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NSW MID NORTH COAST FLOOD IMPACT RESEARCH

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Risk Frontiers & Bushfire and Natural Hazards CRC





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ABSTRACT

On March 18, 2021, an extreme rainfall event kicked off, resulting in severe flooding in the Mid North Coast of New South Wales. 18,000 people were evacuated, including 1,000 flood rescues. Flooding also impacted the North Coast, Hunter, Western Sydney, South Coast, Central West, and North West Regions of NSW. Flooding was also experienced in Southeast Queensland. The focus of this briefing is on flood impacts experienced on the NSW Mid North Coast.

OVERVIEW

On March 24, Risk Frontiers, with assistance from the BNHCRC, deployed a survey team to the NSW Mid North Coast region to observe and report on significant flooding in the area. Areas surveyed included, Bulahdelah, Taree, Wingham, Port Macquarie, North Haven, Laurieton, and Dunbogan. In addition to measuring flood depths and recording noteworthy damages to belongings and infrastructure, the team spoke with residents, business owners, and rescue personnel (Rural Fire Service, NSW Fire and Rescue, and State Emergency Services). Discussions covered evacuation, emergency response and communication, community resilience, and the insurability of their homes.

A couple of key issues emerged during the investigation. The first was insurance affordability in areas that were clearly at risk of flooding. Some residents and business owners we spoke with cited quotes for policies covering flood ranging from \$5k - \$30k per year. Our survey indicates that the full extent of damage will not be evident in claims data due to the low rates of insurance as a lot of individuals had chosen to remain uninsured due to the prohibitive costs quoted for them. Disaster mitigation needs to be considered in these areas to assist with insurance affordability.

Another common concern expressed was the lack of warning and mitigative action. For example, some residents had not considered sandbagging. Residents claimed they were either misinformed or warned too late, and then felt aspects of the process to recover were unclear.

WEATHER AND FLOODING

On 18th March 2021, a low pressure trough formed along the eastern seaboard (Figure 1), causing intense and prolonged rainfall and extensive flooding across Southeast QLD, coastal and inland NSW and parts of Victoria. The trough was extensive, covering some 1,200 km of north-south length.

This type of synoptic pattern is not uncommon for this time of year (late summer/early autumn), but there were two main factors that contributed to the heightened flood risk. The first was that this event occurred at the end of a wetter-than-usual summer period driven in part by the La Niña state of the Southwest Pacific region. The second was the stationarity of this event. Heavy rain persisted for 4 to 5 days (depending on the location) from the onset of the event on 17th/18th March 2021 through to 22nd March. The trough was held in place by a blocking high pressure system in the Southern Tasman Sea (seen in Figure 1).

