Theory vs Practice:
The Challenges of Flood Risk Management

Jacquie Hannan and Carrie Dearnley

Agenda

- What is Flood Risk Management (FRM)?
- What is best practice?
- Barriers to achieving best practice
- Is best practice essential?
- When is it ok to compromise?
- Understanding stakeholder needs
- Compromise in action
- Recommendations & conclusions
- Questions!

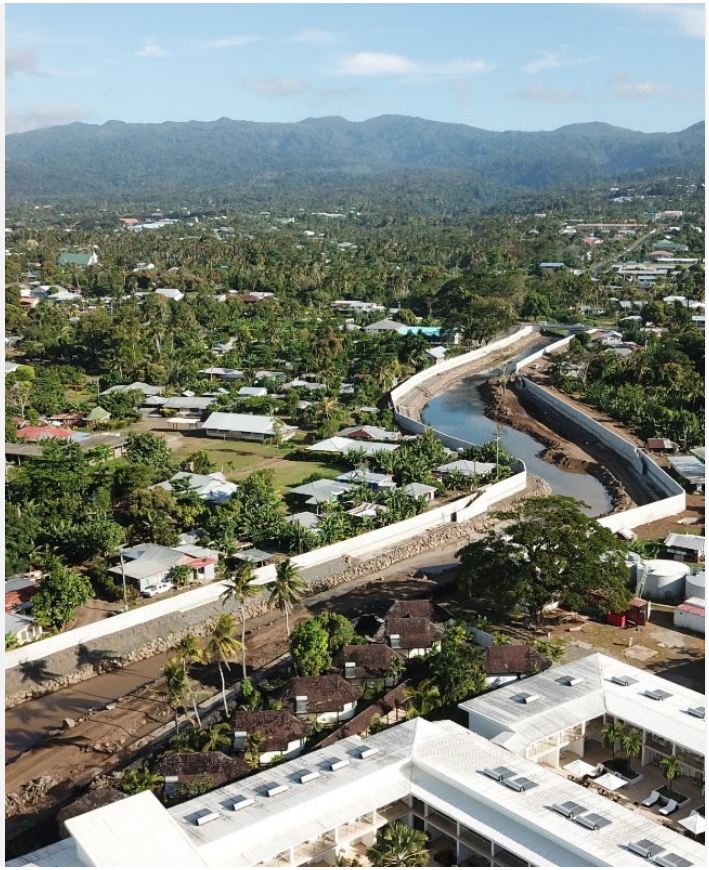
BMT

TUFLOW

What is Flood Risk Management?

What is FRM?

- Process of defining flood risk and identifying, assessing and implementing measures to mitigate and manage the impact of this risk to people, property and infrastructure.
- Aims to ensure communities are as flood resilient as possible
- Flood risk management hierarchy:
  - Avoidance – limit or avoid risk exposure
  - Minimisation – reduce the consequences
  - Acceptance – accepting the residual risk



BMT

TUFLOW

FRM measures

What is best practice Flood Risk Management?

What is best practice FRM?

BMT

TUFLOW

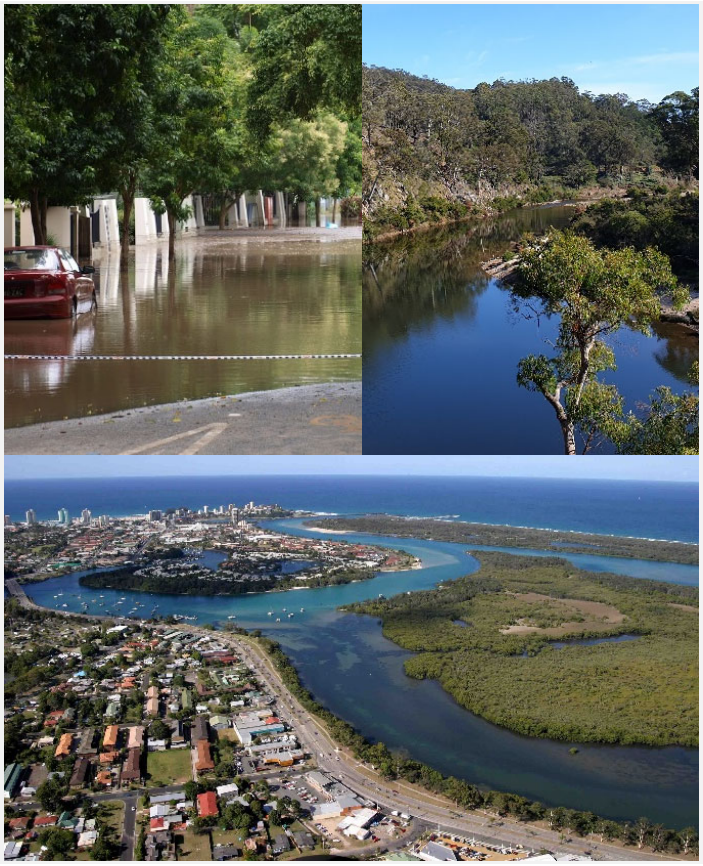
Flood mechanism

Type/s of flood mechanisms:

- Riverine (or mainstream)
- Overland flow (or local)
- Storm surge (or coastal) flooding
- Or combinations of these!

