

Managing flood risk in the Hawkesbury – Nepean Valley

A report on the alternative flood management measures to raising Warragamba Dam wall.

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Flood risk in the Hawkesbury-Nepean floodplain

The Hawkesbury-Nepean Valley is particularly prone to flooding as it is naturally constricted in two places that, in conditions of severe rainfall, results in floodwaters backing up and inundating floodplains in north-west Sydney. During large flood events there is a risk of roads being inundated by floodwaters before residential areas are properly evacuated.

Flood risk has been exacerbated by local councils and the NSW Government approving housing developments on low lying lands over several decades. Unfortunately, flood risk is likely to worsen given NSW Government plans to dramatically expand the number of people living on the floodplain in north-west Sydney, combined with increased frequency of severe storm events due to climate change.

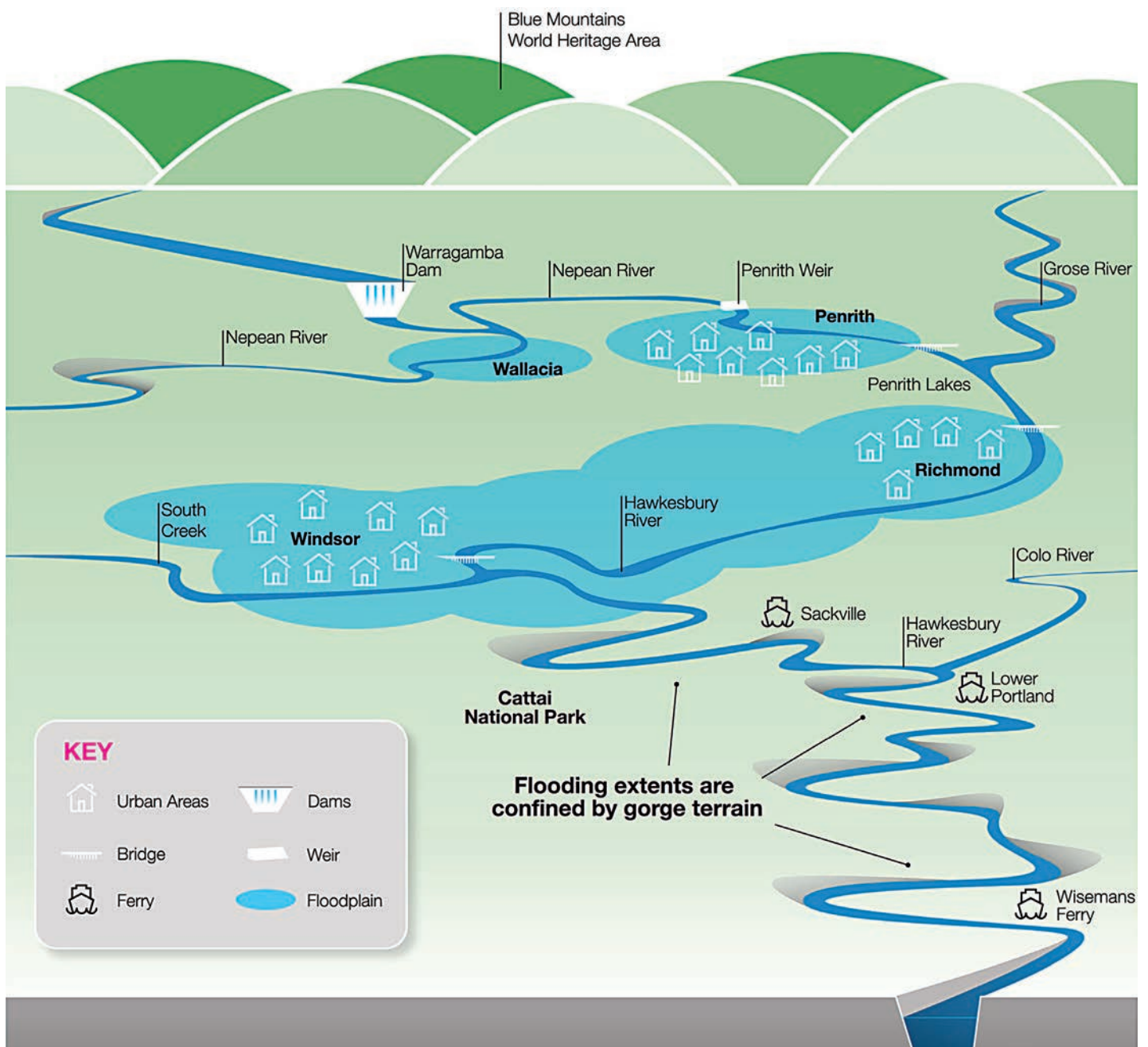


Figure 1. The Hawkesbury-Nepean floodplain (Infrastructure NSW Flood Factsheet, February 2018).

