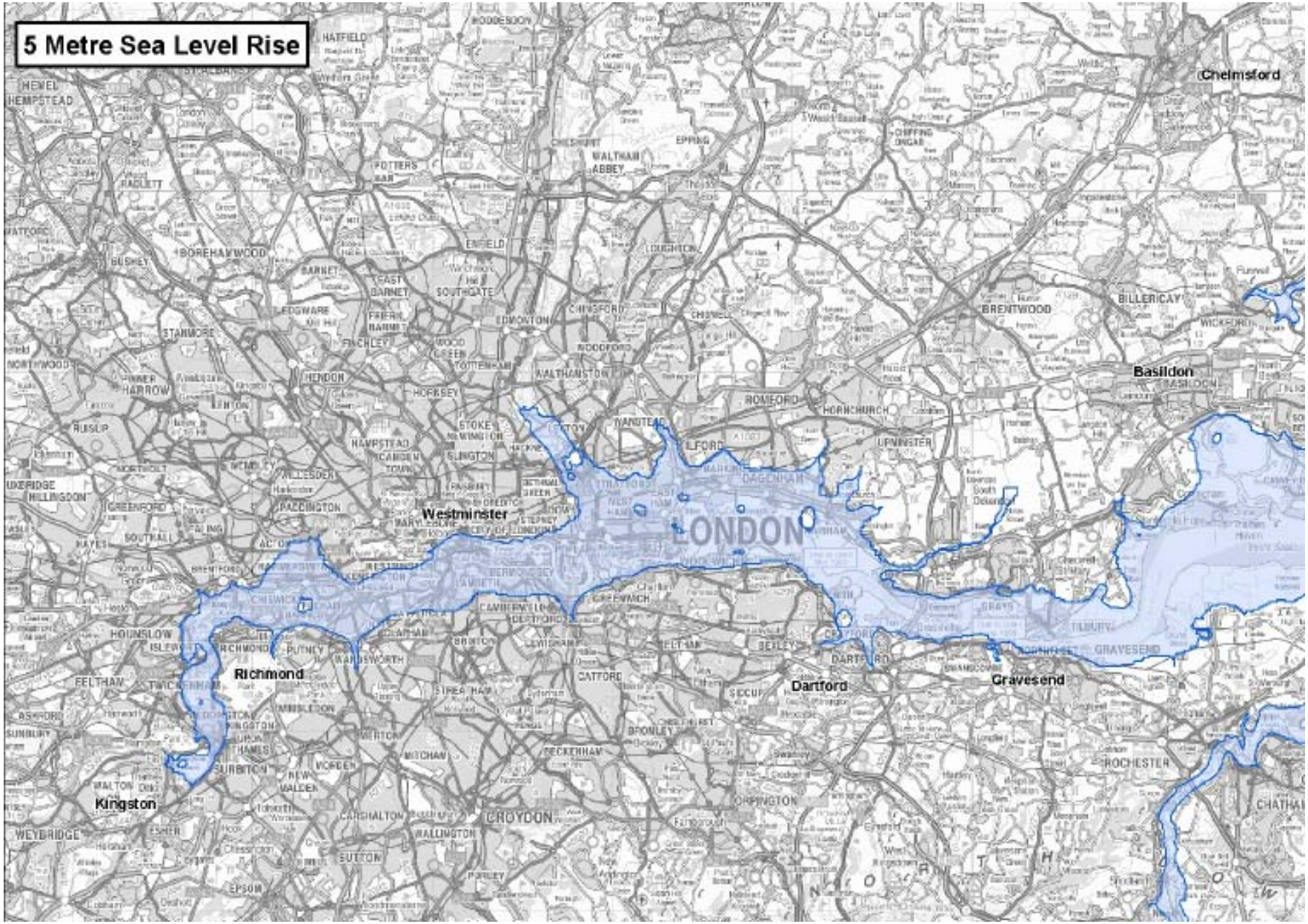


GREATER LONDON AUTHORITY

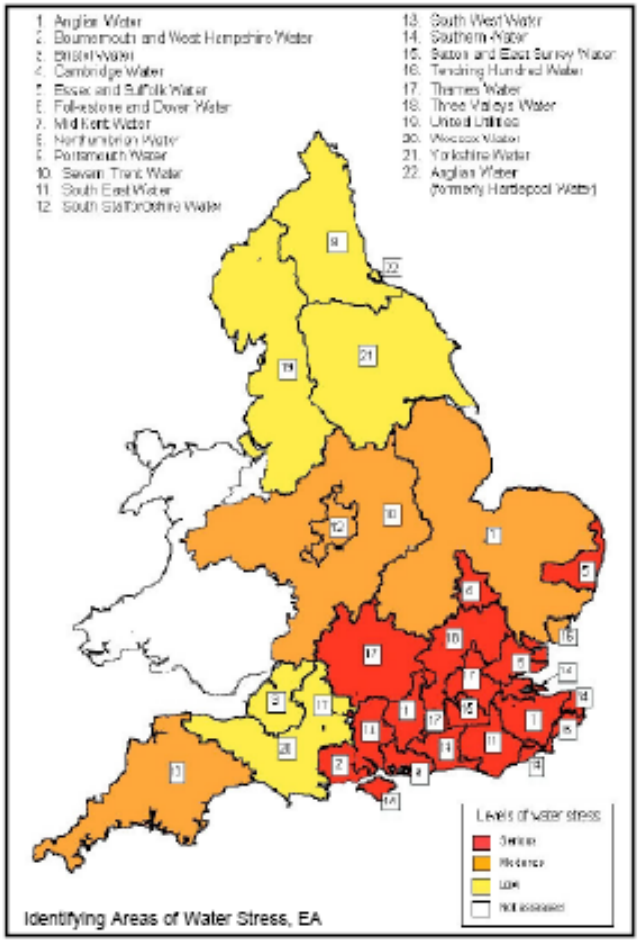
Adaptation pathways - flooding



GREATERLONDONAUTHORITY


5 Metre Sea Level Rise
Chelmsford
Basildon
Westminster
LONDON
Richmond
Dartford
Gravesend
Kingston
CROYDON

Drought



Identifying Areas of Water Stress, EA

- The Thames Region has lower water availability per capita than Morocco, Spain and Greece
- The South East of England is already seriously 'water stressed'
- In a dry year, Thames Water forecast that current demand would be 170Ml/d greater than available supply
- London's catchments and aquifer are already 'over licensed' or 'over abstracted'
- Londoners use more water than the national average (168 vs 150 l/p/d) – largely due to small household size
- Thames Water loses 23% (609Ml/d) of water through leakage
- 19% of London households are metered (vs 26% national average)

GREATERLONDONAUTHORITY

Drought – climate impact

- 30% less summer rainfall by 2050s, 60% less by 2080s
- Heavier rainfall tends to runoff before it can be absorbed, limiting recharge
- Increased evaporation due to higher temperatures and more cloud-free days
- Increased demand from extended growing season
- Increased demand from people
- Increased risk of water mains breakage

