Southern Floodplain Risk Management Committee

Meeting Date: Wednesday, 31 March, 2021
Location: Council Chambers, City Administrative Centre, Bridge Road, Nowra

Minutes Attachments

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Floodplain Risk Management

Shoalhaven City Context
NSW Government Floodplain Management Program
Floodplain Development Manual & Flood Prone Land Policy
Council's Role
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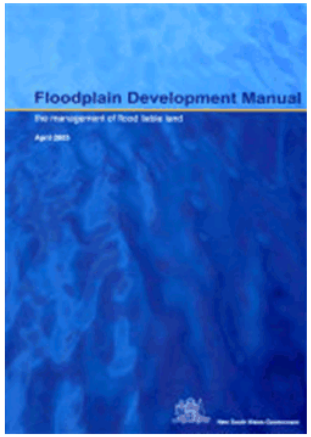
Floodplain Risk Management Committee



John Murtagh
Senior Natural Resource Officer Floodplain Management
John.murtagh@environment.nsw.gov.au

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Known flood risk across Shoalhaven City

- Shoalhaven City Council (SCC) has 13 Adopted Floodplain Risk Management Plans (FRMP) which identify risk and management options across the City

- Residential properties flooded (any part of the land) by 1% AEP (Annual Exceedance Probability) Flood
- SCC FRMPs = 2,488, Department of Planning Industry and Environment estimate from other Geographic Information System Layers = 3,421 , Insurance Australia Group (many brands) = 3,520 (2016 estimate)

- SCC FRMP identify residential properties flooded above floor
- 20% AEP = 5, 5% AEP = 761, 1% AEP = 1,906, Probable Maximum Flood (PMF) = 3,236

- The Shoalhaven Local Strategic Planning Statement identifies 55,000 dwellings across the City , the rates database identifies a similar number and nearly 59,000 rateable properties so only about 6% of residences are flooded above floor in PMF and only 3.5% in 1% AEP

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Shoalhaven City Council program in progress

- Shoalhaven City Council actively involved since mid 1980s when first Manual gazetted
- City wide understanding of flood risk with forward program including monitoring of progress
- Working through unstudied settlements and reviewing adopted plans where required in priority order
- Progressively implementing measures from the 13 adopted Floodplain Risk Management Plans (City wide)
- Current Works and Studies (co-funded by NSW Government)
  - Maintenance of Lower Shoalhaven River Flood Mitigation Scheme (North)
  - Lower Shoalhaven River Floodplain Risk Management Study and Plan Review (North)
  - Currarong Creek Flood Study (Central)
  - St Georges Basin Floodplain Risk Management Study and Plan Review (Central)
  - Millards Creek Flood Study (South)

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NSW Government floodplain management program

- Department of Planning Industry and Environment administers the program supporting Councils with:
- Policy advice, including a Manual and series of technical guides as well as access to grant funding all of which is available via the Department of Planning Industry and Environment website
- Technical support from Regional Representatives such as myself with:
  - Grant Applications
  - Technical Briefs
  - Review of Progress, Draft and Final Reports
  - Works Investigation, Design, Construction
  - Floodplain Risk Management Committee Operation
  - Councillor briefings when requested

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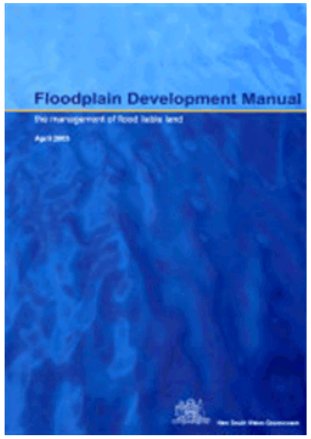
Floodplain Development Manual



- Current edition gazetted in 2005
- Available from the Department of Planning Industry and Environment website, it documents the:
  - NSW Government Flood Prone Land Policy
  - Floodplain Risk Management principles and process
  - Roles, responsibilities and
  - Section 733 (Local Government Act 1993) indemnity provisions
  - Currently under review, aligning with National Best Practice Guideline

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The Flood Prone Land Policy

The Primary Objective is:

to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses from floods utilising ecologically positive methods, where possible.

