Monitoring and evaluating the National Adaptation Programme

Infrastructure theme:

- Design and location of new infrastructure
- Resilience of infrastructure services
  a. *Energy*
  b. *Public water supply*
  c. *Ports and airports*
  d. *Roads and rail network*
  e. *Digital infrastructure*
- Infrastructure interdependencies

Last updated: 26 June 2015

Introduction

- This slidepack:
  - Serves as a technical annex to **Chapter 3: Infrastructure** in the ASC's first statutory report to Parliament on the National Adaptation Programme, available at www.theccc.org.uk/publications
  - Provides the latest trend information on indicators of exposure, vulnerability, action and realised impacts that informed the ASC's assessment. A full list of indicators used by the ASC across all six NAP themes is available at www.theccc.org.uk/publications
  - Will be updated periodically as new data becomes available.
  - Highlights indicators that would be useful but where the necessary datasets have not yet been identified.
  - Follows the structure of the infrastructure chapter in the ASC's progress report, which is based on the 'adaptation priorities' the ASC identified for the infrastructure theme.
- After presenting a high level summary of the ASC's assessment of progress against each of the adaptation priorities, this annex sets out the underlying data by adaptation priority.

Infrastructure theme: overview of progress

Adaptation priority	Is there a plan?	Are actions taking place?	Is progress being made?
1. Design and location of new infrastructure			
2. Resilience of infrastructure services			
2a. Energy			
2b. Public water supply			
2c. Ports and airports			
2d. Roads and rail network			
2e. Digital infrastructure			
3. Infrastructure interdependencies			

Red: plans and policies, delivery of actions, or progress in addressing vulnerabilities, are lacking.
Amber: adaptation priority has been partially addressed, some evidence of progress in some areas.
Green: plans are in place, actions are being delivered, progress is being made.
Grey: insufficient evidence to form a judgement.

Source: ASC (2015) *Progress in preparing for climate change*

1. Design and location of new infrastructure

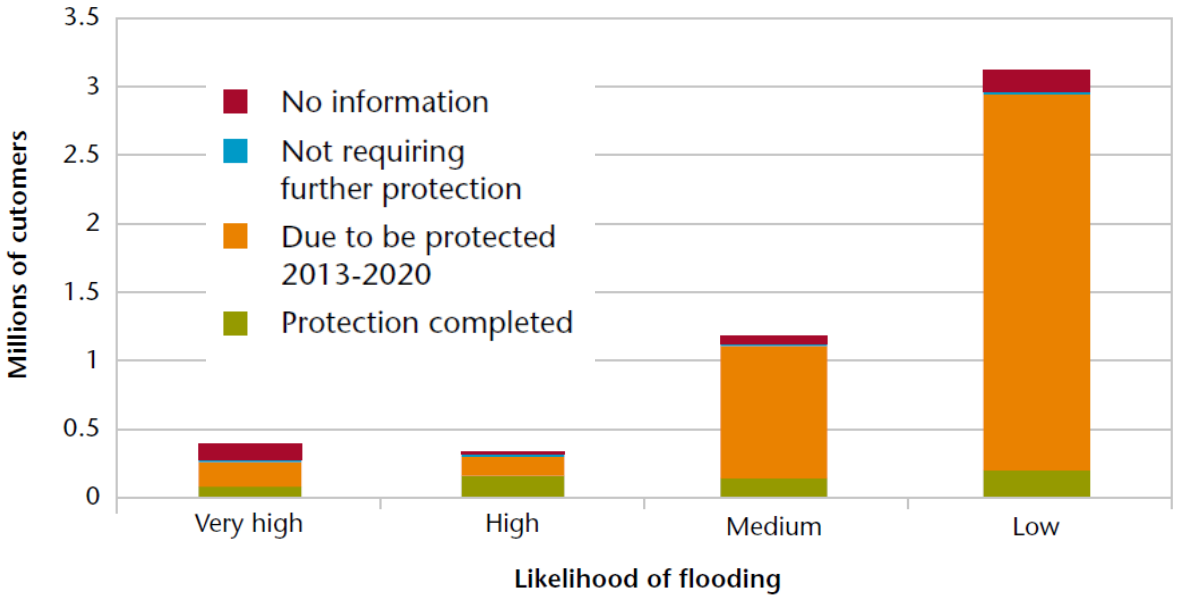
Measure	Data series	Source	Trend	Implication
Number of nationally significant infrastructure project (NSIP) applications in flood risk areas	From 2013	PINS	N/A	No information yet available.
Number of NSIP applications in flood risk areas approved contrary to EA advice, or with EA conditions	From 2013	PINS	N/A	No information yet available.