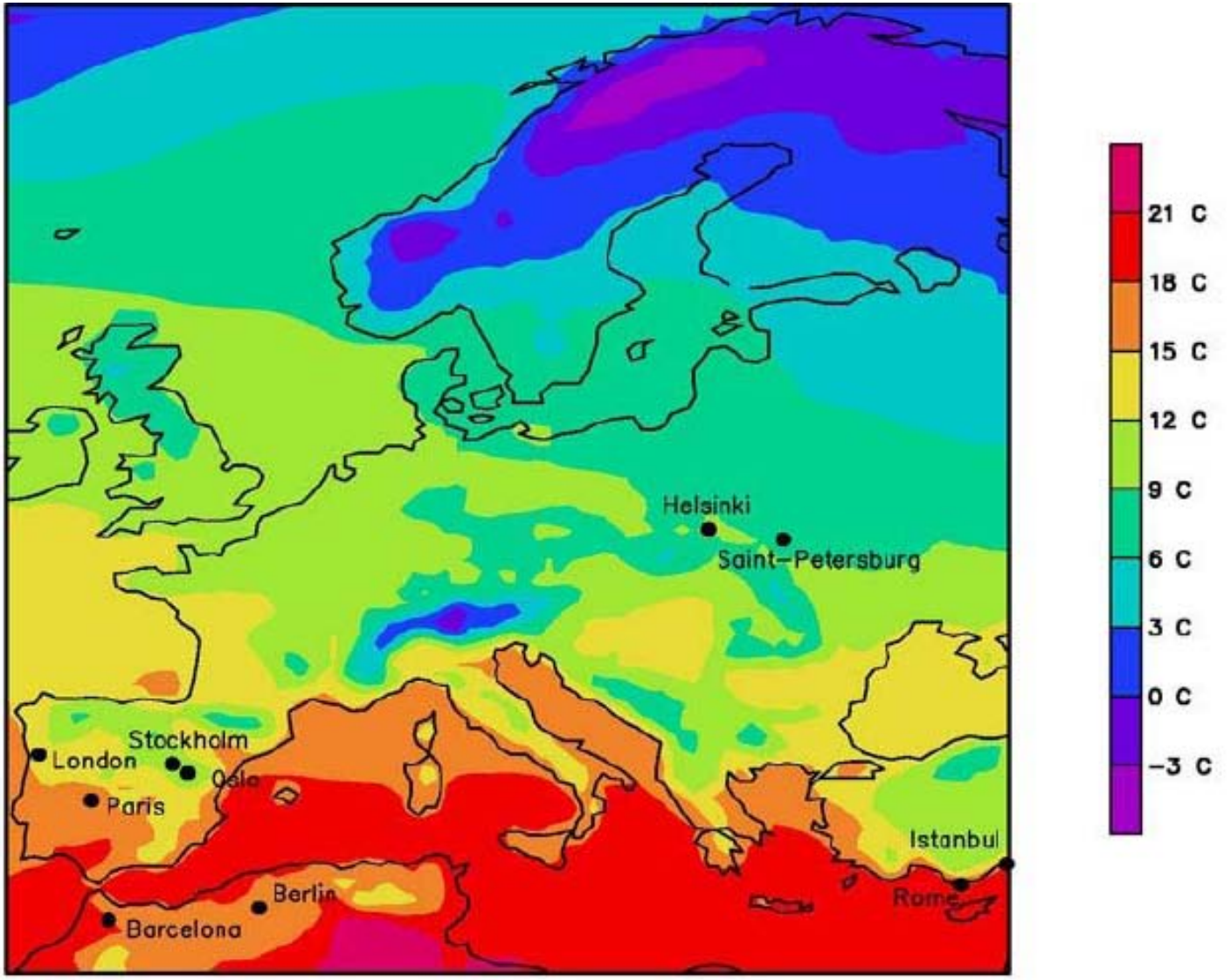
Summary : Climate change will reduce supply and increase demand for water, so increasing the frequency, length and severity of water restriction measures.

Drought - response

Water hierarchy – 'lose less, use less, recycle more'

- Work with water companies to increase speed of replacing distribution network (and review ELL)
- Facilitate compulsory metering (60% 2014-15, 90% by 2019-2020)
- Improve water efficiency standards in new development (essential standard 105l/p/d, preferred standard 80l/p/d)
- Require major developments (>30,000m^2) to provide 50% of own water requirement, >15,000m^2 / 500 units to provide 25%)
- Develop a Water Action Framework to determine the mix of measures and actions to enable a sustainable supply-demand balance under a changing climate

