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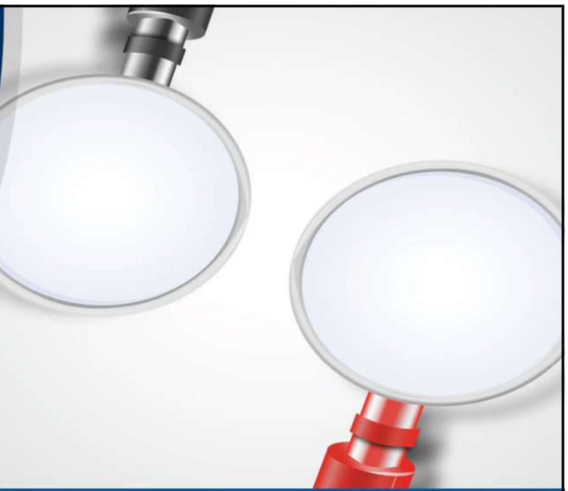
The Economic Society of Australia

Cost Benefit Analysis Forum 2024 - 8 August 2024



Flood Damage Assessment

Rhys Thomson, Rhelm

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Flood Damage Assessment

8 August 2024

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Overview

- Context
- Background on how flood damages are estimated
- Tangible Damage Estimation
  - Residential Damages
  - Commercial Damages
  - Public Infrastructure
- Intangibles
  - Risk to life and Social Impacts
- Other Considerations
  - Probability
  - Affordability & Vulnerability

Source : Maythee Voran

Acknowledgements

- The flood damage tool and guideline were developed with DCCEEW.
- NSW Treasury have added additional functionality to the tool

Context

- Flooding impacts have had increased focus in recent years following the 2021 and 2022 floods
- In the Northern Rivers, in early 2022
  - 13 lives were lost
  - Over 4000 homes were uninhabitable
  - Nearly 11,000 homes were damaged in some way
  - Emergency accom provided for nearly 1500 people
  - One year after the event, more than 1000 people in temporary accom

Source : NSW Auditor Generals Report 2023

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Context

- Central West heavily impacted in late 2022
  - Nearly 80% of Eugowra township impacted
  - 3 fatalities
  - Significant flooding across Parkes, Forbes, Molong and Condobolin
  - Significant periods of isolation for communities on the Lachlan River

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Context

- More than 200,000 properties are impacted by the 1 in 100 AEP (1% AEP) flood event
- Floods can cause impacts to private assets, public infrastructure, and can result in loss of life and injury.
- There can also be significant social (community and personal) impacts following a flood event
- Historically, benefit estimation has been relatively low for flood mitigation infrastructure

Types of Flood Damages

- Tangible Damages
  - Direct – direct impacts on property (e.g. Assets, land or buildings)
  - Indirect – knock-on costs and impacts – e.g. reduced business output, loss of access
- Intangible Damages
  - E.g. social impacts, environmental impact etc
  - Some benefits - e.g. increase social cohesion and identity

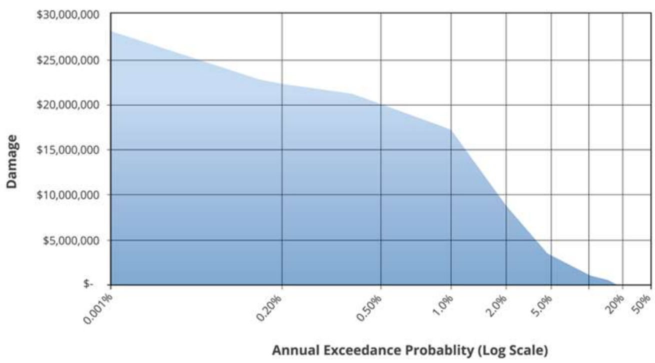
Lismore (NSW) – Household contents on the street after being damaged by the flood (7 – 8 March 2022)

How do we Estimate Property Damages

- Flood modelling estimates how far a flood extends, how deep it is and even how fast it flows, all of which affect damage
- Floor level and building information is typically collected by survey
  - Limitations on how detailed this information can be
- The use of stage-damage curves
  - These are based on 'synthetic' or empirical data sets

Annual Average Damage

- Damages are calculated for one flood event
  - But there are a range of probabilities
  - The calculations are repeated across a range of flood events
- Annual Average Damage is calculated to inform CBA
  - Represents the average damage per year that is expected to occur



Example of AAD Curve (source : ARR2019)

What happens when a house floods?