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The Flood Prone Land Policy

- Recognises the benefits flowing from use, occupation and development of flood prone land.
- Promotes a merit approach balancing social, economic, environmental and flood risk issues.
- Allows Councils to determine what floodplain use is appropriate and sustainable.
- Avoids unnecessary sterilisation of flood prone land.
- Avoids uncontrolled development inconsistent with exposure to flooding.

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Council Flood related Roles and Responsibility

- Develop and implement City wide Floodplain Risk Management Program
- Manage Land Use across the Local Government Area
- Prepare and Implement: Local Environmental Plan; Development Control Plan; Flood Planning Level(s) and Area(s)
- Determine Development Applications
- Issue Planning Certificates (Section 10.7 Environmental Planning and Assessment Act 1979)
- Prepare and Implement Floodplain Risk Management Studies and Plans
- Asset Management
- Community Flood Awareness and Response Education
- Flood Response, Recovery, Recording and Reporting

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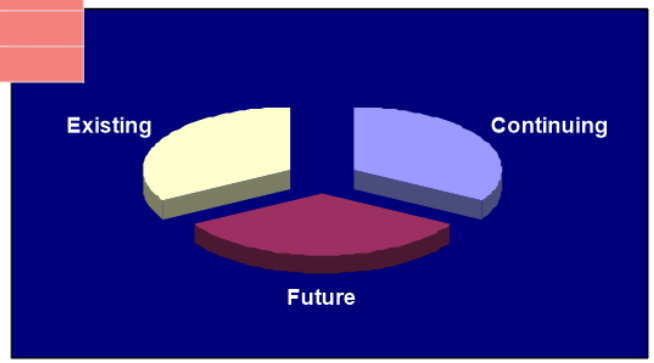
Risk Management Approach

- The Magnitude of the Risk is a product of both:
  - Chance (likelihood or probability, I'll come back to that) and
  - Consequence (e.g. damage, injury, death)

		Likelihood		
		Low	Medium	High
Consequence	Very Low	Low	Low	Low
	Low	Low	Low	Medium
	Medium	Low	Medium	High
	High	Low	Medium	High
	Very High	Medium	High	High

An example of a risk assessment matrix about magnitude



- Consideration of types of risk Existing, Future and Continuing Risk

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Consider Full Range of Flooding

Terminology from Australian Rainfall and Runoff 2019

- Frequent (High Probability)
  - 4.48 year ARI (Annual Recurrence Interval) = 20% AEP (Annual Exceedance Probability)
  - 5 year ARI = 18.13% AEP = 0.2 EY (Exceedances per Year)
- Rare (Low Probability)
  - 100 year ARI or 1% AEP = 50:50 chance over 70 years
- Very Rare (Very Low Probability)
  - 200 year ARI or 0.5% AEP usually above Flood Planning Level + proxy Climate Change
- Extreme (Very Low Probability)
  - Probable Maximum Flood = PMF Derived from Probable Maximum Precipitation = PMP
    Probability can't be precisely defined so none assigned

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Consider all relevant Flooding Mechanisms

This has evolved over time because the public don't care where the water comes from, they want it managed

- Mainstream flooding from creeks, rivers and/or lakes due to catchment runoff
- Mainstream flooding from estuaries (tidal reaches of creeks, rivers and/or lakes) due to storm surge in the Tasman Sea

- Mainstream flooding from trunk drains,
- Overland flow through properties prior to runoff entering drains or creeks
- Low level persistent nuisance inundation behind closed estuary entrances
- Entrance breakout due to catchment runoff
- Tidal inundation by King Tides (has been exacerbated by Sea Level Rise)