NSW Government response

The NSW Government has prepared a Hawkesbury – Nepean Valley Flood Risk Management Strategy (Infrastructure NSW 2017). This strategy does not appear to have benefitted from any independent expertise, nor is there any evidence of scientific peer review. The strategy focuses on infrastructure options that were evaluated by means of a narrowly framed cost-benefit analysis.

The strategy discards a number of response options before focusing on a proposal to spend \$690 million to raise Warragamba Dam wall by 14 metres to provide 995 gigalitres of air space to store flood waters originating upstream of Warragamba Dam (Infrastructure NSW 2017). This proposal would result in flooding of up to 4,700 hectares of the Blue Mountains National Parks and World Heritage Area, including 65 km of wilderness watercourses, populations of 48 threatened species, as well as numerous sites of cultural significance to the Gundungurra people (Colong Foundation for Wilderness 2018).

The Hawkesbury – Nepean Valley Flood Risk Management Strategy concludes that raising the dam is the most cost-effective method of managing flood risk by applying a very narrow economic assessment to the project. For each flood risk reduction option, the Infrastructure NSW assessment converts lack of vehicles evacuated into projected deaths of people, turning these deaths into a monetary value, then adding property losses to estimate the cost of flood damage. This is then compared to the cost of each intervention, such as raising Warragamba Dam wall. Their calculations exclude any additional benefits of alternative risk management measures. For example, in considering the \$950 million costs of upgrading roads to allow residents to evacuate at higher flood levels, none of the other benefits of an improved road system appear to have been considered, such as increased road safety and faster travel times. The cost benefit analysis also excludes any estimate on the economic benefits of conserving the Blue Mountains National Park and World Heritage Area upstream of the proposed raised dam.

The NSW Government's strategy is constrained by two overriding policy decisions, namely that (i) it will not reduce the 5,000 houses on the most flood-prone lands, and that (ii) it will allow an additional 134,000 people to settle in harm's way on the floodplain over the next 30 years (Infrastructure NSW 2017). The flaws in such a policy were seen during the 2011 Brisbane floods. One of the reasons for the severe flood damages during the Brisbane floods were previous state and local government decisions to allow housing development on high-risk areas of the Brisbane River floodplain, falsely believing Wivenhoe Dam had 'flood-proofed' the valley (Cook 2017).

