

How Much Flood Risk is Too Much?

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Overview

- Who says?
- Types of flood risk
- The risk to life dilemma
- A risk to life approach
- Gold Coast – A case study

Who says?

- Developers – as much as possible
- Responders – as little as possible
- Property owners
 - any – when it's not flooding
 - none – when it is flooding
- Experts – opinions differ

Types of Flood Risk

- Built assets and contents
- Infrastructure and service function
- Business interruption
- Community disruption
- Ecosystem function
- Mortality and morbidity – risk to life

Flood Impacts on People

■ Direct

- loss of life through drowning, debris impact, hypothermia
- Morbidity through debris impact, contact with contaminated water

■ Indirect

- Loss of life through electrocution, stress induced
- Morbidity through animal bites, injuries during clean up, stress induced illness

Flood Fatalities

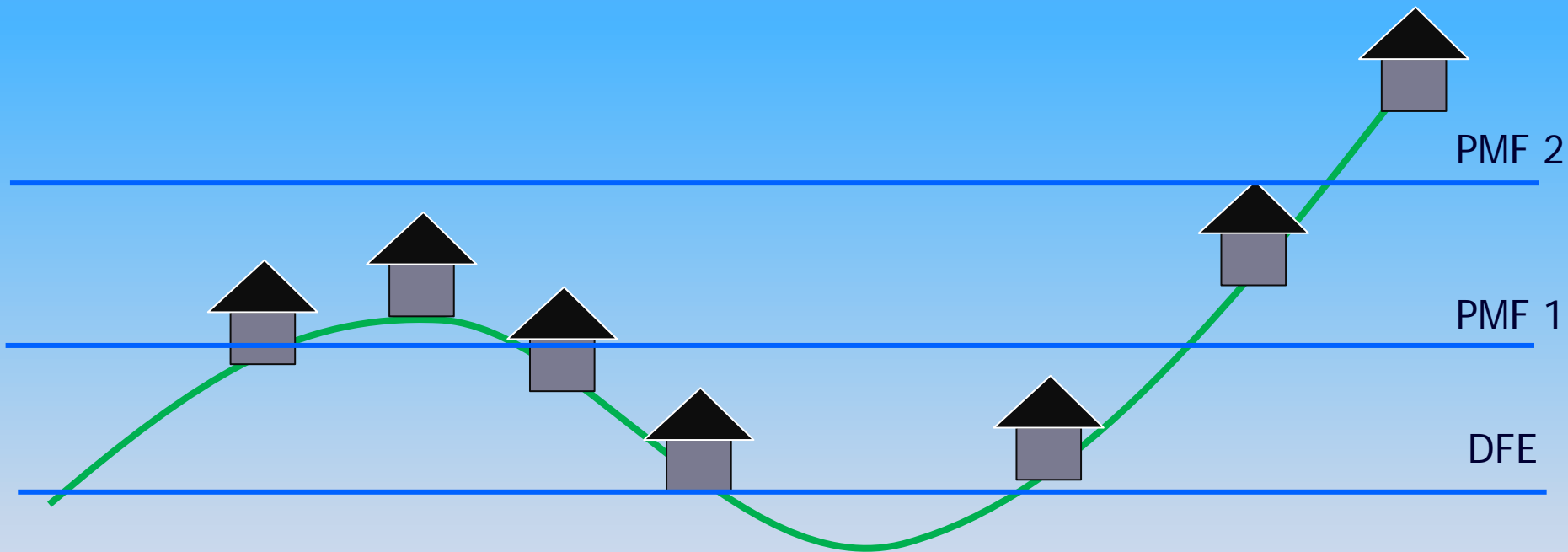
- In Australia 75% through voluntarily entering floodwaters
- Fatalities in buildings generally in low probability events:
 - Lockyer Valley 2011
 - Dungog 2015
- Multiple involuntary fatalities less acceptable than many single voluntary?

Acceptable Risk to Life Guidance

- DPIE Risk Criteria for Land Use Safety Planning – acceptable individual risk
 - 1 in 1,000,000 residential
 - 5 in 1,000,000 commercial
- NSW Dams Safety Committee
 - 1 in 1,000,000 negligible individual risk
 - 1 in 100,000 tolerable individual risk
- Floods – no guidance
 - 2 fatalities in PMF not tolerable?

