Flood Emergency Plan template for Hawkesbury-Nepean caravan parks

This template is for owners and/or operators of caravan parks in the Hawkesbury-Nepean Valley.

Your final Caravan Park Flood Emergency Plan will be *your* plan – it needs to work for you, and you will need to maintain it. It is recommended your plan is reviewed every two years.

Caravan park name:

Review date:

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The NSW State Emergency Service (**NSW SES**) Caravan Park Flood Emergency Plan Workbook and Template has been prepared using available flood level information and is intended to assist you to prepare for a flood at your caravan park. However, the Workbook and Template is not intended as an assessment of the actual flood risk.

The information provided in the Workbook and Template is based on knowledge and understanding at the time of publication. However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date.

The NSW SES takes no responsibility for the accuracy, currency, reliability and correctness of any information in the publication (including, without limitation, any of the information provided by third parties) nor for the accuracy, currency, reliability and correctness of links or references to information sources with regard to the historical flood information.

While all reasonable care has been taken in preparing the Workbook and Template, to the extent permitted by law, NSW State Emergency Service and the State of New South Wales and its employees and agents exclude all liability for the accuracy or completeness of the information, or for any injury, loss, or damage whatsoever (including without limitation liability for negligence and consequential losses) suffered by any person acting, or purporting to act in reliance upon anything contained herein.

INTRODUCTION: WHY DO CARAVAN PARKS NEED TO PLAN FOR FLOODS?

There is a long history of floods in the Hawkesbury-Nepean Valley. While many years can pass without floods, the events of 2020, 2021 and 2022, remind us that flood risk is ever present. Floods in the valley can be deep and fast rising, and evacuation routes can be cut early. We all need to be prepared in advance for future floods.

Caravan parks in the Hawkesbury-Nepean Valley are often located on low-lying land next to rivers. These idyllic settings are also exposed to flooding. Planning and preparing for floods can reduce the flood impacts at your park and can also help you to rebuild and recover more quickly after a flood. Having a plan can also help you meet your local Council's requirements for an Approval to Operate and Workplace, Health and Safety regulations.

KEY ROLES FOR CARAVAN PARK OWNERS AND/OR MANAGERS INCLUDE:

- ✓ **Ensuring people respond safely ahead of flooding, e.g. through timely evacuation**
- ✓ **Protecting your and other people's property ahead of flooding** – typical structures in caravan parks will not cope well with deep flooding.
- ✓ **Reducing the risk to the beautiful river environment** – its health is at risk if caravans, other structures or hazardous materials are washed into the river during a flood.
- ✓ **Educating and supporting your staff and occupants** – even people experienced with the river may not understand how the valley floods or know what to do in a flood emergency.

Flooding in the Hawkesbury Nepean Valley March 2021. Source: Infrastructure NSW. Image: Adam Hollingworth.

This resource has been developed through a partnership with NSW State Emergency Service, Infrastructure NSW, Hawkesbury City Council, The Hills Shire Council and Penrith City Council, in collaboration with caravan parks in the region. This project is part of the Hawkesbury-Nepean Valley Flood Risk Management Strategy.

Please note this workbook and template may be updated as we work to improve it over time in response to feedback.

HOW TO USE THIS PLAN

This Flood Emergency Plan workbook and template is designed to help you work out the flood risk at your caravan park, and to develop an effective plan to manage this risk. It steps through five sections to create your plan:

SECTION 1: WORK OUT YOUR FLOOD RISK (PAGE 9)

Step 1: How has our park flooded in the past, and what could future floods look like?

Step 2: What could be affected by flooding at our park?

Step 3: What are the evacuation routes and safe storage areas for our park?

SECTION 2: PLAN FOR FLOODS (PAGE 18)

Step 4: How can we know a flood is coming?

Step 5: What actions will we take before, during and after flood emergencies?

Step 6: How much time will we need with the resources at hand to complete the required actions in a flood?

Step 7: What do we need to do and when?

SECTION 3: FLOOD EMERGENCY PLAN (PAGE 26)

Step 8: Complete your plan

SECTION 4: PRACTISING AND REVIEWING THE PLAN (PAGE 30)

Step 9: How will our staff and occupants know about our plan?

Step 10: How will we practise our plan?

Step 11: How will we review our plan so it stays current?

TIP: Please note that information provided in Appendices A – H will assist you complete this plan, and will allow your plan to be specific to your site and location.

CARAVAN PARK DETAILS

Name of park:	
Address:	
Phone number/s:	
Plan prepared by:	
Person responsible for plan:	
Role:	
Date plan prepared:	
Date plan due for review:	

Insert a site map here

TIP: Insert a site plan here into this document

TIP: Print this contacts list separately where it is clearly visible for staff

IMPORTANT CONTACTS

Police/Fire/ Ambulance	**Life threatening emergency**	**000** (Triple Zero)
NSW State Emergency Service	**Flood/storm emergency assistance**	**132 500**
Bureau of Meteorology	**NSW weather warning service**	**1300 659 218** www.bom.gov.au/nsw/warnings/ www.bom.gov.au/nsw/flood/greatersydney.shtml (river heights)
Transport for NSW	**Road closures and traffic information**	**13 22 13** (to report unsafe road sites) www.livetraffic.com/
Local Councils	**For area specific information**	**Hawkesbury City Council** https://www.hawkesbury.nsw.gov.au/ **Penrith City Council** https://www.penrithcity.nsw.gov.au/ **The Hills Shire Council** https://www.thehills.nsw.gov.au/ **Central Coast Council** https://www.centralcoast.nsw.gov.au/

LOCAL CONTACTS

Organisation/service	Name	Phone number
Caravan park		
Flood/storm		
Fire		
Police		
Council		
Vehicular ferry operator		
Electricity		
Water and sewerage		
Telecommunications		
Other		

WORK OUT YOUR FLOOD RISK

SECTION 1

The risk of flooding at your caravan park is determined by how likely a flood is to happen and the consequences of that flood.

The steps below help you identify the consequences of past floods and potential future floods, and take you through what could be impacted at your park.

What additional information you will need to fill out this section:

- **Community map for your park** – your park's risk is influenced by its layout. Use your map to mark-up key issues identified in the steps below.
- **Ground level contours and flood maps for your park supplied by your local NSW SES unit.**
- **Information from your local Council such as flood certificates**

STEP 1 - HOW HAS OUR PARK FLOODED IN THE PAST, AND WHAT COULD FUTURE FLOODS LOOK LIKE?

THE IMPACT OF PAST FLOODS

Knowing how past floods have impacted your park can help you plan for future floods.

Fill out the table below with information about how past floods have impacted your caravan park. Describe the height (level) of the flood at your park, and how much of the park was impacted.

If you don't know the history, talk with long term residents or previous managers of your park.

Other ways to find out historic flood levels at your park include:

1. Compare the flood extent or the flood depth at a specific point in your park to the ground level contour map supplied by your local NSW SES unit. For example, if the flood reached a depth of 1m over the floor of an amenities block, and the ground level contour map shows the amenities block is at about 6m, then the flood level is 7m.
2. Refer to the historic flood levels at river gauges in **Appendix A**.

For more information about historic floods visit www.myfloodrisk.nsw.gov.au

TABLE A – FLOOD HISTORY AT PARK

FLOOD DATE	FLOOD DESCRIPTION AT PARK	FLOOD IMPACTS AT PARK
Month and year	e.g. flood about 8m above mean sea level, flood about 2m over camping sites, flood came up to site X	e.g. damage to vans, evacuation of patrons, site isolated for X days, septic tank flooded

FLOOD FACT: The highest floods that have occurred since Warragamba Dam was completed in 1960 were the 1964 flood at Wallacia, the 2021 flood at Penrith, the 1961 flood at Windsor and the 1978 flood in the Lower Hawkesbury.

TYPES OF FLOODING IN THE HAWKESBURY-NEPEAN:

Riverine flooding

The focus of this plan is on riverine flooding. This describes flooding that happens when floodwater overflows the banks of the main Hawkesbury-Nepean River. Several days of rain are usually required to generate serious riverine floods.

The unique geography of the Hawkesbury-Nepean Valley affects the extent and depth of flooding. Most river valleys tend to widen as they approach the sea. The opposite is the case in the Hawkesbury-Nepean. Narrow and winding downstream sandstone gorges between Sackville and Brooklyn create natural choke points that cause a 'bathtub' effect. Floodwater backs up and can rise rapidly, causing deep and widespread flooding across the Richmond-Windsor floodplain – much like a bathtub with five taps (the major tributaries) turned on, but only one plug hole to let the water out.

Flash flooding

Flash flooding occurs quickly (within 6 hours) after rain, causing overland flooding and rapid stream rises. It can occur anywhere in the Hawkesbury-Nepean Valley when the intensity of the rainfall overwhelms natural or artificial drainage systems.

Flash floods can have dangerously high flow speeds and carry large amounts of debris.

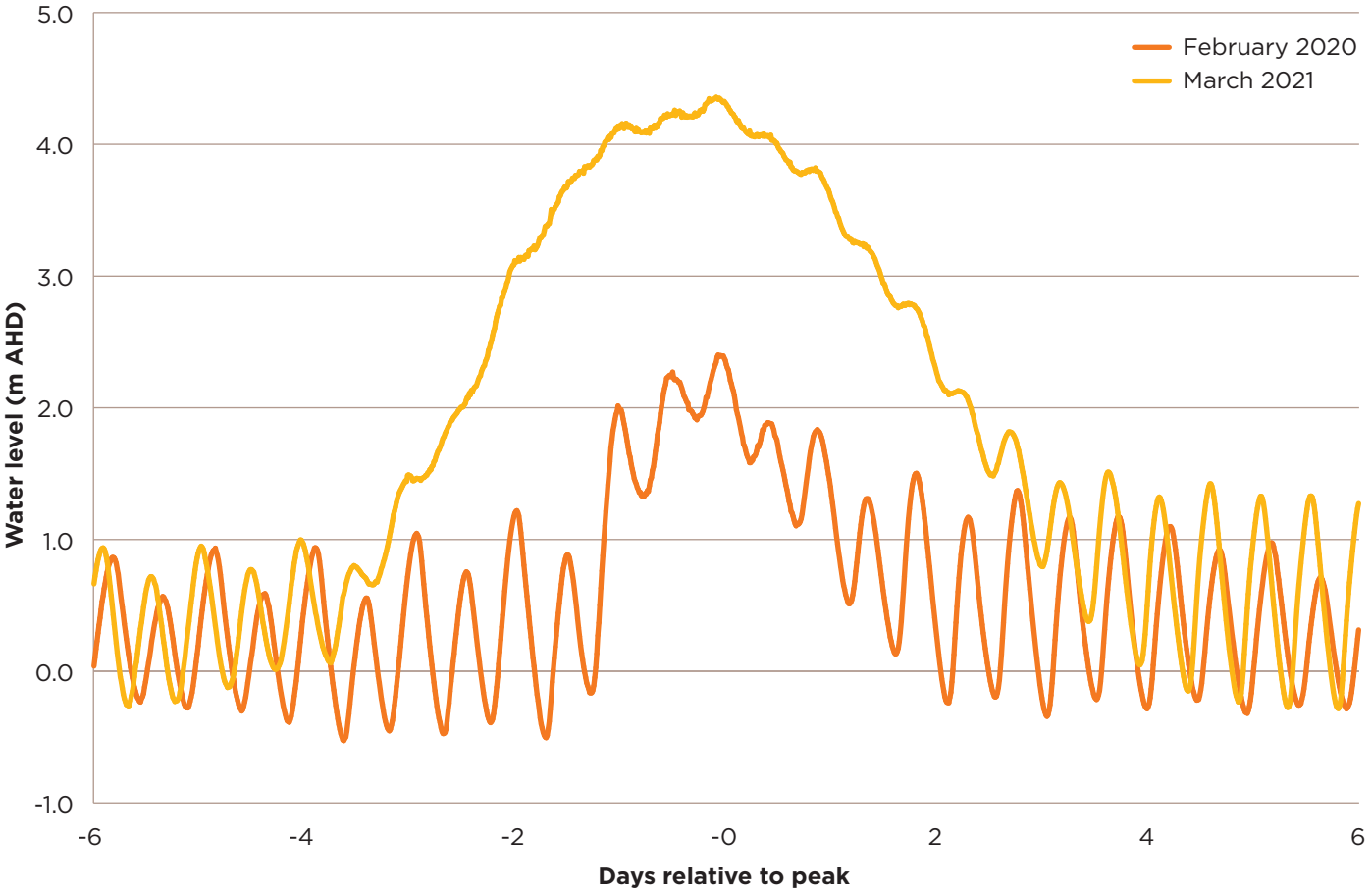
These kinds of floods can impact on evacuation routes before the main river flood arrives.

