

# Evacuation Strategy Review Moorebank Marina Planning Proposal.

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Dave Owens APM  
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The Committee  
Department of Planning, Housing and Infrastructure

Dear Committee Members

This covering letter briefly touches on the issues that I have detailed in the attached report in respect to the principles applied to evacuation management in the Moorebank Marina Planning Proposal. I have reviewed and referenced a variety of material in the development of any opinion/s provided, these are listed in the attached report. I have also provided my CV for the information of the Committee moving. I am also prepared to present to the committee if they wish to hear from me in respect to evacuation management. I have only provided opinion in respect to Section 4.3.2. Flood Evacuation of the Gateway Determination Assessment report.

In the development of an evacuation strategy, one must consider contemporary research, the practical application of lessons learnt and the findings of the NSW Flood Inquiry (2022). The strategies must be developed giving full consideration to a phased evacuation approach, not a one size fits all locations.

I have significant concerns with the following documentation and approaches:

- Georges River Evacuation study (Molino Stewart 2022) commissioned by Council (but not adopted)
- NSW SES adoption of the TEM (Timeline Evacuation Model) as the guide for evacuation management even though it is not research based and has not been peer reviewed and the results published. Research and methodology are not contemporary.
- Failure to adopt or consider a phased approach to evacuation management
- The different types of evacuation and the different timelines associated with these models.
- NSW SES not being the legislated authority on flood planning development.
- Ownership of motor vehicles into the future not considered<sup>12</sup>
- The implementation of technology in early warnings

All of the above are addressed in the attached report in detail and if adopted would present a different outcome to the evacuation modelling undertaken by Molino Stewart as relied upon by the NSW Government.

Yours sincerely

Dave Owens APM  
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27 September 2024

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<sup>1</sup> NSW Future Transport Strategy, released in August 2022

<sup>2</sup> *NSW Movement & Place – Network Planning in Precincts Guide*



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## Table of Contents

<b><i>Executive Summary</i></b> .....	<b>3</b>
<b><i>Documents Reviewed</i></b> .....	<b>6</b>
<b><i>Dave Owens APM – CV:</i></b> .....	<b>7</b>
<b><i>Timeline Evacuation Model (TEM)</i></b> .....	<b>8</b>
<b>Statements in the papers:</b> .....	<b>8</b>
<b>Flood Evacuation Model 2 (FEM2)</b> .....	<b>9</b>
<b>Comment:</b> .....	<b>11</b>
<b>NSW SES – Not legislated authority on flood planning development</b> .....	<b>11</b>
<b><i>Georges River Evacuation study (Molino Stewart 2022)</i></b> .....	<b>12</b>
<b><i>Gateway Assessment Report:</i></b> .....	<b>14</b>
<b><i>‘NSW SES Preliminary Pre Gateway comments 29 April 2024’</i></b> .....	<b>15</b>
<b><i>Recommendation</i></b> .....	<b>18</b>
<b><i>References:</i></b> .....	<b>22</b>

## Executive Summary

This report is a review of documentation and methodology involved in the evacuation strategy for the proposed site at 146 Newbridge Road, Moorebank. The proposed development relates to 340 dwellings (319 apartments and 21 terraces) and the marina. The Gateway Assessment Report comprehensively covers all background of the proposed development.

The strategy for Flood Emergency Response at the Moorebank Marina has been developed through a combination of contemporary research and practical application through lessons learnt. In the development of any flood emergency response, it is vital that a phased or blended approach is adopted to evacuation to ensure:

- Utilising all methods available to the occupants (pedestrian, public transport, vehicle and shelter in place)
- Considers research and innovation in how alternative processes can be introduced
- Learning from recent experiences (including Covid) and implementation into processes, procedures and solutions.

In the development of the Moorebank Marina Flood Emergency Response there is a need to understand the legislated roles and responsibilities and the actions/methodology that can be considered, through research in Australia and overseas. This is supported by the NSW EMPLAN (Sect 109), 'Continuous Improvement'. The solutions have then been embedded in the outcomes/design of the precinct to ensure the best possible outcomes for the community.

In the Liverpool LGA, 7.4% of resident do not own a motor vehicle<sup>3</sup>. As such vehicular evacuation cannot be considered as the **only method of evacuation**. The NSW State Emergency Management Plan and Evacuation Management Guidelines (2014) clearly states that “**evacuation is a scalable activity**” and considers alternatives to evacuation, such as shelter in place, should be considered where people would be safer to stay at their location.

Moorebank Marina adopts a phased approach which incorporates:

- A Pedestrian walkway
- Use of rail/bus system to leave the area
- Use of a private motor vehicles and
- Shelter in place (vertical evacuation) when adequately prepared.

It should be noted that this phased approach, does not rely on shelter in place as the primary means of reducing risk to life. It is supported by contemporary research and its practical application is logical and easy to implement by an Incident Controller. It considers the realities of urban living and is designed for population growth and the modes of transport that much of the growing population is seeking to adopt, that is non-vehicular transport. The phased approach is used in either total or partial evacuation when, due to the slow onset of a hazard or to avoid congestion on roads, affected communities are encouraged or directed to evacuate at different times.

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<sup>3</sup> ABS census data <https://www.abs.gov.au/census/find-census-data/quickstats/2021/127031523>

The assumption that all residents will evacuate an area by vehicle is unrealistic and not supported by data and research. As highlighted above, 7.4% of residents do not own a motor vehicle and 64% use a vehicle to travel to work, therefore it is reasonable to assume that a percentage of these vehicles will not be home. As stated in 'An Overview on Multimodal Emergency Evacuation in an Urban Network'<sup>4</sup>, *"the largely ignored mode of evacuation is pedestrians (by foot). Acknowledgement should be given that pedestrian evacuation will be the first step in a phased approach"*.

Evacuation by motor vehicle is an integral part of the phased approach in the Flood Emergency Response. There needs to be consideration of how many vehicles, the routes they will use, their proposed destination and planned upgrades to the road network.