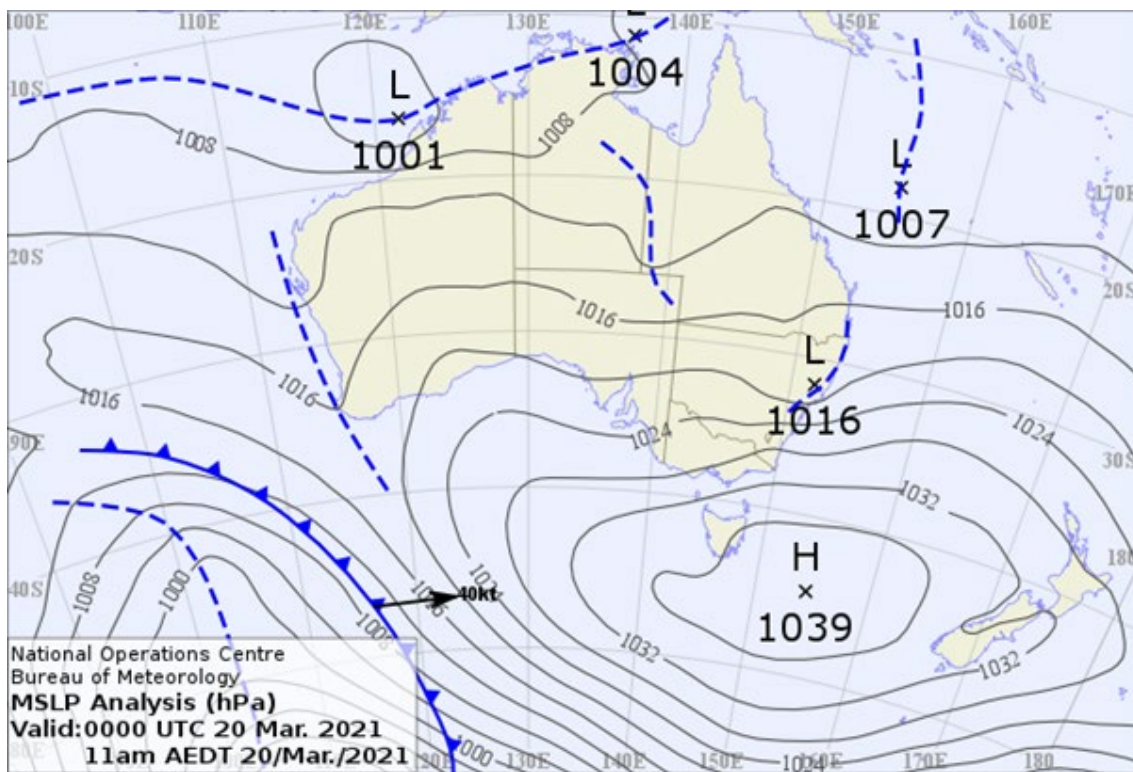


FIGURE 1. SYNOPTIC PATTERN AT 11 AM AEST ON 20TH MARCH 2021, SHOWING THE DEVELOPMENT OF THE LOW PRESSURE TROUGH ALONG THE EASTERN SEABOARD AND THE BLOCKING HIGH PRESSURE SYSTEM IN THE SOUTHERN TASMAN SEA. SOURCE: BOM (2021)

RAINFALL ANALYSIS

Seven-day rainfall totals for the period 17th-23rd March 2021 were obtained for every BoM gauge in flood-affected regions. In total, 1,487 gauges were analysed. The 95th percentile of 7-day rain totals for each region was calculated, and gauges registering values greater than the 95th percentile were run through the Australian Rainfall and Runoff (AR&R) 2016 data portal to estimate return periods (Figure 2).

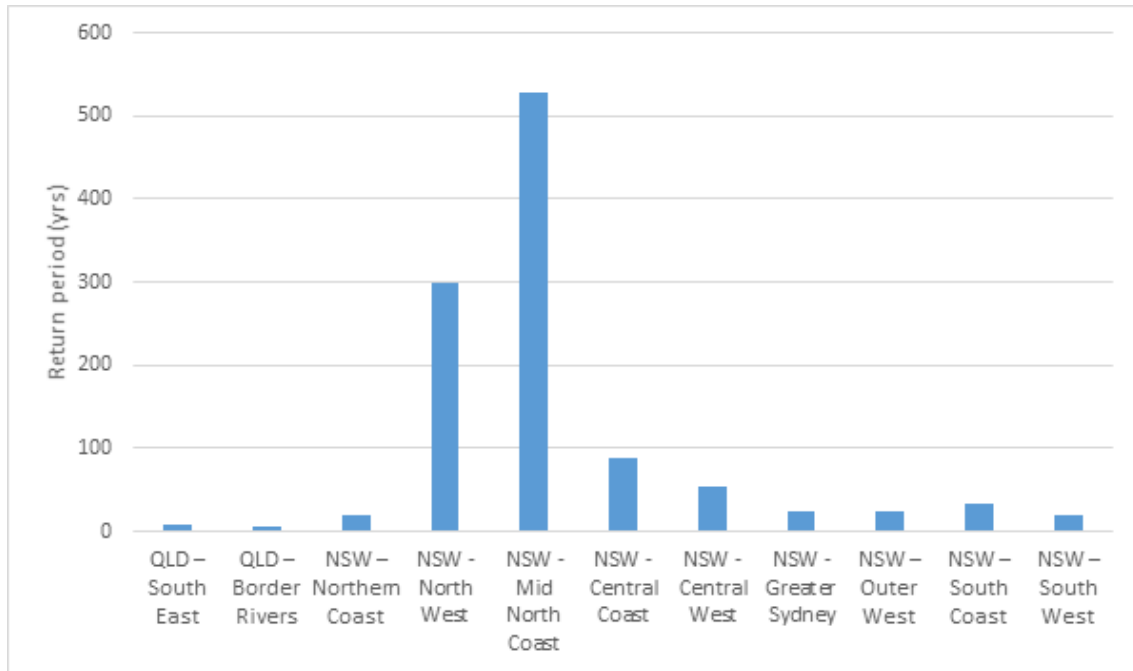


FIGURE 2. RETURN PERIOD ESTIMATES OF RAIN VOLUMES FOR THE MARCH 2021 FLOOD EVENT (REGIONS ORDERED APPROXIMATELY NORTH TO SOUTH).

Results show that while this rain event impacted a large geographic area, there were some significant regional variations in rain volumes. As shown in Figure 2, the highest return period estimates and rain volumes were experienced on the NSW Mid North Coast (~ 500 years) and North West (~ 300 years) regions. The NSW Central Coast region also experienced return period rainfall at around the 100-year level. All other regions were at or below the 50-year return period level.

The largest 7-day rain total recorded of almost 1,500 gauges analysed was at Bellwood (Nambucca Heads), where 1,064 mm of rain (over 1 metre) was recorded between 17th-23rd March 2021. According to AR&R 2016, this is in excess of the 2,000-year return period level.