Tides and storm surge

The Hawkesbury River is tidal up to Yarramundi. Floods can be impacted by tidal conditions, especially for smaller floods, and especially downstream towards Broken Bay.

This can be seen by comparing hydrographs for the February 2020 and March 2021 floods at Wisemans Ferry. There is a very clear tidal signal in February 2020, even at the peak (2.4m), whereas the tidal variation is suppressed in the larger March 2021 flood (peak 4.4m).

Flooding of low-lying areas in the lower valley can also be impacted by storm surges.



Hawkesbury River at Webbs Creek (Wisemans Ferry) gauge, flood hydrographs, February 2020 and March 2021
Data source: Department of Planning, Industry and Environment

THE IMPACT OF FUTURE FLOODS AT OUR PARK

The table below helps describe the potential impacts of different sized floods at your park. You will need the following information to fill out this table:

- Flood level contours, depths and extents for your park – see the flood maps supplied by your local NSW SES unit
- Flood levels at river gauges in **Appendix B**
- Flood levels at caravan parks in **Appendix C**.

TIP: You can also find an overview of flood extent maps at a suburb scale here www.myfloodrisk.nsw.gov.au. Via this interactive tool, users can see how different floods impact a location (as general examples).

TABLE B – TABLE OF IMPACTS AND CONSEQUENCE

CHANCE PER YEAR	FLOOD LEVEL AND DEPTHS AT PARK	FLOOD EXTENT: % OF SITES IMPACTED	
		all more than half half	less than half none
1 in 2*			
		all more than half half	less than half none
1 in 5			
		all more than half half	less than half none
1 in 10			
		all more than half half	less than half none
1 in 20			

* Note that impacts may occur in very frequent floods such as 1 in 2 chance per year flood or 50% chance in a year. (Mapping is not available for flooding of this size, but you can refer to Appendix C for these flood levels).

TABLE B – TABLE OF IMPACTS AND CONSEQUENCE CONTINUED

CHANCE PER YEAR	FLOOD LEVEL AND DEPTHS AT PARK	FLOOD EXTENT: % OF SITES IMPACTED	
		all more than half half	less than half none
1 in 50			
		all more than half half	less than half none
1 in 100			
		all more than half half	less than half none
1 in 200			
		all more than half half	less than half none
Probable maximum flood**			

** Probable maximum flood or PMF is an extremely rare flood that defines the limit of the floodplain.

HOW FAST MIGHT FLOODS RISE AT OUR PARK?

How fast floods rise affects what you are able to do during a flood emergency. Floodwaters in the Hawkesbury-Nepean can rise quickly.

Use **Appendix D** to look up rates of rise in two historic floods and one potential flood. Record here the fastest rate of rise at a location near your caravan park.

Note that faster rates of rise than shown in **Appendix D** are possible.

HOW LONG MIGHT FLOODS LAST AT OUR PARK AND ON ROADS?

How long floods last impacts the duration of isolation for anyone who hasn't evacuated, and the speed with which clean up can commence.

The March 2021 flood was quite a long-lasting flood. At Windsor, it was higher than the 'moderate' flood level for more than 6 days.

STEP 2 - WHAT COULD BE AFFECTED BY FLOODING AT OUR PARK?

Identify your park's key elements so you can then work out how they may be impacted by flooding. Fill out the tables below and mark up on your community map as required.

TABLE C - SITES, STRUCTURES, PEOPLE AND VEHICLES

SITE TYPE	NUMBER OF SITES	THE NUMBER OF VANS EXPECTED TO EVACUATE*	APPROX. NUMBER (Low Season)		APPROX. NUMBER (High Season)	
			PEOPLE	VEHICLES	PEOPLE	VEHICLES
Privately owned vans/ cabins on leased sites (including long-term/ permanent residents)						
Onsite vans/cabins for hire (park owned)						
Other sites (including powered/unpowered/ camping sites)						
Manager/staff						
Day-trippers	n/a	n/a				
Special event attendees (e.g. festivals)						
TOTAL						

* This should be the number of vans that can easily be relocated in a few hours. Structures attached to a rigid annex or sewer, with flat tyres and/or without a draw bar will not be moveable with the warning time you are likely to have in a flood emergency.

OTHER STRUCTURES, BOATS AND EQUIPMENT

List other buildings, structures, boats and other equipment at your park (e.g. office, shop, BBQs, kitchen, amenity block, septic tank, storage). Mark this up on your existing community map if not there already.

HAZARDOUS AND OTHER MATERIALS

List hazardous materials and other materials stored at your park that may need to be moved in a flood (e.g. fuel, LPG). Mark this up on your existing community map if not there already.

PEOPLE WHO MAY NEED HELP IN A FLOOD EMERGENCY

Provide information about occupants or staff likely to require assistance to safely evacuate. For example, someone who has a health issue or someone with no vehicle to evacuate.

STEP 3 - WHAT ARE THE EVACUATION ROUTES AND SAFE STORAGE AREAS FOR OUR PARK?

A key issue in understanding the consequences of flooding for your park is knowing at what height of flooding your evacuation route/s are affected. Having this knowledge helps you to allow enough time in your plan for everyone at your park to leave safely before access roads are cut.

You also need to understand how and where you will transport any moveable structures, boats, other equipment or hazardous materials to store them safely.

- Use the flood maps supplied by your local NSW SES unit to look at the evacuation routes for your park and consider the height of flooding that impacts these routes. You can also view a 'Know how to get out' factsheet for local evacuation routes in the Hawkesbury-Nepean Valley on the NSW SES website - **https://www.ses.nsw.gov.au/flood-awareness-nsw/sydney-rivers/hawkesbury-nepean-valley/**

MAIN AND BACKUP EVACUATION ROUTES

Provide information about the main evacuation route for park occupants below.

Provide information about the backup evacuation route/s for park occupants, if there are any.

TRANSPORT AND STORAGE LOCATION OF STRUCTURES, BOATS, OTHER EQUIPMENT AND HAZARDOUS MATERIALS

Provide details about the evacuation route/s and suitable storage area/s for any moveable structures, boats and equipment that will need to be relocated.

Safe storage location	Evacuation routes

Provide details about any hazardous materials on my site (e.g. fuel, pesticides), and how they will be stored safely onsite (e.g. moved to a higher building) or relocated offsite.

Hazardous material	Transport required and safe storage location

PLAN FOR FLOODS

SECTION 2

Now that you better understand what impacts floods could have at your caravan park, it's time to plan how you can reduce those risks to life and property.

This section steps through what actions you will take before, during and after flood emergencies. It shows you how you can detect flood threats, and stage your actions so you have sufficient time to complete them before a rising flood stops them.

What additional information you need to fill out this section:

➔ **Flood level contour, depth and extent maps for your park supplied by your local NSW SES unit.**

STEP 4 - HOW CAN WE KNOW A FLOOD IS COMING?

There are several ways to detect the threat of flooding, including:

- follow Bureau of Meteorology weather forecasts and warnings
- follow NSW State Emergency Service flood bulletins and evacuation instructions
- listen to trusted media
- monitor rain and river height gauges, and tides
- keep an eye on your environment
- talk to your networks and neighbours.

A range of sources of flood information, and indicators of a flood threat, are listed below. Some indicators (e.g. Flood Watch) happen earlier than others (e.g. park starts to flood). To develop an effective flood emergency plan, you will likely need to use multiple indicators.

BUREAU OF METEOROLOGY

Website: www.bom.gov.au/nsw/warnings

App: BOM Weather

- Check rainfall forecasts using MetEye
- Severe Weather Warning for torrential rain
- Flood Watch for the Hawkesbury, Nepean, Colo or Macdonald rivers (with minor, moderate and major flood classifications provided except for the Macdonald)
- Flood Warning for a height of Xm to be reached by a particular time at a forecast location

NSW STATE EMERGENCY SERVICE

Website: https://www.ses.nsw.gov.au/

NSW SES Facebook page – https://www.facebook.com/NSW.SES

- Advice
- Watch and Act
- Emergency Warning

MEDIA

ABC for latest news and information about floods.

Website: www.abc.net.au/emergency

Radio: ABC 702

App: ABC 702

YOUR OWN MONITORING OF RAIN AND RIVER HEIGHT GAUGES

(http://www.bom.gov.au/nsw/flood/)

- Look up the rainfall
- Look up the river height at a gauge near or upstream of your park

YOUR OWN MONITORING OF TIDES

- Look up the predicted tides using a reliable source
- If you see a tide higher than what was predicted, this may indicate a rising flood
- High tides may increase the height of the flood

YOUR OWN MONITORING OF RIVER HEIGHTS AT YOUR PARK

- Pick a local marker
- But don't rely solely on this – you need to consider a rising flood upstream

YOUR OWN NETWORKS AND NEIGHBOURS

- Draw on your own social networks to share information

STAYING CONNECTED

Be ready in advance by bookmarking websites, downloading apps and having a battery-operated radio ready to use.

Be aware that during a flood you may lose power and telecommunications. Plan in advance for how you will stay connected to the latest information. It may be handy to ensure your vehicle has a full tank of fuel so you can listen to the radio in the car.

Indicate below which telecommunication options you will use at your park:

Telecommunication options for our park:

Internet **smart phone** **landline** **satellite phone**

UNDERSTANDING OFFICIAL WARNINGS

NSW SES has implemented the national Australian Warning System (AWS), with clearer, more action-oriented flood information and warnings for communities. It is a three three-tiered warning level system reflecting the severity of the event based on consequence to the community, with:

- **Advice** – there is a heightened level of threat. Stay up to date as the situation changes.
- **Watch and Act** – conditions are changing and you need to start taking action now to protect you and your loved ones.
- **Emergency Warning** – the highest level of warning. You may be in danger and need to take action immediately.