Estimating Risk to Life

- Population at Risk
 - Time of year
 - Time of day
- Potential Loss of Life
 - Flood hazard – depth, velocity, temperature, debris
 - Rate of rise
 - Warnings
 - Access to refuge
 - Response by those affected

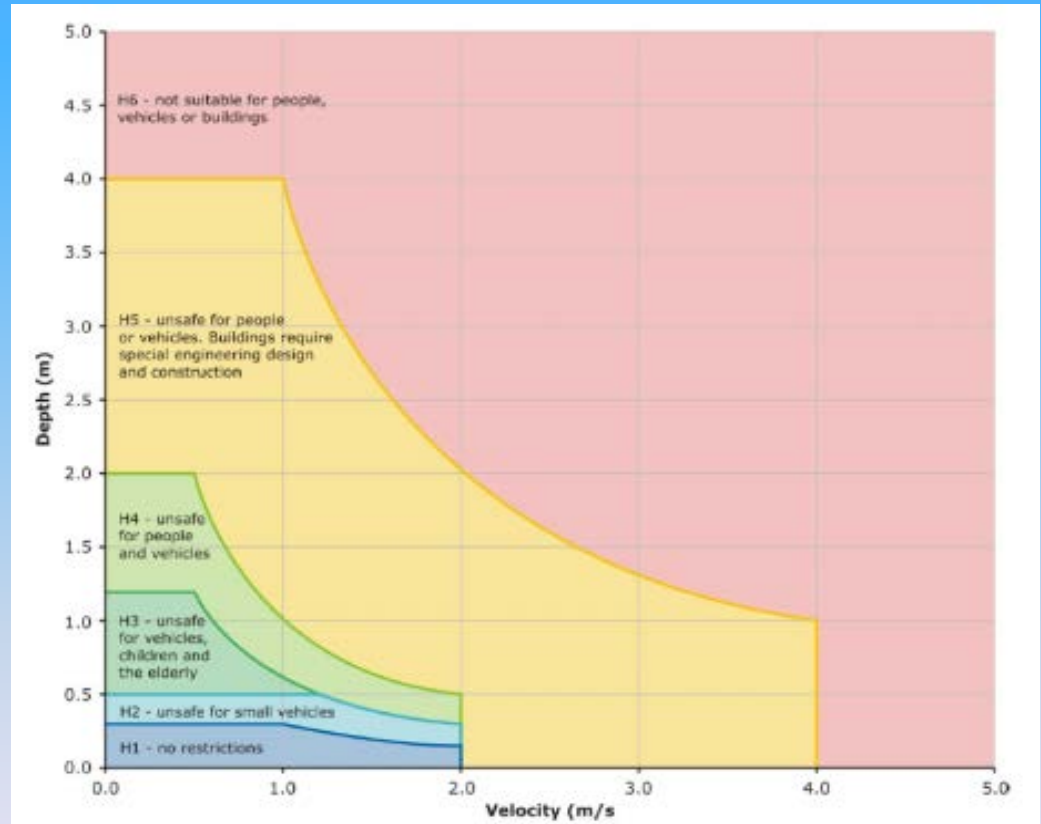


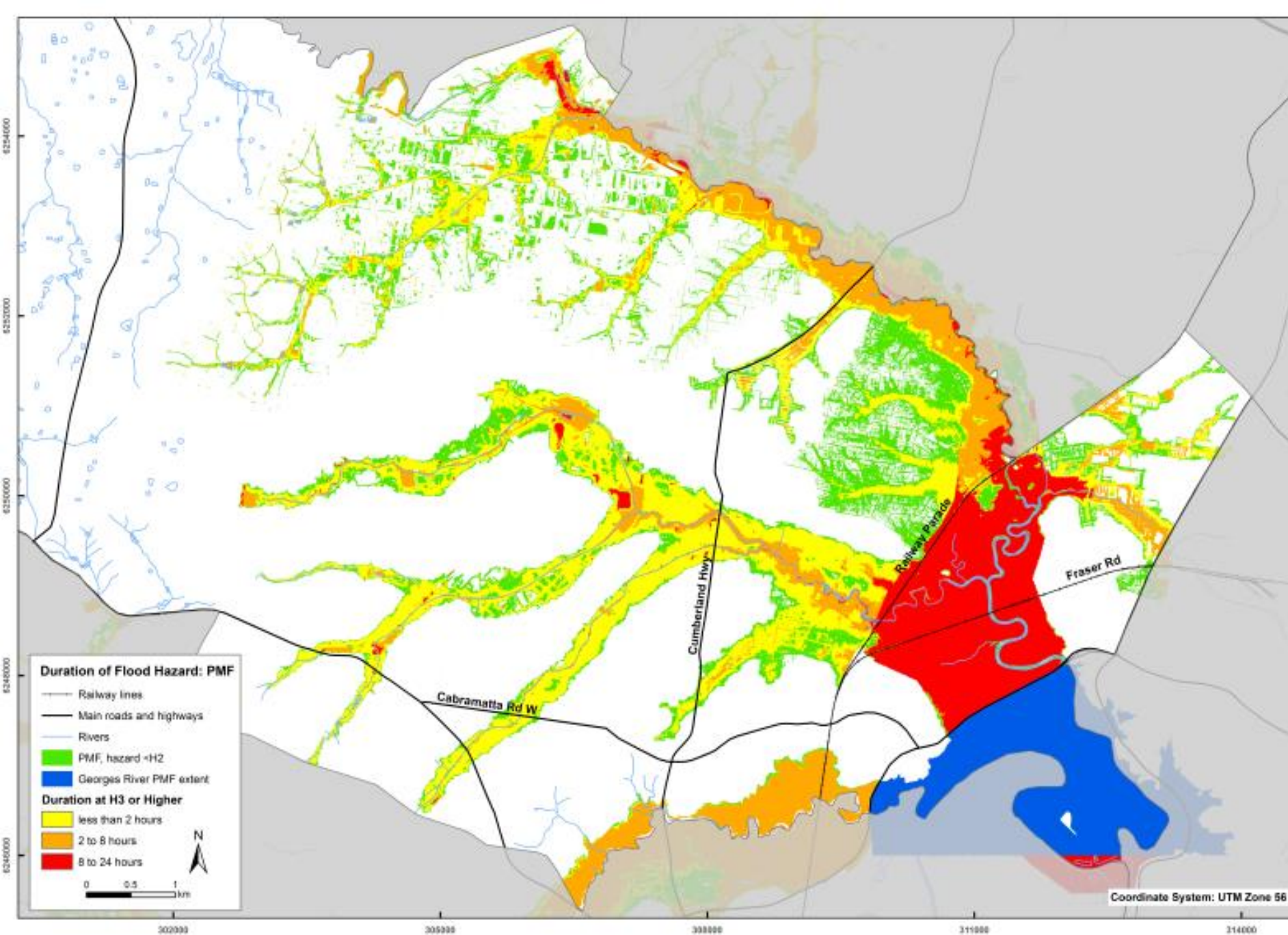
What is isolation?



Risk Thresholds

- Flood Probability - 5% AEP, 1% AEP and PMF
- Flood Hazard
- Duration of Isolation
 - 2 hours
 - 8 hours
 - 24 hours
 - 72 hours





Gold Coast a Case Study

- Flooding on Gold Coast
- Development and Redevelopment
- Flood Affected Areas Constraints Code
- Arora Constructions
- Large scale developments with FEMPs
- Small scale developments

Practical Considerations

- Life Safety Risks
 - Safe refuge – not in contact with floodwaters
 - Fire
 - Medical emergency
 - Sustenance – food, water, medications
 - Power failure
 - Communication failure
- Human Behaviour
 - Relationship to building
 - Desire to be elsewhere
 - Building amenity
 - Duration of isolation
- Warning Time
- Who is responsible
- How ensure implementation?

