Experience of and Lessons Learned in City's Response to Extreme Events: The case of Greater Manchester

Extreme Floods: Greater Manchester, December 2015)

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Outline

- Introduction to the city
- Extreme weather event
- Post-Disaster Emergency Services & Short-Term and Mid-Term Recovery
  - the decision-making process : How did the city prioritize; what were the trade offs?
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  - Lessons Learned
  - Recommendations
- Key take aways

Greater Manchester Facts

Greater Manchester Authorities

GMCA GREATER MANCHESTER COMBINED AUTHORITY

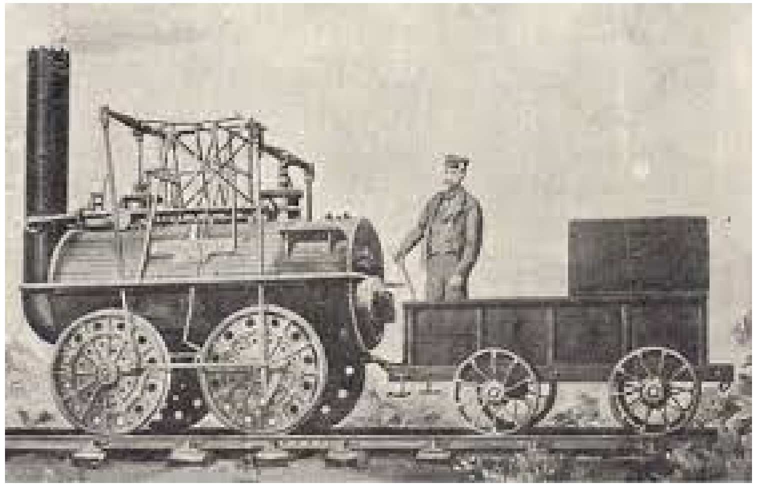
The Greater Manchester Combined Authority(GMCA) is made up of the ten Greater Manchester councils and Mayor, who work with other local services, businesses, communities and other partners to improve the city-region.

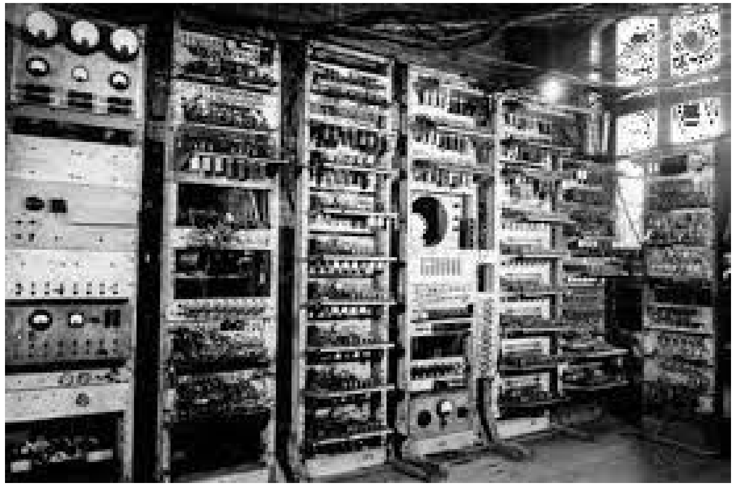
The 10 districts of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan are home to over 2.8 million people and together they form the Greater Manchester city-region

https://www.greatermanchester-ca.gov.uk

Greater Manchester Facts

- Greater Manchester has a proud history of innovation that includes the world's first passenger railway, the first stored-program electronic computer and, in our own time, the Nobel Prize-winning isolation of graphene
- We have also driven social progress. The Chartists, the Trade Union movement, the Co-Operative movement, and women's suffrage were all born in the city-region
- England's first civic university, the University of Manchester, was established here and the area is now home to five universities, all with a leading role in education, research and discoveries that have global importance.





Greater Manchester Facts

GMCA GREATER MANCHESTER COMBINED AUTHORITY

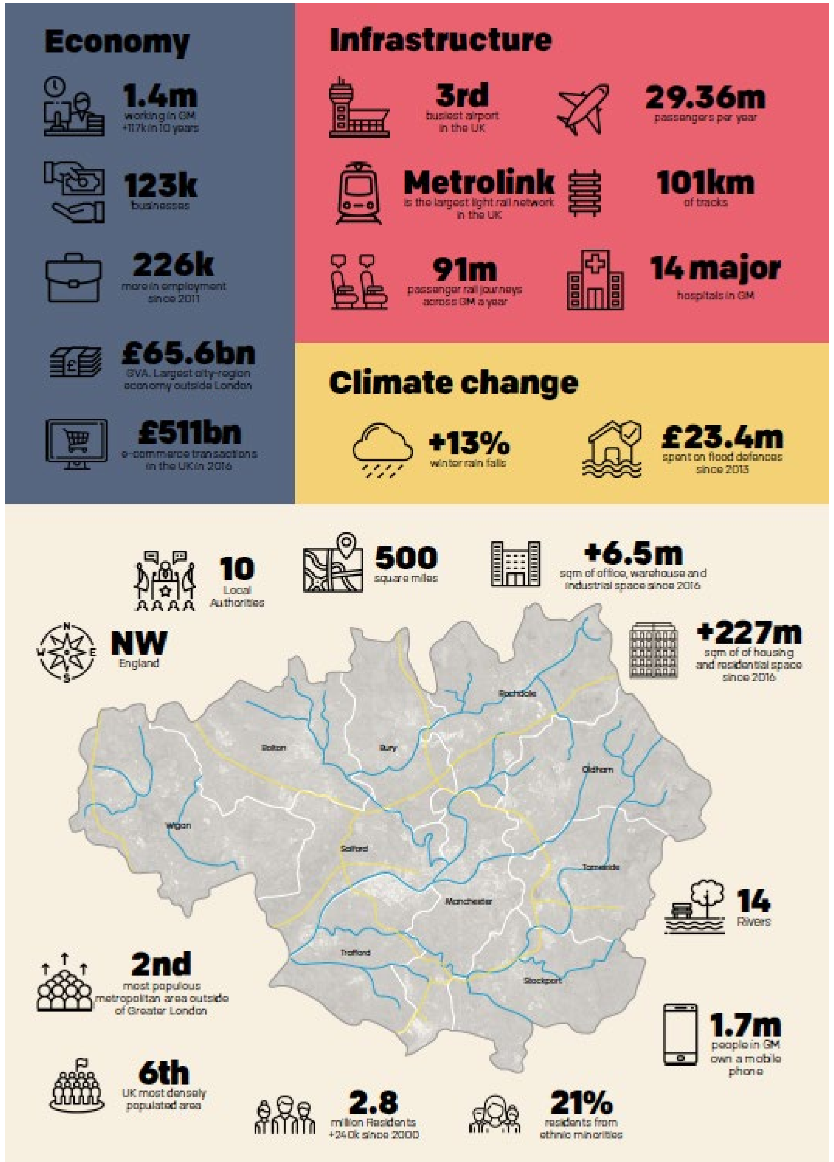
- Greater Manchester is one of the country's most successful city-regions. Home to more than 2.8 million people

- With a Gross Value Added of £65.6 billion (Office for National Statistics, 2017), Greater Manchester represents the largest functional economic area outside of London.

- Our vision is to make Greater Manchester one of the best places in the world to grow up, get on and grow old. We're getting there through a combination of economic growth, and the reform of public services.

- The ten councils-
(Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan) have worked together voluntarily for many years on issues that affect everyone in the region, like transport, regeneration, and attracting investment

https://www.greatermanchester-ca.gov.uk



Greater Manchester Facts : the socio-economic and spatial contexts of the city

Urbanisation

Greater Manchester, like many other urban centres, is an engine of economic growth and a place of social opportunity.

Looking forward, the population of Greater Manchester is predicted to grow by 10% over the next 20 years. This equates to 190,000 - 240,000 more people living in the city-region which will require around 179,000 new homes by 2037. This growth is also expected to create up to 100,000 new jobs by 2037 (Greater Manchester Spatial Framework Publication Plan, 2020).

Well-designed urban areas can reduce the exposure and vulnerability of people to risk and can help them to cope when the unexpected occurs. As well as protecting people, good urban design can protect businesses, the economy and people's livelihoods.

10%
Population growth over the next 20 year

179K
New homes by 2037

100K
New jobs

Flooding

The impacts of flooding and coastal change in the UK are already significant and expected to increase as a result of climate change