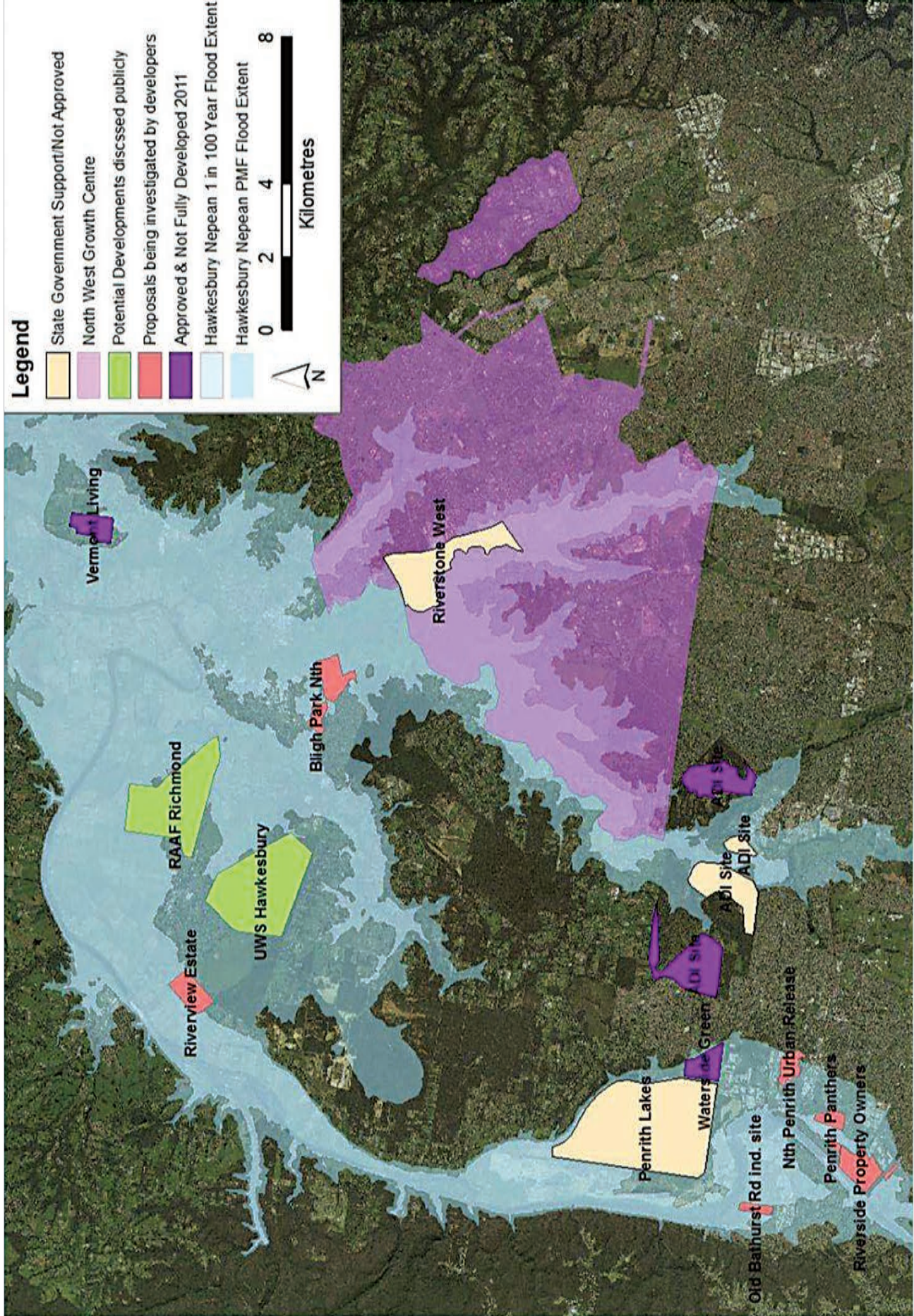


Figure 2. Future development areas overlaid with flood extent on western Sydney floodplains (Infrastructure NSW, Molino Stewart 2012a)

Importantly, no configuration of Warragamba Dam will prevent flooding in the Hawkesbury-Nepean Valley. Since the dam's construction in 1960, contribution of the Warragamba catchment to major flooding events has ranged from 73% to 42%. An average of 45% of floodwaters originate from catchment areas that are not upstream of Warragamba Dam (NSW SES 2015). This means that even if a raised Warragamba Dam was to hold back some flood waters, other catchments could still cause significant flooding in the valley. In fact, flood waters from the Grose River alone can cause moderate to major flooding of Richmond in the lower Hawkesbury (AWACS 1997).

Further, flood mitigation dams tend to 'control' only small and medium sized floods from upstream catchments. In large flood events, once a dam is full, operators have no choice but to spill the water from the dam. This was seen in the case of Queensland's Wivenhoe Dam which was kept half full to provide 1,450 billion litres of flood mitigation airspace. The airspace was not enough to prevent extensive damage to Brisbane when the dam waters were released in the January 2011 floods. Water released from the dam was ruled as the "principal immediate cause" of the floods by the Insurance Council of Australia (2011), which affected over 200,000 people and cost insurers \$2.55 billion (van den Honert & McAneney 2011).

While a bigger flood control airspace in a dam may delay a flood peak, the captured water takes longer to release from the dam, and so prolonging flood durations in downstream areas. It would appear that prolonged downstream flooding resulting from the raised dam has not been considered in the Infrastructure NSW flood strategy.