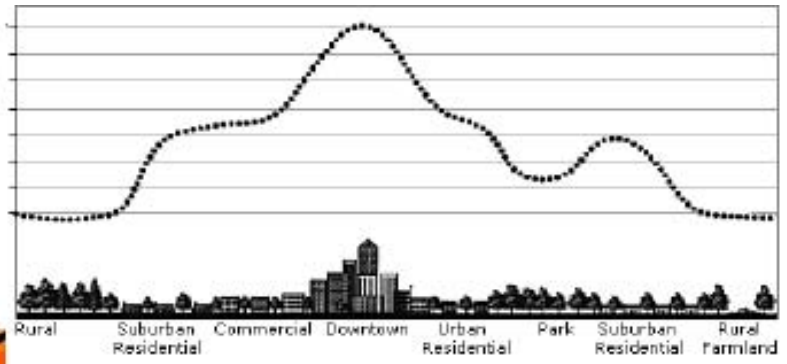
European climate map 2071

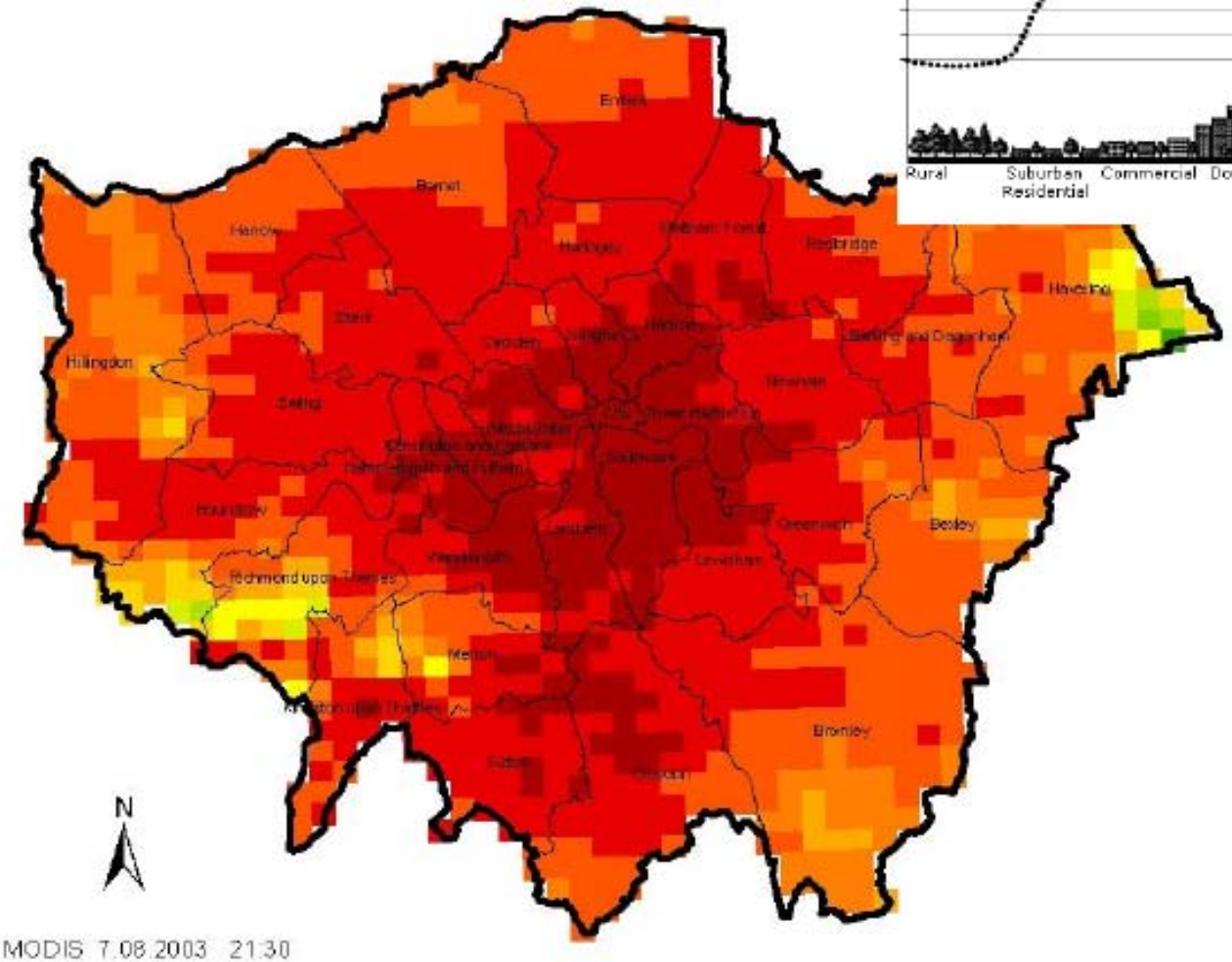


Centre International de Recherche sur l'Environnement et le Développement and
Ecole Nationale de la Météorologie, Météo-France

GREATERLONDONAUTHORITY

Temperature distribution in London, August





Temperature Celsius

8	
9	14
10	15
11	16
12	17
13	18
13.5	19

MODIS 7.08.2003 21:30

Overheating - analysis

London will experience an increasing risk of overheating due to:

- Global warming induced climate change
- The intensification of the Urban Heat Island (UHI) effect from:
  - climate change
  - increase in development density from London's growth
  - increase in man-made heat contributions as a response to higher temperatures (eg air conditioning) and London's growth
  - reduced evaporative cooling due to drier summers

Overheating - response

5 parallel courses of action

- Managing London's urban heat island
- Designing new, and adapting existing buildings and infrastructure to minimise the need for cooling as far as possible
- Ensuring that where cooling is still required, that low carbon, energy efficient methods are used
- Enabling a cultural adaptation to high temperatures
- Ensuring that a tried and tested heatwave emergency plan exists to manage extreme events