The State Flood Plan states *"Research and experience in flood operations shows that most evacuees go to family, friends and commercial accommodation outside the impact area"*. As recently demonstrated in the 2022 floods in the Hawkesbury Nepean Valley Region, the Major Evacuation Centre (Homebush) was not utilised as they are not used by the public. Newgate Research (2018) highlighted that only 17% would travel to an evacuation centre and only 7% would use the M7 to get to safety. Therefore, the traffic flow on the M5 and M7 would be less than that used for the study. In a number of instances, it is safer to remain where you are, then travel through potentially flooded roadways (discussed below under Shelter in Place).

The blanket policy of evacuation of all buildings (100%) in contemporary society is not feasible or realistic. Experience has demonstrated that residents are unwilling to evacuate even when instructed to do so, as evidenced by (Molino Stewart Parramatta Report):

- *Residents have demonstrated an unwillingness to evacuate when orders have been given to evacuate in floods throughout Australia in recent years, so it may be especially difficult to get people to leave an elevated dwelling in a high rise building on foot in torrential rain*
- *Residents tend to remain in their dwellings for several hours or more even if they are without services such as electricity.*

The NSW State Flood Plan lists 12 different options that can be used together to notify the public of an evacuation, door knocking is but one. The Flood Plan also states, *"The NSW SES, in its evacuation modelling, assumes **that it takes two hours** for people to begin evacuating once they have received a warning: one hour to accept that the warning is for them and an additional hour to prepare to evacuate. In those two hours the river could have risen to a level which cuts their evacuation routes"*. Newgate Research for Infrastructure NSW found that 75% of participants stated it would take them 30 minutes to evacuate. Whilst this research was for the HNV, the same principles can be applied to other areas, understanding that there are different timings involved for the flood peaks. Georges River being much slower than HNV. If

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<sup>4</sup> An Overview on Multimodal Emergency Evacuation in an Urban Network, [https://www.australasiantransportresearchforum.org.au/sites/default/files/2013\\_shiwakoti\\_liu\\_hopkins\\_young.pdf](https://www.australasiantransportresearchforum.org.au/sites/default/files/2013_shiwakoti_liu_hopkins_young.pdf)

a phased model of evacuation is implemented, residents can be warned early and use a variety of methods (Foot, public transport and vehicle) to evacuate.

Doorknocking is, but one means available to the NSW SES and is in fact antiquated and technology must be embraced to ensure all methods of notification are utilised. The NSW SES would not have sufficient staff to undertake door knocking of all premises affected by flooding (remembering that other significant areas of Sydney would be flooding at this time also). The difficulty in the Liverpool area is further complicated by the multicultural nature of the residents and in many instances, English is a second language (66.7% non-English spoken at home ABS data<sup>5</sup>). Therefore, getting these residents to firstly open the door to someone in uniform is extremely difficult (as demonstrated in the COVID outbreak in southwestern Sydney) and then having them comprehend the message may be extremely difficult and time consuming. The differing styles of dwellings has also not been considered in the modelling. High rise apartment dwellings, as opposed to widely spread single dwelling houses allows for different use of technologies such as multilingual PA systems within buildings to provide warnings to residents. Again, this is a factor not considered by the NSW SES in the modelling.

The historical approach to Shelter in Place has been horizontal evacuation, however a continual improvement approach looks at alternatives such as vertical evacuation. This is supported by the Australian Disaster Resilience Handbook – Flood Preparedness (2009). If implemented correctly, **it is safer for people to stay at their location and shelter in place**, rather than exposing them to possible greater risk through evacuation.

In December 2017 the NSW SES wrote to the then Department of Environment and Planning, stating *“the NSW SES recognises that the situation may result in it being safer for a population at risk to remain in place as long as the building in which the occupants are sheltering is structurally sound and there is sufficient accessible space available above the PMF for all occupants to shelter where adequate services are available and maintained.”* The strategy of structurally sound and adequate services has been incorporated into the Flood Emergency Response. In high population density areas, vertical evacuation must be considered as an alternative strategy (Pannier 2016<sup>6</sup>). The Pannier report discusses the feasibility and relevance of vertical evacuation strategies in high population density areas.

Much of the research into vertical evacuation relates to Tsunami responses, with the United States and New Zealand incorporating designing vertical evacuation into structures to provide refuge. Lessons from the Japanese tsunami (2011) demonstrated effective use of both designed and informal vertical evacuation. These design factors have been incorporated into the Moorebank Marina Flood Emergency Response. It is our contention that the inputs into the flood modelling are inconsistent and not based on any scientific research, but rather conference papers, where the author, to their credit acknowledges this fact<sup>7</sup>. We simply seek to have input data that is factually based used for the flood modelling.

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<sup>5</sup> ABS census data <https://www.abs.gov.au/census/find-census-data/quickstats/2021/127031523>

<sup>6</sup> Pannier, Rodolphe (2016) *Ensuring safety of people in case of severe floods: feasibility and relevance of vertical evacuation strategies in high population density areas*

<sup>7</sup> Oppen. S & Cinque. P. 2010 First International Conference on Evacuation Modelling and Management <https://www.sciencedirect.com/science/article/pii/S1877705810004868>

## Documents Reviewed

In preparation of this report, I have reviewed the following documents:

- Gateway Determination Assessment Report - PP 2024-658
- Gateway Determination Letter (11/7/24)
- Georges River Evacuation study (Molino Stewart 2022) commissioned by Council but not adopted.
- NSW SES Preliminary Pre Gateway comments 29 April 2024.
- NSW Evacuation Management Guidelines (March 2014).
- NSW Future Transport Strategy, released in August 2022
- NSW Movement & Place – Network Planning in Precincts Guide
- Georges Cove Marina Report (Risk-e Business Consultants)
- Mirvac Flood Planning Response (Draft)
- Stantec Hazard Assessment Report (26 August 2024)
- Ministerial Briefing note Mr Scully (June 2023)
- Discussion Paper FEM2 – Deputy Secretary NSW Planning (June 2023)

## Dave Owens APM – CV:

For the information of the Committee, I have attached my full CV to this report. However, I would like to raise the following for the information of the Committee:

I had over 30 year's experience in the NSW Police Force retiring at the rank of Deputy Commissioner. I have worked with State and Commonwealth Governments along with the Vatican, Federal Bureau of Investigations and the United Nations.