- When just overground flooding
  - Impacts to sheds, gardens, cars etc
- When overfloor
  - Initially carpets/ flooring, and then low lying contents
  - If it gets into the walls, then insulation etc needs to be removed to get it dry and wash out mud
  - Deeper depths will start affected contents that has been reaised

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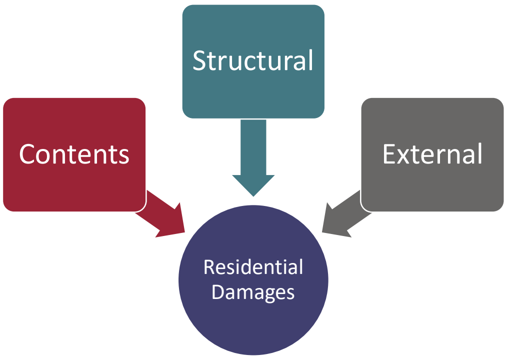
Residential Stage Damage Curves

- Housing stock is highly variable
  - More of a representative average

*2021 Flooding in Forbes, NSW**



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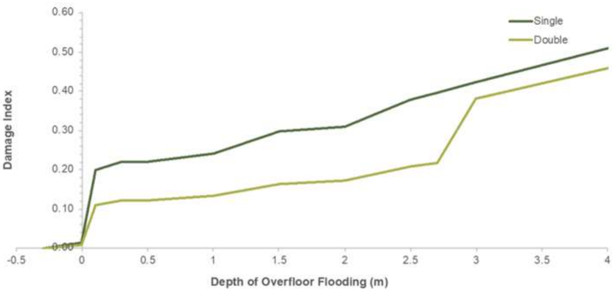
Residential Stage Damage Curves

- Compiled based on extensive literature review
- Structural Damages expressed as an index
  - Scaled based on replacement cost
  - Allows them to be scaled to the future and be specific to an area



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Residential Damage Considerations

- Actual to Potential Ratio
  - The difference between the estimated damage and the actual damage that occurs
  - Damages are reduced through mitigating actions by residents
  - Can depend on experience of residents
    - But this experience only lasts for a short period of time
- Cleanup costs
  - Based on a range of literature
  - Likely that it is a conservative estimate
- Structural Damage

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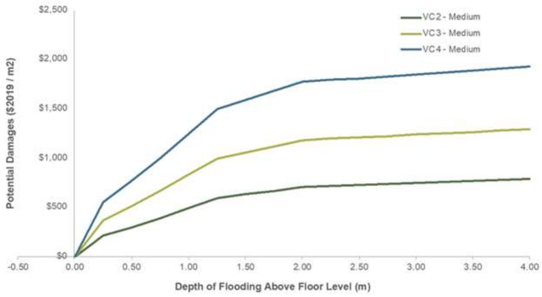
Commercial/ Industrial Damages

- Potentially even more variable than residential damages
  - A lot of the damage is associated with the stock/ contents
  - Estimated based on floor area
- Any surveys are a snapshot in time – usage of the building can vary over the economic lifetime



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Commercial Indirect Costs

- Cleanup costs
- Loss of Trading
  - Guideline needed to be careful not to incorporate transfers
    - Other businesses benefit for reduced trade
  - Focus was on reduction in economic output

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Public Infrastructure

- Range of critical infrastructure within the floodplain
- There are some "explicit" methods for estimating damages
  - NSW Treasury have now included a rate for road impacts
- Alternative is through proportion of residential damages