2a. Resilience of infrastructure services: *Energy*

Measure	Data series	Source	Trend	Implication
Power generation capacity in areas of very high/high flood risk, and coastal erosion	2014	HR Wallingford	N/A	No trend information available. See ASC 2014 for results.
Number of customers reliant on major electricity substations in areas of very high/high flood risk	2010 – 2013	Ofgem V11	↓	Likely to mean less chance of electricity supply disruptions due to flooding of major substations.
Total abstraction of freshwater for energy	2000 – 2012	Environment Agency	↔	Levels steadily declined between 2000 and 2006 but have increased since.
Power stations reliant on freshwater for cooling in areas of water scarcity	2012	UKERC based on DUKES and Byers et al	N/A	Almost all electricity generation that relies on freshwater abstraction is situated in catchments at a low risk of water shortages in an average summer.
Electricity supply customer minutes lost due to weather impacts on high voltage network	1995 – 2011	NaFIRS	N/A	Severe weather is a significant cause of disruption to electricity networks

2a. Resilience of infrastructure services: *Energy*

Number of customers reliant on major electricity substations in areas of very high/high flood risk	↓	Likely to mean less chance of electricity supply disruptions due to flooding of major substations.



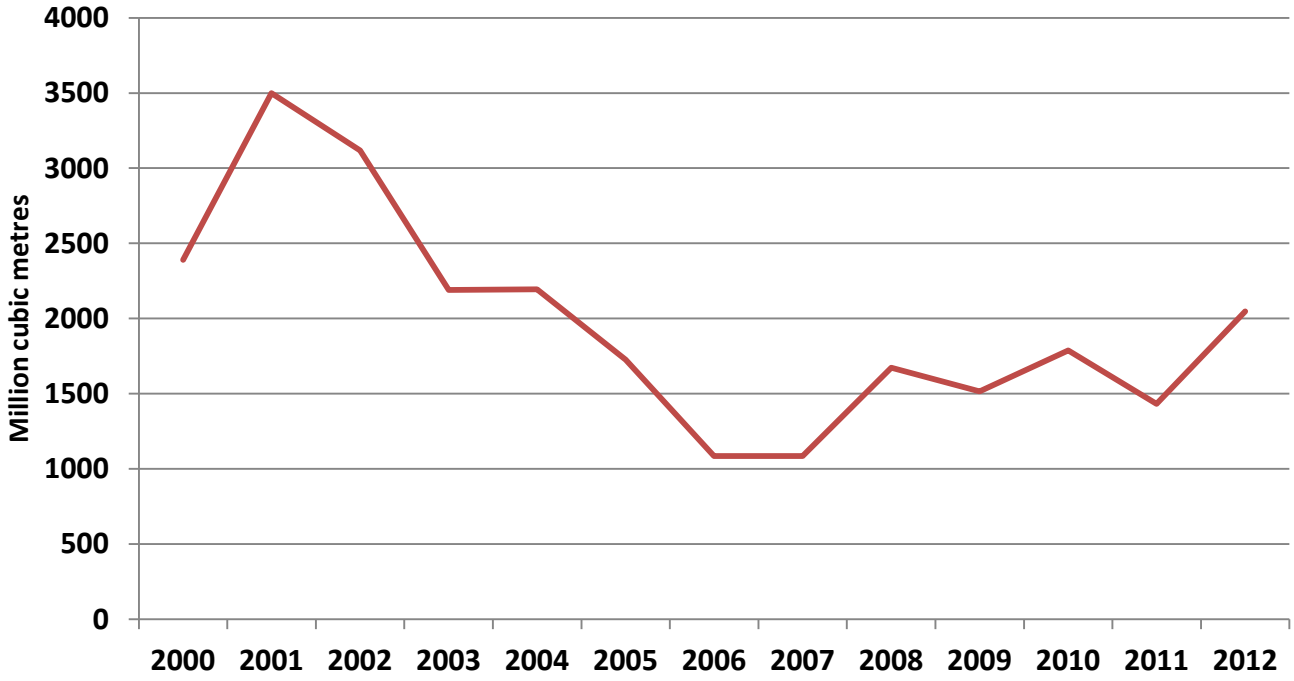
Notes: Number of customers reliant on major electricity distribution substations located in areas susceptible to river and coastal flooding at differing flood likelihoods that have protection measures completed or due to be completed.