I was appointed to the legislative role of State Emergency Operations Controller (SEOCN) on 01 December 2007 and performed this position for some four years, making him the longest serving officer in this role. As SEOCN, I was responsible for overall emergency management responses within the New South Wales. A sample of some of the Operations that he conducted are: Sydney 2000 Olympics, Venue Commander, Sailing; Equine Influenza (2007) with Department of Primary Industries; Pasha Bulka and North Coast Floods (2007); Black Saturday Bushfires Victoria (2009) 150 staff deployed; Emergency Management for World Youth Day and APEC Leaders Week; Christchurch New Zealand Earthquake 2011; Japanese Tsunami (2011) Urban Search & Rescue Deployment and United Nations Urban Search & Rescue accreditation Turkey (2011). In addition, I represented the NSWPF on the State Emergency Management Committee and the State Rescue Board.

I was appointed to the NSW Energy Security Taskforce in 2017, 2016 NSW Recovery Coordinator for the East Coast Low and Regional Recovery Coordinator for the Central Western Floods. I have worked for the National Resilience & Recovery Agency (NRRRA Commonwealth); Greater Sydney Mass Care Exercise, 2018 Largest State Exercise for Energy, 2019 State Emergency Management Committee Catastrophic Flood Exercise Hawkesbury Nepean (4 months planning & facilitation); 2020 Co-Lead NSW Independent Bushfire Inquiry (76 Recommendations accepted by NSW Govt) 2023 NSW largest bushfire exercise and currently engaged by Sydney Airport and CFA (Victoria) to write and facilitate their exercises. I was also engaged by the NSW SES to rewrite the Hawkesbury Nepean Valley Flood Emergency Sub Plan.

I hold a Masters in Emergency Management and a Masters in Leadership in Management (Deans Award for Academic Excellence). 2022 Risk Management Institute of Australasia Consultant of the Year. I am also the first external appointment by the NSW Government as a Deputy Incident Controller for Department of Primary Industry for Bio Security (current).

Lecturer, National Centre for Emergency Management Studies (2021 – 2022)  
Professor/Lecturer Rabdan Academy UAE Integrated Emergency Management (2021 – 2023)  
University of New England (2025) Masters of Strategic Leadership in Risk and Emergency Management (Write and facilitation). I am a trained Gateway assessor.

I have been accepted by the NSW Coroners Court, the NSW Land and Environment Court and the Office of the Chief Scientist as a Subject Matter Expert in Emergency and Evacuation Management. I was a representative on the Flood Technical Advisory Group, Department of Planning and Environment (2023).



## Timeline Evacuation Model (TEM)

The Timeline Evacuation Model (TEM) development and implementation needs to be understood so that one can then question its appropriateness to be used as a one model fits all approach by the NSW SES in evacuation management. This approach has not changed since 1997 and in the words of the man who developed it – ***“Is not the result of extensive academic research and development program”***<sup>8</sup>

Research undertaken discovered the following as to the development of the model:

- **1997 – Achieving a Hawkesbury Nepean Floodplain Management Strategy**<sup>9</sup>  
A report prepared by the Hawkesbury Nepean Flood Management Advisory Committee (163 pages)
- **40th Annual Conference, NSW Floodplain Management Authorities**<sup>10</sup>  
Emergency Planning for the Hawkesbury Nepean Valley – Steve Oppen
- **2004 – Coffs Harbour FMA Conference paper**<sup>11</sup>  
The application of Timelines to Evacuation Planning. Stephen Oppen
- **2010: First International Conference on Evacuation Modelling and Management**<sup>12</sup>  
Timeline Modelling of flood evacuation operations – Stephen Oppen/Peter Cinque
- **Flood Evacuation Model 2**<sup>13</sup> – Hawkesbury Nepean Flood Evacuation Model.

### Statements in the papers:

The basis for the 600 vehicles per lane per hour is described initially in a 2004 conference paper by Oppen and then subsequently in a 2010 conference paper by Oppen, Cinque and Davies: “this paper was a result of the involvement in 1997... Hawkesbury Nepean Flood Advisory Committee”

The 2004 paper states: **“The evacuation timeline tool continues to evolve based on suggestions of interested colleagues”**. It refers to the 600 veh/Ln/Hr, but only references the 1997 paper mentioned above.

The 2010 paper states that **“the model does not attempt to dynamically model traffic demand or flow rates”**. In the conclusion of the paper, it states that **“the method of timeline**

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<sup>8</sup> Oppen, S & Cinque, P. 2010 First International Conference on Evacuation Modelling and Management  
<https://www.sciencedirect.com/science/article/pii/S1877705810004868>

<sup>9</sup> <http://nswcoastalexplorer.domorewithmaps.com/documents/ACHIEVING%20A%20HAWKESBURYNEPEAN%20FLOODPLAIN%20MANAGEMENT%20STRATEGY%20%2000.11.1997%20%20HAWKESBURYNEPEAN%20FLOOD%20MANGT%20ADVISORY%20COMM.pdf>

<sup>10</sup> [https://www.ses.nsw.gov.au/media/2547/emergency\\_planning\\_for\\_the\\_hawkesbury\\_nepean\\_valley.pdf](https://www.ses.nsw.gov.au/media/2547/emergency_planning_for_the_hawkesbury_nepean_valley.pdf)

<sup>11</sup> [http://www.ext.ses.nsw.gov.au/media/2557/the\\_application\\_of\\_timelines\\_to\\_evacuation\\_planning.pdf](http://www.ext.ses.nsw.gov.au/media/2557/the_application_of_timelines_to_evacuation_planning.pdf)

<sup>12</sup> <https://www.sciencedirect.com/science/article/pii/S1877705810004868>

<sup>13</sup> <https://www.nsw.gov.au/sites/default/files/202308/Flood%20Evacuation%20Modelling%20Report%20May%202023.pdf>

**analysis is not claimed to be unique or without parallel nor is it the result of extensive academic research and development program” and by their own admission, that “the SES has been unable to get any individual or organisation to authoritatively provide a different number”**

The 2010 paper goes on to say the following which raises significant concerns:

*Section 4 – Estimating timeline element duration.*

*‘The SES considers that it is best to have some basis for planning and executing evacuation **knowing the assumptions are uncertain**, that it is to face operational paralysis through analysis.’*