Why does the flood mechanism matter?

- Influences rate of onset, potential for isolation, typical velocities, etc.
- Different flood risk management responses are required for different mechanisms



BMT

TUFLOW

Flood Risk

“You can’t manage what you don’t measure”

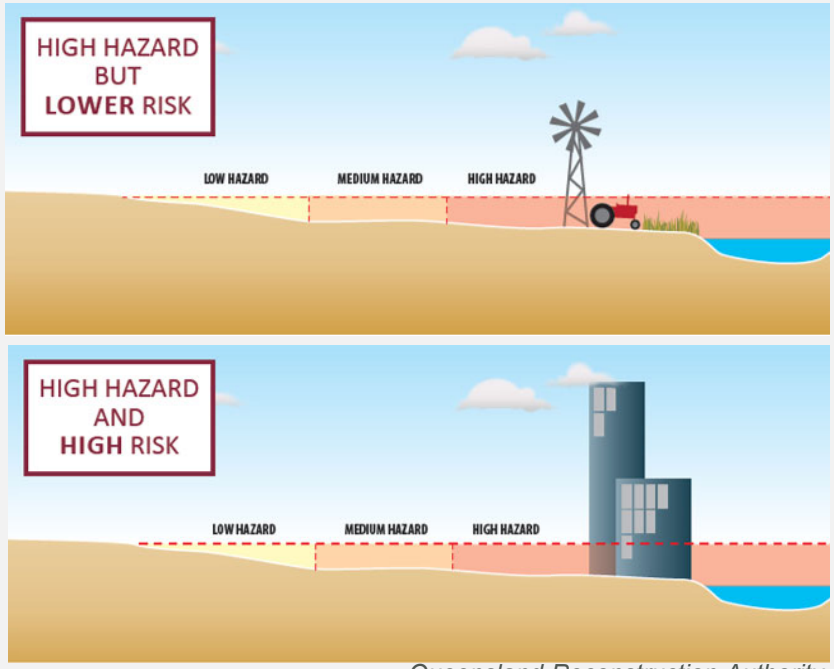
So, what is flood risk and how do you measure it?

BMT

TUFLOW

How do we define flood risk?

RISK = LIKELIHOOD (of a hazard occurring) X CONSEQUENCE (of impact if it does occur)



Queensland Reconstruction Authority

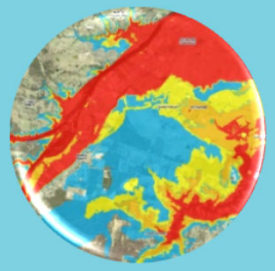
Same 'high' flood hazard (or 'hydraulic risk') but different actual flood risk

Same 'high' flood hazard but different consequences because of land use, people and assets in place

BMT

TUFLOW

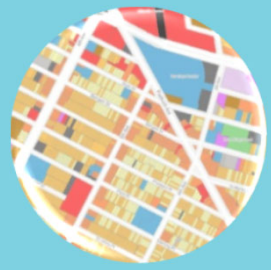
Flood risk components



Hydraulic Risk
Where will the floodwaters go?

Evacuation Risk
Will there be loss of evacuation access or isolation?

Exposure
What population/ development is in the path of the flood?



Vulnerability
Is the land use / community sensitive to flooding?