Climate Change

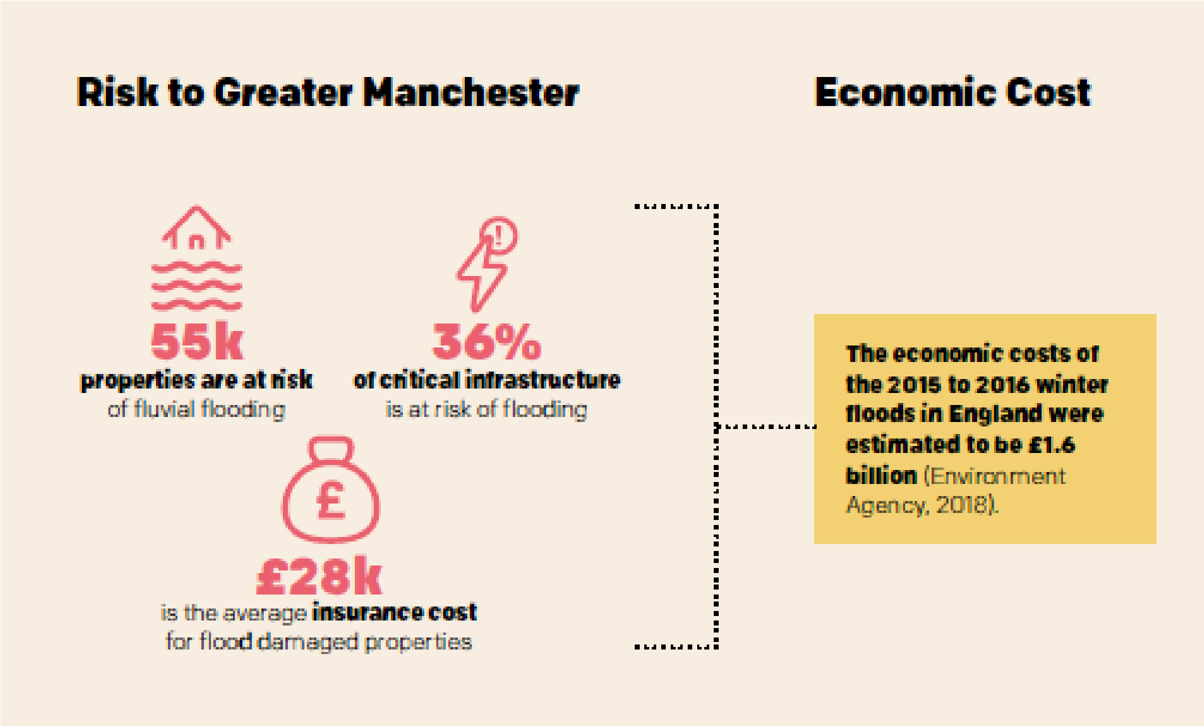
> **Climate change is the single biggest threat the world faces.**
>
> GM 5-Year Environment Plan, 2019

Greater Manchester, the notable shocks

- Natural hazards including flooding and, in future, heatwaves
- Infectious diseases such as Covid-19 and pandemic influenza
- Infrastructure or technology failures
- Those resulting from human activity, including terrorism

Top Risks in Greater Manchester

- Flooding remains one of the greatest risks identified on the Greater Manchester Community Risk Register
- Wetter winters and more extreme downpours across the year are projected for the coming decades, suggesting that flood risk will intensify.
- Current estimates suggest that across Greater Manchester there are more than 48,000 properties at risk from river flooding



GMCA Journey

work supports the delivery of the targets outlined in the **Sendai Framework for Disaster Risk Reduction 2015-2030** and the **Sustainable Development Goals**, both adopted by all UN member states. These international frameworks, alongside national policy, help to shape the thinking locally.

- In, joined the UNDRR's Making Cities Resilient programme, joining over 3,000 cities in an international collaborative effort to reduce disaster risk. More recently we supported the launch of UNDRR's Making Cities Resilient 2030.
- In 2017 Greater Manchester was invited to become a member of 100 Resilient Cities (now the Resilient Cities Network), an initiative pioneered by the Rockefeller Foundation. The Resilient Cities Network brings together cities from across the world that are committed to building and investing in urban resilience

Running the GMCA

- The GMCA is run jointly by the leaders of the ten councils and the Mayor of Greater Manchester
- The Mayor joins Greater Manchester's Combined Authority as its chair and eleventh member.
- A variety of boards, panels and committees look specifically at areas like transport, health and social care, planning and housing.

Greater Manchester has seen major change over past decades and this is projected to continue…

- Many people experience serious poor health and deep-rooted inequalities.
- People who live in Greater Manchester are likely, on average, to have a shorter life expectancy and a lower healthy life expectancy (years of life with good general health) than the average for England, with some areas experiencing a healthy life expectancy of below 50 years of age.
- Over 1 million of our residents live in areas amongst the 20% most deprived in England (University College London Institute for Health Equity, 2020).

These drivers of vulnerability, if left unchecked, will mean that any shock events or emergencies will have greater consequences for our residents.

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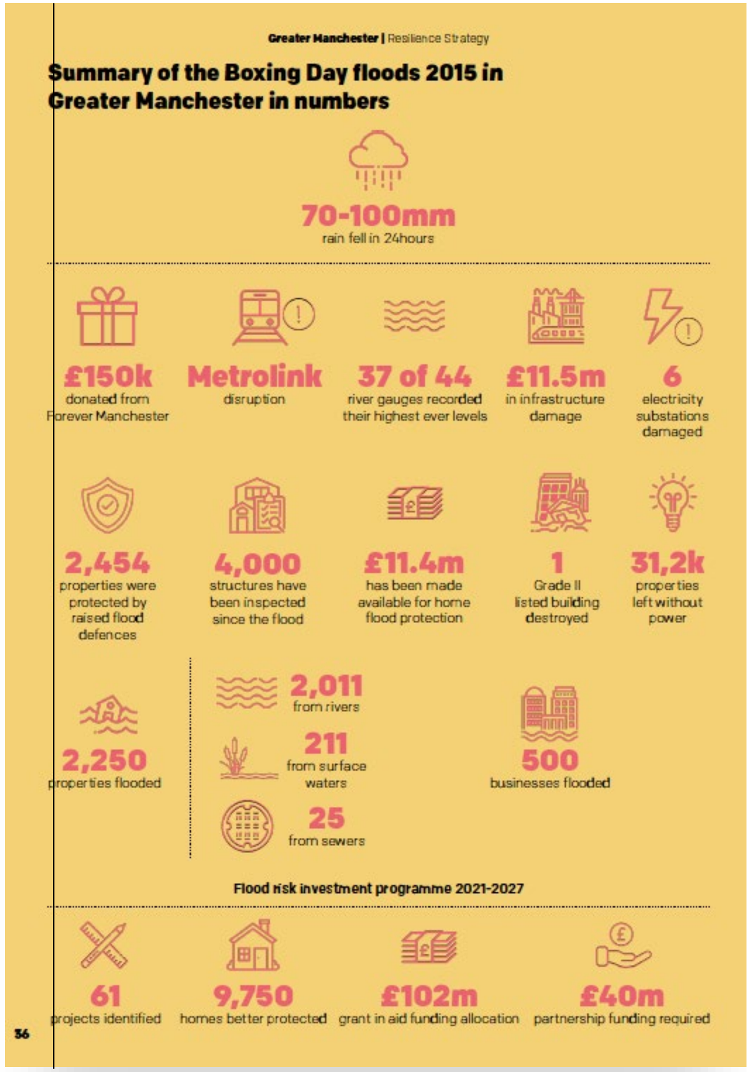
The extreme event : Flooding due to Storm Eva on Boxing Day 2015

- The impacts of Storm Eva on Boxing Day 2015 caused some of the most widespread flooding ever experienced in Greater Manchester.
- Prolonged, intense rain falling on already saturated catchments led to river levels rising rapidly.
- Many rivers reached record levels with some recording levels over 1 metre higher than previously recorded.
- Three river-flow gauging stations, with flows of around 1,700 m3/s exceeded the previous peak flow record for England and Wales
- This caused significant impacts in local communities affecti homes, businesses, local infrastructure and the environment.
- Over 2,200 properties flooded internally across 65 communities in 8 Local Authority districts. In addition, tens of thousands of properties experienced disruption due to power loss and road closures.