*Section 4.3 – Warning Time*

*‘While warning technology does hold great promise in terms of broadening the arsenal of warning methods, **the SES is confident that door knocking provides a high degree of warning reliability....**’*

*Section 4.6 – Vehicle Movement Time*

*‘The timeline model is not a traffic network model, and it **does not attempt to dynamically model traffic demand or flow rates.**’*

*‘The purpose of the model is to produce **a best estimate** of how much time is expected to be needed for traffic clearance from the area being evacuated.’*

***SES has been unable to get any individual or organisation to authoritatively provide a different number. When pressed for some sign off on their suggested better number, all parties to date have stepped back and admitted that in a risk to life context such as flood evacuation the adopted rate of 600 veh/lane/hr is a justifiably conservative planning figure.”***

## Flood Evacuation Model 2 (FEM2)

In 2019, I commenced interaction with Infrastructure NSW (INSW) in respect to the State Level Exercise that I wrote and facilitated for the Hawkesbury Nepean Valley. INSW is the lead agency responsible for the Hawkesbury Nepean Flood Evacuation Model (FEM), in partnership with Transport for NSW and (NSW SES). At that time, I raised concerns as to some of the assumptions that were being considered in the model. The development of the FEM model was done under a ‘Cabinet in Confidence’ process that meant that I did not have any vision on the assumptions being used for the model. The road capacity is again put forward as the 600 vehicles per lane per hour on the following basis:

- Rural road
- Heavy Rain
- Darkness
- Driver unfamiliarity.

In 2024 the above is an incorrect assumption as the roads have been upgraded over the years with additional road funding. Evacuation does not always occur in darkness, noting that this is used as a worst-case scenario by the NSW SES. Drivers evacuating from their homes will be **highly familiar** with the roads that are the evacuation routes because these are **the same roads that service their daily needs** for travel to work, school, shopping etc. Austroads supports this concept with the following statement: *“The driver population can have a significant impact on traffic capacity. Local knowledge and regular use of a road network is a protective factor, whereas ‘where weekend or recreation drivers are a significant portion of the traffic stream, the capacity may be reduced’<sup>14</sup>.”* This is not the case with the development proposal.

*FEM2 states that the assumptions are based on NSW SES experience with local flood evacuation and informed research. However, they fail to nominate any research that they rely on. It further states that the 600 vehicle per lane per hour has been reviewed several times over the past 15 years and benchmarked against international examples. Again, they have failed to provide reference documentation to allow this assumption to be researched.*

*I have significant concerns that the assumption provided in respect to the 600 vehicles per hour per lane is an incorrect assumption since Mr Opper developed it in 1997 and presented it in a conference paper in 2004. This appears to have been accepted as fact by agencies in the planning process. **I have spoken at length with Mr Steven Molino, flood planning expert and extensively used by the NSW SES, who confirmed his view that my assumption is correct as the NSW SES has not been able to provide him with any background data.***

The model itself was a prototype developed by the National Information and Communication Technology Australia (NICTA, now the Data61 division of CSIRO)<sup>15</sup> It was developed in collaboration between a number of international developers, and I do not contest the model itself. The FEM2 document does however state:

*“The development of FEM2 was achieved through an expert-led interagency government process driven by continuous validation, verification and responsive iteration”*

*“The FEM simulates the NSW SES evacuation timeline arrangements under a range of assumptions”*

The document itself does not site the make-up of the experts who were in the development of the inputs (NSW SES evacuation timeline) nor what validation and verification was used. There is limited referencing and no peer reviews in the document. Ms Abood, one of the authors of FEM2 was requested by Deputy Premier Carr on the 21 June 2023 at Parliament House to provide Risk-e Business with referencing material for the above statements and contra flow’s alleged inclusion in the model (discussed later). A letter was sent to Ms Abood

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<sup>14</sup> [www.austroads.com.au](http://www.austroads.com.au) *Austroads Guide to Traffic Management* – Part 3, page 36.

<sup>15</sup> <https://www.nsw.gov.au/sites/default/files/202308/Flood%20Evacuation%20Modelling%20Report%20May%202023.pdf>

on the 23/6/23 requesting access. Both requests remain unanswered, and one can only assume it is because the peer review did not occur as it is not published.

The NSW SES in their preliminary Pre Gateway comments (29/4/24) states that the FEM2 model **“is being applied to other areas in the future”** The NSW SES is stating that in the future, this model might be applied to other areas, however it is not being used presently and as such should not be considered.

### Comment:

The TEM was produced in 1997 (through involvement in the HNV Flood Plain Management Strategy) and subsequently in 2004, 2010 (Conference papers) and in 2023 for the FEM2 Model. Statements in these papers give great insight into how the TEM was developed:

- The 2004 paper states: **“The evacuation timeline tool continues to evolve based on suggestions of interested colleagues”**.
- The 2010 paper states that **“the model does not attempt to dynamically model traffic demand or flow rates”** and
  - **“the method of timeline analysis is not claimed to be unique or without parallel nor is it the result of extensive academic research and development program”** and by their own admission, that **“the SES has been unable to get any individual or organisation to authoritatively provide a different number”**
- FEM2 developers were requested by the Deputy Premier to provide referencing and peer reviews and they failed to do so.

I would raise with the Committee that there should be significant academic concerns around the development of the TEM and its failure to have peer reviews. It does not appear to have been the subject of continuous validation or verification. It is based on military convoy figures from the USA. As such the use of 600 vehicles per lane per hour cannot be accepted as the ‘expert’ advice for the purposes of evacuation management.

I will discuss later in this report the additional factors considered (or not considered) by the NSW SES and Molino Stewart of 100% vehicle evacuation: all evacuation occurring at the one time (the different types of evacuation<sup>16</sup>) and consideration of a phased approach to evacuation.

### NSW SES – Not legislated authority on flood planning development

The NSW Rural Fire Service is the legislated authority in planning and development for bushfires. They have clear guidelines and parameters for developers. The NSW State Emergency Service is not legislated as the authority for flood planning development. They are

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<sup>16</sup> NSW Evacuation Management Guidelines (March 2014)

the Combat Agency for Floods and Tsunami under the State Emergency and Rescue Management Act 1989 No 165<sup>17</sup>.