For each warning level there are a range of call to action statements to guide protective action by the community. These statements evolve as the warning levels increase in severity. As the situation changes and the threat is reduced, the level of warning will decrease accordingly.

Find out more about these warnings: https://www.ses.nsw.gov.au/warnings

Leading up to, during and after a flood, NSW SES may issue a series of flood warnings:

- **Advice – Stay Informed AND/OR Watch and Act – Do not Enter Floodwater:** translates predicted flood heights at gauges to consequences, describing what actions need to be taken if there is no immediate isolation or evacuation consequences. These warnings may escalate if isolation or evacuation impacts develop.

ISOLATION–SPECIFIC

- **Watch and Act – Prepare to Isolate:** issued when floodwaters are expected to isolate property. If the situation escalates people may be told to urgently seek shelter, evacuate (if still possible) or move to higher ground.
- **Emergency Warning – Shelter Now:** may be issued if it is too late to leave safely as evacuation routes are likely to be cut off, with instructions to seek shelter in a sturdy raised structure that can be safely accessed.
- **Watch and Act – Do not Enter Floodwater** and/or **Advice – Monitor Conditions:** as floodwater falls but there may still be water around changes will be reflected in warning messages and community advice

EVACUATION-SPECIFIC

- **Watch and Act – Prepare to Evacuate:** warns when evacuation routes are likely to be cut or when floodwaters are expected to inundate property, preparing people to evacuate and respond quickly if the situation escalates, and evacuation becomes necessary. If you require more time or assistance to evacuate you should consider leaving when you receive this warning.
- **Emergency Warning – Evacuate efore/now:** advises people what to do in an evacuation and where to go. You might receive this warning via radio stations, or by automated telephone and/or SMS, NSW SES social media, or door knocks. **It is vital that you leave if you receive an Emergency Warning – Evacuate before/now, this is the same as having formerly received an Evacuation Order.**
- **Emergency Warning – Move to Higher Ground:** may be issued if there is dangerous localised heavy rain and/or flooding making it unsafe to evacuate the area. People should immediately move to higher ground (e.g. inside a tall sturdy building or a hill). **It is vital to move as high above ground as possible.**

- **Advice – Avoid the Area:** issued as floodwater falls and there is no longer a need to evacuate, however it is still not safe to return due to hazards. This will be followed by an Advice – Returned Threat: Return with Caution when it is safe to return to the area.
- **Watch and Act – Do not Enter Floodwater:** as floodwater falls but there may still be water around changes will be reflected in warning messages and community advice.
- **Advice – Reduced Threat:** Return with Caution: when floodwater falls to a safe level and engineer checks are completed for key levees, roads and bridges, communities who received an Evacuate before/now message, will receive this Advice informing them they can return to homes and businesses taking care and caution as there may still be hazards.

MONITORING RIVER HEIGHTS

You most likely already keep an eye on the river height and tides. During periods of heavy rain, it's also wise to monitor the river height, both at your park and at river gauges.

There is a good spread of river gauges along the Hawkesbury-Nepean River and its tributaries. Locations of river gauges are shown in **Appendix F**. You can access near real-time river heights at these gauges using the links in **Appendix G**. Some of these river gauges function as forecasting locations, for which the Bureau of Meteorology predicts heights in flood warnings.

Select some river height gauges you will monitor when floods threaten. It's a good idea to select a gauge near your park as well as a flood warning gauge upstream.

For example:

- Wallacia Weir gauge is the main flood forecasting station for the Wallacia floodplain (Camden Weir and Warragamba Weir might also be of interest)
- Penrith gauge is the main flood forecasting station for the Penrith/Emu Plains floodplain (Wallacia Weir and Warragamba Weir might also be of interest)
- Windsor gauge is the main flood forecasting station for the Windsor floodplain and is important for parks in the Lower Hawkesbury (North Richmond and gauges upstream might also be of interest)
- Sackville, Colo Junction (Lower Portland) and Webbs Creek (Wisemans Ferry) gauges are flood forecasting stations along the Lower Hawkesbury (Upper Colo and St Albans gauges are also important because the Colo and Macdonald rivers can generate floods too).

Note: Sometimes river gauges may not work as expected, and during floods they can be damaged and not work or not report correct heights. For example, riverbank erosion damaged the Sackville gauge in the February 2020 flood. It's good to have identified back up gauges to also look up.

List below the river height / flood forecasting gauges you will monitor:

INTERPRETING RIVER HEIGHTS

If the Bureau of Meteorology issues a Flood Watch for, say, 'moderate' flooding in the Hawkesbury River, or issues a Flood Warning with a predicted height of, say, 12.0m at the Windsor gauge, it's important to work out what that means for your caravan park.

One way to do this is to consider the recent history. The February 2020 flood was in the 'moderate' range at Windsor but 'minor' nearly everywhere else. The March 2021 flood was in the 'major' range at Windsor and in the Lower Hawkesbury, the 'moderate' range at Penrith, and 'minor' at Wallacia. Knowing how those two floods impacted (or didn't impact) your park provides some indication of the effect of different flood classifications on your park.

Similarly, you could look up the heights of historic floods (**Appendix A**) to make sense of a predicted height during a live flood.

For those with a mathematical bent, there is value in estimating the relationships between flood heights at your park and flood heights at your chosen forecast gauge. This can help you to estimate at what height on the forecast gauge key consequences happen at your park including:

- the evacuation route from the park is cut (the road low-point could be on an internal driveway or on a public road)
- the lowest site is flooded
- the entire park is flooded, where applicable.

The flood heights listed in **Appendix C** are an important resource for this, and **Appendix H** presents a worked example for a hypothetical caravan park. NSW SES personnel may also be able to assist.

It's important to know that there is a high degree of variability in floods in the Hawkesbury-Nepean River system. For example, one flood might have higher inflows from the Upper Nepean River, or the Colo River, than another. This means the relationship between flood heights at a forecast gauge and flood heights at your park is likely to change somewhat from flood to flood.

Drawing on the mapping package supplied by your local NSW SES unit, the flood history, the potential flood heights in **Appendix C**, and the worked example in **Appendix H,** complete **Table D**.

TIP: No two floods are the same - monitor your local conditions and remain alert

You may need to include a range of flood levels because the ground level at your park may fall between two flood levels.

TABLE D – FLOOD FORECASTS AND CONSEQUENCES

LOCATION	CONSEQUENCE	GROUND LEVEL (m)	CORRESPONDING LEVEL RANGE AT FORECAST GAUGE	FLOOD CLASSIFICATION RANGE AT FORECAST GAUGE
Evacuation route(s)				
Low-point on internal access road*	People isolated and exposed to flooding if not evacuated			
Low-point on external evacuation route*				
Low-point on back up evacuation route*				
Low-point on evacuation route for relocated structures or boats*	Property exposed to flooding			
Property				
Lowest site in park	Park begins to flood			
Highest site in park	Park entirely flooded			
Environment				
Septic tank	Health and/or environmental hazard if flooded			
Hazardous goods storage	Health and/or environmental hazard if flooded			

* It is possible that local flooding could cut evacuation routes before the main river flood arrives

STEP 5 - WHAT ACTIONS WILL WE TAKE BEFORE, DURING AND AFTER FLOOD EMERGENCIES?

Emergency management plans generally consider three stages of planning: prepare, respond and recover.

Preparing describes things that you can incorporate into your park's routine practices. These could include:

- actively monitoring weather forecasts, river levels and tides
- displaying flood evacuation procedures in communal areas
- maintaining database of occupants with up-to-date contact details
- preparing warning messages to issue to occupants
- ensuring vans intended to be relocated before a flood are maintained in a moveable condition
- identifying extra staff/resources to assist in the event of a flood emergency.

Responding describes things that you will do when a flood threatens. These could include:

- contacting all upcoming bookings to defer travel to your park
- 'doorknocking' all park occupants to advise them of the flood threat / direct them to evacuate
- relocating hazardous chemicals to higher area
- relocating moveable vans to higher ground
- securing objects that can float away
- isolating power to low-lying areas.

Recovering describes things that you will do after a flood subsides. These could include:

- communicating with authorities about safety of entering park
- undertaking risk assessments with qualified specialists
- contacting all owners to request assistance in cleaning their dwellings.

Use the checklists in Section 3 to tick off actions for the prepare and recover phases.

Record in **Table E** the actions you will take when a flood threatens.

STEP 6 - HOW MUCH TIME WILL WE NEED WITH THE RESOURCES AT HAND TO COMPLETE THE REQUIRED ACTIONS IN A FLOOD?

Part of understanding and managing the flood risk is working out how long the required actions will take. You can use the worksheet below to estimate how long each action might take. It is important to also consider what additional resources you can access in a flood.

TABLE E – ACTION WORKSHEET

ACTION	AVAILABLE PEOPLE	AVAILABLE EQUIPMENT AND MACHINERY	TIME NEEDED

TABLE E – ACTION WORKSHEET CONTINUED

ACTION	AVAILABLE PEOPLE	AVAILABLE EQUIPMENT AND MACHINERY	TIME NEEDED

STEP 7 - WHEN WILL WE NEED TO DO EACH ACTION?

It's important to plan how you will respond when a Flood Watch or Flood Warning is issued, or from your own monitoring of rain and river gauges and the river height at your park.

An effective flood emergency response plan ensures that the time available for an action is greater than the time required for that action. You estimated the time required for key actions in Step 5. Here, you need to align those actions to triggers that will allow sufficient time to safely complete them, remembering that Hawkesbury-Nepean floods can rise quickly (see Step 2 and **Appendix D**). In short, the triggers need to be *realistic*.

An effective plan also accounts for the unique characteristics of your park. Think about key consequences from Table D – when might the evacuation route be cut?; when might the sites be flooded? – and select your triggers accordingly. In short, the triggers need to be *meaningful*.

Here are some tips for choosing triggers:

- A **Flood Watch** from the Bureau of Meteorology is likely to be the first trigger for most caravan parks. Many parks downstream of Windsor are quite low-lying and are impacted even by minor flooding. This means that you will need to start your response earlier than issuance of a Flood Warning to ensure the required actions can be done in time.
- **Factor in a fast rising river** (see Step 2 and **Appendix D**)
- Factor in the possibility of **local flooding**, e.g. runoff from a local creek or hillside that could impact the evacuation route before the main river flood arrives.
- For these reasons, **allow extra time**, i.e. choose a conservative, early trigger
- In choosing triggers, **use a combination of official warnings and your own monitoring** of river heights and tides (see Step 4)
- **List two triggers for the one set of actions**. Whichever trigger happens sooner will initiate the actions.
- **Factor in a 'Plan B'** for imperfect scenarios – not everything goes to plan during floods.

A hypothetical example of setting triggers is described in **Appendix H**.