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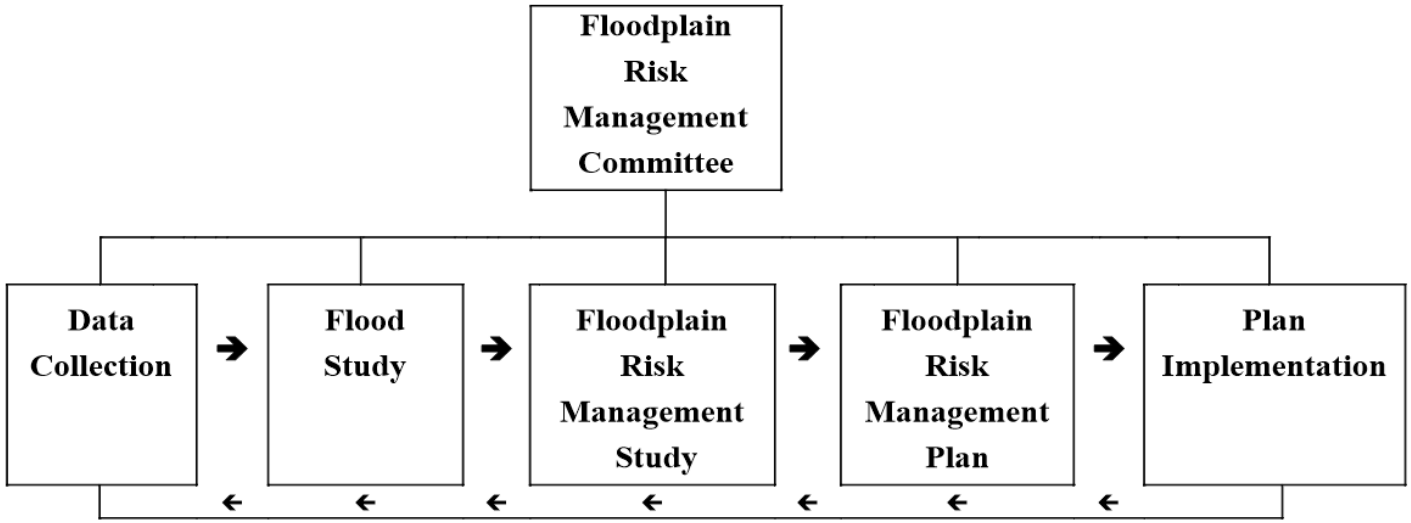
Floodplain Risk Management Process



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Data Collection and Flood Study

- Define a study area, usually based on areas of known flood risk &/or proposed development area
- Consult with committee & community then compile information on current / historic topography / geography of catchment, flood history and weather that caused floods
- Build hydrologic model to convert rainfall to runoff across the catchment
- Build hydraulic model to work out how fast, how deep, how wide flows spread across the study area
- Adjust model parameters to reproduce known historic flood behaviour (Calibration & Validation) preferable to use multiple floods of varying probability where historical information is available
- Use calibration parameters and current topography / geography with “design rainfall data” to produce and map Annual Exceedance Probability Neutral design existing flood estimates (extent, depth, level, velocity) across the study area
- Use post processing of model flood outputs to map existing flood hazard, function, emergency response classification, flood planning area,
- Maps out the existing flood risk to be managed and consult on findings
- Finalise and ask committee to recommend Council adoption

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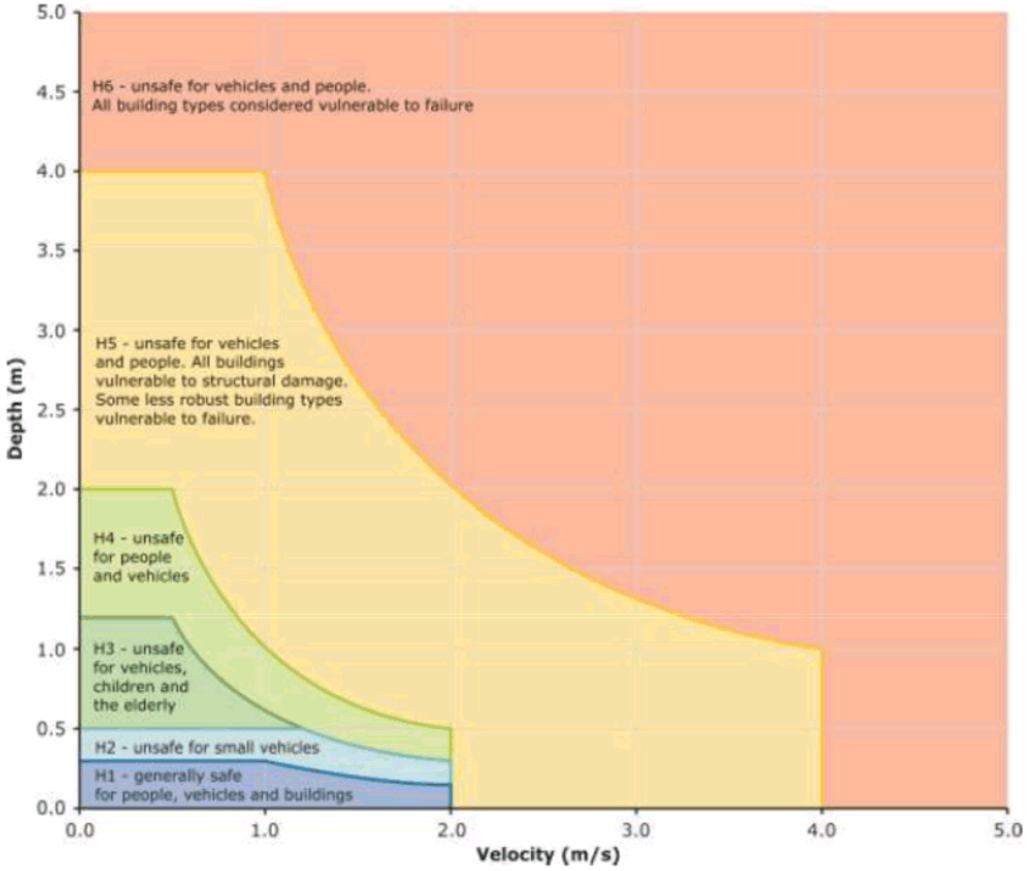