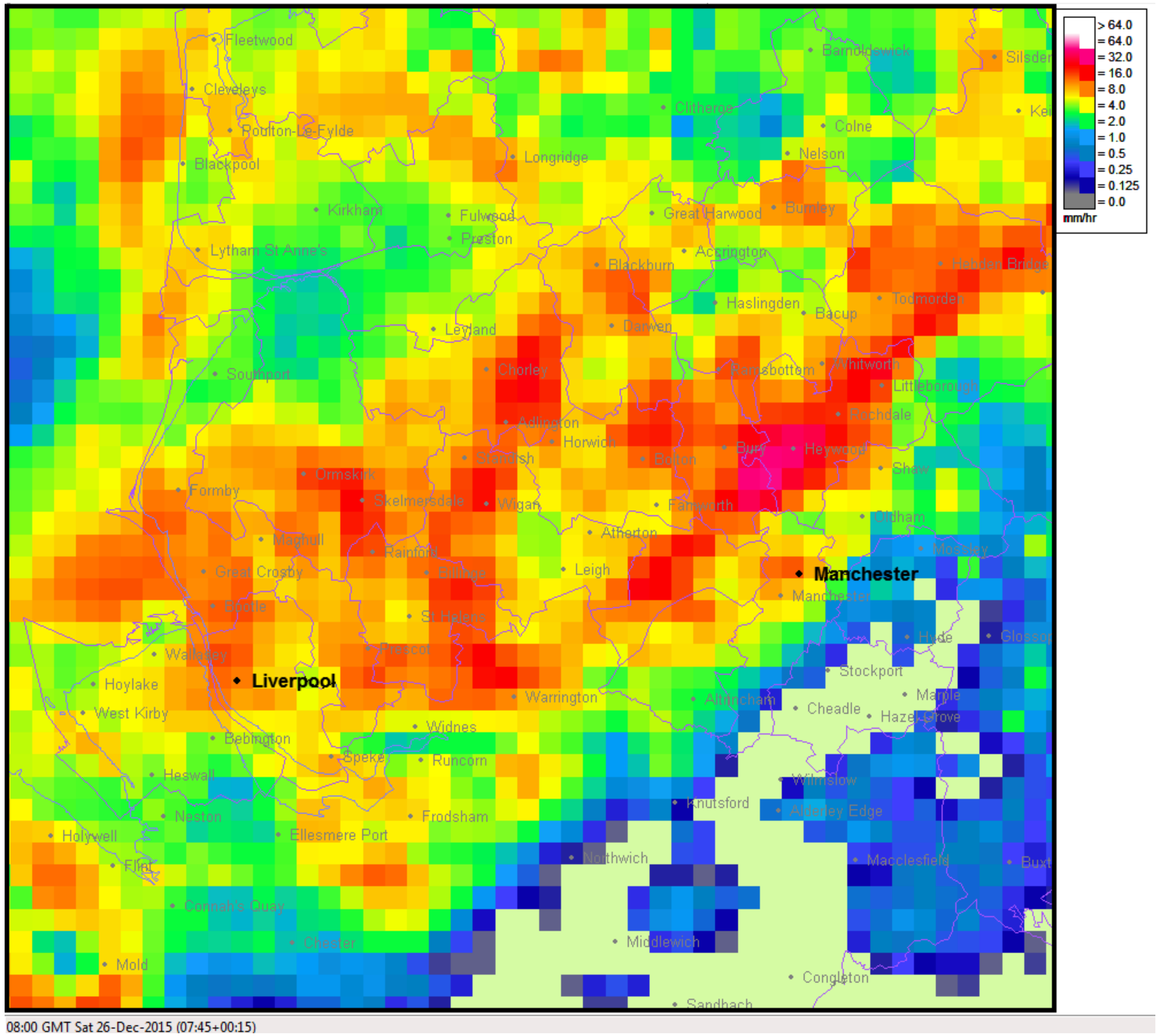
Impacts of Storm Eva on Boxing Day 2015



Before and during the flood

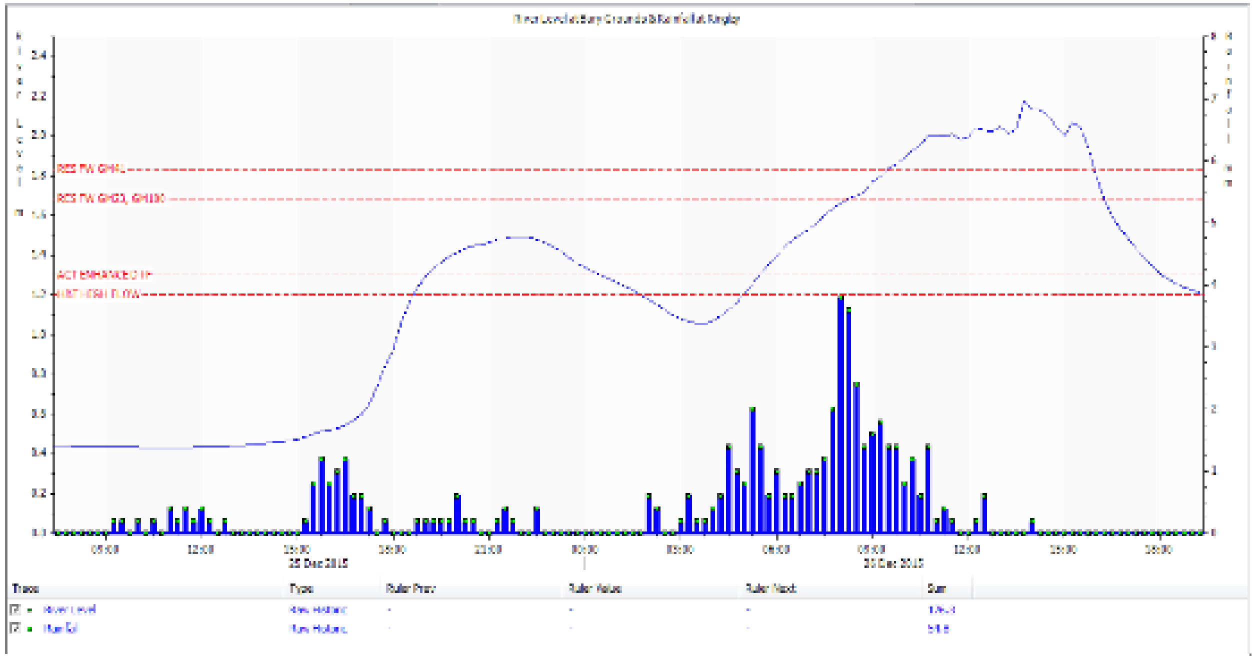
- 2015 was the sixth wettest year on record.
- December's weather was substantially warmer than normal and this warmer air carried more moisture resulting in twice the long-term average December rainfall total, creating saturated catchment conditions over large parts of the Irwell catchment.
- The heaviest rain from Storm Eva on Christmas Day and Boxing Day was experienced mostly in the North of Manchester. In the preceding days, soils in these areas had become saturated and close to capacity.
- The combination of prolonged average rainfall, saturated catchments, rapidly responding rivers and heavy showers on and around the 26th resulted in an extremely rapid onset of flooding.
- The sheer speed of response made the flooding very difficult to predict, and placed a huge strain on the relevant authorities and responders and their ability to co-ordinate pre-emptive activities. Water levels rose rapidly in the Rivers
- The sudden onset, extent and depth of the flooding was unprecedented and meant that its impacts across Greater Manchester were devastating.
- Depths were so great in parts of Bolton, Bury, Salford and Rochdale that some residents were evacuated by boat, tractor and wheelie bin. For some areas this was the worst flooding for a generation

Rainfall

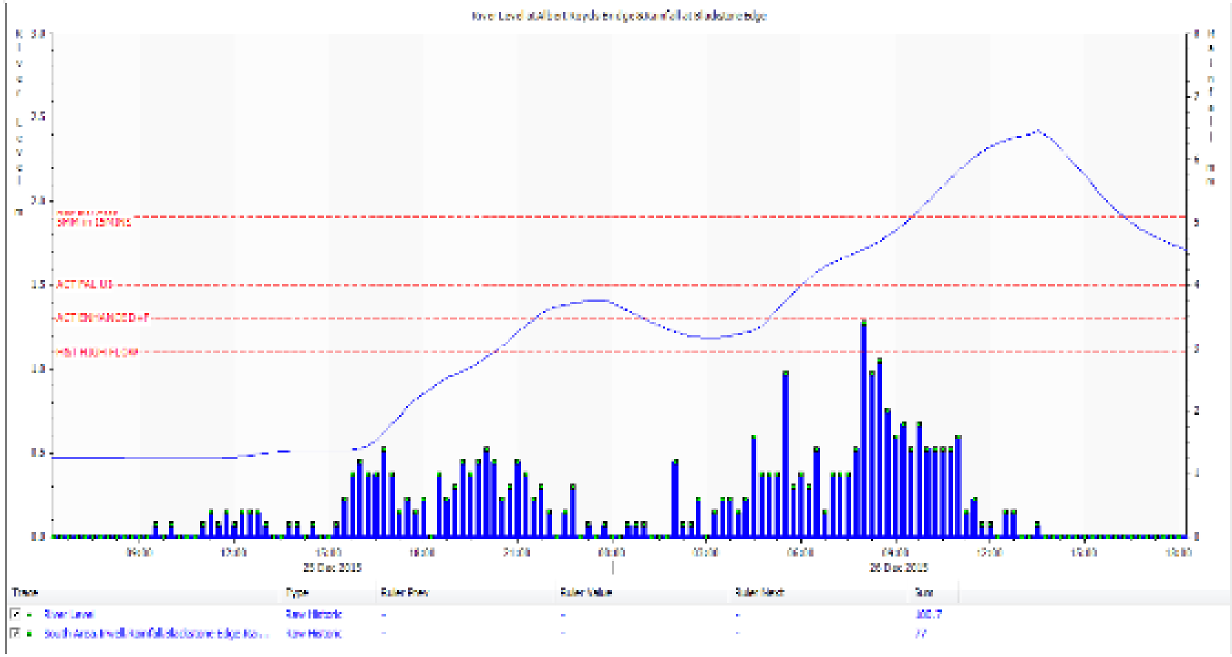


Rainfall intensity across Greater Manchester at 8am on Boxing Day

- Flooding occurred in 8 Boroughs within Greater Manchester (only Stockport and Trafford avoided flooding)
- 128mm of rain in 36hours (Average annual rainfall approx. 881mm)
- As a result of the heavy rainfall, rivers across Greater Manchester responded rapidly
- The river level for the River Roch, at its downstream confluence with the Irwell, was 1.1m higher than anything recorded in its 64 year history.
- 37 of 44 river gauges (level sensors) recorded highest ever level
- Manchester Racecourse recorded a level 1.3m higher than the 1946 Flood (previous record)