Risk = Likelihood x Consequence

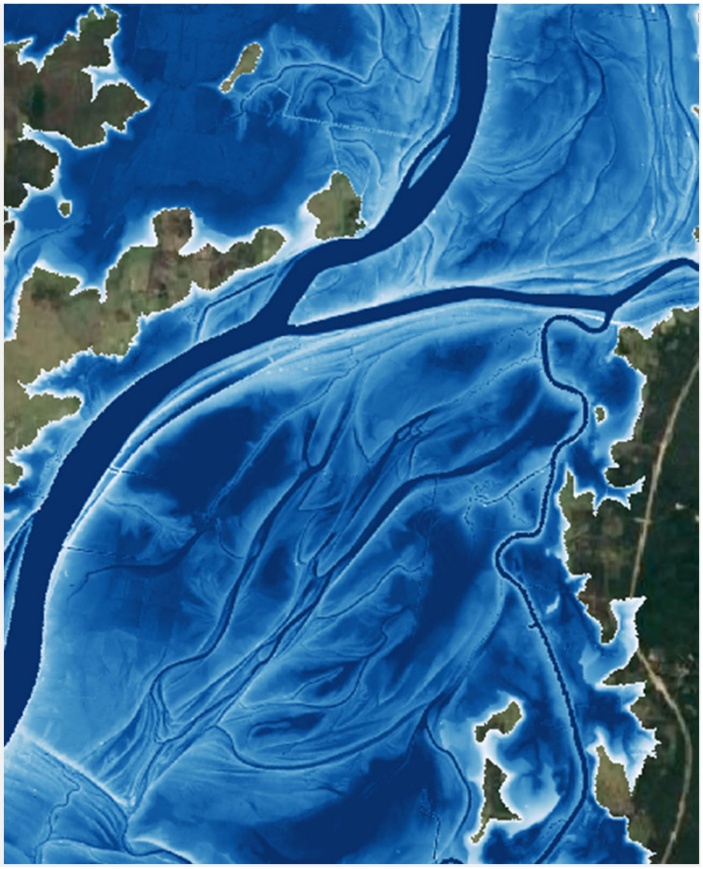
BMT

TUFLOW

Types of flood risk

Consider all types of flood risk:

1. **Existing** – *current* conditions
2. **Future** – how flood risk may *change* over time (impacts of development, climate change, deterioration of mitigation measures – e.g. levee)
3. **Residual** – *remaining risk* after measures are implemented



BMT

TUFLOW

Consultative and Collaborative

Best practice FRM is a partnership between government and the community

Need to understand

- Flood risk management roles and responsibilities
- Flood risk and response - Engage relevant agencies (Emergency Services, local council, etc)
- Community profile (e.g. demographics, vulnerability, exposure to flood risk), values and needs

BMT

TUFLOW

Informed and Tailored

Informed by

- Legislative and policy framework
- Best available information

Tailored to

- Catchment (e.g. coastal, rural, urban)
- Type of flooding
- Type of flood risk (existing, future, residual)
- Magnitude and extent of flood risk
- Type of development
- Needs of the community

BMT

TUFLOW

Strategic

Be strategic rather than reactive (if possible)

- Make informed decisions as early as possible
- Have a plan

Prioritise!

- Implementation plan – timing, responsibility, funding?
- Short term / long term measures
- Financial costs vs. economic benefits – where are the bigger wins?
- Further studies – if further data or detail needed

BMT

TUFLOW

Multi-disciplinary

Consider a range of factors

- Social, environmental, financial, community acceptance, other constraints (e.g. constructability, available land, etc)…

Involve multi-disciplinary teams

- Engineers, planners, hydrologists, floodplain managers, emergency services, planners, environmental scientists, ecologists…

Dynamic

FRM is a cyclical process responding to changes in:

- Catchment, floodplain and climate conditions
- New legislation, policies and guidance
- New data (flood events, topography, modelling, etc)
- Funding availability

Don’t set it and forget it!

- Set a program for review
- Update studies, plans and measures when required or when possible

What are the barriers to achieving best practice?

Possible barriers to achieving best practice

Data Availability

- What flood information is available?
- Limitations, confidence and gaps need to be understood and communicated

Cost

- Both for studies and implementation

Practicality

- Feasibility of implementation

Timing and Scope

- Project program, defined scope, funding deadlines

BMT

TUFLOW

Is best practice essential?

Is best practice essential?

What's the alternative? Worst practice? Kind of OK practice?

Best practice is difficult and expensive – maybe even impossible across all aspects

Can always:

- Collect more data
- Consult more
- Test more options
- Refine approach

How far do you go?

BMT

TUFLOW

Is best practice essential?: Fit-for-purpose

- Councils have a duty of care to understand, communicate and mitigate flood risk
- This doesn't mean "gold standard". (Is "gold standard" even possible?)
- Apply a risk-based approach to managing risk
- What level of risk is the community exposed to?
- Will this risk increase in future (development, climate change)
- Approach needs to be 'fit for purpose' (fit for risk)

"Perfect is the enemy of good"

- Voltaire

When is it ok to compromise?

When is it ok to compromise: survey results

When is it ok to compromise in the flood risk management process?

A) Never

B) Sometimes, but only if you have no other choice

C) Always

BMT

TUFLOW

When is it ok to compromise: considerations

Our answer? ALWAYS! … and NEVER!

You should never compromise on fundamental FRM principles

You can always compromise on data, scope, budget etc. (with caveats)

BMT

TUFLOW

When is it ok to compromise: considerations

If you are deviating from best practice "gold standard" it should be a deliberate, informed decision.