Figure 6 General flood hazard vulnerability curves

Floodplain Risk Management Study and Plan

- If the flood study identified risks requiring management conduct a Risk Management Study
- Define study area based on flood risk areas from flood study &/or proposed development area
- Consult with committee and community on known risks and preferred options
- Re-run models for new study area for foreseeable future conditions & map future risks, hazards & etc
- Consider Floodplain Management Measures which could reduce existing and future risks
- Model any flood modification measures considered feasible and useful to document impacts
- Multi-criteria analysis of options (risk/damage reduction, cost/benefit, statutory considerations, community acceptance, social impacts, Council capacity to fund and deliver, owners consent) to identify preferred
- Ranking of preferred options and recommendations in priority order for implementation
- Consult committee and community on findings and recommended measures
- Finalise the Study, compile the Plan, seek committee endorsement for Council adoption

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Floodplain Management Measures typically considered

Flood Modification	Property Modification	Response Modification
• flood control dams	• zoning	• community awareness
• retarding basins	• building and development controls	• community preparedness
• levees	• flood access	• flood prediction and warning
• bypass floodways	• flood proofing buildings	• flood plans
• channel improvements	• voluntary house raising or voluntary purchase	• evacuation arrangements
• flood gates		• recovery plans

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Floodplain Risk Management Plan Implementation

- Prioritise works and measures identified in Council work programs and forward budgets
- Seek grant funding if/when available and complete concept and detailed design of works
- Seek grant funding when available to implement measures and works
- Monitor progress of implementation and changes in development patterns
- Monitor flood impacts occurring during implementation
- After any major floods or full implementation monitor priority in LGA flood program
- As/when deemed necessary review the floodplain risk management study and plan

Floodplain Risk Management Committee

- The committee:
  - Advises Council on formulating and implementing Floodplain Risk Management Plans.
  - Typically consists of Councillors, community representatives, council staff, industry bodies, NSW Government Agency representatives.
  - A forum to contribute ideas, professional expertise, experience, and local knowledge.
  - Has a purely advisory role to Council.
  - There is a handbook which contains links to the web sites I have discussed

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Floodplain Risk Management Committee

- The roles of members:
  - Councillors: typically chair and guide on Council needs, opportunities and constraints.
  - Community affected stakeholders: individual residents & businesses, or CCBs, chambers of commerce, environmental groups, link to and from the community
  - Council Staff: secretarial services and technical advice: such as engineering, planning, operations, community, environment, engagement
  - NSW Government agency reps advise on relevant technical, statutory & policy matters.
  - I won't move, second or vote on recommendations as it is Council's committee not the NSW Government's.