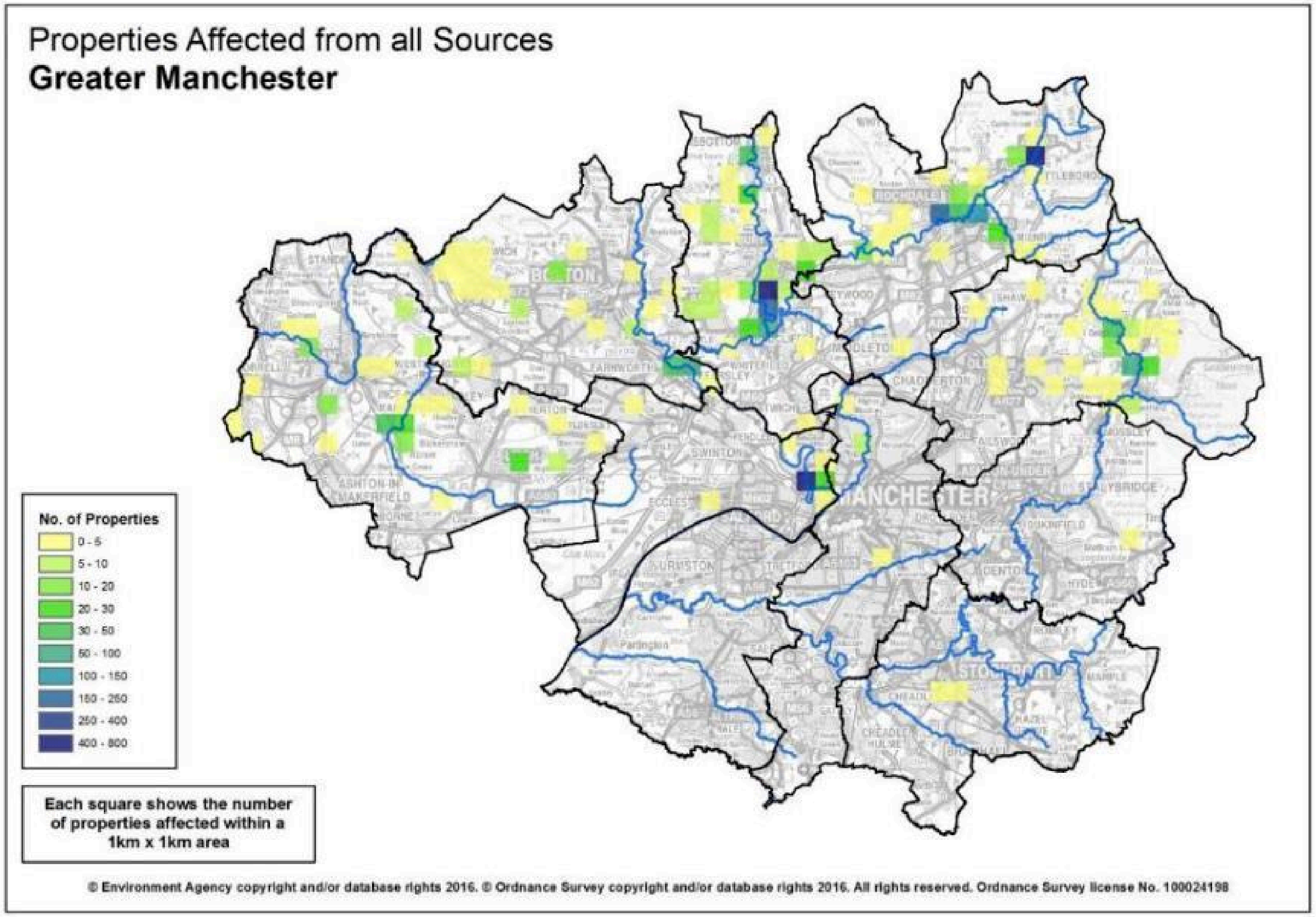


river levels in the Irwell and Roch over the course of Boxing Day.



These figures demonstrate just how quickly river levels were rising in response to the rainfall, due largely to the already saturated nature of the catchment from a month of double the average amount of rain.

Locations Affected



- Over 80% of the flooding was caused by main rivers.
- 1, 649 properties were flooded in 3 principal locations; Salford (750), Radcliffe/Redvales (670), and Littleborough/Rochdale (229).
- Many locations suffered severe impacts such as Prestolee/Stoneclough and the Radcliffe Riverside estate, Bury, where flooding inside homes was up to head height.
- Many Local Authorities had to respond to flooding at multiple locations from multiple sources, such as across the boroughs of Wigan, Bolton and Rochdale and Bury.
- 65 communities across 8 LA districts (not including Stockport, as impacts were less than the definition threshold for significant flooding) were impacted, making this the single largest flooding incident to affect Greater Manchester for over a generation.

The geographical scale and extent of flooding impacted across Greater Manchester. Over 2,200 properties were affected, as well as businesses, road and transport links, utilities and other local infrastructure assets

Infrastructure Impacts : Electricity Supply

Flooding in December 2015 exceeded the defence levels required by guidance for infrastructure resilience

- **Over 31,200 properties** across Greater Manchester were without power as a result of the Boxing Day floods
- **143 Properties** were off supply for two days due to access issues following the flooding, 1 property was off supply for three days due to access issues following the flooding, 3 properties were off supply for more than four days due to no access at the properties.
- Seven sub-stations were damaged by floodwater, in Rochdale (2), Littleborough (1), Radcliffe (3) and near Horwich (1).
- Some sub-stations which flooded provide supply to properties via secondary sub-stations. 30 mobile generators were mobilised by Electricity North West to provide a temporary power supply, mostly to properties not directly affected by flooding.

Bridges

Several small bridges were damaged or displaced by the flood. Some bridges over rivers were closed pending structural inspection after river levels receded. Extensive permanent repairs at multiple locations are complete, ongoing, or planned.

Waterside Restaurant at Kay Street Bridge, Summerseat

Landslip debris and damage to footbridge

Transport

- Public transport on Boxing Day operates on a reduced service so disruption was not as extensive as on a normal working day.

- However, there was significant disruption to transport services across Greater Manchester :
    - Trams
    - Railways
    - Roads

Other sectors

- Gas Supply
- Environment Agency Assets
- Wastewater Treatment
- Water Supply
- Manchester Ship Canal

Other impacts : Environmental Impacts

- **Water Quality** have been affected through a combination of combined sewer overflow (CSO) discharges, inundation of waste water treatment works and waste materials and fine sediments and other contaminants being washed into watercourses.
- **Habitats.** The flood and associated discharges and deposition of debris caused short-term detriment to habitats and biodiversity. The flood waters spread an invasive species, such Himalayan Balsam, Giant Hogweed and Japanese Knotweed into new areas in the catchment.
- **Fish.** No reports of direct impacts to wild fish were received after the flood, though some have been stranded or displaced and spawning gravels covered or scoured
- **Gravel management.** Large quantities of material were mobilised and transported down rivers catchments during the flood. Sediment transport and deposition is a natural process which can provide excellent habitat for fish and invertebrates and create or alter natural meanders. In some cases, gravel and masonry rubble were deposited in areas where it might increase the risk of flooding or bank erosion.
- **Waterlogged ground** resulted in some slope failures (landslides) adjacent to watercourses. These resulted in increased flood risk and erosion of the opposite bank, especially if the landslide results in trees falling into the watercourse

Other impacts : Public Health Impacts

- Following the flooding, water quality was monitored closely due to the damage to Bury wastewater treatment works, specific advice was given to those intending to use the affected watercourses for recreation and no ill effects were reported.
- Flood basins and flooded public spaces were managed in accordance with relevant guidance and sampled were necessary to ensure they were suitable for the public to use again.
- Flooding is known to have longer term effects on mental health, mainly due to the damage and protracted disruption caused to homes and livelihoods.
- The psychological impacts of the 26th December 2015 flooding - the stress caused to those affected has also been clear.
- Many people affected by flooding were highly vulnerable due to health, age, income as well as other factors.

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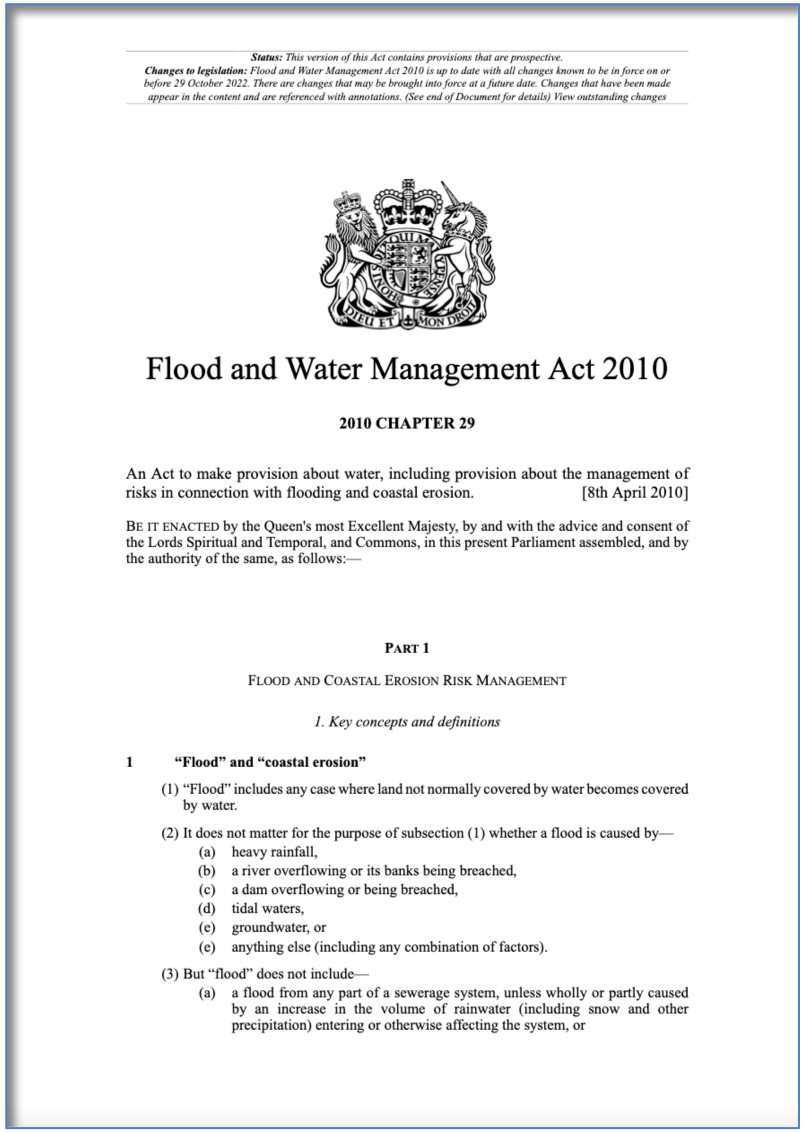
Flood risk management

- Flood risk management is multi-faceted and requires **a multi-agency response**. It spans across duties, responsibilities, and agencies. It involves planning, preparation, engagement, investment, partnerships, responding to events and helping with recovery.
- The legislation governing flood risk management is "**The Flood and Water Management Act 2010",** which provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges, and protects water supplies to the consumer. This act also aims to reduce the flood risk associated with extreme weather.