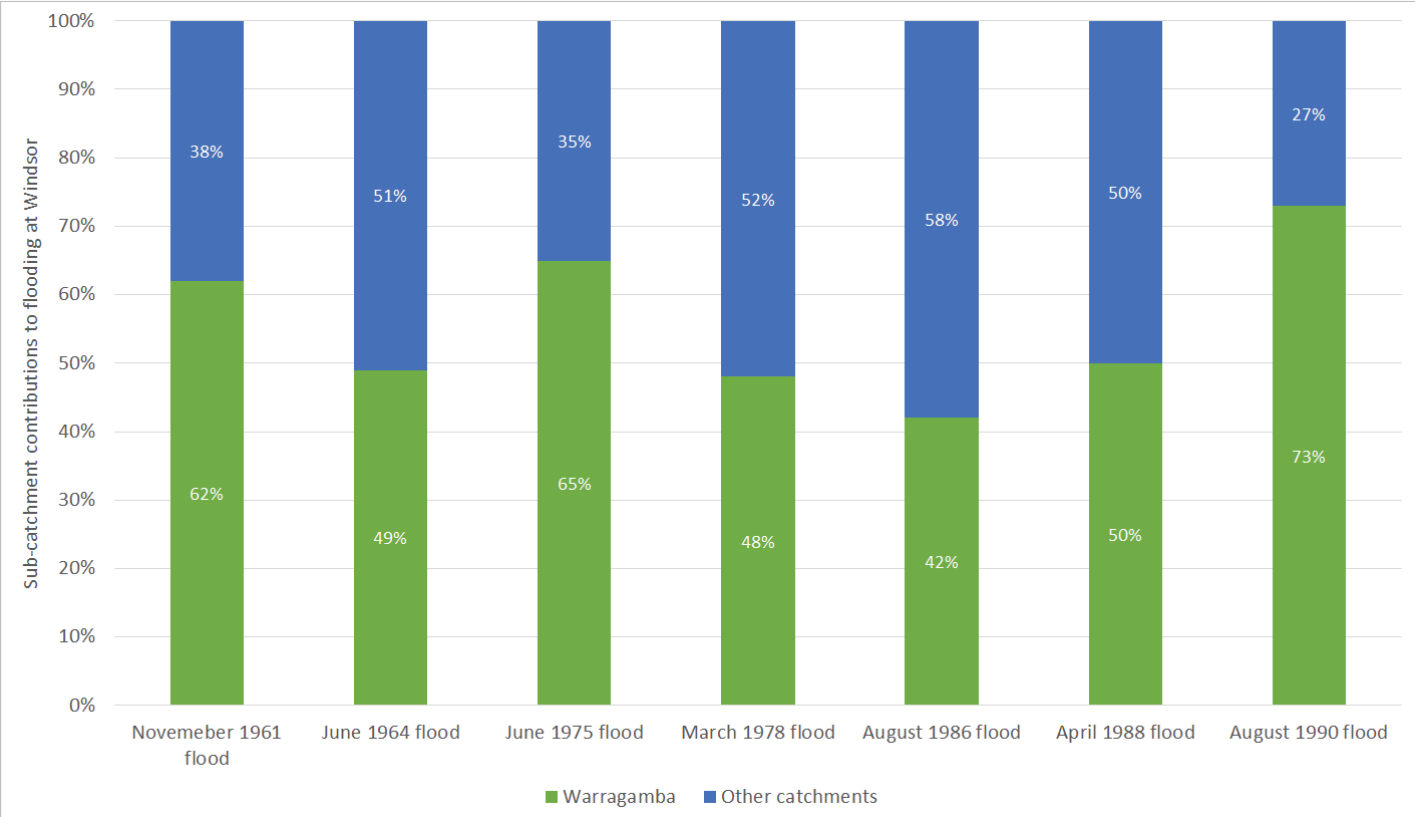


Figure 3. Sub-catchment contributions to flooding at Windsor from recent floods (NSW Office of Water 2014).

Alternative options – a different vision

There are several alternative options that the NSW Strategy either does not adequately consider or does not consider at all. Four key alternative options are discussed below.