Due to no fault of their own, their resources in the flood planning area have been limited as demonstrated by their inability to maintain up to date sub plans, including the Hawkesbury-Nepean Valley Flood Plan which was revised by Risk-e Business Consultants at the request of the NSW SES.

The NSW State Flood Plan states that they (NSW SES) should “*work with land use planning and consent authorities to inform and influence the consideration of the risks...*”. It should be noted that the NSW Reconstruction Authority is currently working towards more resilient communities, where sensible resilient methodology is used to improve evacuation and recovery.

## Georges River Evacuation study (Molino Stewart 2022)

In June 2022, Risk-e Business Consultants P/L was requested to review and comment on the Molino Stewart Flood Report to provide advice to Liverpool City Council.

There are a number of inconsistencies within the Molino Stewart Report identified within our review that are covered in the body of the document. These have been placed together under the headings of:

- Phased approach to evacuation management
- Vehicle capacity per lane during evacuation (TEM model)
- Assuming full capacity of residents and/or workers requiring evacuation
- Assuming a 100% evacuation warning compliance rate
- Evacuation route modelling not taking into consideration local evacuation centre in Liverpool
- Warning times

The TEM model has been discussed above and I do plan to rehash that information. The additional issues that should be considered are as follows:

### **Phased approach to evacuation not considered**

Phased evacuation is a strategy used in either total or partial evacuation when, due to the slow onset of a hazard or to avoid congestion on roads, affected communities are encouraged or directed to evacuate at different times.<sup>18</sup> It has always been our contention that a Phased Approach to evacuation should be implemented where pedestrian, vehicle and shelter in place are all considered in the modelling process.

The Molino Stewart Report (March 2022) includes the comment that ‘*while the NSW SES evacuation planning for the Georges River relies upon motor vehicle evacuation, there are currently thousands of people within the floodplain that do not have access to a vehicle (over*

<sup>17</sup> <https://legislation.nsw.gov.au/view/html/inforce/current/act-1989-165>

<sup>18</sup> Australian Disaster Resilience Handbook collection – Evacuation Planning (2017)

30% of dwellings in some areas)<sup>19</sup>. The same report also states that **'it is emphasised that the modelling is only as good as the model's inputs and assumptions'**. This is further supported by ABS census data (2021) for the Liverpool LGA that **7.4% of the population don't own motor vehicles**, and therefore would not be able to evacuate in the manner assumed by Molino Stewart and steadfastly stipulated by the NSW SES<sup>20</sup>. This highlights again that due to poor assumptions provided to Molino Stewart by the NSW SES, a less than accurate report has been produced.

As a phased approach is not considered, nor is the impact of the overhead pedestrian bridge over Brickmakers Drive (approved by Liverpool Council) that provides easy pedestrian access from the proposed marina and residential areas. It is our contention that this should have been considered as an input for the modelling.

The NSW State Emergency Management Plan, Evacuation Management Guidelines (2014) clearly states that "evacuation is a scalable activity" and as such it should be a phased approach that is modelled. It should however be noted that the phased approach, does not rely on shelter in place as the primary means of reducing the risk to life. It is supported by contemporary research (post COVID lessons learnt) and its practical application is logical and easy to implement by an Incident Controller. It considers the realities of urban living and is designed for population growth and the modes of transport that much of the expanding population is seeking to adopt, that is non-vehicular transport. **The phased approach is used either total or partial when, due to the slow onset of a hazard or to avoid congestion on roads, affected communities are encouraged or directed to evacuate at different times.** Noting that in the Georges River catchment there is a 36 hour 'window' prior to reaching a PMF event.

#### **Assuming a 100% evacuation warning compliance rate:**

The Molino Stewart report (page 74)<sup>21</sup>, referring to post-flood surveys undertaken for the NSW and Victorian SES, suggest that the **'vast majority of residents do not evacuate at all when ordered to do so. Most would probably await the arrival of floodwaters at their doorstep before leaving and then it would be too late for vehicular evacuation and, for those who get isolated by floodwaters, too late for pedestrian evacuation'**.

A blanket policy of evacuation of all buildings is not feasible or realistic.

In a paper<sup>22</sup> prepared for the guideline for the use of the FETM tool makes it clear that **'some, or all, of the evacuees may be unable, or unwilling to evacuate by motor vehicle even when the modelling indicates that everyone should be able to evacuate.'** One of the authors was S. Molino from Molino Stewart Pty Ltd and another was Mr P. Cinque from the NSW SES. Mr Cinque was the Principal Advisor Hawkesbury Nepean Strategy (FEM2) and is now the Senior Manager Emergency Risk Management.

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<sup>19</sup> Molino Stewart – Georges River Evacuation Modelling. *Flood Evacuation Analysis*. Final. March 2022

<sup>20</sup> ABS census data <https://www.abs.gov.au/census/find-census-data/quickstats/2021/127031523>

<sup>21</sup> Molino Stewart – Georges River Evacuation Modelling. *Flood Evacuation Analysis*. Final. March 2022

<sup>22</sup> Are There Better Ways to Quantify Flood Risk to Life? by S Molino; M Davison; A Tagg; and P Cinque

The assumption imposed on Molino Stewart (we believe by the NSW SES) that shelter-in-place is an unacceptable emergency response in a flood is flawed where that shelter comprises habitable areas located above the predicted peak level of the PMF and where the residents of those premises would be isolated for less than 2 days. **There is no formal government policy** that states that shelter in place is not a viable or acceptable mode of emergency response in floods. Therefore, it must be considered as an input into any flood modelling.

The model fails to consider that the proponent has undertaken to locate all critical infrastructure (water, sewer and power) above the PMF level in buildings to facilitate shelter in place. The Parramatta precinct has also adopted Shelter in Place as an evacuation strategy which further strengthens the reasoning to adopt a staged approach, including shelter in place in any evacuation strategy.

It is acknowledged by the NSW SES<sup>23</sup> of the very real scenario where a proportion of residents will refuse to leave even when directed to do so. As demonstrated in the recent Covid 19 response, many residents in these areas will also not open their doors to an uniformed person, due to their past interactions or experiences in the country that they have come from. Therefore, you will never achieve 100% evacuation compliance as sought by the NSW SES. It is clearly an unrealistic assumption as it disregards known human behaviour.