You must:

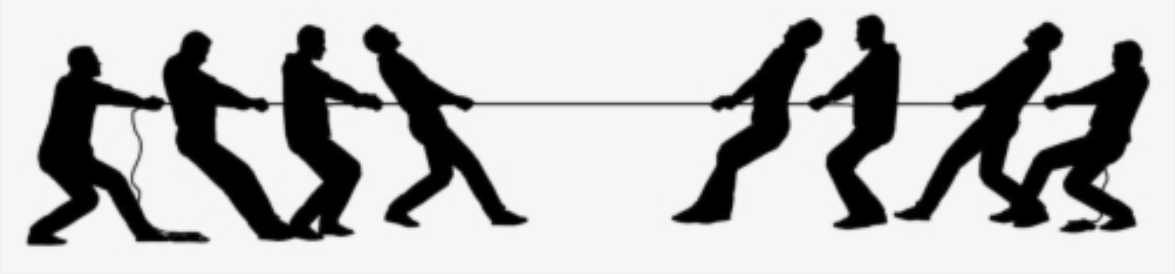
- Start with a good understanding of best practice
- Understand stakeholder needs and other limitations
- Be clear (to yourself and stakeholders) why you're compromising
- Communicate any deviations from best practice and likely implications

When is it ok to compromise: considerations

Consider:

- What are the implications? Will you have less confidence in results and recommendations?
- How will the compromise affect the study outcomes and usability?
- Will stakeholders lose trust in the process and its outcomes?

Be careful not to be too conservative!



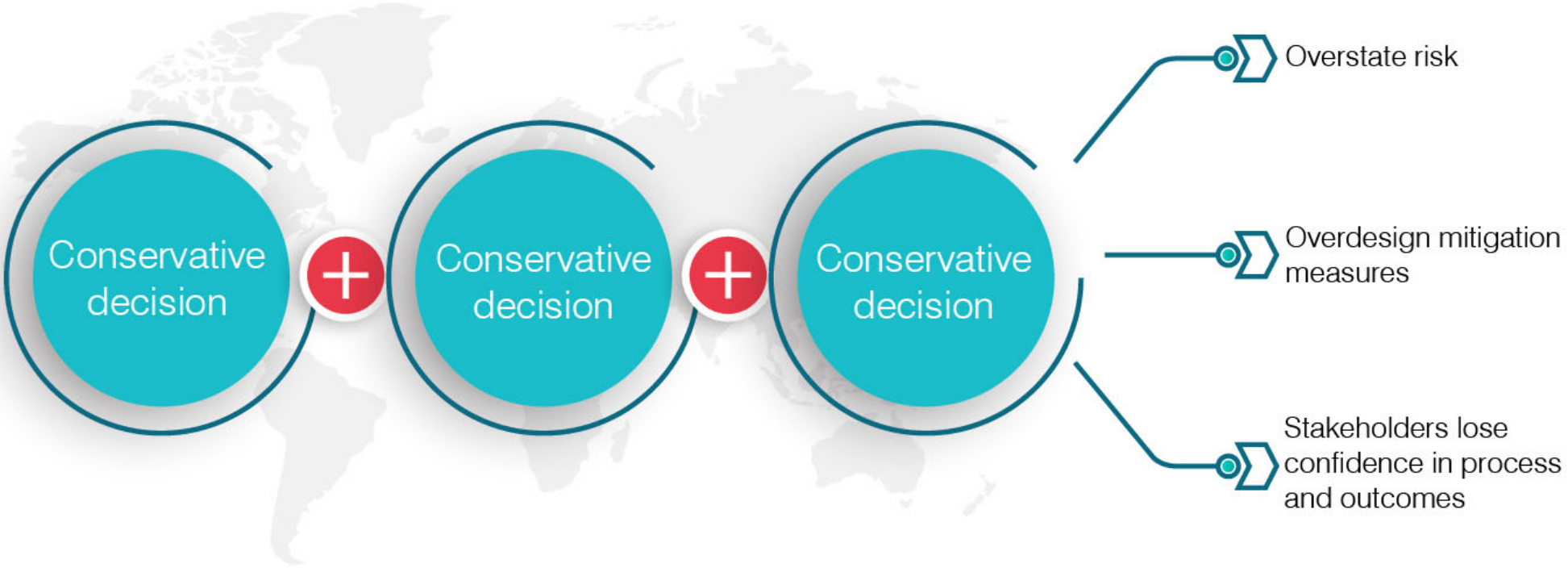
BMT

TUFLOW

When is it ok to compromise: being conservative

- It's easy to adopt the mindset: "if in doubt, be conservative"
- It's better to overstate than understate flood risk *but* be conscious of cumulative effects. Try your best to make "realistic" estimates rather than "conservative"
- Remember that assumptions were also made during development of flood models – *possibly also conservative*

When is it ok to compromise: being conservative



BMT

TUFLOW

When is it ok to compromise: trade-offs

Compromises can (usually) be avoided with more time and money. You should consider:

- How much will it cost?
- How much will it delay the study? Half-completed studies aren't used to increase community awareness, implement mitigation measures etc … **delaying the study delays release of information**
- How much does it improve the confidence of process and outcomes?
- Is it a dealbreaker?