1. Provide alternative flood storage in Warragamba Dam.

Lowering the full storage level of Warragamba Dam by 12 metres would free 795 billion litres of airspace for flood control. Further, lowering the full storage level would have no upstream environmental impacts and can be implemented immediately. This option was briefly mentioned as part of the Hawkesbury – Nepean Valley Flood Risk Management Strategy but dismissed on the grounds that it would compromise Sydney's water security (Infrastructure NSW 2017). Independent, peer reviewed research by the University of Technology Sydney has examined this option and shown that coupled with use of current and new desalination plants, lowering the FSL could be more cost effective than raising the Warragamba Dam wall (Turner et al. 2016). The University of Technology modelling found that this approach not only provides some level of flood mitigation, but also enhances Sydney's water security. Feasibility and cost benefit analysis research has also been undertaken by the University of Sydney on this option (Paton 2014), as well as receiving support from UNSW water specialist Assoc. Prof Stuart Khan (2012).

2. Stop putting people in harm's way.

The state government is proposing to allow a further 134,000 residents to join the 70,000 existing residents on the floodplain over the next 30 years (Infrastructure NSW 2017; Molino Stewart 2012a). As discussed above, no dam can stop the largest of floods, so this proposal will put more people in harm's way regardless of whether the dam wall is raised. Infrastructure NSW consultants have stated that over 16,000 residential lots are currently unable to be developed "due to flooding constraints" (Molino Stewart 2012b). These lots are located on flood-islands that are unable to be properly evacuated during flood events (Molino Stewart 2012b). The NSW Government's strategy states that it will permit development on land immediately above the 1:100 flood level. In the United States, a minimum 1:500 year threshold is now widely used (Wenger et al. 2012), whereas in the Netherlands they have adopted a 1:1,250 year flood return threshold (Wenger et al. 2013). The NSW Government should impose a safer planning standard on local governments that is in line with the rest of the western world. Doing so would save billions of dollars in future flood damages and dramatically reduce the risk to life that floods pose.

Changes to flood planning limits have already been put forward in the Land Use Guidelines prepared for the Hawkesbury-Nepean Floodplain Management Steering Committee. These guidelines highlighted that more comprehensive floodplain risk management measures are required, rather than a single 1:100 flood planning limit that is currently applies (HNFMSC 2006). This is not to say that the Hawkesbury-Nepean floodplains should be undeveloped. These guidelines describe the need to develop 'graduated planning controls', which allow for maximum use of the floodplain, while ensuring that risk to property and life is minimised (HNFMSC, 2006).