I would also note that the proponent has undertaken the ongoing management / maintenance of flood evacuation measures, such as the early warning system (multilingual) to improve early evacuation where possible as part of the staged evacuation process.

I would encourage the Committee to refresh themselves with the original report provided by Risk-e Business on the Molino Stewart Report 'issues'<sup>24</sup>.

## Gateway Assessment Report:

The Gateway Assessment Report rightly identifies that the BMT 2020 Flood Study and Molino Stewart 2022 Flood Evacuation study has not been adopted by Council, State agencies including SES, Department of Climate Change, Energy, the Environment and Water and the Department of Planning, Housing and Infrastructure consider this information the latest available data **and should be considered in assessing development proposals**. It is our contention that great care needs to be taken when using the report as the only model for assessing development proposals.

The TEM model that was used in this report, we consider to be faulty in the assumption of vehicles per lane per hour, 100% evacuation occurring at once, 100% evacuation is by motor vehicle and a phased approach is not considered even though warning times have significantly improved.

There is a need to consult with the NSW SES, however, as previously stated, they are not the legislated flood planning authority. It should also be noted that they are applying a model

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<sup>23</sup> 2021 NSW SES Liverpool City Flood Emergency Sub Plan

<sup>24</sup> Georges Cove Marina – Moorebank 30 June 2022.

(TEM) across all areas of NSW as if the areas are all rural roads. **Liverpool is now not a rural road area.**

The Report states:

During the preparation of this study, there was extensive consultation with NSW SES, Liverpool Council, Infrastructure NSW, Transport for NSW, Department of Planning and Environment and others to inform the model's inputs and assumptions, such as the most up to date information on future urban development and road upgrades and NSW SES' approach to managing a flood emergency in the area. **It is noted from Council's December 2023 report that 'some of the assumptions used to inform the study were contested by proponents as well as Council staff.**

It should be noted that the NSW SES approach to managing a flood emergency in the area is outdated and in many instances cannot be implemented anyway (such as door knocking). If one continues to use the TEM model, the same result will be produced time and time again. The modelling not considering the phased approach and only using vehicle evacuation is going to place a strain on the road system. However, how can 100% of the residents evacuate by vehicle when 7% don't own a motor vehicle<sup>25</sup> Therefore they are flawed inputs to begin with, therefore you will obtain flawed outputs.

The report and approach place the Committee in a difficult position, as in the absence of the report, there is very little credible information to reply upon. However, we would contend that the reports inputs (as outlined above) and as such its findings are open to questions as to its accuracy and as such the weight that the Committee can give to the report and therefore the outcome of the gateway review.

['NSW SES Preliminary Pre Gateway comments 29 April 2024'](#)

I would like to draw to the attention of the Committee to some of the erroneous statements made by the NSW SES in their letter 'NSW SES Preliminary Pre Gateway comments 29 April 2024'. It is not my intention to go back and forth, however these statements need to be corrected as it goes to reliance on what the NSW SES presents as fact.

#### **NSW SES not legislated authority for flood planning development:**

I put forward that:

***NSW SES is not legislated as the authority for flood planning development. Currently, the NSW SES is providing advice in a process where its representatives are not subject matter experts."***

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<sup>25</sup> ABS census data <https://www.abs.gov.au/census/find-census-data/quickstats/2021/127031523>



The response was:

*the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.*

The NSW SES may 'have an interest in public safety'.... However, the fact remains that they are not legislated as the authority for flood planning development. To suggest otherwise is factually incorrect.

#### **Warning Delivery:**

*"Doorknocking is a strategy to do one final check of the area to be evacuated as belts and braces approach".*

On my estimation of modelling done by the NSW SES for door knocking, it would take 600 staff/volunteers to undertake this task. This area does not have 600 staff/volunteers that could undertake this action within specific suburbs or SES Units within the Georges River Catchment area. To suggest otherwise is factually incorrect.

#### **Evacuation Models:**

*Given the location of the proposed development it is not appropriate to only use the simple SES timeline evacuation model (TEM) given that nearby areas could be also evacuating to the main evacuation routes, resulting in converging traffic. The TEM was only designed for areas which have only one evacuation route with no interaction with adjacent or nearby evacuation areas.*

*Instead, an agent-based model is more appropriate. The Hawkesbury Nepean FEM was developed to address the need to better model complex areas. The FEM is being applied to other areas in the future.*

The Timeline Evacuation Model is what has been used (600 vehicles per lane per hour) and this has also been used by FEM2<sup>26</sup>. To suggest otherwise is factually incorrect. FEM2, it should also be noted has NOT been applied to this area. It is also not the HNV, it is the Georges River.

*Scenarios must assume full compliance for evacuation capacity planning purposes*

The Molino Stewart report (page 74)<sup>27</sup>, referring to post-flood surveys undertaken for the NSW and Victorian SES, suggest that the 'vast majority of residents do not evacuate at all when ordered to do so....' The NSW SES own surveys clearly state that 100% full compliance to evacuate is not possible but is still used within modelling.

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<sup>26</sup> Hawkesbury-Nepean Valley flood evacuation modelling to inform flood risk management planning Pg 41

<sup>27</sup> Molino Stewart – Georges River Evacuation Modelling. *Flood Evacuation Analysis*. Final. March 2022

*For the purpose of the modelling, it has been assumed that all residential evacuees will head north on the M7 towards the M4 and the Homebush Evacuation Centre.*

The Molino Stewart makes contradictory statements about this assumption. *“It is noted that in reality, most people will make their own accommodation arrangements with only residual travelling all the way to evacuation centre<sup>28</sup>”*. It is a fact that approximately 80% of evacuees relocate to family or friends, which is supported within the Evacuation Management Guidelines. Yet the modelling was done with 100% travelling by vehicle to an evacuation centre at Homebush. A factually incorrect input.