Status: *This version of this Act contains provisions that are prospective.*
Changes to legislation: *Flood and Water Management Act 2010 is up to date with all changes known to be in force on or before 29 October 2022. There are changes that may be brought into force at a future date. Changes that have been made appear in the content and are referenced with annotations. (See end of Document for details) View outstanding changes*

Flood and Water Management Act 2010

2010 CHAPTER 29

An Act to make provision about water, including provision about the management of risks in connection with flooding and coastal erosion. [8th April 2010]

BE IT ENACTED by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

PART 1

FLOOD AND COASTAL EROSION RISK MANAGEMENT

1. Key concepts and definitions

1 **"Flood" and "coastal erosion"**

(1) "Flood" includes any case where land not normally covered by water becomes covered by water.

(2) It does not matter for the purpose of subsection (1) whether a flood is caused by—
(a) heavy rainfall,
(b) a river overflowing or its banks being breached,
(c) a dam overflowing or being breached,
(d) tidal waters,
(e) groundwater, or
(e) anything else (including any combination of factors).

(3) But "flood" does not include—
(a) a flood from any part of a sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system, or

Under the Flood and Water Management Act 2010 all risk management authorities have a duty to co-operate with each other and to share data

There is no single body responsible for managing flood risk in the UK. Responsibility is shared across a number of bodies :

- **DEFRA** has overall national responsibility for policy on flood and coastal erosion risk management and provides funding for flood risk management authorities through grants to the Environment Agency and local authorities.
- **The Environment Agency** is responsible for taking a strategic overview of the management of all sources of flooding. The Agency also has operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea, as well as being a coastal erosion risk management authority.
- **Local Authorities** - Manchester City Council, along with the other 9 GM local authorities, is a **Lead Local Flood Authority** (LLFA) and is responsible for developing, maintaining and applying a strategy for local flood risk management in our area and for maintaining a register of flood risk assets. The council also has lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses, which can include streams, drains and culverts.
- **Highway Authorities** are responsible for providing and managing highway drainage and roadside ditches and must ensure that road projects do not increase flood risk.
- **United Utilities** is responsible for managing the risks of flooding from water and foul or combined sewer systems providing drainage from buildings and yards.

Managing flood risks and flooding : relevant to Greater Manchester

The responsibilities for managing flooding in the UK is divided between different RMAs as defined in the Flood and Water Management Act, 2010 . RMAs have powers and duties to manage the different forms for flooding that can occur. The Environment Agency is responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion

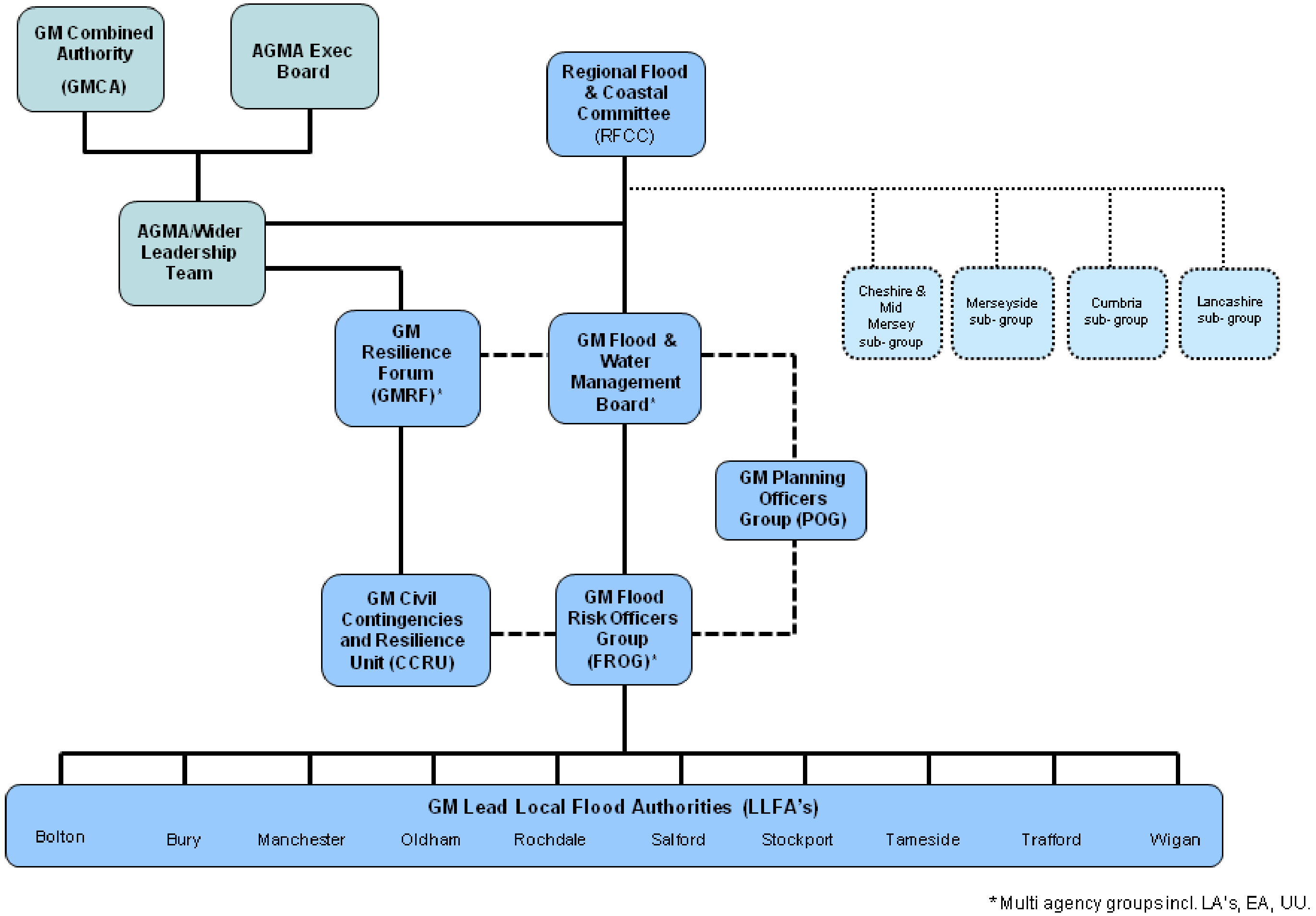
Risk from:	Environment Agency	Lead Local Flood Authority	Water company	Highway authority
Main river	✓			
Surface water		✓		
Surface water (from highway)				✓
Sewer flooding			✓	
Ordinary watercourse		✓		
Groundwater		✓		
Reservoirs	✓*	✓*	✓*	✓*
Strategic overview of all sources of flood risk (and the coast)	✓			

Flood risk management across Greater Manchester

- **The Regional Flood and Coastal Committee (RFCC)** is a statutory committee as defined by the Flood and Water Management Act (2010). It has 3 main purposes:
  - Ensuring coherent plans are in place for identifying, communicating and managing flood risks across catchments,
  - Promoting efficient, targeted investment in flood risk management,
  - Providing a link between flood risk management authorities and other relevant bodies to develop mutual understanding of flood risks in their areas.
- **The Civil Contingencies Act 2004** is one of the most relevant legislation that provides emergency planning for flooding. The Act provides a framework for responders to support the planning for and response to civil emergencies, including flooding incidents. Under The Act, responders are responsible for warning and informing residents, before during and after incidents.
- For flooding, **the Environment Agency** is the lead agency and will provide this information through flood alerts and warnings.
- During a flooding incident, **the Fire Service** is responsible for any water rescues and **the Local Authority** is responsible for supporting displaced people and providing Humanitarian Assistance. **The Greater Manchester Resilience Forum (GMRF)** is the statutory partnership with overall responsibility for coordinating activity under this legislation.

Flood risk governance structures in Greater Manchester

Governance and collaborative working arrangements in Greater Manchester.



Response and Recovery : Flood Warnings

- **The Environment Agency issues flood warnings throughout England and Wales**. Flood warnings aim to give time for communities to prepare for flooding from main rivers (It is currently not possible to provide flood warnings for other sources of flooding)
- Its power to provide and issue flood warnings is permissive and not a statutory duty; it aims to give flood alerts, flood warnings and severe flood warnings with as much advance notice as possible, however, this may not always be feasible.
- The rapid onset of the 2015 Boxing Day event put the Flood Warning Service under tremendous pressure to provide warnings as the observed weather began to deviate from its forecasted track and rainfall totals increased by double.
- Over **5,700 properties were issued a direct flood warning in the space of 8 hours on Boxing Day**, however, given the extreme nature of the incident, changes to forecast and rapid onset of flooding meant some warnings were not issued.

Response and Recovery : Multi agency response

- Teams from the **Local Authorities, Environment Agency, United Utilities, Greater Manchester Fire and Rescue Service, Greater Manchester Police and the North West Ambulance service** were on the ground in flood locations on Boxing Day, acting to minimise flooding and to support and assist those affected. Other utility companies, Highways England and Transport for Greater Manchester were also in operation

- 2,450 properties benefited from protection, such as raised defences and from operational activities, such as debris screen clearance at culverts and operation of pumping stations.

Response and Recovery : Communications and community engagement

- Within three days of the flood, 36 of the 65 communities affected by flooding were visited by Local Authority and Environment Agency staff, and many more in the weeks following. They provided support and assistance with drop ins, gathering information and offering welfare support.

