



DARWIN FLASH FLOODING – IS A LEVEE THE SOLUTION?

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Outline

- Background
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Thanks to my Jacobs SKM co-authors:

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- Shane Ruschinsky (Sydney)



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Background

- **Rapid Creek**, in the northern suburbs of Darwin, experiences flash flooding
- The most recent major flood - **Cyclone Carlos** in February 2011
 - A significant number of houses were inundated (71 in Millner)
 - Major roads were cut by the floodwaters
 - Local residents and emergency services had very little time to react
- The **NT Government** created an interagency Project Control Group and provided funding for floodplain risk management studies to develop an **Action Plan** to reduce the risk to life and damages
- The flood study, mapping and damages assessment showed that:
 - over 350 properties would be impacted by the PMF event
 - average annual damage (AAD) about \$0.5 million, with the NPV of the potential AAD about \$12 million

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Location



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Location



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Rapid Creek Catchment

- Rapid Creek rises in the Marrara Swamp at the eastern end of Darwin Airport
- Flows for 9.8 km discharging into the sea (Beagle Gulf) at the southern end of Casuarina Beach
- Catchment covers an area of 28 sq. km
- Includes the floodprone suburbs of Jingili, Millner & Rapid Creek
- A Flood Control Weir exists which attenuates floods - constructed in 1985



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Catchment Urban Development

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Cyclone Carlos (Category 1) - February 2011

- Rapid Creek flood on 16 February 2011 is estimated to be a 0.7% AEP event (140yr ARI)
- 24 hour record rainfall 435mm & 3 day total of 685mm at Marrara
- The damage bill - estimated at \$6 million

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Flood Risk

- The floodplain community of Rapid Creek, particularly in the Millner area, experiences flooding that allows little time to respond
- In storms, Rapid Creek Road and areas in suburban Millner flooded within 1.0 to 1.5 hours of the onset of heavy rainfall.
- Residents experience difficulties evacuating to higher ground
- NT SES / Police stretched – poor access to suburbs
- Properties at risk
 - > 1% AEP – 67
 - > PMF – 350
 - > 28 have habitable areas constructed at or near ground level.

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Flood Risk - 1% AEP Flood

- A 1% AEP (Q100) flood will spread into the entire lower part of Millner including Rapid Creek Road
- Flooding over Rapid Creek Road commences at a 10% AEP flood
- For larger storms the duration of inundation may be up to 4 hours
- The 5% AEP flood is 480mm lower than the 1% AEP flood level

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Flood Risk

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Floodplain Risk Management Options Study

The NT Government requested:

- Examination of NT's flood risk management **policies and planning** instruments
- Identification and assessment of **flood risk management options** eg **Rapid Creek Road Levee**
- Review of existing **flood warning** arrangements
- Consultation** about local issues and emergency responses
- Flood and hazard **mapping**
- Recommendations** for priority options

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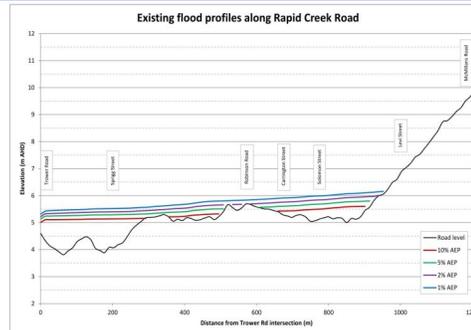
Rapid Creek Road Levee

- A levee along Rapid Creek Road - Millner protection
- The levee 1.1km with average height of 1.5m
- Need to be up to 2.0m high near the intersection with Trower Road



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Levee Profile



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Levee considerations

- Impact on local drainage
- Increase in flood levels
- Amenity
- Ownership
- Operation and maintenance
- Residual risk
- Cost



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Local Drainage

- When the Creek is high, the local runoff generated from the Millner sub-catchments cannot drain out
- Impact would be between one (1) to four (4) hours
- There are 12 sub-catchment areas of Millner – largest being 18.2 ha draining about half way along the proposed levee
- Significant volume of local water could potentially be stored behind the levee eg 15,000 cubic metres of runoff in the 1% AEP storm
- The local catchment runoff travel time is **15 minutes** compared with time to peak in major Creek events of about **60 minutes** - potential for some drainage

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Local Drainage



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Local Drainage

- The residue runoff volume would cause local flooding to properties fronting Rapid Creek Road. To manage this trapped runoff, it is possible to:
 - Pump this flow beyond the levee - large high volume, low head pumps
 - Re-arrange the underground drainage outlets
 - Construct detention basin(s) near the levee
- Flood gates would be constructed to prevent water from flowing back up stormwater drains
- A more detailed flood & drainage assessment is required for design



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Amenity

- A levee up to 2.0m high in the northern low lying section
- A physical and visual barrier - change the character of the area and reduce the amenity of the creek corridor.
- Possible increase in unsocial behaviour of some recreational users.
- A lesser height levee may be possible to manage more frequent events ie. the 5% AEP event



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Increase in Flood Levels

TUFLOW modelling

- Option 1: 300mm increase
- Option 2: 80mm increase



Ownership & Residual Risk

Ownership, operation and maintenance

- Clear arrangements required
- Darwin City Council has responsibility for the Millner drainage systems
- NT Government may also have responsibility as this would be a significant public asset

Residual risk

- Residual risk remains to people and property for flood events larger than the levee design flood

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Costs & Benefits

- Multi-million \$ project including levee, drainage system, creek foreshore redevelopment
- The main benefit of a Rapid Creek Road levee is:
 - the protection of 67 properties (and residents) from the 1%AEP flood
 - the estimated Net Present Value (NPV) reduction in damages for the 1%AEP event for the levee is \$8.9 million
- Realistically, it is likely the construction cost will exceed the benefits – Treasury funding risk!

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Summary & Conclusion

- **Risk:**
 - In Cyclone Carlos 71 properties were flooded, roads cut, emergency services stretched and a \$6M damages bill
 - PMF event there are 350 properties at risk
 - Warning times are short and risks to people and property are high
- **NT Government** requested investigation into a broad range of options for flood mitigation. Mitigation options include:
 - **Flood modification** options: eg levees
 - **Response modification** options: eg flood warning
 - **Property modification** options: eg planning controls

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Summary & Conclusion

- The recent broad option study identified that there is **no single mitigation option** that 'solves' the problem of flooding
 - Levee challenge is managing both Creek and local catchment flooding
- The **Rapid Creek Road Levee** could form:
 - a structural solution with catchment detention basins
 - a solution with non-structural measures, such as:
 - improved flood response measures
 - strategic precinct planning to redevelop the Millner area with commercial and residential development that mitigates flood risk
- The NT Government's development of a **Strategic Action Plan** for floodplain risk management remains under consideration.

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