- The Distribution Network Operators provide annual returns to Ofgem on the progress being made with flood mitigation (known as the V11 returns). We used the data in the V11 returns to assess the number of major substations located within areas of very high, high, moderate and low likelihood of river and coastal flooding that have had protection works completed, or due to be completed.
- By 2013, flood risk assessments had been completed for nearly 80% of the major distribution substations identified as being at flood risk. The remaining substations are due to have flood risk assessments completed by 2015.
- Progress with the implementation of flood protection measures generally appears to be on track with nearly 20% of the 300 major substations located in areas susceptible to river and coastal flooding having already benefitted from protection and most of the remainder on course to have measures implemented by 2020.

Source: ASC (2014)

2a. Resilience of infrastructure services: *Energy*

Total abstraction of freshwater for electricity supply	↔	Levels steadily declined between 2000 and 2006 but have increased since.



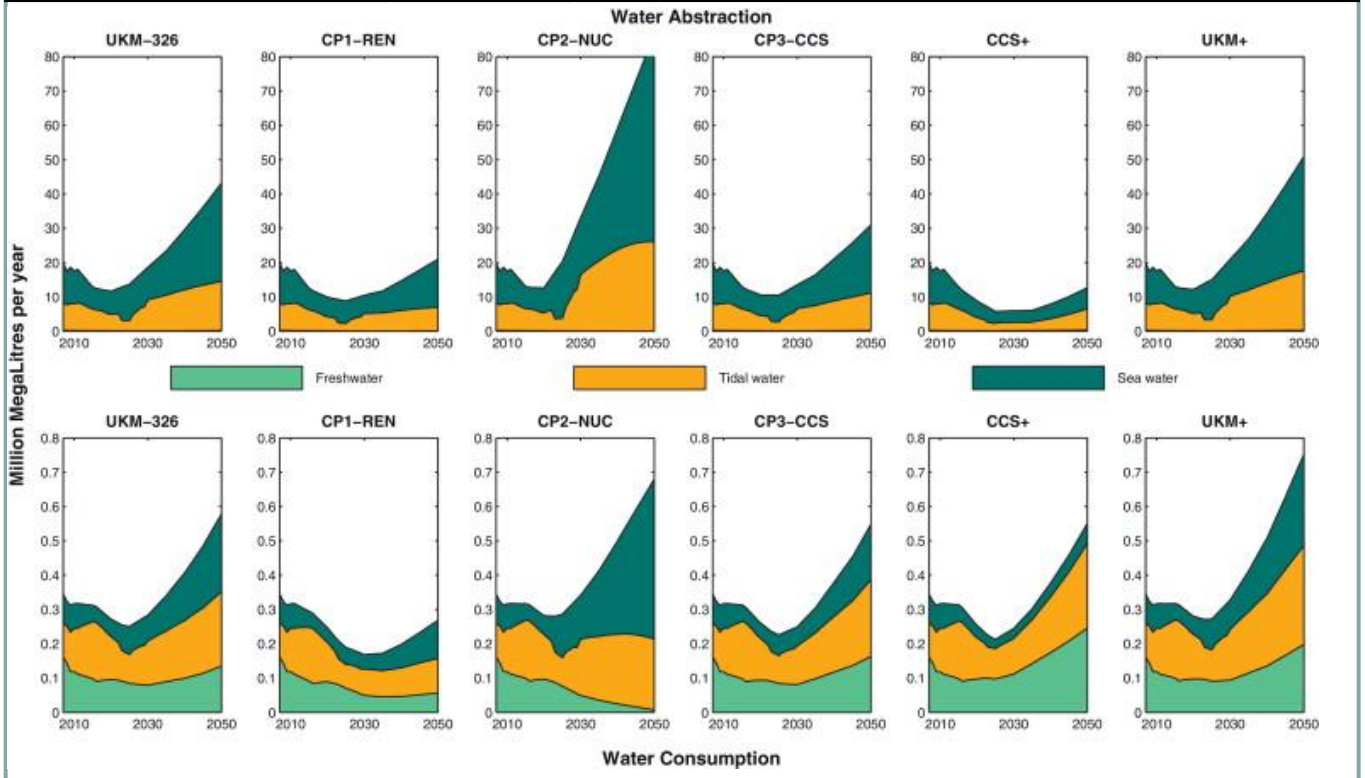
Notes: Non-tidal abstraction for electricity supply in England, including for hydro-power.