BMT

TUFLOW

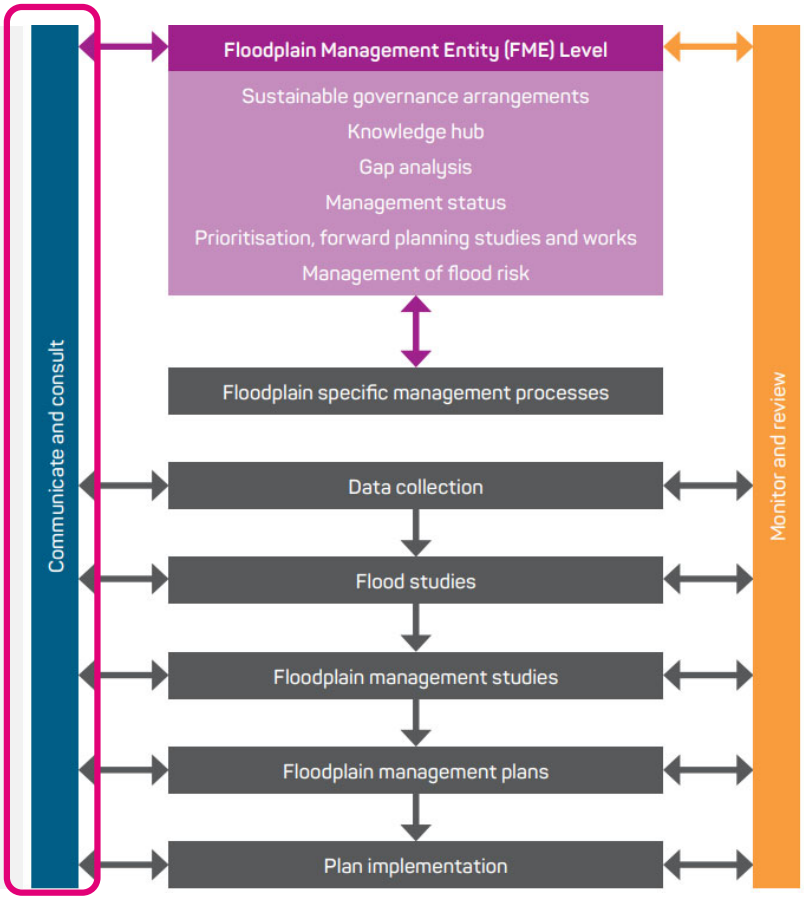
Understanding stakeholder needs

Understanding stakeholder needs

Engagement is a critical element of any successful FRM study

Engagement identifies stakeholder needs:

- What are the intended applications of the study?
- What are the time and budget limitations?
- Is this the first stage in a broader scope of works?
- What are the drivers for the study?
- Are there any sensitive / political issues?
- How and when should stakeholders be involved in the study?



BMT

TUFLOW

Understanding stakeholder needs

- Use this information to help develop a fit-for-purpose approach
- Continue to engage to communicate how proposed approach deviates from “gold standard” and what this means
- Ongoing, upfront communication builds trust and stakeholder “buy-in” to the process and outcomes

BMT

TUFLOW

Compromise in action

Floor level data collection: what's the challenge?

A key input to FRM studies used to assess:

- Property-scale risk
- Inform flood damages assessment

Flood damages assess the change in estimated damages between one scenario and another (e.g. if a levee is built or a policy introduced to raise floor levels)

BMT

TUFLOW

Floor level data collection: what's the challenge?