You can record the triggers, linked to actions, directly in your park's flood emergency response plan in Section 3. You may choose to use the pre-populated triggers in **Table F**, or you can use a Word document to list your own triggers.

TIP: In the Hawkesbury-Nepean Valley, it is expected a **Flood Watch** will most likely trigger some sort of response at all parks.

COMPLETE YOUR FLOOD EMERGENCY PLAN

SECTION 3

It's now time to bring all the information together and populate your caravan park's flood emergency plan.

What you have done so far includes identifying:

- How has our park flooded before and what could future floods look like? (Step 1)
- What could be affected by flooding at our park? (Step 2)
- What are the evacuation routes and safe storage areas for our park? (Step 3)
- How can we know a flood is coming? (Step 4)
- What actions can we take before, during and after flood emergencies? (Step 5).
- How much time will we need with the resources at hand to complete the required actions in a flood? (Step 6)
- What do we need to do and when? (Step 7)

STEP 8 - PREPARING FOR, RESPONDING TO, & RECOVERING FROM FLOODS

PREPARING FOR FLOODS: A CHECKLIST

Flood monitoring:	
	• We have downloaded the Bureau of Meteorology app: 'BOM Weather' – **http://www.bom.gov.au/app/**
	• We regularly check the Bureau of Meteorology website page for weather warnings – **http://www.bom.gov.au/nsw/warnings/**
	• We follow the NSW State Emergency Service (NSW SES) on social media: — Facebook – **https://www.facebook.com/NSW.SES** — Twitter – **https://twitter.com/NSWSES** — Instagram – **https://www.instagram.com/nswses** — also follow your local units which have their own pages
	• We have access to the ABC for latest news: — ABC Website – **https://www.abc.net.au/emergency/** — Radio: ABC 702 — Download the ABC Listen app – **https://www.abc.net.au/radio/listen/** where you can access local news
	• We follow tides and monitor river heights
Occupant communication:	
	• We provide all occupants with current NSW SES information on what to do if there is a Flood Watch/Warning, including how to contact park managers. We also provide all occupants with a copy of the park's flood evacuation procedure. We have this information visible and accessible and is a key component of our induction process with new occupants.
	• We inform our occupants of how to monitor weather updates and access weather warnings, via the Bureau of Meteorology, NSW SES, and ABC.
	• We have a process in place for contacting occupants in the event of a flood emergency – including who will do this, how it will be done and have prepared messages ready to go. We keep track of which occupants will need assistance in the event of an evacuation.
Evacuation	
	• We understand our main and back up evacuation routes and have included this in our communications for occupants.
	• We have evacuation maps clearly visible for occupants and staff in key locations.

Site management	
	• We have identified resources we would need in the event of a flood warning – including additional staff, equipment and storage. We have a list of local suppliers identified.
	• We have identified hazardous material, how we will move it and where we will store it.
	• We have identified where we will move/store any moveable boats and vans.
	• We keep our park clear of clutter and ask our occupants to store personal items in their van
	• We have supplied tie down points for each van site
	• We have checked that vans intended to be relocated before a flood are maintained in a moveable condition
Emergency "Get Ready to Go" kit	
	• We have prepared an emergency kit which includes items such as a battery powered radio, spare batteries, a torch, first aid kit and a copy of our emergency plan.
Insurance	
	• We have considered flood insurance for our park

FLOOD RESPONSE PLAN

TIP: Avoid driving, riding, walking, boating or playing in floodwaters – these are the main causes of death during flood

TABLE F

Triggers	What actions will you take and who is responsible?		How long will this take?
Bureau Flood Watch/Severe Weather Warning or NSW SES Emergency Warning issued (whichever comes first)	Communicating with site occupants and visitors	•	
	Managing the site	•	
	Communicating with authorities	•	
Bureau Flood Warning or NSW SES Emergency Warning or relevant flood gauge reaches certain level (whichever comes first)	Communicating with site occupants and visitors	•	
	Managing the site	•	
	Communicating with authorities	•	

TABLE F CONTINUED

Triggers	What actions will you take and who is responsible?	How long will this take?
Vehicular evacuation route flooded and flood rising	Communicating with occupants	
	Managing the site	
	Communicating with authorities	
	Communicating with site occupants and visitors	
	Managing the site	
Sites begin to flood	Communicating with authorities	

RECOVERING FROM FLOODS - A POST-FLOOD CHECKLIST

The NSW SES will issue an 'Advice - Reduced Threat: Return with Caution' when it is safe for caravan park owners to return to site.

It is important that occupants do not come back to the park prior to it being deemed safe, including submitting required documents to your local Council. Before allowing your occupants to return to site after a flood event, the following should be completed:

Communicating with site occupants:	
	• We have advised occupants that we will inform them when they are able to return to the park, explaining the necessary safety checks that must be done first.
	• We have advised occupants who wish to return to the premises to collect items or to engage in site clean-up should only attend if approved by the Park Manager. We have informed occupants of dates when works are being undertaken as access may be restricted.
	• We have informed occupants that the site has been deemed safe to re-occupy.
Site management:	
	• Drinking water supply has been assessed and any necessary repairs have been undertaken. Water sample has been sent for microbiological analysis, and verification of results provided to my local Council.
	• On-site wastewater system(s) for the premises and individual connections from each site have been assessed by a qualified plumber, any necessary repairs/replacement has occurred.
	• All electrical infrastructure on the premises, including connections to individual sites, has been assessed by a suitably qualified electrician. Confirm requirements with your electricity provider.
	• All community structures (amenities buildings, kitchens, boat sheds) affected by flood have been assessed by a suitably qualified practising structural engineer. A list of recommended remedial works has been provided to my local Council for approval.
	• An Occupational Hygienist has been engaged to assess where flood inundation of amenities and moveable dwellings has occurred. A report has been obtained confirming the suitability of all structures on the premises for human habitation and provided to my local Council.
	• Check with local Council for approved locations accepting flood waste and for queries in the handling or disposal of any hazardous materials (eg asbestos, chemical containers). All flood waste must be disposed of at a licensed waste facility.
	• Riverbanks have been assessed by a geotechnical engineer for damage by inundation, scouring and erosion and a report has been provided to my local Council.
	• A qualified arborist has assessed trees on the property for damage and a report has been provided to my local Council.
Communicating with authorities:	
	• Provide all reports and required documentation to local Council, confirm their receipt.
	• Check requirements for approval from Council for replacement or rebuilding of structures and installations within the park.
	• Confirm that no other correspondence is required prior to re-opening to occupants.
Access support for you or your occupants:	
	• View any support offered by the NSW Government or local organisations. Visit NSW Reconstruciton Authority **https://www.nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority** for more information.
	• Disaster Recovery Centres may be established following some disasters. Recovery centres may provide a range of welfare services including financial assistance, personal support, organising temporary accommodation and providing information and referrals. You can contact Disaster Welfare Services on 1800 018 444.

PRACTISING AND REVIEWING YOUR PLAN

SECTION 4

Your final Caravan Park Flood Emergency Plan is your plan – it is a living document and it needs to work for you. Making sure it works involves sharing information about your plan, practising it and reviewing it regularly so it stays current.

STEP 9 - HOW WILL OUR STAFF AND OCCUPANTS KNOW ABOUT OUR PLAN?

Making sure your Flood Emergency Plan works, involves sharing information about *your* plan, testing it to make sure it works, and regular reviews so it stays current.

Fill out the following table about the activities you will do to develop and maintain awareness of the park's flood risk and what to do with your staff and occupants.

TABLE G – FLOOD AWARENESS AND PREPAREDNESS ACTIVITIES FOR STAFF AND OCCUPANTS

Activity	Audience	Date	Timing
Flood information signage on site	Staff and occupants		Ongoing
Flood information in new occupant packs	Occupants		Annual and with new occupants
Flood Emergency Plan on display in office	Staff		Ongoing

TABLE G – FLOOD AWARENESS AND PREPAREDNESS ACTIVITIES FOR STAFF AND OCCUPANTS CONTINUED

Activity	Audience	Date	Timing

STEP 10 - HOW WILL WE PRACTISE OUR PLAN?

In a flood emergency, it will be much easier to remember what to do and to know it works if you have run through it before. This involves testing and practising key elements of your plan.

Fill out the table below to keep a record of your training and testing of this plan.

TABLE H – FLOOD EMERGENCY PLAN TESTING

Activity	Who	Date

STEP 11 - HOW WILL WE REVIEW OUR PLAN SO IT STAYS CURRENT?

You will also need to maintain your plan over time. It is recommended your plan is reviewed every two years to keep it up to date.

Provide details below about when and who has reviewed the plan.

TABLE I – REVIEWING YOUR FLOOD EMERGENCY PLAN

Plan Review Date	Position/Role	Date Completed

APPENDICES

SECTION 5

APPENDIX A - HAWKESBURY-NEPEAN VALLEY FLOOD HISTORY

Gauge Location	Observed Peak Flood Levels (metres on local gauge)										
	Jun-1867	Nov-1961	Jun-1964	Mar-1978	Aug-1986	Apr/May 1988	Aug-1990	Feb-2020	Mar-2021	Mar-2022	Jul-2022
Blaxlands Crossing (Silverdale Road Bridge)	-	15.3	18.0	16.3	10.5	-	-	8.5	-	-	-
Wallacia Weir	20.5	14.9	17.3	15.8	9.0	14.3	12.7	7.3	8.6	11.4	13.9
Penrith	13.3	9.8	9.6	9.2	5.8	8.5	9.3	6.1	10.0	8.3	9.5
Castlereagh	-	-	-	-	14.0	16.3	-	13.4	16.8	15.9	-
Yarramundi	-	-	-	-	-	-	15.2	12.7	15.6	-	-
North Richmond WPS	-	-	15.5	-	-	14.4	14.9	11.6	13.9	14.1	14.3
North Richmond Bridge	20.1	16.2	15.7	15.3	12.7	14.4	15.0	-	-	-	-
Freemans Reach	-	-	-	-	-	13.0	-	11.3	13.4	13.9	14.0
Windsor	19.7	15.0	14.5	14.5	11.4	12.8	13.5	9.3	12.9	13.8	13.9
Ebenezer	-	-	-	-	-	-	-	7.5	11.8	12.7	13.0
Sackville	15.5?	10.4	11.0	10.7	8.2	8.6	10.0	5.8	9.7	10.7	10.9
Upper Colo (Colo River)	-	7.8	13.1	19.2	-	16.1	13.8	15.7	15.0	16.7	15.0
Colo Junction (Lower Portland)	11.7?	7.8	8.3	8.3	6.1	5.9	7.5	4.7	7.9	8.7	9.0
Leets Vale	-	-	-	-	-	-	-	3.0	-	-	-
St Albans (Macdonald River)	10.8	1.0	7.6	8.5	2.3	-	6.0	5.2	7.7	8.3	10.0
Webbs Creek, Wisemans Ferry	-	3.8	4.2	4.8	3.1	2.9	4.3	2.4	4.4	5.2	5.8
Wisemans Ferry Wharf	8.6	-	-	-	-	2.6	-	2.2	3.9	4.7	-
Gunderman Caravan Park	-	-	-	-	-	-	-	1.8	2.5	3.1	3.4
Spencer	-	-	-	1.5	-	-	-	1.5	1.4	1.8	1.9

Notes:

1. Only active gauge locations as of June 2021 are listed. Gauges for which flood warnings are issued are shaded blue. Gauges on tributaries are shaded light brown.
2. Wallacia Weir: The 1867 flood level is believed to be similar to the 1873 flood level.
3. Penrith: The 1867 flood level at Penrith is based on an observation that the flood was 3 ft below the deck of Victoria Bridge. Other evidence indicates it may have been only 1.5 ft below the deck i.e. 13.8m
4. Sackville: The 1867 flood level is estimated by applying a gradient to the level surveyed upstream near St Thomas cemetery
5. Colo Junction: The 1867 flood level is estimated from a profile in Hawkesbury River Flood Level Profiles (1985). The 1961, 1964 and 1978 flood levels are taken from the Regional Flood Study (2019). Other sources put these lower at 7.2, 7.7, and 7.8m, respectively
6. Webbs Creek: The 1961 flood level is taken from the Regional Flood Study (2019). Other sources put this lower at 3.2m
7. St Albans: The 1867 flood level is adopted from Erskine (1986)
8. Wisemans Ferry Wharf: The 1867 flood level is derived from a report that it was 6 ft higher than the 1889 flood, which in turn was reported to be 19 ft above high water mark. High water mark is estimated at 1.0m AHD.