- Of the 2,000 million cubic metres abstracted for electricity supply, 90% is for hydropower.
- Around 50% of the 200 million cubic metres abstracted for electricity generation cooling is returned to the environment.

Source: Environment Agency

2a. Resilience of infrastructure services: *Energy*

Power stations reliant on freshwater for cooling in areas of water scarcity	N/A	Almost all electricity generation that relies on freshwater abstraction is situated in catchments at a low risk of water shortages in an average summer.



Notes: The chart is from Byers et al (2014) Electricity generation and cooling water use: UK pathways to 2050, *Global Environmental Change* Volume 25, March 2014, Pages 16–30

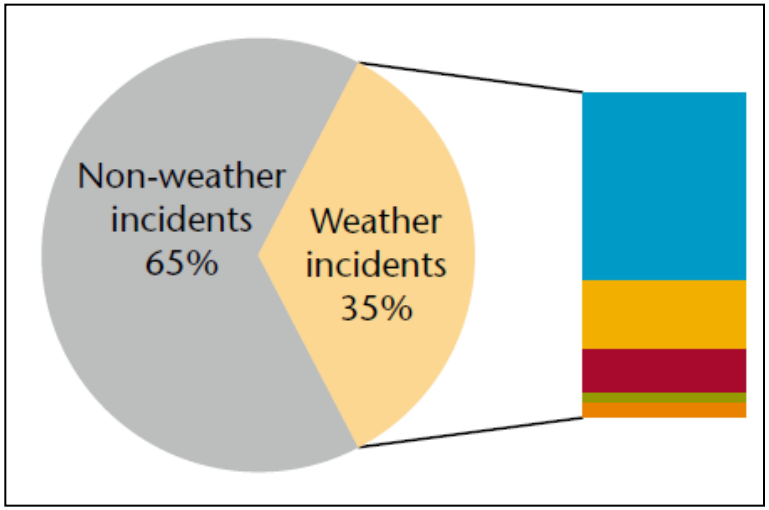
- 12% of power plants in England rely on freshwater for cooling, together accounting for 16 GW of capacity.
- Only two power stations are located in catchments where there is not enough water available during an average summer. These have a combined capacity of 0.5 GW
- The remaining power stations reliant on freshwater are located in catchments that have sufficient water available during an average summer.
- The future requirement for freshwater will be driven by the energy mix (see chart). Scenarios with high levels of nuclear, renewables and energy efficiency show the least need for freshwater, whilst coal CCS plant would be the most water intensive for freshwater (assuming new nuclear plant would be located on the coast).

Source: UKERC based on DUKES and Byers et al (2014)

2a. Resilience of infrastructure services: *Energy*

Electricity supply customer minutes lost due to weather impacts on high voltage network	N/A	Severe weather is a significant cause of disruption to electricity networks.

Total average annual disruption (UK):
1.3 million customer minutes



Notes: Data provided by Energy Networks Association based on the National Fault and Interruption Scheme (NaFIRS).

- Between 1995 and 2012 , 35% of customer minutes lost from high-voltage stations were due to natural hazards
- High winds and storms caused the most damage, accounting for nearly 80% of all customer minutes lost due to natural hazards
- Although less frequent, flooding caused the longest average length of disruption per incident.