- The Environment Agency engaged with over 30 MPs whose Constituencies were affected by flooding in order to provide them with the facts and information they need to support their constituents and provide local points of contact within LLFAs and the Environment Agency.

Response and Recovery : Asset inspection and Future Maintenance

- **The Environment Agency is responsible** for carrying out inspections of assets on main river e.g. walls, embankments, culverts and river banks (natural or manmade).
- **Local Authorities** do similar for other watercourses and drainage networks and United Utilities look after the sewer network.
- Following the Boxing Day flooding, visual inspections were undertaken across all affected areas where significant flooding was reported and where it has formal flood defence assets such as walls and embankments.
- Nearly 4,000 assets were inspected in the first 6 weeks of 2016, and £2 million of asset repair work is scheduled to be complete by autumn 2016.
- Visual inspections are primarily to record the condition of flood risk assets.
- Checks are also carried out on structures which influence flood risk, such as screens (grilles upstream of culverts) and flood gates.
- Conditions of assets are recorded in an asset register.
- All Environment Agency assets were inspected by the second week of January 2016. 24 formal flood defence assets are recorded as having some damage following the floods and one wall completely failed at a residential Care Home next to the River Roch at Littleborough.

Response and Recovery : Records

- Relevant RMAs jointly recorded and explained the extent of flooding in their area and to consider and prioritise those actions relevant to each authority.
- In this way, communities affected by the flooding can be clear what has happened since the flood, what is proposed and which organisation is leading in their area
- This investigation report contained recommendations to manage flood risk across Greater Manchester.
- There are general recommendations which apply across the whole of Greater Manchester and where available ongoing or planned actions to be taken in specific locations.
- Due to the widespread nature of the flooding it has not been possible to produce detailed actions for each location affected.
- The RMAs involved in this report will continue to work together, engaging with communities to identify all potential options for each location. Recommendations were prioritised in line with other commitments and subject to bidding and securing funding and resources.

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Long-Term Recovery : Greater Manchester Strategic Flood Risk Management Framework (GM SFRMF)

- The purpose of the Greater Manchester Strategic Flood Risk Management Framework (GM SFRMF) is to provide a spatial framework for FRM across Greater Manchester, highlighting the key strategic flood risks including cross-boundary issues within and outside the City Region and recommending key priorities for intervention taking account of previous, existing and planned interventions delivered or to be delivered by Risk Management Authorities (RMAs).
- This Strategy is high level and focused on the management of those flood risk issues that are of importance to the Manchester City Region, as a whole, and that have the potential to contribute to or affect its economic, social and environmental sustainability.
- It highlights flood risk issues that cross local authority (LA) and City Region boundaries.
- The GMSF is intended to support an ambitious growth agenda across Greater Manchester involving a step change in development that needs to be planned sustainably ensuring that current and future flood risk is not increased.

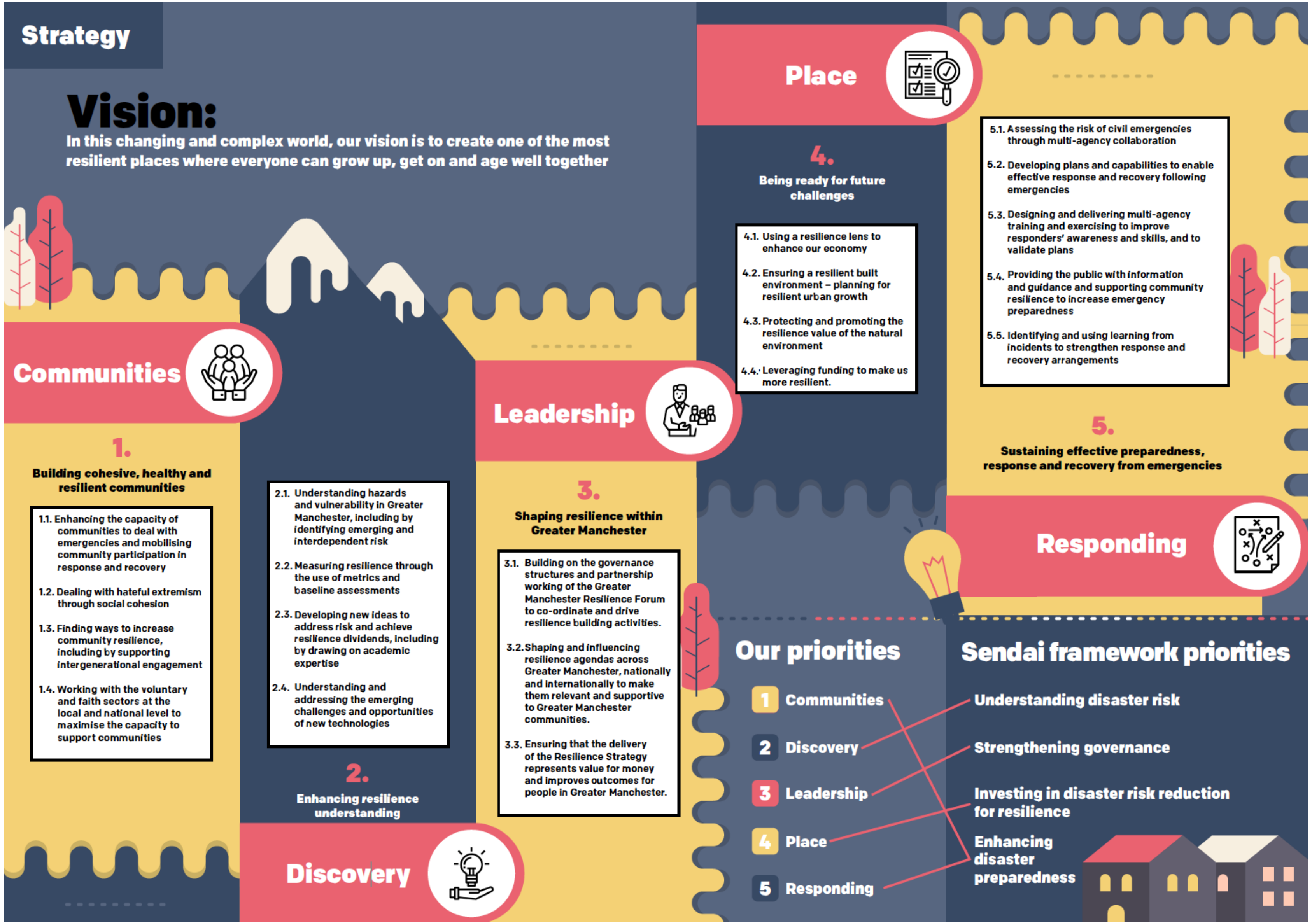
Long-Term Recovery : Greater Manchester Resilience Strategy 2020-2023

- This Strategy sets out the vision for a resilient Greater Manchester.
- Its vision is to create one of the most resilient places where everyone can grow up, get on and age well together.
- It describes five priority areas to guide our work through to 2030 and sets out key themes within these priorities.
- The Strategy will be accompanied by an action plan, reviewed regularly to ensure we stay on track.
- The Strategy runs to 2030 since this is the date by which countries across the world have committed to making a real difference to reducing the occurrence of disasters. This commitment is captured in the UN Sendai Framework for Disaster Risk Reduction 2015-2030 which, as one of its 7 targets, sets out to substantially increase the number of local disaster risk reduction strategies.

The priorities and themes that we have determined to be important for building upon Greater Manchester's resilience.

Resilience is the ability to survive and thrive regardless of the challenges we face. Resilience is a key enabler of the Greater Manchester Strategy, helping to improve the quality of life for all.

The Greater Manchester Strategy is also a key enabler of resilience, as its aims are driven by the challenges we face.