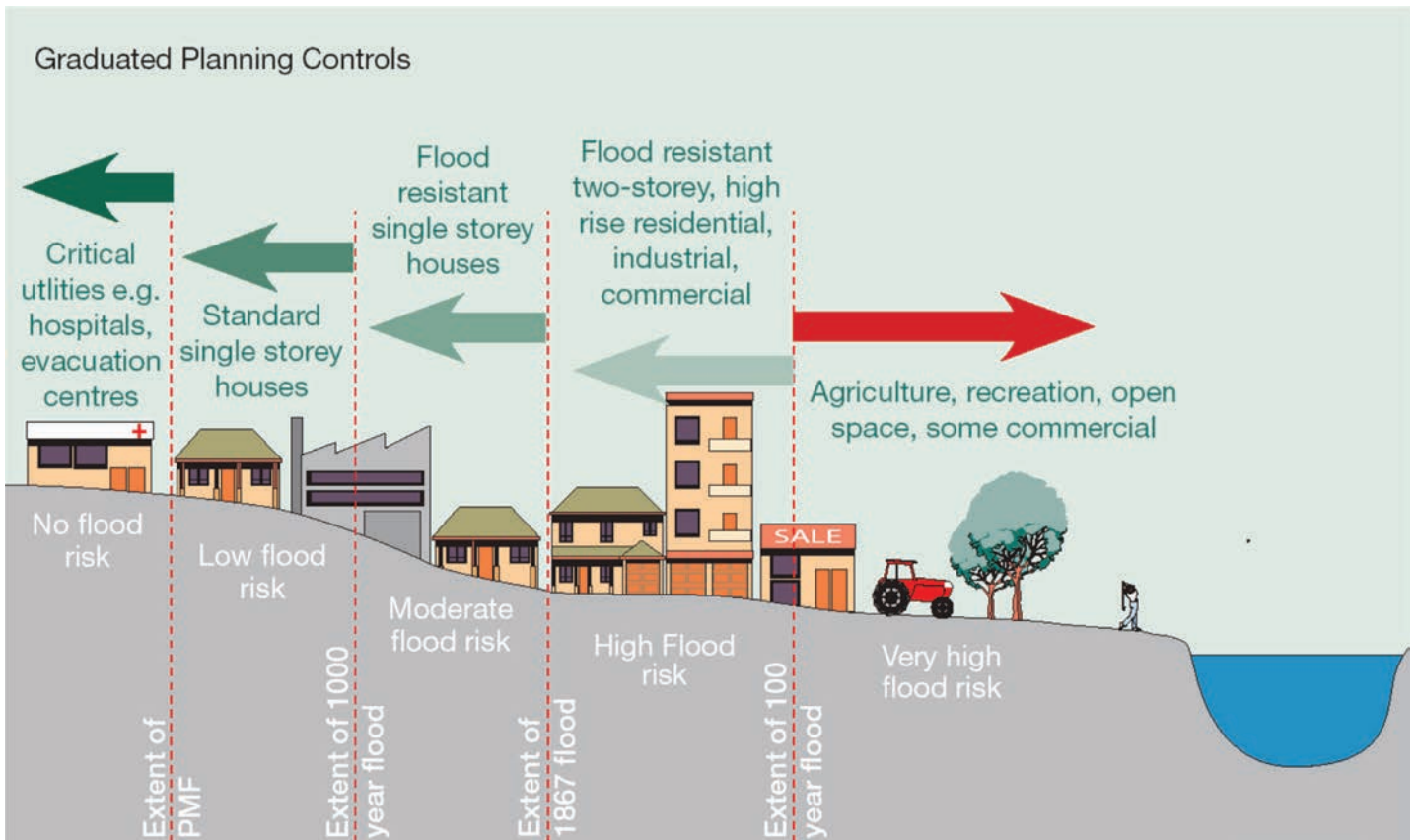


Figure 4. An example of distribution of Land Uses on the Floodplain to reduce risk (HNFMSC 2006)

3. Improve evacuation routes.

Previous government investigations into flood mitigation strategies have found that effective evacuation is the only measure that guarantees a reduced risk to life in the Hawkesbury-Nepean Valley (Infrastructure NSW 2017). Given the multitude of catchments from which floodwaters are sourced, a \$950 million program of upgrading roads to allow evacuation at higher flood levels, as was considered before being dismissed due to cost in the Government's 2017 strategy, would dramatically increase the safety of residents in the Hawkesbury-Nepean Valley. The Windsor Viaduct, completed in 2005, is an example of such infrastructure.

An evacuation infrastructure analysis that was completed for Infrastructure NSW (Molino Stewart 2012c) found that significant flood evacuation upgrades were needed in the Hawkesbury-Nepean Valley. Without evacuation infrastructure upgrades, the analysis found there was a significant risk that people would not be able to evacuate their homes before roads became inundated by flood waters. The report recommended that evacuation routes surrounding Windsor, Bligh Park, Richmond and Penrith be significantly improved. The report also noted that new floodplain development proposals in the north-west corridor of Sydney, including at Penrith Lakes, would put significant pressure on evacuation routes into the future.