FLOOD DEPTH ANALYSIS

While the rain volumes recorded at some locations were very large - with long associated return periods - peak water levels (flood depths) recorded at river gauges did not, in general, equate to comparably long return periods. This highlights the importance of not using rainfall return periods as proxies for flooding - there are a number of rainfall-runoff processes that mean the relationship between rainfall and flood depth is most often not linear.

Flood depths recorded at river gauges were analysed for some of the highest-impacted areas surveyed: Taree, Wingham, Port Macquarie and Laurieton. The return periods of the BoM Peak Water Levels were estimated from the SES Greater Taree City Local Flood Plan (2014) and SES Port Macquarie-Hastings Local Flood Plan (2015) (Table 1).



TABLE 1. PEAK WATER LEVEL (FLOOD DEPTH) AND ESTIMATED RETURN PERIOD, FOR A SELECTION OF GAUGES IN AREAS OF RECORDED FLOOD DAMAGE.

Location/Gauge	Peak Water Level (m, BoM)	Return Period (years)	Reference	Catchment / Water Source
Taree (Traffic Bridge)	5.65	~ 100	SES 2014	Manning River
Wingham	14.5 (peak value not yet verified)	~ 50	SES 2014	Manning River
Settlement Point (Port Macquarie)	1.89	~ 10	SES 2015	Hastings River
Laurieton	2.47	~ 20	SES 2015	Camden Haven River

As can be seen, return period estimates of river flood depths were, in general, considerably lower than those estimates obtained from rain gauges.



FIGURE 3. THE MANNING RIVER ADJACENT TO THE TAREE CBD. THE VEGETATION DEBRIS (LEFT) AND WATER HEIGHT (RIGHT) ON THE MARTIN BRIDGE INDICATE THE FLOOD PEAK.



IMPACTS

BULAHDELAH

We visited a holiday accommodation business that experienced only minor flooding, none of which entered buildings. An employee mentioned that another holiday business at the end of Bombah Point Road had experienced severe flooding and much more extensive damage. Bombah Point road was not accessible at the time and there were other road closures in the area as the flood water had not receded.

TAREE

Much of the damage in Taree was focused in a portion of the CBD near Brown's Creek. Nearby residential areas in lower lying areas, near the old railway, also experienced significant water levels with belongings piled by the curb for collection. The Martin Bridge, the main bridge over the Manning River, was undergoing general maintenance before the storm, but received significant structural damage at the flood's peak because of the heavy debris - contractors repairing the bridge cited a concrete tank, a cargo shipping container, and a floating house as having collided with the bridge (the final location of this debris was unknown). A significant amount of mud had been deposited on the banks of the river and was being cleaned from public walkways and parks near the bridge. There was seemingly little knowledge or concern about the potential for the flood water to be contaminated as many children were taking the opportunity to enjoy the river following several days of rain. The Taree Aquatic Centre was 75cm underwater and closed, as were a number of businesses near Brown's Creek, including an antique furniture store and motorcycle shop.

WINGHAM

The situation in Wingham was much more extreme regarding impact on residents and the extent of damage. The entrance to Wingham, Chrissy Gollan park, a local sheltered picnic area, shaped first impressions of the town and the fast, high flowing water it experienced. The water had raised and carried shelters from their concrete foundations and scattered them in the area, as well as dislodging mosaics and plaques from the paved walkways. The waterway at its back, Cedar Party Creek, also passes around a nearby neighbourhood Mortimer Street. Homes on this road were submerged past their eaves, with residents being rescued from their roofs via a neighbour's boat around 4am. No belongings were salvageable. The water height inside was at least 61cm higher than the 1978 flood as recalled by a resident on Mortimer Street, who has lived their entire life there.

In the nearby but higher elevated Appletree Street, a resident shared text messages from the SES issued at two different times - during the night and early the following morning. The first communicated minor to moderate flooding and suggested voluntary evacuation for residents in lower lying areas. A few hours later, after this resident had already been awoken and alerted by a neighbour at 2am (and water had already reached shin-deep in their garage), they got

the second message regarding evacuation (around 7am). Sandbags had not been suggested or offered, and he said up until the first text message, he had no reason to be concerned, even from watching news bulletins, which had only indicated there would be severe rain. When evacuation was expressed as being voluntary, the reason people stayed was because they had animals to manage.

In Wingham's main street, a retail business had been inundated to 1.75m, losing all their stock with an estimated value above \$1 million. The staff indicated that the business was not insured. They indicated that there was no warning and this was worse than the 1978 flood event. A general store, selling produce and animal feed, also lost all of their stock.