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Floodplain Risk Management Committee

- The committee should meet on an as needs basis, typically at decision points in the process which might be:
  - input to or review the consultant brief.
  - review model results.
  - advise on options to be assessed
  - review draft reports and plans
  - consider and recommend exhibition
  - consider and recommend Adoption and implementation by Council

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Technical Working Group(s)

- Discretionary: A Process Engine Room usually ad hoc
- Can be used to resolve specific or technically complex issues as they arise
- Membership is as required such as
  - Relevant Council staff (report to Committee)
  - Department of Planning Industry and Environment and State Emergency Service
  - Other agencies as required
  - Community representatives if relevant

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Floodplain Risk Management

Our Task translated into layman's terms

Working out what gets how wet, how often and what, if anything, Council should do about it.

Our Guiding Principles

Does flooding impact development?

Does development alter flooding?

Are People and their Property Safe?

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Thank you

Any Questions?

John Murtagh
John.murtagh@environment.nsw.gov.au

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Water Level Summary

Table 1 Summary of Peak Water Levels and comparison to Design Flood Levels in Quoted Reports

River	Region	Town	Peak Level (mAHD)	Date	Estimated probability	20%	10%	5%	2%	1%	0.50%	Notes/ Regional Info	Report
Mehi	North West	Moree	10.43*	25/03	Between 5% and 2%		8.51	10.22	10.85	11.15	11.4		Review of Moree and Environs Flood Study FRMS&P 2017
Clarence	North East	Grafton	6.5	24/03	Between 10% and 5%		6.10	7.9	8.2			9 yr ARI	Lower clarence flood model update 2013
Nambucca	North East	Bowraville	10.06	19/03	Between 10% and 2%	8.67	9.28		10.49				Nambucca River and Warrell Creek Hydraulic Modelling Report 2013
Nambucca	North East	Macksville	2.9	19/03	Between 10% and 2%		2.25		3.31				Nambucca River and Warrell Creek Hydraulic Modelling Report 2013
Macleay	North East	Kempsey	6.48	19/03	Less than but close to 20%	6.64	7.24						Kempsey Tuflow Update Report 2016
Hastings	North East	Wauchope	8.6	20/03	Less than but close to 1%			6.9	7.9	8.70	9.4	1 in 80 year	Hastings River Flood Study 2006

River	Region	Town	Peak Level (mAHD)	Date	Estimated probability	20%	10%	5%	2%	1%	0.50%	Notes/ Regional Info	Report
Wilsons	North East	Telegraph Pt	4.508	20/03	Greater than 0.5%			3	3.3	3.7	4.1	1 in 200 - 500 year	Hastings River Flood Study 2006 (also update 2018 (results not too different)
Hastings	North East	Port Mac	2.18	20/03	Greater than 0.5%			2.2	2.2	2.2	2.2		Hastings River Flood Study 2006 (also update 2018 (results not too different)
Camden Haven	North East	Laurieton	2.47	20/03	Between 5% and 2%			2.3	2.65	2.92		AEP values at confluence w/stingray creek access to Dunbogan was flooded by 300mm	Camden Haven and Lakes System FS
Manning	Hunter Central Coast	Taree	5.65	20/03	Between 1% and 0.5%			4.4	5.1	5.50	5.80		Review and Update Manning River Flood Study 2016
Manning	Hunter Central Coast	Croki	2.94	20/03	Between 1% and 0.5%			1.9	2.5	2.80	3.00		Review and Update Manning River Flood Study 2016

River	Region	Town	Peak Level (mAHD)	Date	Estimated probability	20%	10%	5%	2%	1%	0.50%	Notes/ Regional Info	Report
Myall	Hunter Central Coast	Bulahdelah	4.3	22/03	Less than 5%			4.76	5.15	5.54			Bulahdelah FRMS 2002
Myall Lakes	Hunter Central Coast	Bombah Pt	~2.8	22/03	Greater than 1 in 200				2.21	2.3	2.54	Estimated from Bulahdelah Gauge Houses flooded at Nerong	Lower Myall River and Myall Lakes Flood Study 2015
Paterson	Hunter Central Coast	Gostwyck	13.6	20/03	Between 20% and 10%	13.3	14.4						Paterson River FS 2017
Paterson	Hunter Central Coast	Paterson	9.5	20/03	20%	9.50	10.50						Paterson River FS 2017
Wollombi	Hunter Central Coast	Bulga	63.129	23/03	Between 10% and 5%		62.90	63.40					Wollombi Brook FS 2016

*not AHD

Resilient Valley, Resilient Communities
Hawkesbury-Nepean Valley Flood Risk Management Strategy

Frequently asked questions

March 2021 flood

What caused the March 2021 flood?