Category	Infrastructure	1 in 100 AEP [32]	PMF [33]
Emergency Services	Police Station	64	98
	SES Facility	54	81
	Ambulance Station	45	77
	Fire Station	203	298
	General Hospital	19	39
Community Services	Retirement Village/ Residential Care Facilities/ Community Home	207	328
	Medical Centre/ Integrated Health	81	224
	Local Government Chambers	37	57
Education	Schools (Primary and High)	274	461
	Special Schools	15	33
	Child Care Centre/ Preschool	43	97
	TAFE/ University	37	47
Utilities	Sewerage Works	103	151
	Pumping Station	58	75
	Filtration Plant	30	44
	Power Station	1	2
	Gas Facility	4	6

Source : SDMP, 2024

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Agricultural & Environmental Impacts

- Agricultural
  - NSW Treasury has provided some additional guidance on this
  - Note that short term impacts may be off-set by longer term benefits
- Environmental
  - Difficult to quantify, particularly for frequent flooding that may be part of the natural process

Flooded Crops in Central West of NSW
Source : Vibe Images

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Intangibles

- Intangibles can be significant, but difficult to quantify
- Many approaches adopt an “uplift” on the tangible damages
  - But this can often be significant (e.g. 120% increase)
  - Can make it difficult to justify the CBA terms
- There are a number of references that included total intangible costs
  - But some of these are economic impact, include multipliers etc
- Many references are also skewed by significant events
  - The uplift may not be as significant for smaller events

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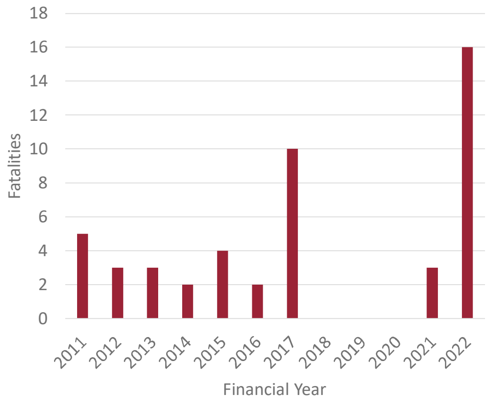
Intangibles - Loss of Life

- In Australia, around 2.9 fatalities per 100,000 people (from 1900 -2015)
- Tends to come in “clusters” with wider scale flooding
- Key stats
  - Largest proportion (40%) are crossing a waterway
  - 79% were male
  - 43% under 29 years



NSW Flood Related Fatalities

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Intangibles – Risk to Life

- No locally derived models for estimating probable loss of life
- A number of references in the dam break space
- A UK based method has been adjusted for Australia
  - Informed based on the flood conditions at the home and the population estimated based on households
  - This method allows for more sensitivity around changes to flood behaviour (e.g mitigation)
  - Further research and work required in this area

Lismore, 2022
(source : Cloudcatcher Media/ Shutterstock.com)

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Intangibles – Social Impacts

- These can include a range of impacts, such as mental health, family violence
- The current tool adopts a willingness to pay approach from the UK
  - Updated by NSW Treasury based on the most recent research
  - The approach is likely to be conservative
  - Is correlated with the depth of overfloor flooding

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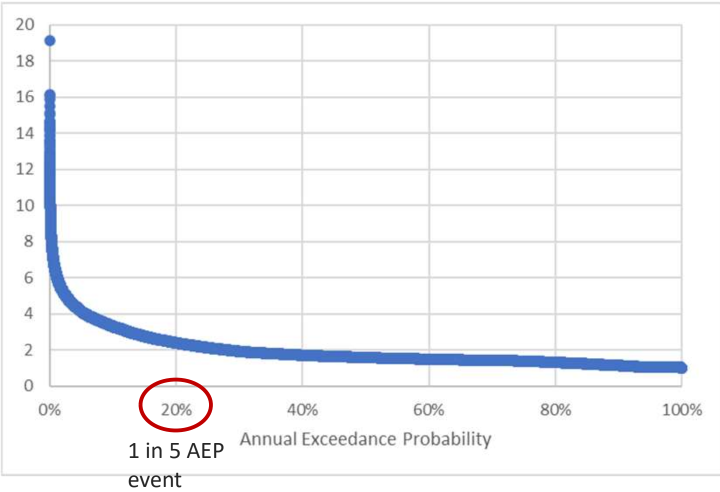
Probability