### **TEM – 600 vehicles per lane per hour**

In their Pre Gateway Letter the NSW SES highlights that a working group engaged consultants who *“This model used the previously determined 600 vehicles/lane/hr flow rate’* However they again fail to provide academic research that produced the TEM and cannot ignore the TEM author’s comments of:

- The 2004 paper states: **“The evacuation timeline tool continues to evolve based on suggestions of interested colleagues”**.
- The 2010 paper states that **“the model does not attempt to dynamically model traffic demand or flow rates”** and
  - **“the method of timeline analysis is not claimed to be unique or without parallel nor is it the result of extensive academic research and development program”** and by their own admission, that **“the SES has been unable to get any individual or organisation to authoritatively provide a different number”**

They then site ‘recent summary of research’ which states:

***Although contraflow might never be used, establishing standard evacuation flow rates for conventionally flowing lanes is particularly important for this chain of islands because, as noted earlier, there is only a single route of egress for over 80,000 residents and visitors. Research designed to provide a quantitative basis and explanation Research designed to provide a quantitative basis and explanation of evacuation flow phenomena was conducted by Dixit and Wolshon (2014) and Wolshon and McArdle 2009.***

This highlights that even if not used, contraflow must be considered in evacuation flow. The FEM2 model that the NSW SES relies so heavily upon, **clearly states that Contra flow is not to be considered**. The two statements cannot stand together.

The Hawkesbury-Nepean Valley flood evacuation modelling to inform flood risk management planning on page 39 states:

**“Contraflow is not supported or undertaken for this modelling”**

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<sup>28</sup> Molino Stewart – Georges River Evacuation Modelling. *Flood Evacuation Analysis*. Final. March 2022

The use of contra flow in the assumptions in FEM2 was excluded from consideration. I have raised this on a number of occasions that contra flow is a world-wide accepted practice and must be considered as an assumption within the FEM2 model. In March 2023 I provided a copy of the Sydney CBD Safety Sub Plan (2019) which uses contra flow as a primary strategy. Infrastructure NSW was not aware that this contra flow system was used for the Sydney CBD.

## Recommendation

Reliance on the Georges River Evacuation study (Molino Stewart 2022) commissioned by Council but not adopted, is fraught with danger as it clearly fails to address significant inputs into the modelling that would clearly provide different outputs of vehicles that could be evacuated within the timeframe.

The inputs that have been 'imposed' upon Molino Stewart by the NSW SES, that we contend need to be reconsidered are as follows:

- Input: 100% of persons evacuating do so by vehicle. This clearly ignores the ABS data that states that at least 7% of residents do not own a motor vehicle. Therefore, it would be practical to reduce the 100% by vehicle to 93-90% by vehicle at a minimum. This is a 10% reduction of motor vehicles evacuating as an input.
- Input: 100% of persons evacuating all at the one time. We have demonstrated that this is not factually correct and as such should be reduced as an input to provide a more realistic outcome.
- Input: TEM model – Not researched based, not academically reviewed and produced by like-minded individuals. Accepted as fact through the passage of time. 600 vehicles per lane per hour (on what they describe as a rural road) is not a realistic input for a non-rural area. There needs to be a more balanced approach through an increase in the numbers (not to the 1200/1400 per hour) but to 800/900 but long term needs to be research based and peer reviewed.
- Input: Phased approach to evacuation has not been considered. It is an accepted methodology in academic literature and Australian guidelines. This means that all forms of evacuation are considered in modelling (pedestrian, vehicle, shelter in place) and put as inputs to provide a more realistic outcome.
- Input: Shelter in Place is an accepted practice in many countries, the NSW SES approach is a flat no to everything associated with Shelter in place. There is no consideration of the 'Covid affect', safer to stay where you are and location of sewer, power and water above the PMF. Shelter in place needs to be an input as one approach, but not the primary approach.

It is accepted that the cumulative impact of the surrounding area needs to be considered as an input. However, we would contend that other inputs listed above need to also be modified for those areas, so a more accurate outcome is provided. In consideration of the need for these modifications, I would suggest moving to Gateway to simultaneously allow for these considered inputs to be remodelled.

**David Owens APM MLshipMgmt MEmergMgmt DipCrim  
Managing Director  
Risk-e Business Consultants**



David established Risk-e Business Consultants, an Executive Level Management Consultancy, when he retired as Deputy Commissioner of the NSW Police Force after over 30 years of service. The NSW Police Force is Australia's oldest and largest policing organisation and one of the biggest in the English-speaking world. As the Deputy Commissioner, David was responsible for the leadership and management of nearly 13,000 police and 1200 public servants, with responsibility and accountability of a budget of \$3 billion.

David has demonstrated that he clearly understands that large organisations must establish robust accountability mechanisms for crisis & emergency management, fiscal responsibility, project and performance management. Whilst strategically focused on the areas of human resources, operations and finance, he also ensured that innovation and project management was incorporated into all aspects of his work. This leadership was recognised in the awarding of the 2012 Australian Business Awards for Innovation and Project Management (project Eyewatch).

David worked with all levels of Government (Federal and State) along with private organisations and volunteer groups. David has effectively worked with Senior Executives at The Federal Bureau of Investigations, The Vatican, The Olympics, Ministers of Parliament (Federal & State) and Boards of Companies/ Emergency Services. In 2009, David was selected as the only Australasian representative to attend the National Executive Institute conducted by the FBI with participants selected from around the world for their leadership abilities.

David has performed in various roles which include Venue Commander for the Sydney 2000 Olympics, Operation Commander, Operation CONTEGO (APEC 2007 Leaders Week) having responsibility for policing & security arrangements. He was also the overall Operation Commander, Operation ANGELUS (World Youth Day 2008) during which His Holiness Pope Benedict XVI conducted services for over 500 000 pilgrims in Sydney.

David was appointed to the legislative role of State Emergency Operations Controller (SEOCN) on 01 December 2007 and performed this position for some four years, making him the longest serving officer in this role. As SEOCN, he was responsible for overall emergency management responses within the New South Wales. A sample of some of the Operations that he conducted are: Sydney 2000 Olympics, Venue Commander, Sailing; Equine Influenza (2007) with Department of Primary Industries; Pasha Bulka and North Coast Floods (2007); Black Saturday Bushfires Victoria (2009) 150 staff deployed; Emergency Management for World Youth Day and APEC Leaders Week; Christchurch New Zealand Earthquake 2011; Japanese Tsunami (2011) Urban Search & Rescue Deployment and United Nations Urban Search & Rescue accreditation Turkey (2011).