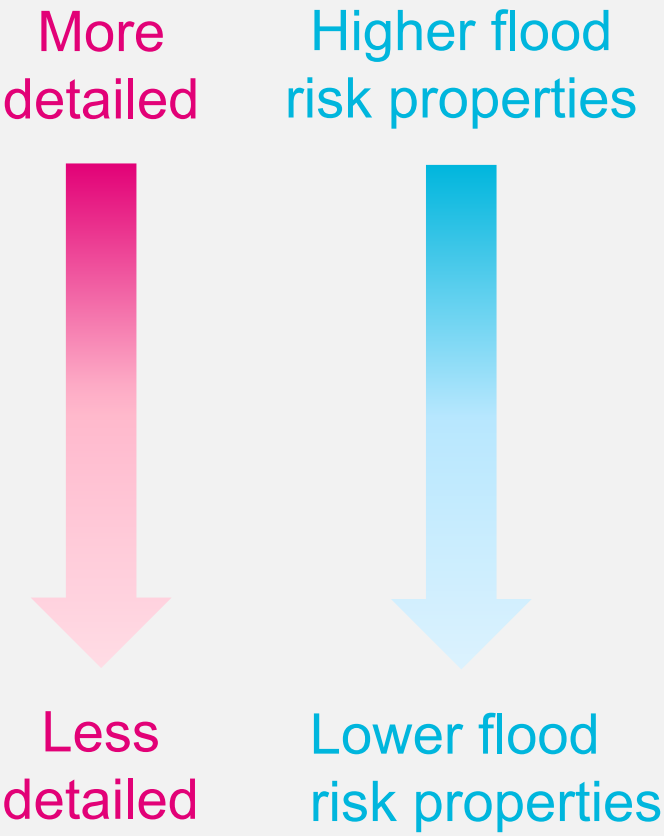
- "Gold standard": detailed floor level survey for all flood affected properties within the study area
- Size of the floodplain and number of flood affected properties means detailed floor level survey of all flood prone properties may be **cost-prohibitive**.

BMT

TUFLOW

Floor level data collection: what are the options?

- Detailed floor level survey
- Drive-by / walk-by mobile LiDAR survey
- Desk-based assessment for all properties
- Desk-based assessment for representative sample, then application of representative floor heights across sub-sets within wider property database
- Application of indicative floor height above ground for all properties (e.g. 200mm / 300mm)



BMT

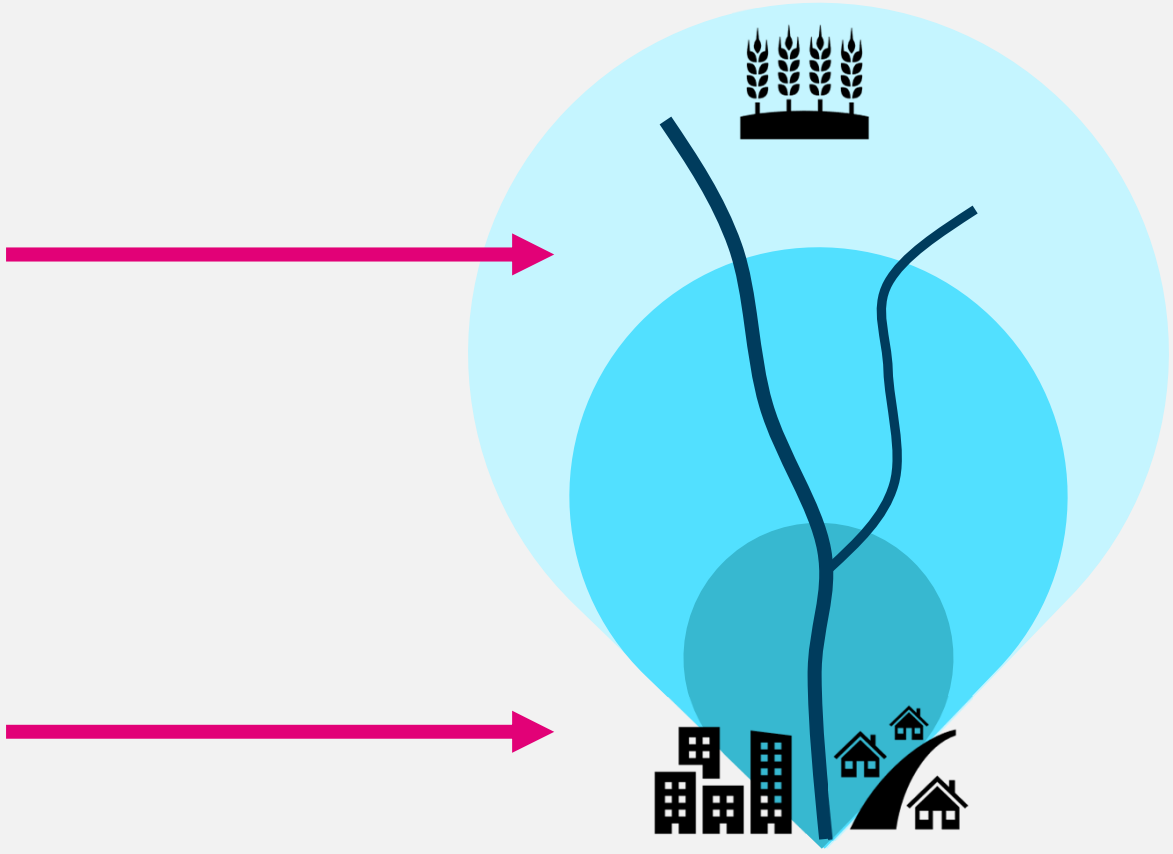
TUFLOW

Floor level data collection: what do we recommend?