Tinonee Road was still underwater and closed with visible subsidence pictured in Figure 4. On Farquhar Street, we found examples of how powerful and damaging the flood waters were with heavy white goods strewn in the grass, many large scraps from farm buildings, and even an entire caravan wrapped around a tree (bottom left image of Figure 4). Saplings and shorter trees in the nearby floodplain were completely bent over, if not uprooted and carried from elsewhere.



FIGURE 4. POST-FLOODING IMPACTS AT WINGHAM. CHRISSY GOLLAN PARK (TOP), DEBRIS SCATTERED ACROSS THE FLOODPLAIN INCLUDING THIS CARAVAN WRAPPED AROUND A TREE (BOTTOM LEFT) AND THE CLOSURE OF TINONEE ROAD (BOTTOM RIGHT) DUE TO SUBSIDENCE.

PORT MACQUARIE

Our first stop was in Hibbard Drive and despite land being inundated, early indications were that the flood was well below the 100-year return period level. This was based on discussions with residents whose floor level was constructed 10cm above the 100-year level and the flood was substantially below this. We then travelled to Settlement Point Road, where the flood had impacted houses,



some businesses including a cafe and bed and breakfasts and the ferry (Figure 5). Emergency services and the Australian Defence Force were using shovels, bobcats and other machinery to move mud and debris, and the entire street was lined with piles of damaged furniture, spoiled groceries and white goods.



FIGURE 5. THE SETTLEMENT POINT FERRY AGROUND AND FACING ~45° DOWNSTREAM AFTER IT'S STEEL GUIDING CABLES RUPTURED BY THE VELOCITY OF THE HASTING RIVER FLOW. RED ARROW INDICATES THE FERRY'S USUAL DIRECTION OF TRAVEL AND WHERE THE FERRY WAS LOCATED ON THE OPPOSITE BANK PRIOR TO THE CABLES RUPTURING.

Local residents also expressed major discrepancies between warnings received and the ultimate outcomes of the storm as it proceeded. One recounted that after watching how quickly the water was rising, he initially called the SES and was told the flood would not exceed 1.65m. Not convinced this would be the case, he phoned the BoM who in turn referred him back to the SES. He then began photographing flood heights when it surpassed the 2m level on the flood depth indicator directly across from his property. Figure 6 shows this resident indicating the peak water height on an external wall just below his power box.



FIGURE 6. A RESIDENT FROM SETTLEMENT POINT ROAD, PORT MACQUARIE INDICATING THE PEAK WATER LEVEL FROM THE FLOOD ON AN EXTERNAL WALL OF HIS HOME.

In the CBD, an office supply and consumer electronics business on one side of Short Street reported water depths as ankle deep (27cm), with an estimated \$20-\$40k damage (insured), mainly furniture products. Water entered through the front door gap and rear dock. The worst affected businesses on the other side of the street experienced depths almost above the pedestrian curbside rubbish bins (Figure 7), with a printer and fax shop, a sushi restaurant, and a tobacconist, losing most of their stock. The maximum water height on the inside of these businesses ranged from 80cm to 120cm.



FIGURE 7. WATER LEVEL AT THE SOUTH WEST END OF SHORT STREET, PORT MACQUARIE

CAMDEN HAVEN

The last surveyed townships were Laurieton, Dunbogen, and North Haven along the Camden Haven River. The damage here was primarily residential, uninsured and numerous impacted dwellings were older, particularly in North Haven. Some buildings along Ocean Drive in North Haven saw water depths of ~20cm and greater depths were experienced in surrounding streets. Both North Haven and Dunbogan have large caravan parks (with permanent residential sections) and these suffered significant damage (Figure 8). These towns were reportedly inundated from multiple directions - from the rain itself (a resident from Kendell's rainwater gauge measured 980mm in 5 days), runoff from North Brother Mountain as well as the surrounding Camden Haven River, Gogleys Lagoon, Queens Lake and Stingray Creek. Residents on Camden Head Road saw water depths of at least one metre.



FIGURE 8. A CARAVAN PARK IN DUNBOGAN IN CLOSE PROXIMITY TO THE INLET THAT HAD BEEN HEAVILY IMPACTED.



CONCLUSION

The observations from this field study further support the need for flood mitigation to reduce flood damages and promote insurance affordability. Effective warning systems are critical to enable communities to reduce damages and keep people safe. Further study on the effectiveness of flood warnings during this event and the community response to these warnings in impacted areas is recommended.

Risk Frontiers has recently undertaken another field trip to survey flood damage in Western Sydney and the findings will be reported in a follow-up Briefing Note.



FIGURE 9. SKIP BINS FULL OF WATER DAMAGED BELONGINGS (TOP), A COMMON SIGHT THROUGH MANY OF THE SURVEYED NEIGHBOURHOODS. PILES OF WHITEGOODS SUCH AS FRIDGES, FREEZERS, WASHERS AND DRYERS WERE FREQUENTLY ENCOUNTERED (E.G. NORTH HAVEN, BOTTOM)