The March 2021 flood in the Hawkesbury-Nepean Valley was caused by significant rainfall across the catchment from 17 to 24 March 2021. This included:

- 157mm of rainfall at Warragamba over 24 hours from 9am 20 March to 9am 21 March 2021
- 536mm of rainfall at Blackheath in the 8 days from 9am 16 March to 9am 24 March 2021.

Initial analysis suggests the Warragamba catchment contributed about 60% of floodwaters. The other catchments contributed around 40% of floodwaters.

How big was the March 2021 flood?

The peak river levels at key locations within the Hawkesbury-Nepean Valley are listed in Table 1. The flood height is expressed as metres AHD (Australian Height Datum) which is equivalent to metres above sea level.

The March 2021 levels are compared with the 1 in 20 and a 1 in 100 chance per year flood levels. At Penrith, the flood was about a 1 in 20 chance per year event, while at Windsor was slightly more likely.

Before the March 2021 flood, the last major event in the valley was in August 1990 when the flood peak reached 13.5 metres at Windsor.

Table 1: Likelihood of the March 2021 Hawkesbury-Nepean flood

Location	Observed March 2021 peak level (metres AHD) [2]	Approximate likelihood (1 in X chance per year) [3]	1 in 20 chance per year level (metres AHD) [1]	1 in 100 chance per year level (metres AHD) [1]
Warragamba Dam	118.26	1 in 10-20	118.56	121.47
Wallacia Weir	35.2	1 in 5-10	39.2	44.6
Penrith [4]	24.2	1 in 20	24.0	25.9
North Richmond	14.6	1 in 10-20	15.4	17.6
Windsor	12.9	1 in 10-20	13.7	17.3
Sackville	9.7	1 in 10-20	10.1	13.2

Notes:
[1] Modelled flood levels are taken from the 2019 Hawkesbury-Nepean Valley Regional Flood Study model results (excluding Penrith)
[2] Peak flood levels are obtained from the Bureau of Meteorology
[3] Approximate chance per year are based on the levels from the HNVRFS model for the location of interest (excluding Penrith)
[4] Modelled flood levels at Penrith have been updated to take account of revegetation in and near the river in recent years.

How does the March 2021 flood compare with other Hawkesbury-Nepean floods?

The Hawkesbury-Nepean Valley has a long history of flooding, stretching back many thousands of years. The valley has the longest records of any floodplain in Australia, dating from early days of European settlement.

The records show that since the 1790s there have been around 130 moderate to major floods and many minor floods in the Hawkesbury-Nepean. Table 2 below lists the 14 floods that exceeded the peak level of the March 2021 flood at Windsor. In this location, the March 2021 flood was similar to the April/May 1988 flood which reached 12.8 metres AHD.

Table 2: Floods exceeding March 2021 levels at Windsor

Year	Level (m AHD)
1809	14.7
1816	14.1
1817	14.4
1864	15.1
1867	19.7
1870	14.1
1873	13.1
1879	13.6
1900	14.5
1956	13.8
1961	15.0
1964	14.6
1978	14.5
1990	13.5

View of the Windsor 'island' in the 1867 flood
Source: *Illustrated Australian News*, 27 Jul 1867 p.8; State Library of Victoria

When was the largest flood in the Hawkesbury-Nepean Valley?

The largest flood in the valley happened in June 1867 (illustrated above). That flood reached 19.7 metres AHD at Windsor, nearly 7 metres higher than the March 2021 flood. Table 3 below compares the peak flood level in March 2021, with the June 1867 flood at key locations in the floodplain.

Table 3: Comparison to June 1867 flood at key locations

Location	Observed June 1867 peak level (metres AHD)	Observed March 2021 peak level (metres AHD)	Height below June 1867 peak level (metres)
Wallacia	47.1	35.2	11.9
Penrith	27.5	24.2	3.3
North Richmond	20.4	14.6	5.8
Windsor	19.7	12.9	6.8

For more information about flooding in the Hawkesbury-Nepean Valley, visit www.myfloodrisk.nsw.gov.au