Typically, we recommend a mix (risk-based data collection)

Lower risk:
Lower-confidence data

Higher risk:
higher-confidence data



BMT

TUFLOW

Floor level data collection: what are the considerations?

- Is the data for property-scale risk assessment, damages estimation or both?
  - Damages estimation is about comparison (base case vs developed) – can generally handle less confidence
  - Property-scale risk assessment requires higher-confidence data
- What is the purpose of the study?
  - Regional-scale assessment vs design of infrastructure that will impact an acute area
  - If acute, you'll need higher-confidence data in that area

BMT

TUFLOW

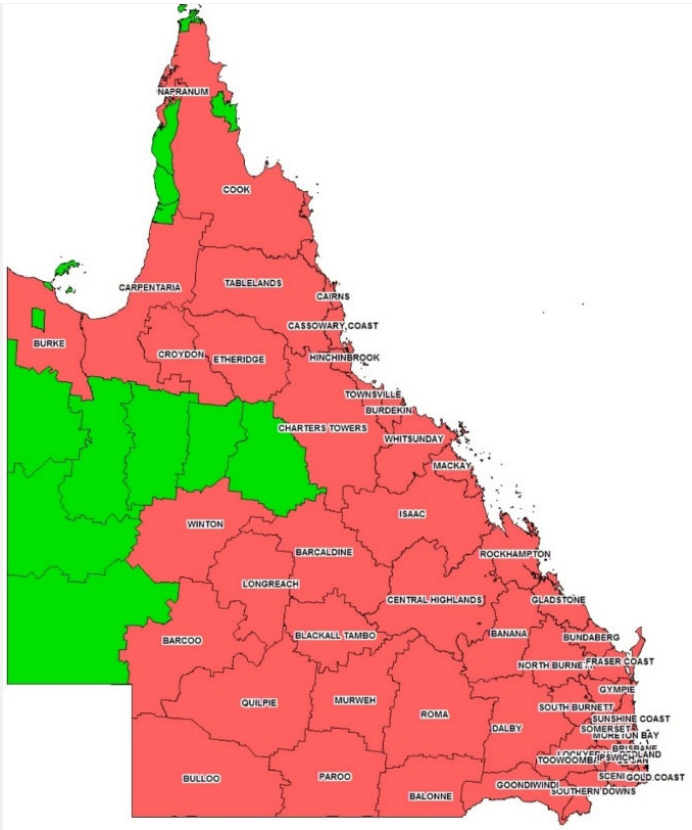
Floor level data collection: what are the considerations?

- How good is the underlying topography / LiDAR?
- Is there a pathway for readily updating data in future?
  Typical process might be:
  - Start with lower confidence floor level data
  - Assess range of structural mitigation measures
  - Short-list promising measures
  - Improve floor level data in areas likely to be impacted
  - Undertake cost-benefit analysis with higher confidence data

Sensitivity analysis – compare data for representative properties using different collection techniques

Making the most of low-quality data: QFAO

- In 2010 / 2011, 98% of QLD councils disaster declared with cyclones and flooding throughout the state
- Limited flood studies available in regional areas
- Recovery / build-back costs high
- QLD Government needed to rapidly understand extent of floodplain across the state and where to focus limited resources (a risk-based approach to flood mapping)



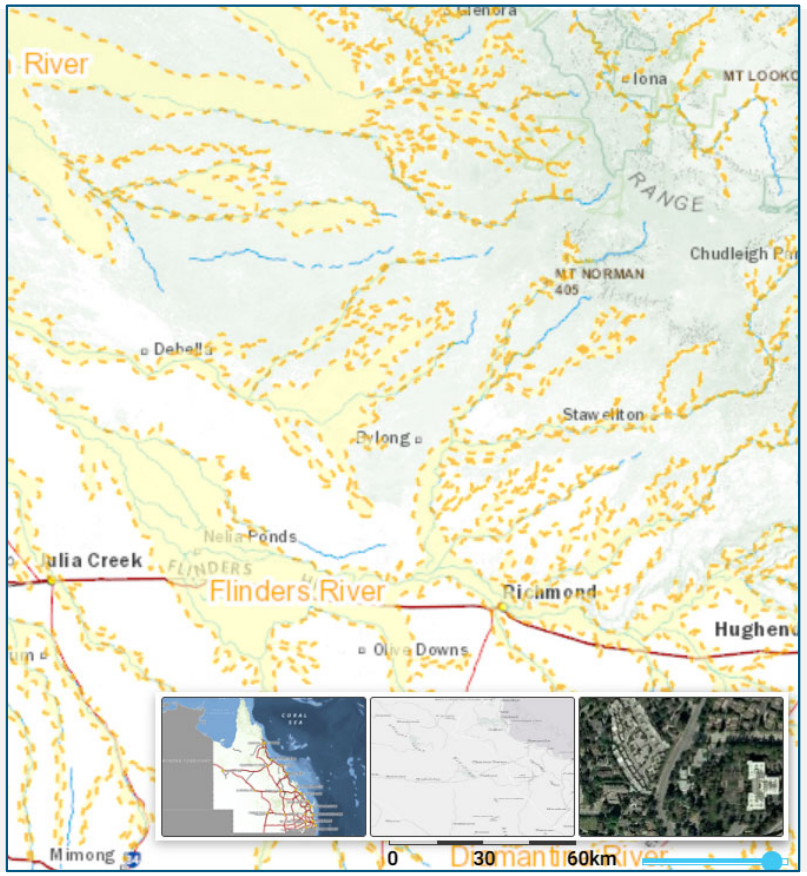
[The Chronicle]