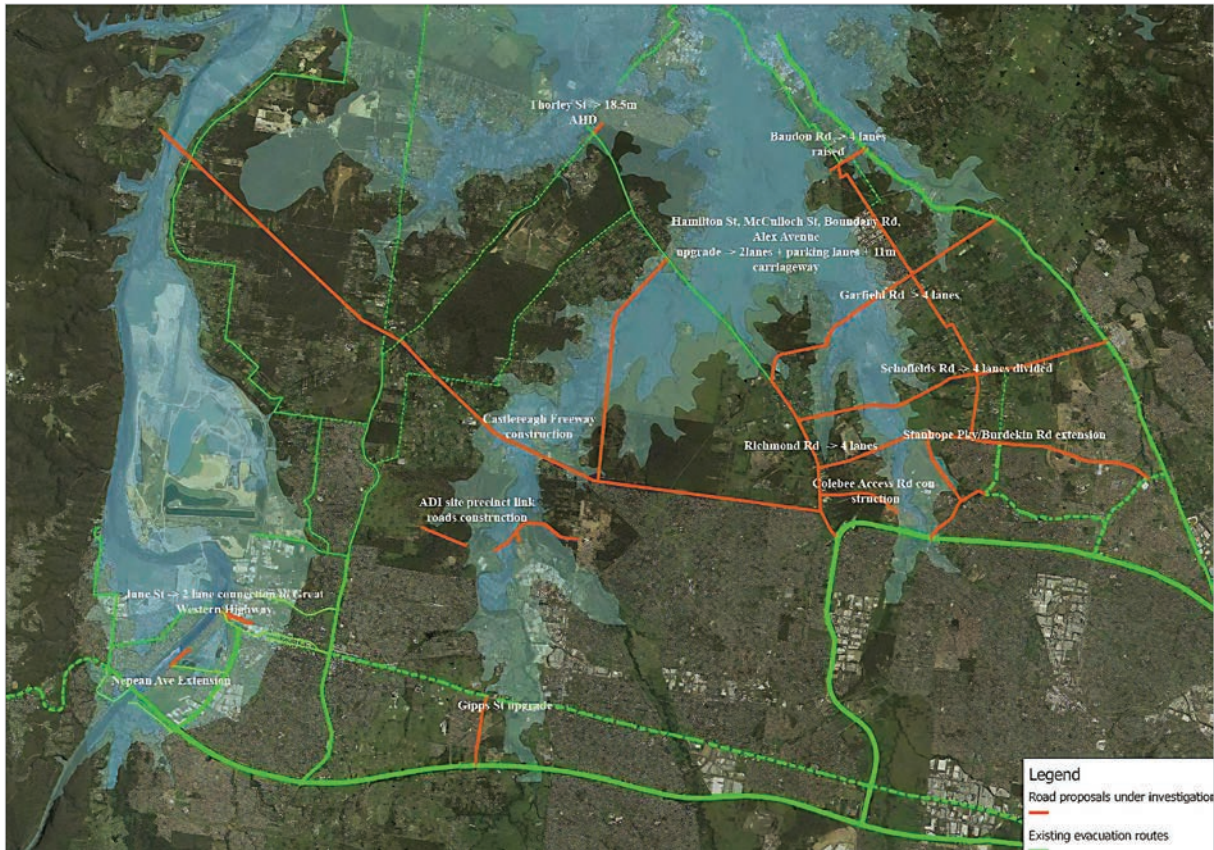


Figure. 5 Proposed and existing flood evacuation infrastructure in North-West Sydney (Infrastructure NSW, Molino Stewart 2012c).

4. Relocate the most flood prone residents.

A large number of people on the Hawkesbury-Nepean floodplain live in houses that are flooded regularly: 5,000 houses lie under the 1:100 year flood level, and a further 7,000 lie under the 1:500 year flood level (Infrastructure NSW 2017). Importantly, many of these residences can potentially be flooded by lower catchment tributary rivers that are not regulated by Warragamba Dam. Around the world, in Europe, the United States and China, governments are increasingly relocating people living in harm's way. Such relocations have also happened in Australia: most recently, the town of Grantham was relocated after the 2011 Queensland floods (Wenger et al. 2013). More than 100 residences were moved to higher ground, and the shift is believed to have reduced the damage bill from the latest floods by "tens of millions of dollars". Relocation also has recent precedents in NSW. For example, 147 residences were acquired under the high noise portion of the Sydney airport flight path (Sydney Airport 2018).

While the NSW Government puts the cost of relocation at \$3.3 billion (Infrastructure NSW 2017), the cost recovery of such a scheme should be properly considered in terms of the alternative economic benefits of floodplains. Relocation could occur in a staged manner over several decades, and by removing the most frequently flooded properties, the total flood damage bill will be significantly reduced. In other countries, floodplains have been restored for agriculture, forestry, fisheries, recreation and nature conservation (Ebert et al. 2009, Pittock and Xu 2011). The Dutch Government program of giving "room for the river" is an example of how regional communities like Arnhem and Nijmegen on the Rhine River can thrive with targeted relocation for better flood management (Bekhuis et al. 2005).

Conclusion

The NSW Government's strategy for managing flood risk in the Hawkesbury-Nepean Valley is predicated on allowing more people to move into harm's way. The assessment of flood control favours raising the Warragamba Dam wall by ignoring its environmental and social impact, and any the non-flood control benefits of alternative options. Alternative flood management options have additional benefits for western Sydney, including greater safety for the most flood prone residents, better transport, a more vibrant agricultural sector, a healthier environment and improved water security. It is therefore crucial that other flood management measures are considered in a transparent process that is tested through an independent review process to avoid the serious economic and social impacts of major flood events.

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