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In addition, he represented the NSW Police Force on the State Emergency Management Committee and State Rescue Board respectively, significantly contributing to planning and policy development. David was the corporate sponsor and driving force behind the implementation of the NSW Police Force Mental Health Intervention Team (MHIT) which is now recognised as International best practice. He also implemented the Incident Commanders course and the standardisation of Operational Risk Management for the NSWPF. David was responsible for the introduction of the *EyeWatch* project in 2011 which is a platform for the delivery of information to the community utilising *Facebook* as the network tool. This effectively created 21st Century Neighbourhood Watch Communities. This project won the 2012 Australian Business Awards for Project Management and Innovation.

Transitioning from Government to the Private sector, David has been a consultant to the NSW and ACT Governments on Investigations, Policy Development and Emergency Management. David has also worked with the Office of Liquor, Gaming and Racing (investigations and policy advice); Ambulance NSW (Strategic reviews and leadership development); Customer Service (Investigations), Sydney Metro Trains (Emergency and Crisis Management Exercises and coaching) and in 2015 was the independent Chair for the NSW Government on Loose Fill Asbestos Insulation (a \$280m project), all recommendations accepted by NSW Government.

David has also consulted to private industry on a range of issues in the security and emergency management arenas and in 2014 David completed accreditation as an OGC Gateway Review Team Member. In 2015 David was appointed by the State Emergency Management Committee as the facilitator for the Greater Sydney Mass Care Exercise. In June 2016, appointed as the NSW State Recovery Coordinator for the East Coast Low and in September 2016 as the Regional Recovery Coordinator for the Central Western floods. In 2017, David was appointed by the NSW Government to the NSW Energy Security Taskforce. State Emergency Management Committee (Exercise Lumen Tenebris) 2018 – largest public/private partnership exercise conducted NSW. 2018 facilitation of NSW Health Influenza Pandemic Exercise and ANSTO Health Supply Workshop. 2018 – NSW Govt Summer Readiness Review. 2019 ANSTO (Executive mentoring), 2019 State Emergency Management Committee Catastrophic Flood Exercise Hawkesbury Nepean (4 months planning & facilitation). 2020 Co-Lead NSW Independent Bushfire Inquiry (76 Recommendations accepted by NSW Govt) and rewrite of the Hawkesbury Nepean Valley Flood Emergency Sub Plan (highest insurance risk in Australia).

Fresh Hope – Master EM, BCP and 8 Individual BCP Plans. Georges River LEMC – EM Plan, Lecturer, National Centre for Emergency Management Studies. Exercise Development & Facilitation Big Fat Smile Childcare, WestConnex M4/M5 tunnel extension and New Haven Farm Home Disability Services. 2021 Review Response Wingecarribee Shire Council 2019/20 Bushfires. 2021 & 2022 Consultant Subject Matter Expert LEAMAC Property Group and Proponent Group for Marsden Park North on flood plain management.

National Resilience & Recovery Agency (6 Emergency Management Exercises – 2021/22). ACT Government Bio Security plan rewritten (2022) NSW Department of Primary Industry operationalising plans/processes for Foot & Mouth preparation (2022). The Star Casino (NSW/QLD) transformational uplift of services (2022). 2023 – NSW Government WelFAC Sub



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Plan rewrite & develop handbook for Evacuation Centres. Crown Lands Governance structure for Emergency Management; ARTC Inland Rail - Crisis and Emergency Management Framework development 2023 – current); Mid North Coast Local Health District Emergency Management Review; Appointment to the NSW Reconstruction Authority Advisory Board (2023); State Exercise Alinta NSW RFS (2023), Independent Review into the 2023 Fish Deaths in the Darling-Baaka River at Menindee (2023); Youth Off the Streets Crisis workshop

In 2024 David was engaged to develop, write and facilitate the Sydney Airport and the CFA Victoria major bushfire exercise

### **QUALIFICATIONS:**

David holds two (2) Masters in Emergency Management (2013) and Leadership and Management (2011); Diploma in Criminology (1998); Graduate Certificate in Management (1999) and attended the National Executive Institute Session XXXIV, Federal Bureau of Investigation (FBI), 2009. Certificate IV in Training & Assessment (2015); Diploma of Security & Risk Management (2017); Master Licence (Security Industry Act) and Master Licence (Commercial Agents and Private Inquiry Agents Act). Mental Health First Aid Australia (2017). Lecturer, National Centre for Emergency Management Studies (2021 – 2022) Professor/Lecturer Rabdan Academy UAE Integrated Emergency Management (2021 – 2023)

### **AWARDS:**

David has received the following awards: National Medal (1997 & 1<sup>st</sup> Clasp)), NSW Police Medal (1<sup>st</sup>, 2<sup>nd</sup> & 3<sup>rd</sup> Clasp); Three Commissioner's Unit Citations; Commissioner's Olympic Commendation; Two Commissioners Commendations; Australian Police Medal (2007) and the NSW State Government Service Medal. 2012 Australian Business Awards for Project Management and Innovation. Resilient Australia Award Government Category – Activate Wollondilly project (2018)

2022 Risk Management Institute of Australasia Consultant of the Year.

### **AFFILIATIONS:**

Member International Association of Emergency Managers; Risk Management Institute of Australia; ASIAL (Australian Security Industry Association Ltd); Member – The Academy of Investigation, Risk and Loss Adjustment Professionals (2022) and NSW Police Legacy – Backup for Life Program. Westpac Helicopter Rescue Service (Chair/Board Member 2012-2018) NSW Ambulance Board (2019 – current). Career Transition Program Work Safe Solutions (2019 – 2021) NSW Reconstruction Authority Advisory Board (2023 – 2023) International XPrize Advisory Board (\$20m) Wildfire detection and suppression (2024)

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- Public Private Partnerships Exploring the opportunities (2014 – ASIAL Security Insider).
- Independent Review of the NSW SES Operational Response Northern River Floods 2017.
- Harnessing the power of social media in Emergency Management and Community Engagement (2013 Disaster Management conference paper);
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