APPENDIX B - HAWKESBURY-NEPEAN VALLEY POTENTIAL FLOOD LEVELS (2019)

Gauge Location	Modelled Peak Flood Levels (metres on local gauge)							
	1 in 5 chance per year	1 in 10 chance per year	1in 20 chance per year	1 in 50 chance per year	1 in 100 chance per year	1 in 200 chance per year	1in 500 chance per year	PMF
Blaxlands Crossing (Silverdale Road Bridge)	10.4	-	16.1	-	19.4	20.9	22.5	39.9
Wallacia Weir	9.9	-	15.7	-	19.0	20.5	22.3	39.7
Penrith	5.4	7.2	9.2	10.8	12.2	13.2	13.9	18.7
Castlereagh	12.3	14.7	16.9	18.3	19.3	20.1	20.8	27.0
Yarramundi	11.9	14.3	15.9	17.2	17.9	18.8	20.0	26.7
North Richmond WPS	11.1	13.4	15.2	16.3	17.2	18.2	19.4	26.2
North Richmond Bridge	11.1	13.3	15.0	16.2	17.2	18.2	19.5	26.4
Freemans Reach	10.6	12.5	13.9	16.1	17.4	18.4	19.6	26.6
Windsor	9.9	12.0	13.8	16.1	17.3	18.4	19.6	26.7
Ebenezer	8.5	11.0	13.0	15.3	16.6	17.7	19.1	26.4
Sackville	6.4	8.6	10.3	12.4	13.5	14.5	15.8	23.8
Colo Junction (Lower Portland)	4.8	6.5	8.2	9.9	11.1	12.1	13.6	20.1
Leets Vale	3.4	4.7	6.0	7.5	8.5	9.5	10.9	16.4
Webbs Creek, Wisemans Ferry	2.8	3.7	4.8	6.1	7.1	8.2	9.4	14.5
St Albans (Macdonald River)	7.0	-	9.8	10.9	11.8	12.7	13.9	-
Wisemans Ferry Wharf	2.7	3.6	4.7	6.0	7.0	8.1	9.3	14.4
Gunderman Caravan Park	2.3	2.9	3.8	4.9	5.9	6.8	8.0	12.6
Spencer	1.8	1.9	2.0	2.3	2.6	3.0	3.7	6.4

Notes:

1. Only active gauge locations as of June 2021 are listed. Gauges for which flood warnings are issued are shaded blue. Gauges on tributaries are shaded light brown.
2. Flood levels are subject to revision with further studies.

Sources:

- Blaxlands Crossing and Wallacia Weir – Upper Nepean River Flood Study (1995) and Regional Flood Study (2019)
- Penrith, Castlereagh, Yarramundi – Nepean River Flood Study (2018) and Regional Flood Study (2019)
- North Richmond to Spencer – Regional Flood Study (2019)
- St Albans – Macdonald River Flood Study (2004)

APPENDIX C - FLOOD LEVELS / PROFILES (2019)

The following information should be used with caution. Flood slopes in real events may differ from the flood slopes in modelled events which are presented in the tables below. Flood information is also subject to change – check with your local Council for the latest information.

PENRITH COUNCIL

Note, flood heights at caravan parks in the table below are to metres Australian Height Datum (AHD). Wallacia Weir gauge has a gauge zero of 26.596m AHD. Penrith gauge has a gauge zero of 14.139m AHD. This means that if the Bureau of Meteorology issues a predicted height of, say, 10.0m at Wallacia Weir, the predicted height at the gauge in metres AHD is 10m + 26.596m = roughly 36.6m AHD. To translate that prediction to a caravan park located away from the gauge requires consideration of flood slopes (see **Appendix H**).

Source of flood heights: Wallacia floodplain data - 1 in 5 to 1 in 200 AEP from Upper Nepean River Flood Study (1995), 1 in 500 AEP and PMF from Hawkesbury-Nepean Valley Regional Flood Study (2019); Penrith floodplain data - 1 in 5 and 1 in 10 AEP and PMF from Hawkesbury-Nepean Valley Regional Flood Study (2019), 1 in 20 to 1 in 500 AEP from Nepean River Flood Study (2018). Flood heights are subject to revision with further studies.

Legend	Flood Classification
Forecast gauge	Minor
Gauge	Moderate
Caravan park	Major

Category	Name	Datum	Flood size (chance per year)							
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	PMF
Wallacia floodplain										
Gauge	Blaxlands Crossing (Silverdale Road Bridge) gauge	m AHD	36.8	-	42.5	-	45.8	47.3	48.9	66.3
Caravan park	Wallacia Caravan Park	m AHD	36.8	-	42.5	-	45.8	47.3	48.9	66.3
Forecast gauge	Wallacia Weir gauge	m AHD	36.5	-	42.3	-	45.6	47.1	48.9	66.3
Forecast gauge	Wallacia Weir gauge	Gauge datum	9.9	-	15.7	-	19.0	20.5	22.3	39.7
Penrith floodplain										
Caravan park	Nepean Shores Lifestyle Community	m AHD	20.3	22.4	24.3	26.0	27.4	28.4	29.0	33.3
Forecast gauge	Penrith	m AHD	19.6	21.3	23.3	24.9	25.8	27.3	28.0	32.8
Forecast gauge	Penrith	Gauge datum	5.4	7.2	9.2	10.8	11.6	13.1	13.8	18.6
Caravan park	Nepean River Holiday Village	m AHD	19.5	21.2	22.7	24.2	25.4	26.4	27.1	32.8

HAWKESBURY, THE HILLS, AND CENTRAL COAST COUNCILS

Note, flood heights in the table below are to metres AHD and metres on gauge datum (since all the gauges are to 0m AHD).

Source of flood heights: Hawkesbury-Nepean Valley Regional Flood Study (2019). Heights for the 1 in 2 chance per year flood are estimated and interpolated from supplementary information from that study. Flood heights are subject to revision with further studies.

Legend	Flood Classification
Forecast gauge	Minor
Gauge	Moderate
Caravan park	Major

Category	Name	LGA	Flood heights (m) for different flood sizes (chance per year)								
			1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	PMF
Forecast gauge	Windsor PWD gauge		6.1	9.9	12.0	13.8	16.1	17.3	18.4	19.6	26.7
Caravan park	Windsor Riverside Van Park	Hawkesbury	5.9	9.6	11.8	13.7	16.0	17.3	18.3	19.6	26.7
Caravan park	Hawkesbury Riverside Tourist Park	Hawkesbury	5.8	9.5	11.8	13.7	16.0	17.3	18.3	19.6	26.7
Caravan park	Percy Place Caravan and Ski Park	Hawkesbury	5.5	9.1	11.4	13.4	15.7	17.0	18.1	19.4	26.5
Caravan park	Riverside Ski Park	Hawkesbury	5.3	8.7	11.2	13.2	15.5	16.9	17.9	19.3	26.5
Gauge	Ebenezer gauge		5.1	8.5	11.0	13.0	15.3	16.6	17.7	19.1	26.4
Caravan park	Kallawatta Ski Garden	Hawkesbury	4.9	8.3	10.7	12.7	15.0	16.3	17.3	18.7	26.0
Caravan park	Greenfields Caravan Park	Hawkesbury	4.9	8.3	10.7	12.7	15.0	16.2	17.3	18.7	26.0
Caravan park	Hawkesbury Waters Leisure Park	Hawkesbury	4.7	7.9	10.2	12.1	14.4	15.6	16.6	17.9	25.4
Caravan park	Pacific Park Motorcycle and Water Ski Gardens	The Hills	4.4	7.4	9.6	11.4	13.6	14.8	15.8	17.1	24.8
Caravan park	Tizzana Downs Caravan Park	Hawkesbury	4.0	6.7	8.9	10.7	12.8	13.9	14.9	16.2	24.1
Forecast gauge	Sackville gauge		3.7	6.4	8.6	10.3	12.4	13.5	14.5	15.8	23.8
Caravan park	Sackville Ski Gardens	Hawkesbury	3.7	6.4	8.6	10.3	12.4	13.5	14.5	15.8	23.8
Caravan park	Ulinbawn Ski Park	The Hills	3.6	6.2	8.4	10.1	12.1	13.2	14.1	15.5	23.5
Caravan park	Caradon Leisure Park	The Hills	3.4	5.8	7.9	9.5	11.4	12.5	13.5	14.9	22.7

Category	Name	LGA	Flood heights (m) for different flood sizes (chance per year)								
			1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	PMF
Caravan park	Happy Holidays Ski Park (hypothetical example)	Utopia	3.3	5.7	7.7	9.3	11.2	12.3	13.3	14.7	22.3
Caravan park	Bundarra Ski Gardens	Hawkesbury	3.2	5.5	7.4	9.1	10.9	12.1	13.0	14.5	21.9
Caravan park	Dargle Water Ski Resort	The Hills	3.0	5.2	7.0	8.7	10.5	11.7	12.6	14.1	21.3
Caravan park	Cornelia Water Ski Park	The Hills	2.9	5.0	6.8	8.5	10.2	11.4	12.4	13.9	20.7
Caravan park	Ponderosa Ski Resort	Hawkesbury	2.9	5.0	6.8	8.5	10.2	11.4	12.4	13.9	20.8
Forecast gauge	Colo Junction (Lower Portland) gauge		2.8	4.8	6.5	8.2	9.9	11.1	12.1	13.6	20.1
Caravan park	Hawkesbury Riverside Retreat	Hawkesbury	2.8	4.7	6.4	8.0	9.7	10.9	11.9	13.4	19.9
Caravan park	St George Caravan Park	The Hills	2.8	4.7	6.3	7.9	9.7	10.8	11.8	13.3	19.8
Caravan park	D.M.L. Gardens	The Hills	2.7	4.5	6.2	7.8	9.5	10.7	11.7	13.2	19.6
Caravan park	Mt Andrew Caravan and Ski Park	Hawkesbury	2.7	4.5	6.2	7.8	9.5	10.6	11.6	13.1	19.6
Caravan park	Child's Play Marine (Newall's Ski Park)	The Hills	2.7	4.5	6.1	7.7	9.4	10.6	11.6	13.1	19.5
Caravan park	Riviera Ski Garden Caravan Tourist Park	The Hills	2.7	4.4	6.0	7.5	9.2	10.4	11.4	12.9	19.3
Caravan park	Private park, River Road, Lower Portland	The Hills	2.4	4.1	5.7	7.2	8.9	10.0	11.1	12.5	18.8
Caravan park	Private park, River Road, Lower Portland	The Hills	2.4	4.1	5.7	7.2	8.9	10.0	11.1	12.5	18.8
Gauge	Leets Vale gauge		2.3	3.4	4.7	6.0	7.5	8.5	9.5	10.9	16.4