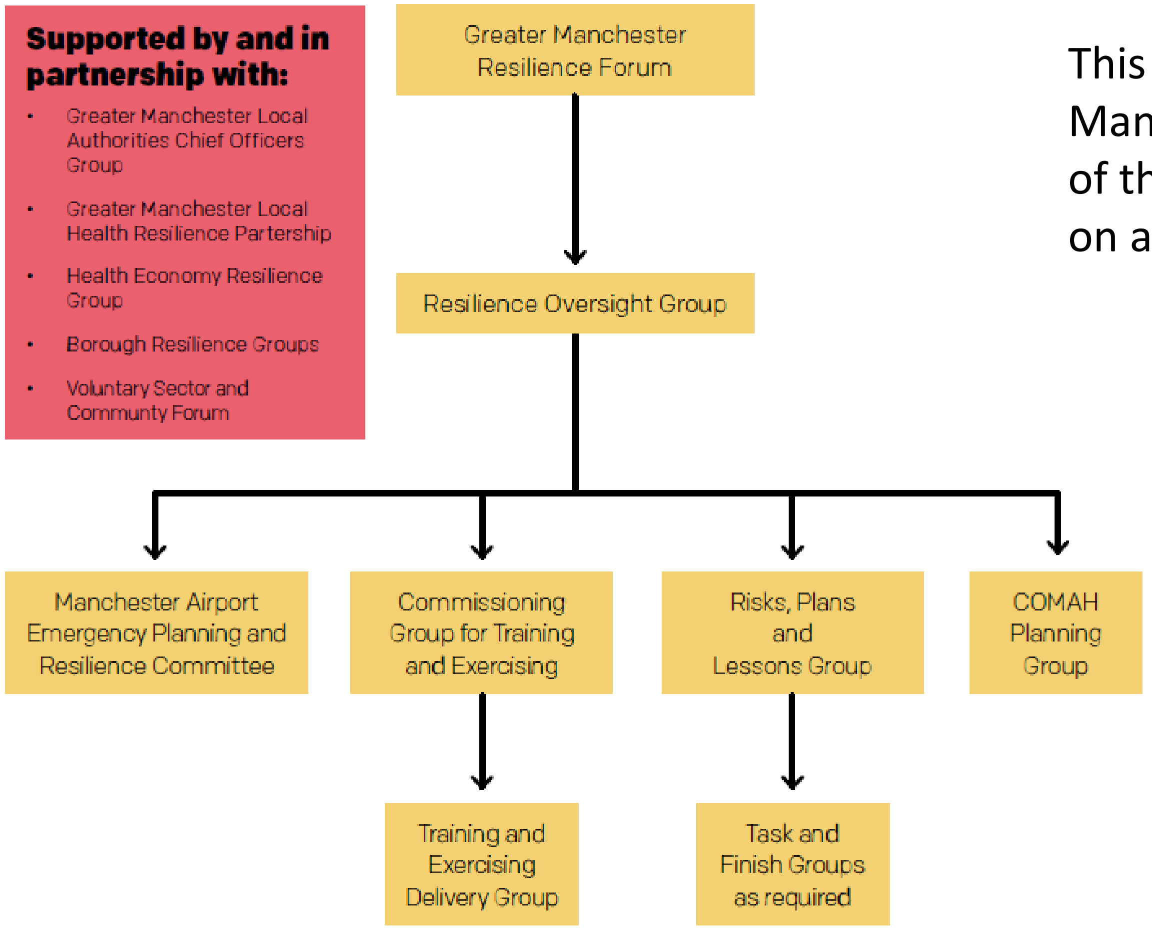
Response

The decisions and actions taken to deal with the immediate effects of an emergency

Recovery

The process of rebuilding, restoring and rehabilitating the community following an emergency

Preparation for emergencies is led by the Greater Manchester Resilience Forum. Established over a decade ago as a requirement of the Civil Contingencies Act 2004, the Greater Manchester Resilience Forum (GMRF) has continued to lead multi-agency emergency planning across the city-region ever since. Planning for shocks is achieved through multi-agency joint working, co-ordinated through a clear, shared structure.



This Strategy provides the roadmap that enables Greater Manchester, in this changing and complex world, to create one of the most resilient places where everyone can grow up, get on and age well together.

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- Long-Term Recovery
- Main messages : Lessons Learned
- Main messages : Recommendations
- Concluding Remarks

Lessons Learned : Warning coverage

- The Environment Agency is already in the process of making improvements to key areas and considering **increases to warning coverage**. Warning thresholds (based on river levels at gauges) are being reviewed, where verified data is available, and amended if appropriate.
- Assessments will be done to see if any areas which flooded from ‘main rivers’ **should be offered a direct Flood Warning service in future, if this is not currently available**. Local communities are involved in this process and are consulted on opportunities to improve or extend the Flood Warning service.

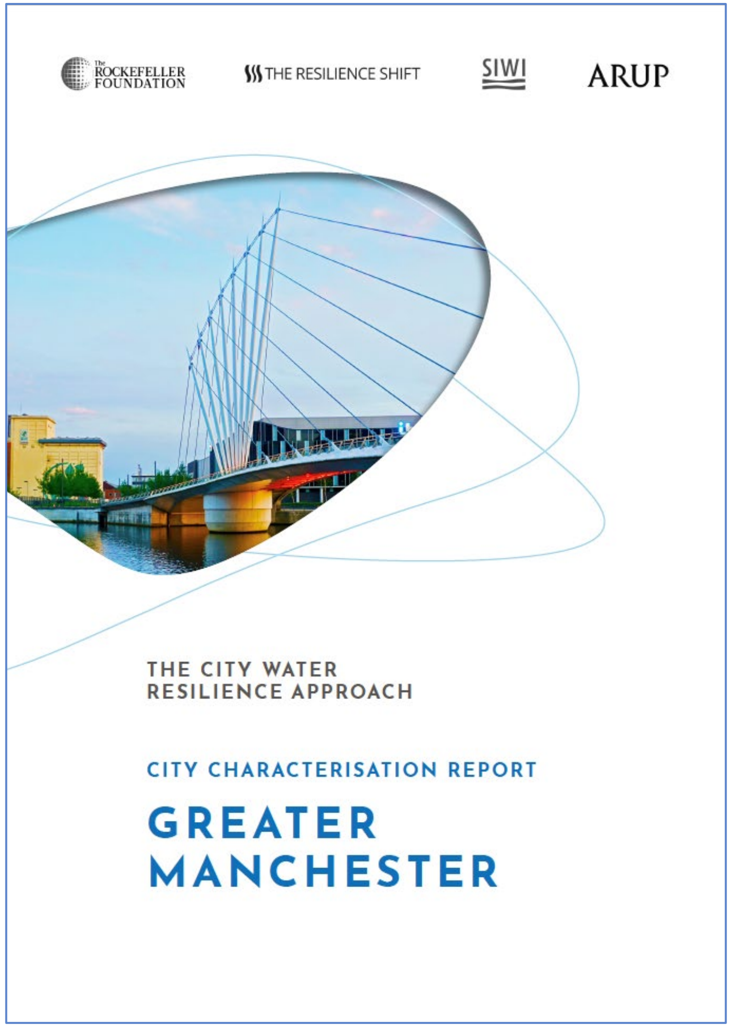
Lessons Learned : *The need to manage current and future flood risk*

GMCA and its constituent LPAs to **look to developing catchment based solutions** with multiple partners from the outset to achieve integrated solutions and maximise funding opportunities.

- **Potential surface water schemes** could benefit from a packaged approach across Greater Manchester to maximise the achievement of Outcome Measures that will in turn influence the funding that can be secured. This should build on the current tracking and oversight provided by the Greater Manchester Flood and Water Management Board.
- PFR schemes should be considered for groups of properties by LLFAs where residual risk needs to be managed.
- Development in areas at flood risk needs to include **resilient design and consider the development of long term climate adaptation strategies** for areas where flood risk is likely to increase in the future.

Lessons Learned: Interdependencies between water and other urban systems

- The 2015 Boxing Day floods highlighted the interdependencies between water and other urban systems, with that event resulting in £11.5million in infrastructure damage and 31,200 properties left without power.
- There is a strong relationship between flooding and urban planning and development control.
- Strategic plans such as the Greater Manchester Spatial Framework include detailed flood risk analysis.
- The importance of building on brownfield land and maintaining green space for drainage has been stressed in various strategic documents.
- The value of Sustainable Urban Drainage Systems (SUDs) and Green Infrastructure (GI) came through very strongly across the literature as a key approach to Greater Manchester
- Flood Risk Management, with stakeholder consultations also recognising this, and encouraging further investment.



April 2019

Lessons Learned: Cumulative and cross-boundary risk

- At a strategic level, it is important to understand implications of development in one area for development elsewhere.
- From the review of development sites, there is potential for development in Bolton to have downstream impacts along the Irwell in the more urbanised areas of Manchester and Salford, and for development outside of city/town centre areas (particularly Bolton, Rochdale, Salford and Wigan) to impact the more built up areas.
- These cross-boundary impacts could potentially have significant flood risk implications and therefore it is essential that GMCA and the relevant LPAs are in dialogue with adjacent LPAs outside of the City Region to manage flood risk on an integrated, cross-boundary basis

Lessons Learned : **Areas of strategic flood risk**

- River flooding is a significant risk across Greater Manchester particularly for Salford, Manchester, Trafford, Wigan, Bolton and Rochdale.
- According to national broadscale flood risk mapping, the majority of Greater Manchester is at risk of surface water flooding - the SFRA has identified CDAs across the City Region and large areas of Manchester, Stockport, Tameside and the town centres of Bolton, Rochdale, Bury and Wigan are within CDAs.
- Groundwater flooding may present a risk in Manchester, Oldham, Rochdale, Salford, Stockport and Wigan based on the location of SPZs.
- There are potentially multiple cumulative, cross-boundary impacts within Greater Manchester and with adjacent LPAs outside of the City Region.

Lessons Learned: Removal of large accumulations of stones, gravel and silt in the rivers

- Following the flooding, the Environment Agency has had reports of large accumulations of stones, gravel and silt in the rivers.
- As part of the recovery programme, its funding bid has included several sites where gravel has typically been removed at intervals of several/many years previously.
- Each of these potential sites is being reviewed in conjunction with Geomorphologists (specialists who advise on sediment movement and build-up in rivers) prior to planning or carrying out any work.
- In addition, revised flood risk computer modelling is being fast-tracked to provide good evidence on the risk presented by gravel in these key locations.
- Work has started on some clear-cut sites where there is recent evidence to support the case for removal.