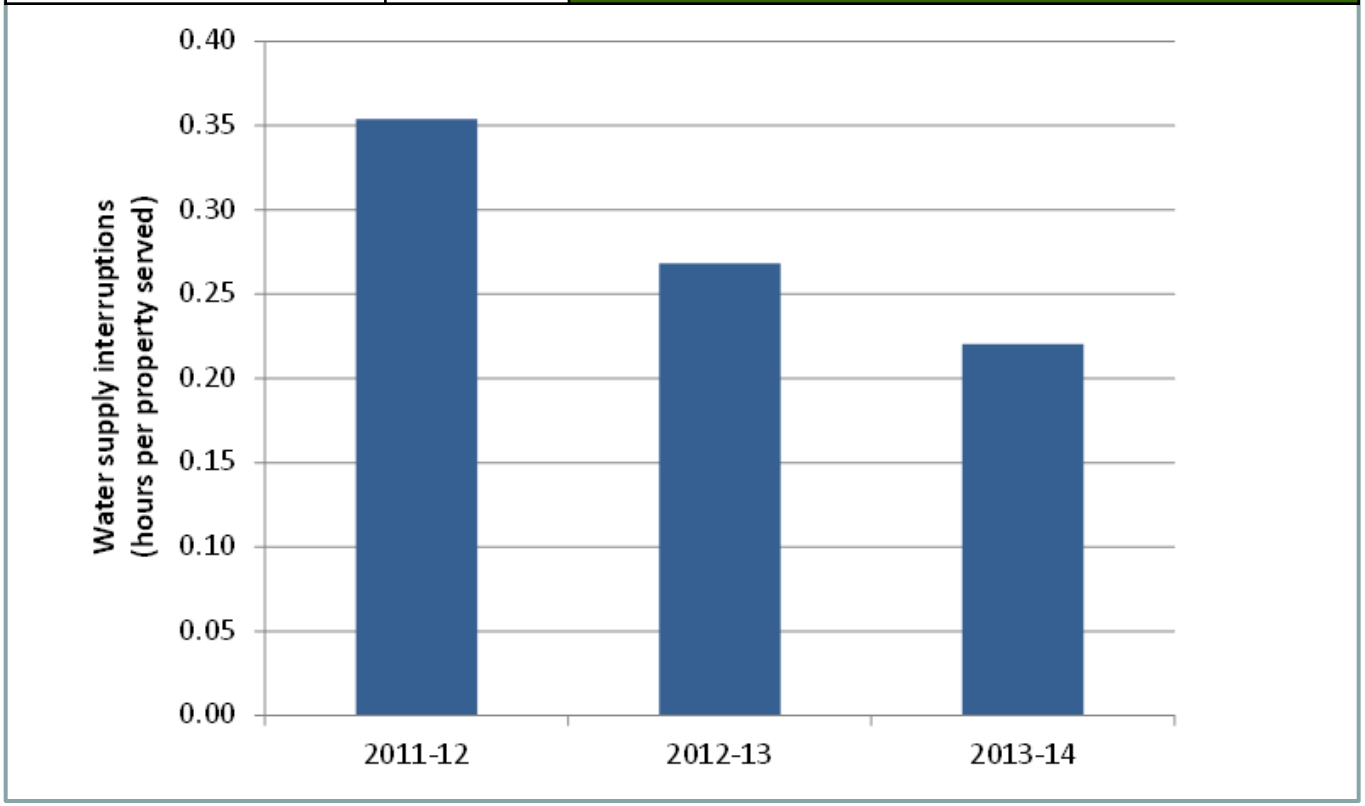
Source: ASC (2014), p68

2b. Resilience of infrastructure services: *Public water supply*

Measure	Data series	Source	Trend	Implication
Clean and waste water treatment works in areas of very high/high flood risk	2014	HR Wallingford	N/A	No trend information available. See ASC 2014 for results.
Number of water customers served by a single source of supply	n/a	Water companies	N/A	No national data exists. Data provided by Anglian Water suggests number of customers with a single source of water declining but this information is not published.
Customers losing supply of drinking water due to severe weather	n/a	Water companies	N/A	No national data exists. Data provided by Severn Trent Water suggests the number of supply disruptions caused by severe weather is very low (<2% of all incidents).
Customer minutes lost per household	2011/12 – 2013/14	Ofwat	↓	Whilst no breakdown is available for lost supplies due to severe weather, the overall trend in customer supply disruption is falling.

2b. Resilience of infrastructure services: *Public water supply*

Customer minutes lost per household	↓	Whilst no breakdown is available for lost supplies due to severe weather, the overall trend in customer supply disruption is falling.