Category	Name	LGA	Flood heights (m) for different flood sizes (chance per year)								
			1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	PMF
Caravan park	Leetsvale Caravan Park	The Hills	2.3	3.4	4.7	6.0	7.5	8.5	9.5	10.9	16.4
Caravan park	Torrens Ski Garden	The Hills	2.2	3.1	4.1	5.3	6.7	7.8	8.8	10.1	15.4
Caravan park	Hawkesbury River Village	Hawkesbury	2.2	3.0	4.1	5.3	6.7	7.7	8.7	10.0	15.3
Caravan park	Carinya Ski Ranch	The Hills	2.2	3.0	4.0	5.2	6.6	7.6	8.6	9.9	15.2
Caravan park	Del-Rio Riverside Resort	Hawkesbury	2.2	3.0	4.0	5.2	6.5	7.6	8.6	9.9	15.1
Caravan park	Koveda Tourist Park and Water Ski Gardens	The Hills	2.2	2.9	3.9	5.1	6.4	7.4	8.5	9.8	14.9
Caravan park	NSW Ski Gardens	The Hills	2.2	2.9	3.9	5.0	6.4	7.4	8.4	9.7	14.8
Forecast gauge	Webbs Creek (Wisemans Ferry) gauge		2.1	2.8	3.7	4.8	6.1	7.1	8.2	9.4	14.5
Gauge	Wisemans Ferry Wharf gauge		2.1	2.7	3.6	4.7	6.0	7.0	8.1	9.3	14.4
Caravan park	Rosevale Farm and Tourist Resort	Central Coast	2.1	2.6	3.4	4.5	5.8	6.8	7.9	9.1	14.2
Gauge	Gunderman Caravan Park gauge		1.9	2.3	2.9	3.8	4.9	5.9	6.8	8.0	12.6
Caravan park	Riverlands Caravan Park	Central Coast	1.9	2.3	2.9	3.8	4.9	5.9	6.8	8.0	12.6
Caravan park	Malaluka Caravan Park	Central Coast	1.6	1.8	1.9	2.0	2.3	2.6	3.0	3.7	6.4
Gauge	Spencer gauge		1.6	1.8	1.9	2.0	2.3	2.6	3.0	3.7	6.4
Caravan park	Charlies Place Caravan Park	Central Coast	1.6	1.8	1.9	2.0	2.3	2.6	3.0	3.6	6.5
Caravan park	Neverfail Park	Central Coast	1.6	1.8	1.9	2.0	2.3	2.6	3.0	3.6	6.5
Caravan park	Greenmans on the Hawkesbury	Central Coast	1.6	1.8	1.9	2.0	2.3	2.6	3.0	3.7	6.6

APPENDIX D - EXAMPLES OF FLOOD RATES OF RISE

	Modelled 1 in 100 chance per year flood			Historical floods			
				Feb 2020 flood	Mar 2021 flood	Mar 2022 flood	Jul 2022 flood
Location	Height range (m AHD)	Rate of rise (m/hr)	Height range (m on gauge)	Maximum hourly rate of rise (m/hr)			
Wallacia Weir	29.0 to 40.0m	1.1	>2.5m	0.6	0.6	0.8	0.7
Penrith	17.0 to 24.0m	0.5	>2.0m	0.6	0.6	0.8	1.1
Yarramundi	6.0 to 17.0m	0.9	>2.0m	1.3	0.8	n/a	n/a
North Richmond	5.0 to 16.0m	0.8	>2.0m	1.2	0.8	1.2	1.6
Windsor	4.0 to 14.0m	0.6	>2.0m	0.9	0.6	0.7	1.2
Ebenezer	2.0 to 12.0m	0.6	>2.0m	0.6	0.4	0.6	0.9
Sackville	2.0 to 10.0m	0.5	>2.0m	n/a	0.4	0.4	0.7
Lower Portland	2.0 to 9.0m	0.5	>1.0m	0.6	0.3	0.5	0.5
Leets Vale	2.0 to 7.0m	0.5	>1.0m	0.5	n/a	0.5	n/a
Wisemans Ferry	2.0 to 4.0m	0.4	>1.0m	0.4	0.2	0.5	0.3
Gunderman	2.0 to 4.0m	0.4	>1.0m	0.4	0.2	0.4	0.3
Spencer	1.8 to 2.5m	0.1	>0.5m	0.4	0.2	0.4	0.3

Notes:

a. Rate of rise rounded up to nearest 0.1m interval

b. Higher rates of rise than shown here are possible (e.g. see Appendix F in the Hawkesbury-Nepean Valley Regional Flood Study (WMAwater, 2019))

c. Modelled rates of rise (e.g. for the 1 in 100 chance per year flood) are subject to revision with further studies

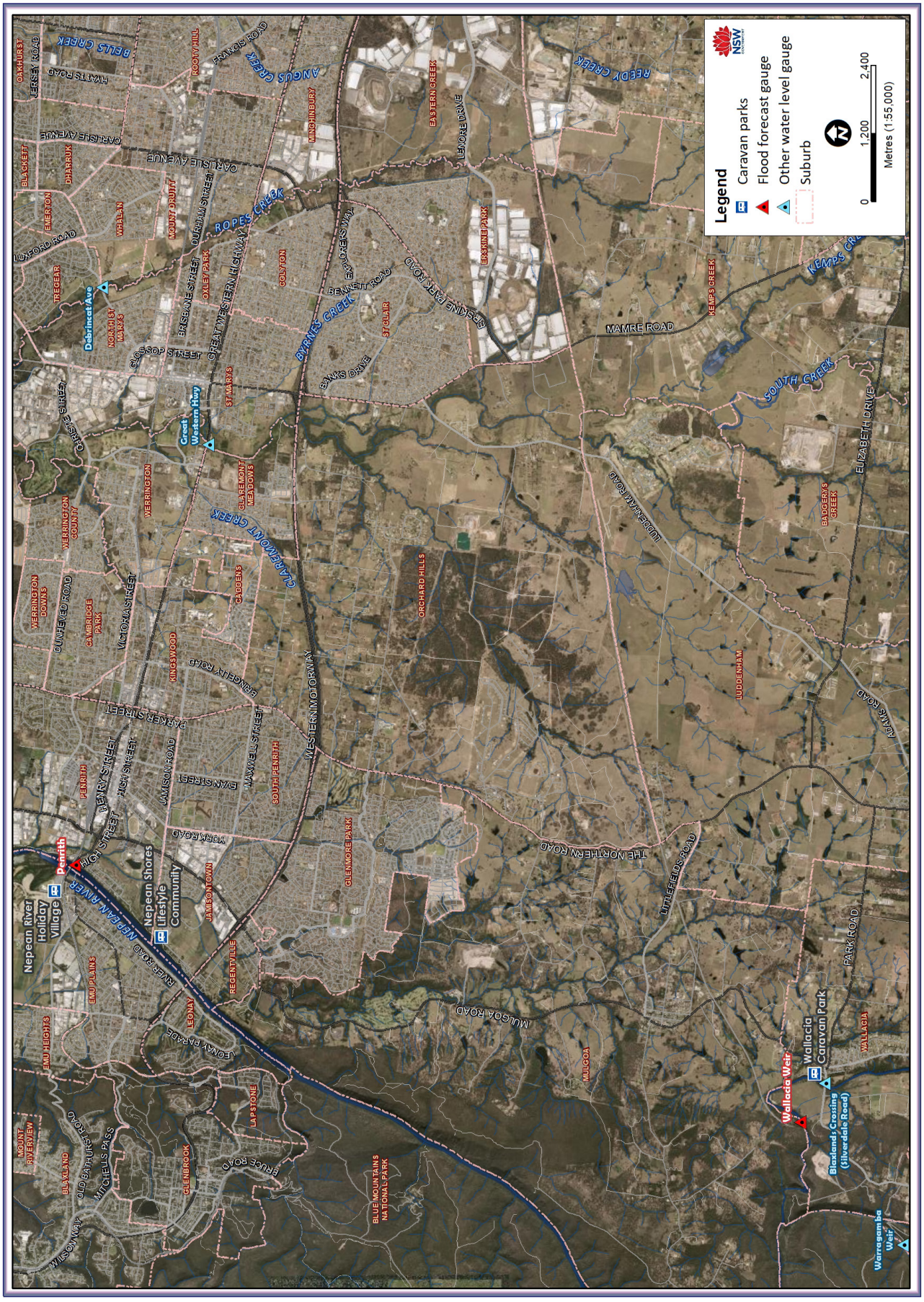
APPENDIX E - HAWKESBURY-NEPEAN FORECAST GAUGE FLOOD CLASSIFICATIONS

Forecast gauge	Flood classification (m)		
	Minor	Moderate	Major
Menangle Bridge	5.2	9.2	12.2
Camden Weir	6.8	8.3	13.8
Wallacia Weir	5.0	8.7	11.0
Penrith	3.9	7.9	10.4
North Richmond WPS	3.8	7.9	10.5
Windsor PWD	5.8	7.0	12.2
Sackville	4.6	7.3	9.7
Putty Road (Colo River)	2.7	5.7	10.7
Colo Junction (Lower Portland)	4.6	6.1	7.6
Webbs Creek (Wisemans Ferry)	n/a	3.5	4.2