Overheating - response

- Implement urban greening programme across London
- Create an ‘urban heat island action area’ in central London
- Develop a ‘cooling hierarchy’ for new development
- Develop London-specific design guidance for new dev’t
- Improve our ability to measure, monitor and predict London’s climate
- Ensure recommendations in the national Heatwave Plan are implemented in London
- Open publicly accessible cool buildings during heatwaves

Rank	City	Country	City GDP as % of country's GDP (1)	Risk index (2)	Natural Hazards (3)							
					Earthquake	Volcanic eruption	Tropical storm	Winter storm	T'storm/ hail/ tornado	Flood	Tsunami	Storm surge
1	Tokyo	Japan	40	710								
2	San Fransisco Bay	USA	<5	167								
3	Los Angeles	USA	<10	100								
4	Osaka, Kobe, Kyoto	Japan	20	92								
5	Miami	USA	<5	45								
6	New York	USA	<10	42								
7	Hong Kong	China	10	41								
8	Manila, Quezon	Philippines	30	31								
9	**London**	**UK**	**15[a]**	**30[a]**								
10	Paris	France	30	25								

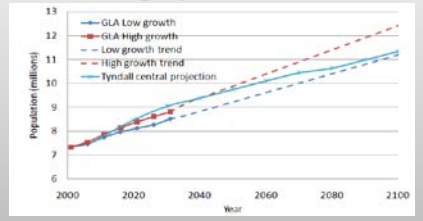
Sources:
1 Statistical authorities, various websites
2 Munich Re, 2004
3 Munich Re, Topics 2002
[a] GLA DMAG estimates

Risk Key :
High, Medium, Low, None

GREATER**LONDON**AUTHORITY

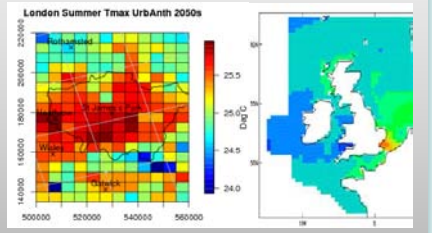
Urban Integrated Assessment Facility

Demographic scenarios

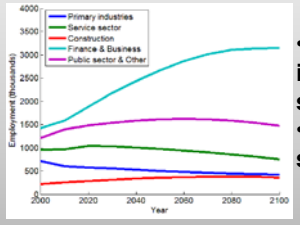


City-scale climate scenarios

- Temperature
- Precipitation
- Sea level rise
- Storm surge

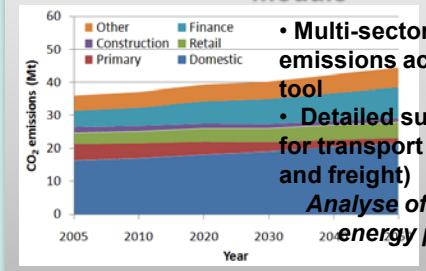


MDM-E3 Multi-sector city-scale economics module



- Dynamic resource interactions between sectors
- Specialist energy sector module

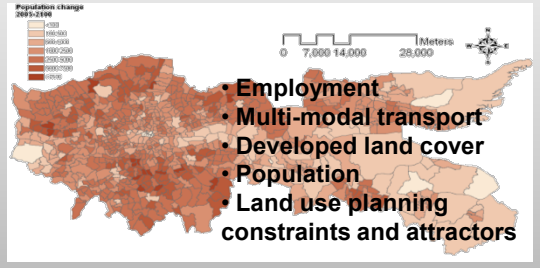
Greenhouse gas emissions assessment module



- Multi-sectoral emissions accounting tool
- Detailed sub-modules for transport (personal and freight)

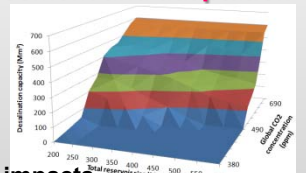
Analyse of city-scale energy policies

Land use and spatial interaction module



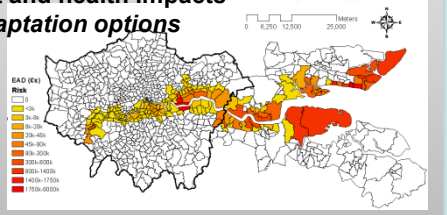
- Employment
- Multi-modal transport
- Developed land cover
- Population
- Land use planning constraints and attractors

Climate impacts assessment and adaptation planning



Analyse risks of
- Flooding
- Drought
- Urban heat and health impacts

Test adaptation options



Interface for testing of policy options

Working with key London stakeholders