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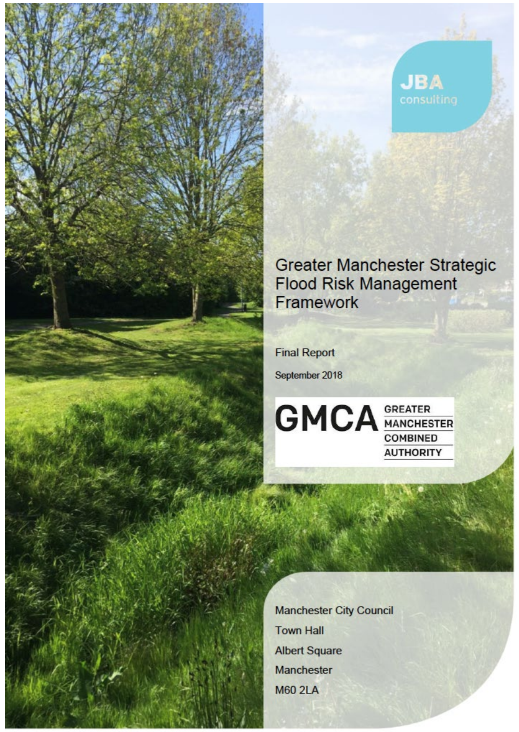
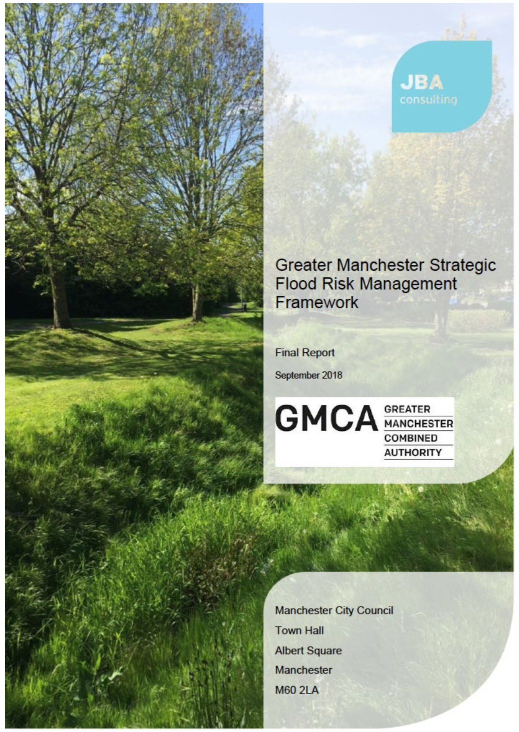
Strategic objectives and associated recommendations

Strategic objectives	associated recommendations
1. Develop and maintain a strategic flood risk evidence base across Greater Manchester and use this to inform FRM • including an understanding of the location of and potential impacts of FRM for the most vulnerable communities	• Review data gaps identified from the SFRA and identify how best to address these • Improve data sharing and access to data across GMCA and with local authorities and other stakeholders. • Move towards and identify options for the development of a single data platform across Greater Manchester where all flood data is held.



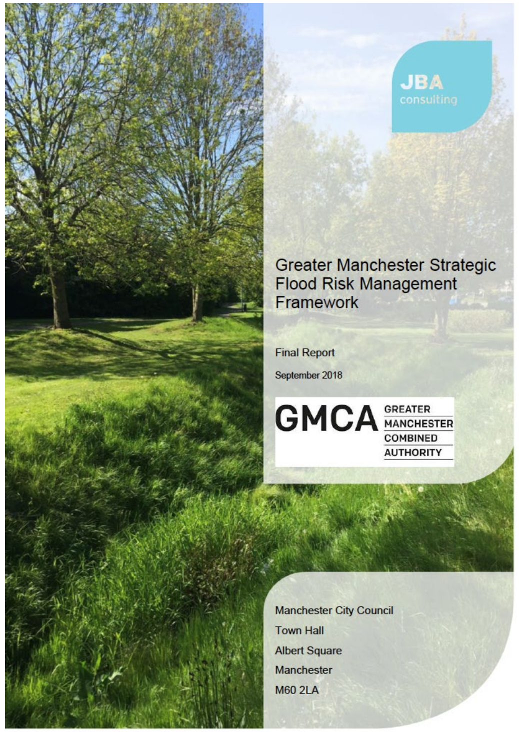
Strategic objectives and associated recommendations

Strategic objectives	associated recommendations
2. Avoid development in areas that are most at risk of flooding now and in the future • unless approaches can be identified that ensure the safety of communities and avoid flood risk elsewhere 3. Adopting a catchment based approach to the development of FRM initiatives that focuses on working with natural processes • linking upstream processes with impacts downstream)	• The GMSF should be updated with evidence from the SFRA and SFRMF to promote a catchment based approach to the management of flood risk. This should include dialogue with adjacent LPAs (within and outside Greater Manchester) to manage cumulative and cross-boundary flood risk. • NfM and wider Natural Capital measures should be promoted through GMSF and Local Plan policies focusing on implementation in the upper catchments to manage flood risk further downstream. • A strategic, catchment approach to pursuing NfM/Natural Capital opportunities should be developed and implemented once mapping complete. This should consider wider benefits, such as for biodiversity, health and climate change and the benefits downstream in the more flood prone heavily urbanised areas



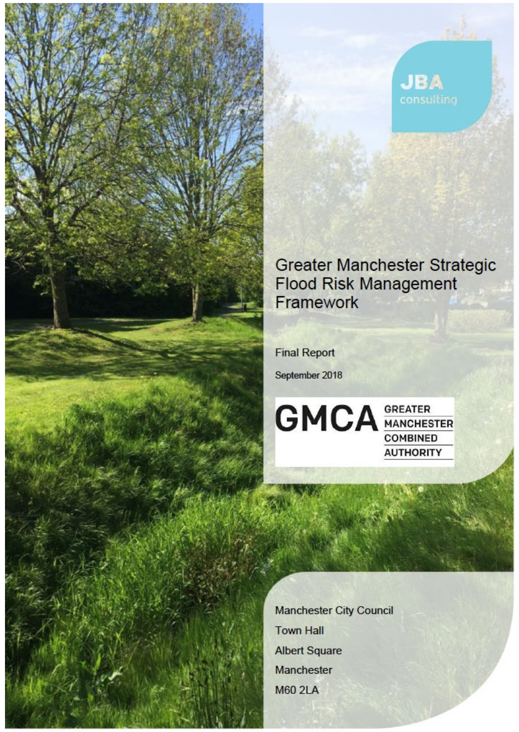
Strategic objectives and associated recommendations

Strategic objectives	associated recommendations
4. Focusing interventions in the areas of Greater Manchester that present the most significant risk now, and in the future • taking into account the ability of local communities to prepare for, respond to and recover from flooding and working with them to manage residual risk, and; • considering adaptive approaches that facilitate changes in approach over time as climate change impacts become more apparent/understood.	• GMCA and its constituent LPAs should look to developing catchment based solutions with multiple partners from the outset to achieve integrated solutions and maximise funding opportunities. • Potential surface water schemes could benefit from a packaged approach across Greater Manchester to maximise the achievement of Outcome Measures that will in turn influence the funding that can be secured. This should build on the current tracking and oversight provided by the Greater Manchester Flood and Water Management Board. • PFR schemes should be considered for groups of properties by LLFAs where residual risk needs to be managed. • Development in areas at flood risk needs to include resilient design and consider the development of long term climate adaptation strategies for areas where flood risk is likely to increase in the future



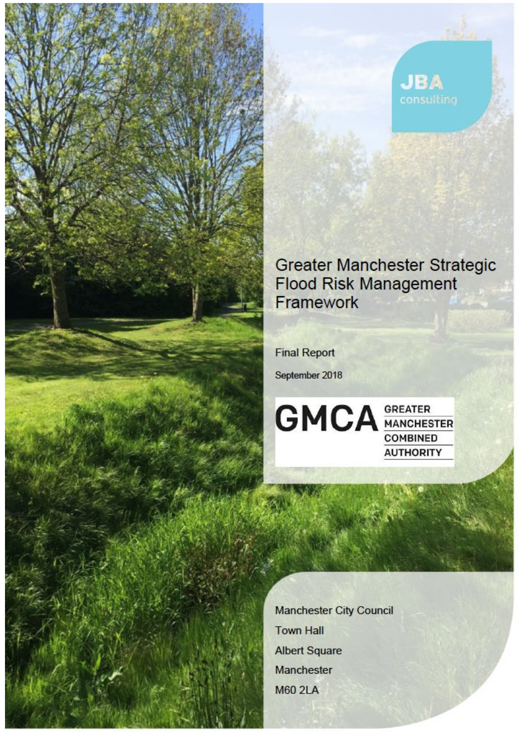
Strategic objectives and associated recommendations

Strategic objectives	associated recommendations
5. Developing a consistent approach to the management of surface water flood risk • including Critical Drainage Area management, the development and delivery of Sustainable Drainage Systems and asset management and maintenance.	• Integrate SuDS requirements with large development and redevelopment opportunities and through development strategies to avoid piecemeal development that could contribute to overall surface water flood risk. • Develop integrated approach to SuDS in the GMSF to achieve flood risk and biodiversity benefits. This should include consideration of adoption and maintenance issues. • Update the current SWMP with updated information on surface water flood risk and using 21st Century Drainage outputs, and ensure delivery is actioned and monitored. • As detailed in the SFRA, all LLFAs should assess the structures and features on their FRM Asset Registers to inform the capital programme and prioritise maintenance work. • Asset management should be prioritised based on condition, capacity and resultant damages to manage liability and the risk of flooding from LLFA assets. • Consider opportunities for asset data sharing between RMAs



Strategic objectives and associated recommendations

Strategic objectives	associated recommendations
6. Working in partnership across local authorities, with the Environment Agency and other stakeholders • to maximise resources and achieve synergy through approaches that address multiple objectives and achieve multiple benefits.	• Use the findings of the water governance review to establish a governance structure that maximises opportunities for collaborative and coordinated working at the catchment scale.



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- Key take aways

Key Takeaways

- Dynamics around a major hazard event, how the city is structured and how the hazards events are managed
- The need to have the multi stakeholder collaborations
- Strategic Flood Risk Management Framework (GM SFRMF) as a spatial framework for FRM and the Greater Manchester Resilience Strategy 2020-2023
- Lessons Learned : decision making processes, warning coverage, hazard hot spots and communication, and how impacts can be experienced unevenly across society, often hitting the most vulnerable and disadvantaged the hardest.
- The recommendations, the need to consider complex challenges we face and establish a pathway to maximise opportunities to build the resilience to the shocks and stresses that could affect us

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