Source: OfWAT KPIs

2c. Resilience of infrastructure services: *Ports and airports*

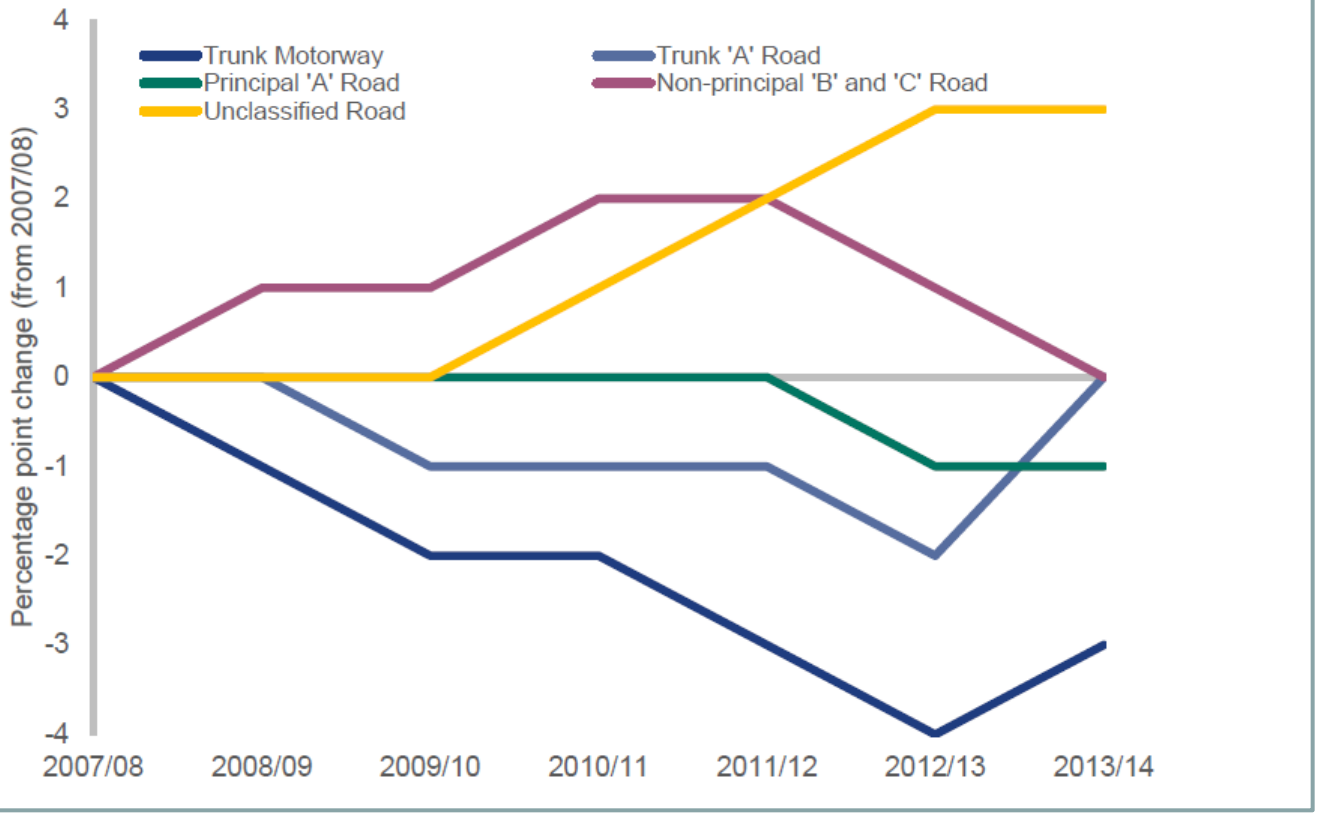
Measure	Data series	Source	Trend	Implication
No measures found				

2d. Resilience of infrastructure services: *Roads and the rail network*

Measure	Data series	Source	Trend	Implication
Condition of roads in England	2006-2014	Highways England	↔	Condition of some major roads has improved (Motorways, Principal A Roads) since 2007/08. No change in some other road types (Trunk A Roads, Non-Principal B + C Roads). Unclassified roads deteriorating.
Rail network earthworks slips and resulting derailments	2004/05 – 2013/14	Network Rail	↔	Disruption caused by severe weather varies year to year, with a longer time series needed to determine any trends.
Disruption to rail services in England due to weather-related incidents	2006-2013	Network Rail	↑	Trends in Network Rail-caused rail passenger delay minutes, including as a result of weather-related incidents, appears to be on the increase, and certainly is not falling.
Kilometres of road and rail network in areas of very high / high flood risk, and coastal erosion	2014	HR Wallingford	N/A	No trend information available. See ASC 2014 for results.