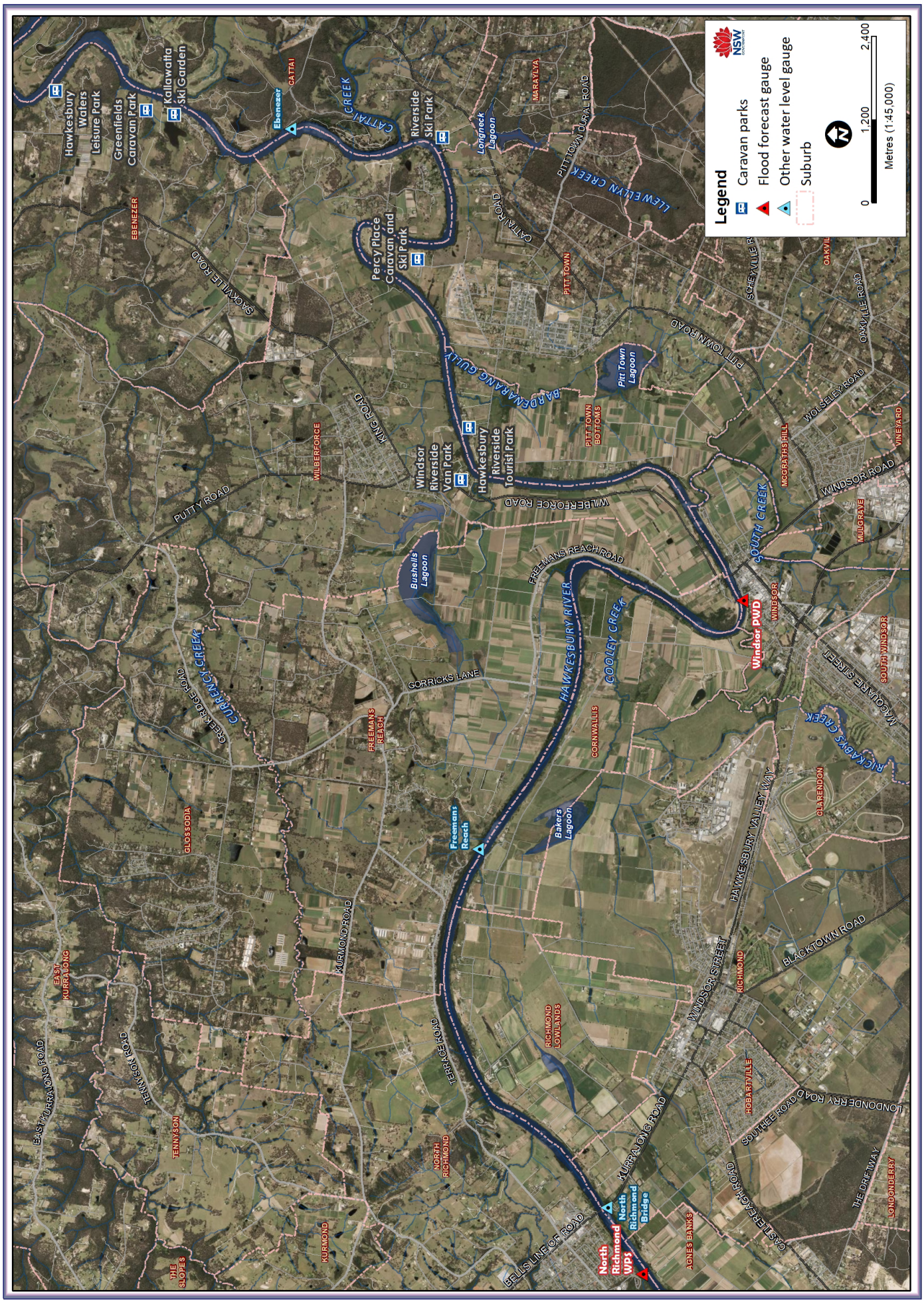
Source: Bureau of Meteorology (2020). Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory, Schedule 2, Version 3.13, March 2020.