- Flood probabilities are at the “tail end” of the probability curve
  - Most years there is not substantial flooding
- Annual Average Damage approach attempts to apply a representative average
  - But flood events can be “spikey” in terms of damages



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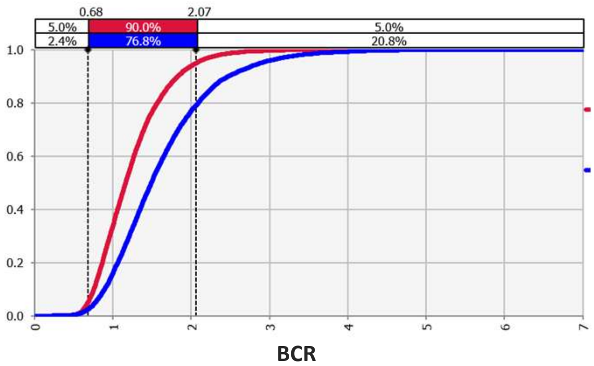
Probability

- Monte Carlo can allow for an understanding of the distribution of annualised damages
  - Treasury has not included this in the updated model
- Can also test the sensitivity of the BCR to different potential scenarios (e.g. large event in near future, or multiple events)
  - As well as climate change
- It is also worth considering however the risk/ affordability of a substantial event



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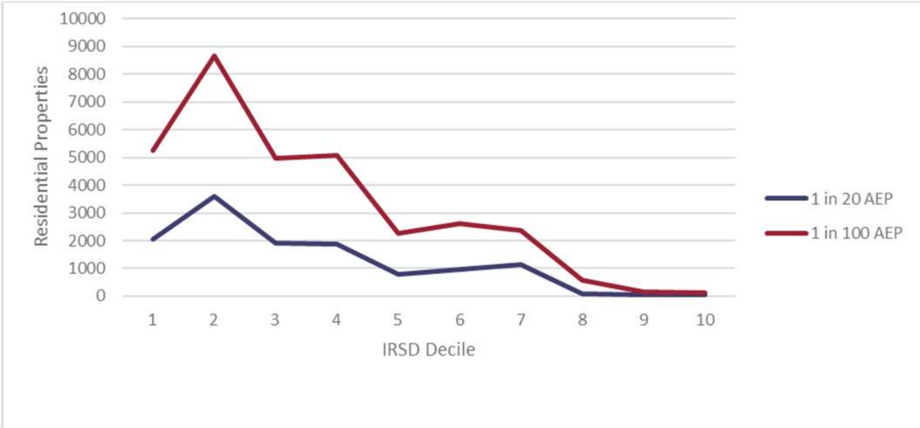
Vulnerability & Affordability



Residential Vulnerability Across a number of representative Areas

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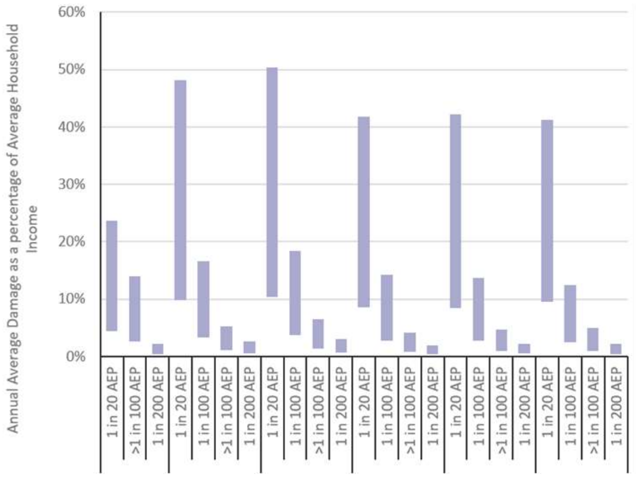
Vulnerability & Affordability

- The impact of flooding can cause long term impacts for vulnerable communities
- Affordability of insurance or annualised damages is low
- People do not necessarily “choose” to live in a floodplain



AAD as % of Average Household Income – Representative Areas across NSW

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Further information

- NSW DCCEEW – Flood Risk Management Manual
  - https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-guidelines
- NSW Treasury

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Questions

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