2d. Resilience of infrastructure services: *Roads and the rail network*

Proportion of the road network that should be considered for maintenance	↔	Condition of some major roads has improved (Motorways, Principal A Roads) since 2007/08. No change in some other road types (Trunk A Roads, Non-Principal B + C Roads). Unclassified roads deteriorating.

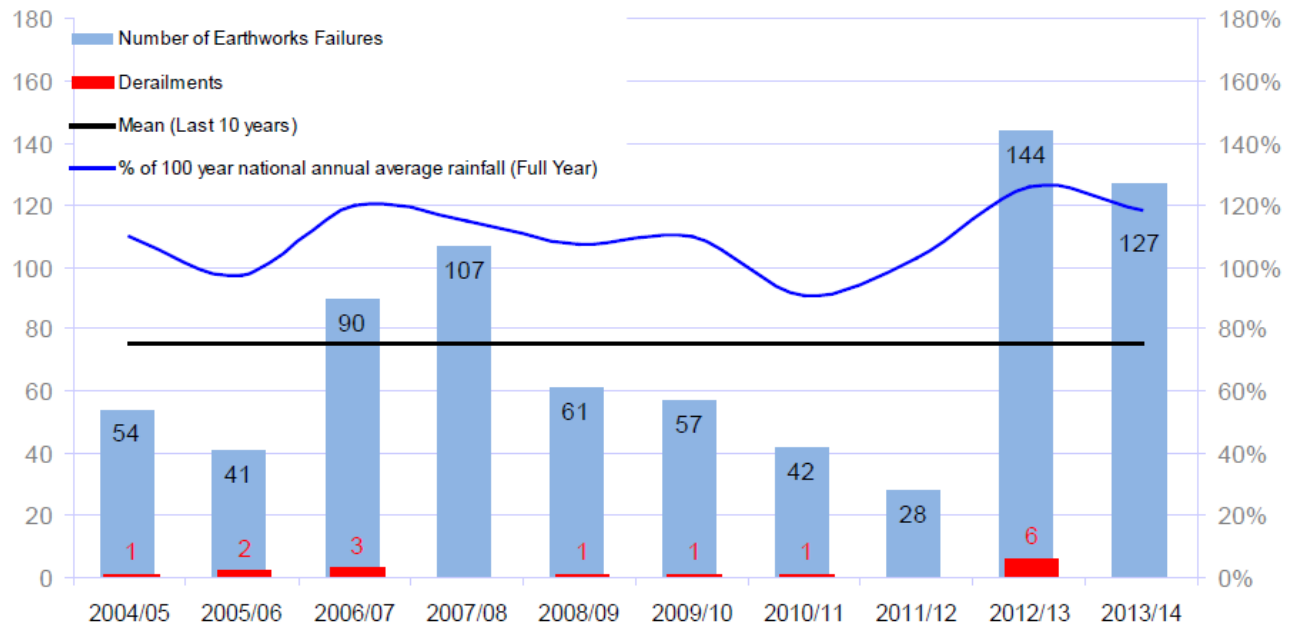


- The chart shows the change in the percentage of the different road networks in England that should be considered for maintenance for each year compared to 2007/08 - the earliest year in the data table.
- For both types of trunk road network, the proportion of the networks that should be considered for maintenance increased between 2012/13 and 2013/14. The trunk 'A' road figure was 5 per cent, the same as in 2007/08. The trunk motorway figure was 3 per cent, 3 percentage points lower than the 6 per cent that should have been considered for maintenance in 2007/08.
- Data collected via different methods showed that 18 per cent of the unclassified road network should have been considered for maintenance in 2013/14, the same as in 2012/13 but 3 percentage points higher than in 2007/08.

Source: DfT (2015) *Road Conditions in England 2014*

2d. Resilience of infrastructure services: *Roads and the rail network*

Number of earthwork failures, derailments, and annual rainfall totals	↔	Disruption caused by severe weather varies year to year, with a longer time series needed to determine any trends.