Shelter Requirements

Dwelling Type	<2 hrs	2-8 hrs	8-24 hrs	24-72hrs	>72 hrs
Torrens-titled residential dwellings	>50% of habitable floor space in each dwelling above PMF	>50% of habitable floor space in each dwelling above PMF	100% of habitable floor space in each dwelling above PMF	Not suitable	Not suitable
Strata-titled residential dwellings or multi-unit dwellings under single ownership	>50% of habitable floor space in each dwelling above PMF	>50% of habitable floor space in each dwelling above PMF	100% of habitable floor space in each dwelling above PMF	100% of habitable floor space in each dwelling above PMF	Not suitable

FEMP Risk Mitigation Requirements

Risk	Risk Mitigation Measure	Duration Threshold (Hrs)	Rationale
Power Supply	<ul style="list-style-type: none"> Backup power supply lasting up to 3 days Power to run at least one lift Power only directed to essential items Regular maintenance of backup power supply 	24-72	<ul style="list-style-type: none"> Power outages for over one day may influence people to resort to improvised lighting and cooking which can increase fire risk Power outages for over two days can cause food in refrigerators and freezers to perish and prompt people into leaving the building
Water and Wastewater	<ul style="list-style-type: none"> Reticulated water supply of normal pressure and quality for at least two days 	24-72	<ul style="list-style-type: none"> Sustained power outages likely to reduce capacity to chlorinate drinking water supply Residual chlorine levels drop substantially after two days
Food Supply	<ul style="list-style-type: none"> Advise to stock up on food with tropical cyclone warnings or flood watches Backup power supply lasting up to 3 days 	24-72	<ul style="list-style-type: none"> Stocking up on food supplies minimises likelihood of occupants leaving the building during flood to replenish food supply Power outages for over two days can cause food in refrigerators and freezers to perish and prompt people into leaving the building
Medical Needs	<ul style="list-style-type: none"> Advise to stock up on medication with tropical cyclone warnings or flood watches Encourage early evacuation of people with life-threatening medical conditions when tropical cyclone warnings or flood watches issued Fully stocked First-Aid Kit Helicopter and/or boat access to isolated building 	24-72	<ul style="list-style-type: none"> Lack of medication can be life-threatening to those who self-administer medication regularly People who need others to administer medication or require immediate hospital care may not have access to it during flooding event Isolation for more than two days can be life threatening without fully stocked First-Aid Kit, First Aid trained personnel, and helicopter and/or boat access to building

FEMP Risk Mitigation Requirements

Risk	Risk Mitigation Measure	Duration Threshold (Hrs)	Rationale
Fire Emergencies	<ul style="list-style-type: none"> Switchboards that automatically shut down when electrical circuits in contact with water 	Any duration	<ul style="list-style-type: none"> Risk of fire very high if water comes in contact with electrical circuitry
	<ul style="list-style-type: none"> Safe evacuation access to flood-free land in event of fire OR Fire suppression equipment as required for residential high rise buildings including sprinkler systems 	≥8	<ul style="list-style-type: none"> Occupants in isolated building unable to evacuate in event of fire or take measures to put out fire
	<ul style="list-style-type: none"> Backup power supply and habitable floor areas to be above reach of the PMF 	24-72	<ul style="list-style-type: none"> Power outages may influence people to resort to improvised lighting and cooking which can increase fire risk
Communications	<ul style="list-style-type: none"> Portable radio and spare batteries for households 	Any duration	<ul style="list-style-type: none"> Lack of communication prevents occupants from contacting emergency services or receiving latest warnings and advice in relation to the flooding event
	<ul style="list-style-type: none"> Flood wardens, Personal Locator Beacons, internal intercoms for multi-units 	≥2	<ul style="list-style-type: none"> Larger numbers of occupants are harder to keep track of during communication blackout period, particularly in emergency situations
Evacuation	<ul style="list-style-type: none"> Encourage early evacuation of people with life-threatening medical conditions or others who wish to evacuate when tropical cyclone warnings or flood watches issued Cessation of evacuation after flood warning has been issued 	≥24	<ul style="list-style-type: none"> People who need immediate hospital care may not have access to it during flooding event; people who do not wish to shelter in place may risk evacuating during flooding event Evacuation after the issue of flood warnings is hazardous

Thankyou