BMT

TUFLOW

Making the most of low-quality data: QFAO

- The Queensland Flood Area Outline is an estimate using 10m contours, historical flood records, vegetation and soils mapping, and satellite imagery.
- No hydrologic or hydraulic modelling, no estimate of design event size.
- How can it be used?
- *Should it be used?*



BMT

TUFLOW

Making the most of low-quality data: QFAO applied

- The QFAO is **low-quality data**. Does it bring any value to FRM? Is something better than nothing?
- One Council incorporated it into their planning mapping – filling the gaps between modelled areas
- Planning condition: if development proposed in QFAO then a flood investigation is required (i.e. QFAO as a trigger)
- Land owners expressed concern about data quality
- Council subsequently commissioned rapid 1% AEP mapping for entire region and replaced QFAO

Making the most of low-quality data: Was it worth it?

Was it worth it as a stop-gap measure?

- Council might have eroded trust in the process by going public with low-quality data
- But, they'd invested a lot of resources in studies for the town areas and had big flood recovery costs
- The technology for the rapid modelling also wasn't available at the time of using the QFAO

This case study highlights the complexity of compromising – no clear right answer

BMT

TUFLOW

Recommendations and conclusions

Recommendations and conclusions

- FRM is an evolving practice and FRM studies are continually updated and revised
- No study is ever “gold standard” best practice across all aspects. You can always get more data, consult more, analyse results in different ways, research in more detail etc. etc.
- You need to decide what your study parameters are. Ideally before you begin but continue to assess throughout

BMT

TUFLOW

Recommendations and conclusions

Start with a solid understanding of FRM best practice and keep a foundation of best practice FRM principles

Then you can decide how far to deviate from "gold standard" approaches

Decision factors include:

- Scale of risk (how many people and properties exposed, nature of flooding)
- Project budget, time and scope
- Physical or data constraints - assess gaps in knowledge and make informed decisions
- Intended application
- Stakeholder needs

Recommendations and conclusions

Once you understand your constraints, establish a fit-for-purpose and risk-based methodology

Talk to industry colleagues, investigate applied case studies for fit-for-purpose approaches

Keep best practice FRM principles as your foundation

BMT

TUFLOW

Recommendations and conclusions

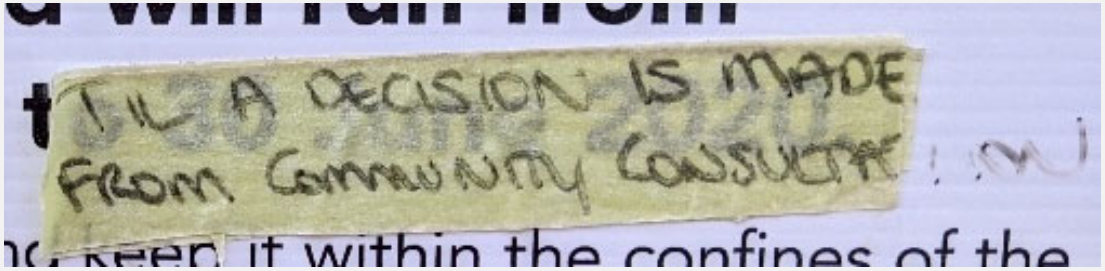
Ensure you understand the implications of compromising. Are you:

- Maintaining confidence in the approach and outputs?
- Considering how the study might be improved in future (betterment roadmap)?
- Being overly conservative by making additive conservative decisions at every step?

Recommendations and conclusions

Be upfront and transparent about the methodology and the fact that it is 'fit for purpose'

Ensure you communicate any limitations or compromises. There's nothing wrong with compromising as long as it is informed and agreed.



Questions