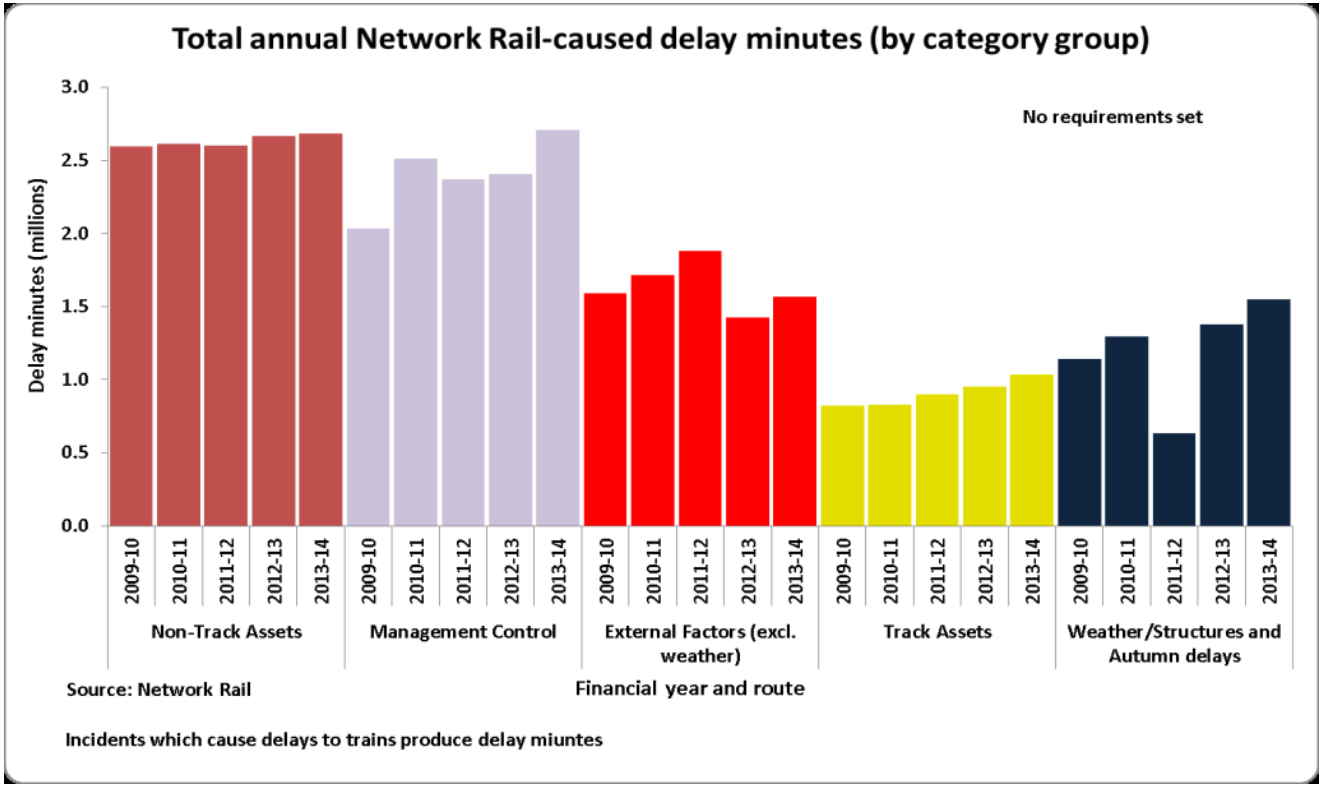


- Chart first published in the report of the Brown Review of transport resilience, initiated after the severe weather disruption during the winter of 2013/14.

Source: Brown Review (2014) for DfT *Transport Resilience Review,* pg101

2d. Resilience of infrastructure services: *Roads and the rail network*

Number of earthwork failures, derailments, and annual rainfall totals	↑	**Trends in Network Rail-caused rail passenger delay minutes, including as a result of weather-related incidents, appears to be on the increase, and certainly is not falling.**



- Chart provided by the TRaCCA project

Source: Network Rail

2e. Resilience of infrastructure services: *Digital infrastructure*

Measure	Data series	Source	Trend	Implication
No measures found				

3. Infrastructure interdependencies

Measure	Data series	Source	Trend	Implication
No measures found				

Adaptation Sub-Committee

http://www.theccc.org.uk

@theCCCuk