APPENDIX F - RIVER GAUGE LOCATIONS

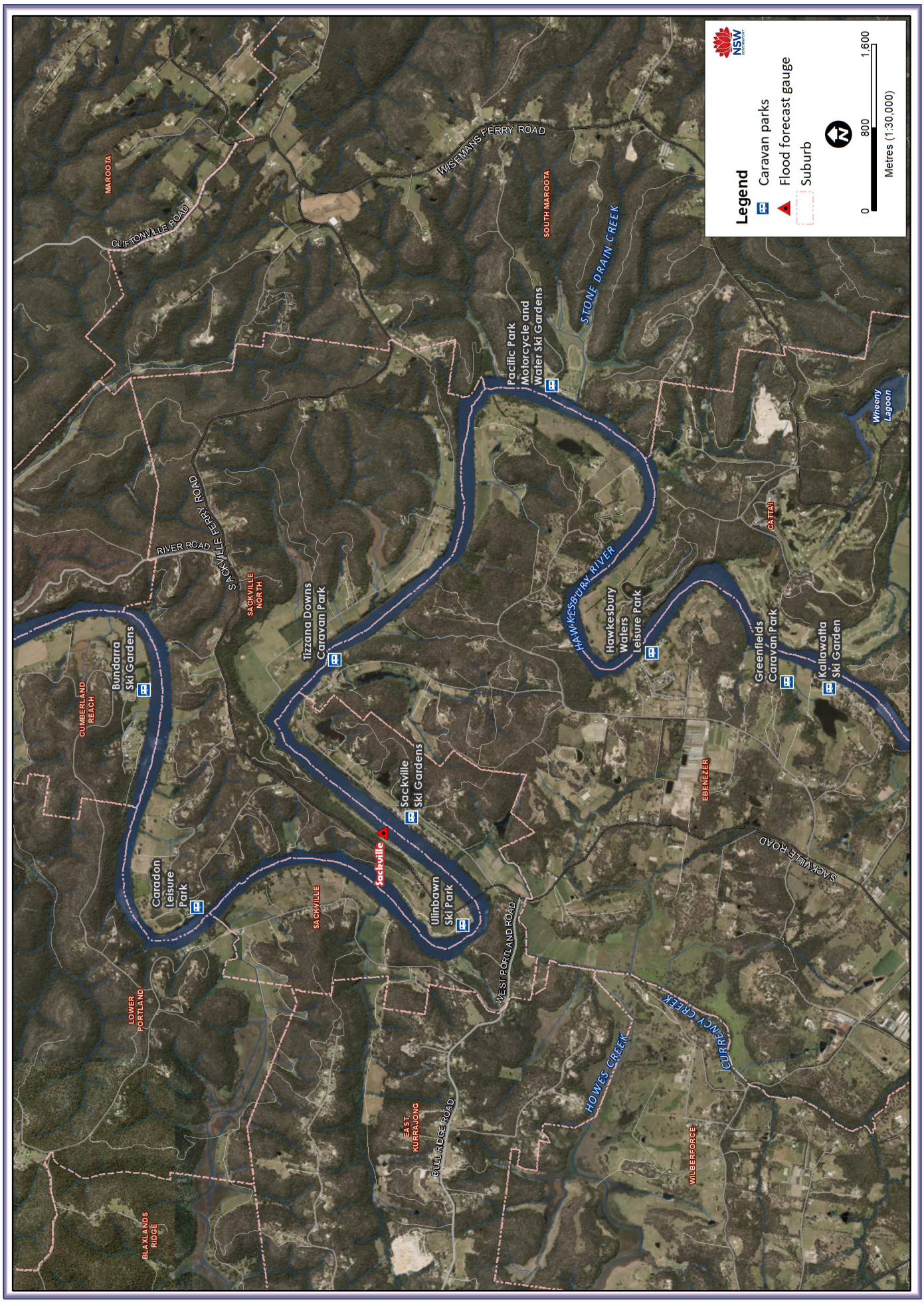
1 PENRITH LOCAL GOVERNMENT AREA CARAVAN PARKS



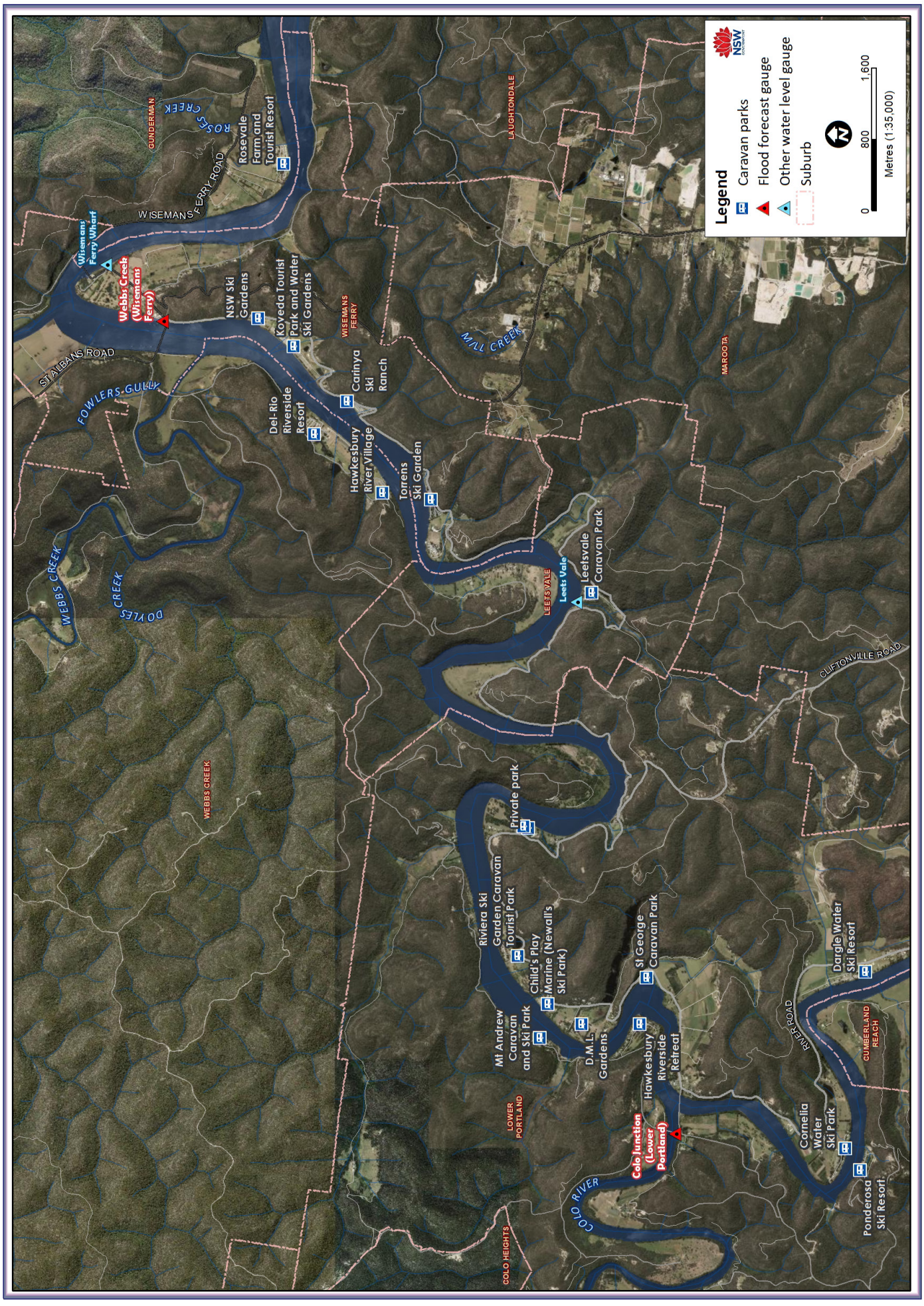
2 UPPER HAWKESBURY CARAVAN PARKS



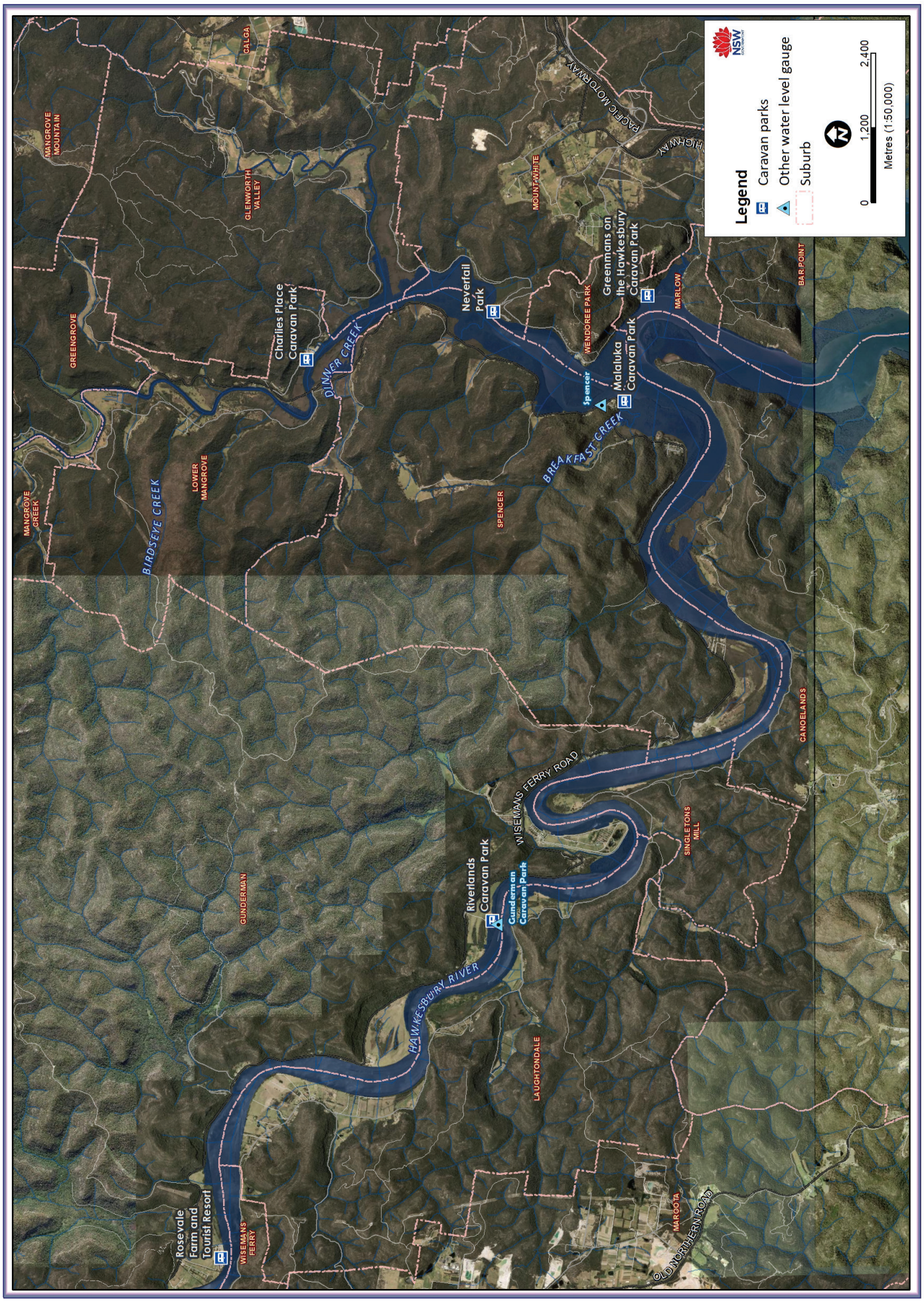
3 EBENEZER TO CUMBERLAND REACH CARAVAN PARKS



4 LOWER PORTLAND TO WISEMANS FERRY CARAVAN PARKS



5 CENTRAL COAST LOCAL GOVERNMENT AREA CARAVAN PARKS



APPENDIX G - RIVER GAUGE LINKS

Gauge	Type	BoM site	MHL site	WaterNSW site
General:		http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDN60143.html	https://mhl.nsw.gov.au/Home (select station of interest from map view)	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station of interest then click on 'Latest Values')
Camden Weir	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.568154.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212216 then click on 'Latest Values')
Wallacia Weir	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.067093.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212202 then click on 'Latest Values')
Warragamba Weir (Warragamba River)	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.568231.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212241 then click on 'Latest Values')
Penrith	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.567047.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212201 then click on 'Latest Values')
Castlereagh	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.567045.plt.shtml	https://mhl.nsw.gov.au/Station-212404	N/a
Yarramundi	Auto	N/a	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 2122001 then click on 'Latest Values')

Gauge	Type	BoM site	MHL site	WaterNSW site
General:		http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDN60143.html	https://mhl.nsw.gov.au/Home (select station of interest from map view)	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station of interest then click on 'Latest Values')
Burralow (Grose River)	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.563024.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212291 then click on 'Latest Values')
North Richmond WPS	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.567098.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212200 then click on 'Latest Values')
Freemans Reach	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.563011.plt.shtml	https://mhl.nsw.gov.au/Station-212410	N/a
Windsor PWD	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.567044.plt.shtml	https://mhl.nsw.gov.au/Station-212426	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212903 then click on 'Latest Values')
Ebenezer	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.563010.plt.shtml	https://mhl.nsw.gov.au/Station-212427	N/a
Sackville	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.063280.plt.shtml	https://mhl.nsw.gov.au/Station-212406	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212406 then click on 'Latest Values')
Upper Colo (Colo River)	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.563033.plt.shtml	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212290 then click on 'Latest Values')
Colo Junction (Lower Portland)	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.067094.plt.shtml	https://mhl.nsw.gov.au/Station-212407	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212407 then click on 'Latest Values')

Gauge	Type	BoM site	MHL site	WaterNSW site
General:		http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDN60143.html	https://mhl.nsw.gov.au/Home (select station of interest from map view)	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station of interest then click on 'Latest Values')
Leets Vale	Auto	N/a	N/a	https://realtimedata.waternsw.com.au/ (click on 'Real Time Data – Rivers and Stream' then locate station 212461 then click on 'Latest Values')
Webbs Creek, Wisemans Ferry	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.561004.plt.shtml	https://mhl.nsw.gov.au/Station-212408	N/a
St Albans (Macdonald River)	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.061353.plt.shtml	N/a	N/a
Wisemans Ferry Wharf	Auto	N/a	https://mhl.nsw.gov.au/Station-212460	N/a
Gunderman Caravan Park	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.561076.plt.shtml	https://mhl.nsw.gov.au/Station-212429	N/a
Spencer	Auto	http://www.bom.gov.au/fwo/IDN60233/IDN60233.561065.plt.shtml	https://mhl.nsw.gov.au/Station-212431	*N/a*

Notes:

1. Only active gauge locations as of June 2021 are listed. Forecast gauges are shaded blue. Gauges on tributaries are shaded light brown.

APPENDIX H - HAPPY HOLIDAYS SKI PARK WORKED EXAMPLES

Happy Holidays Ski Park located along the Lower Hawkesbury River in Utopia LGA is a hypothetical caravan park that we've invented to help explain some tricky issues.

FLOOD SLOPES

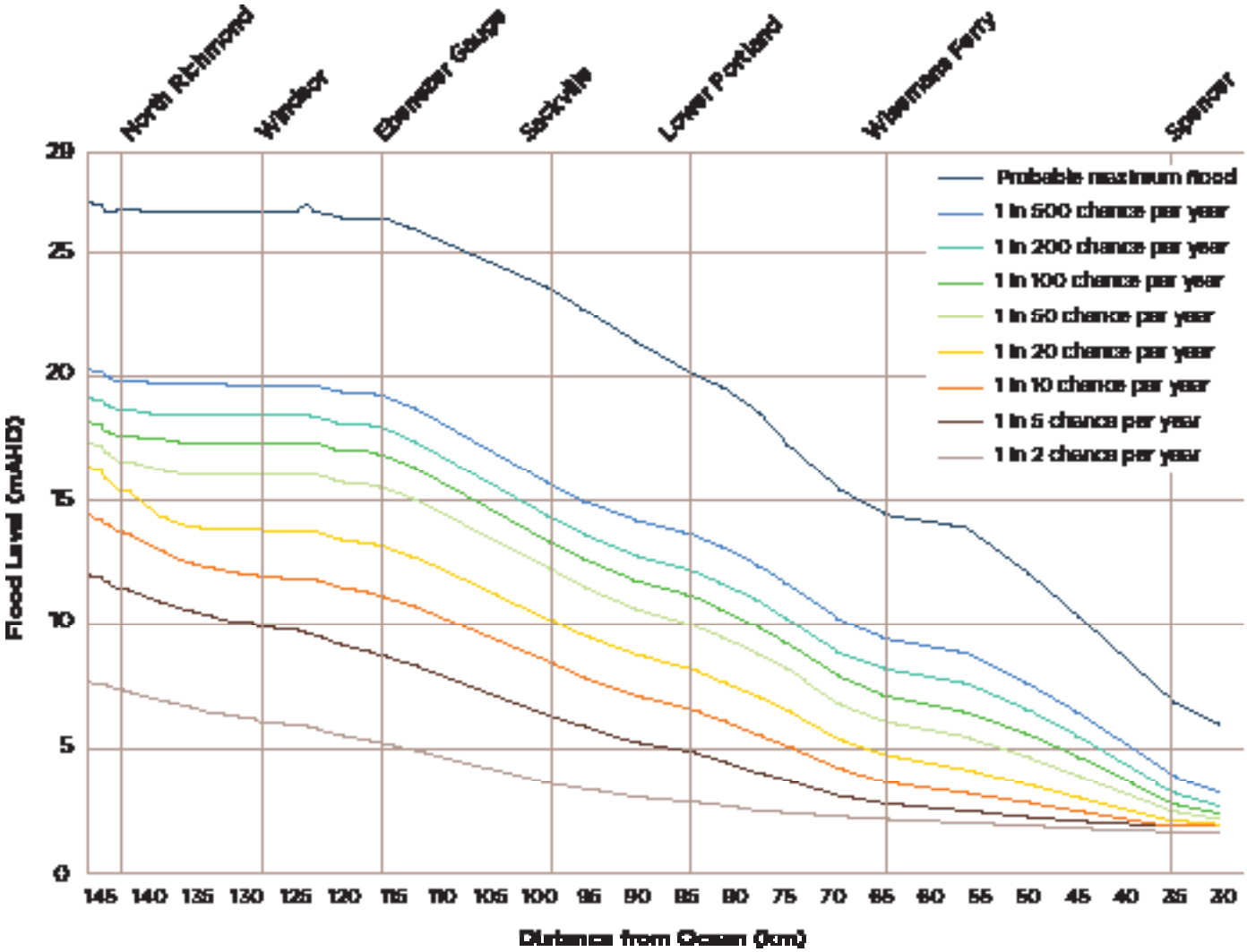
One issue is how a flood height (observed or predicted) at a river height gauge relates to a caravan park located some distance from the gauge, and vice versa. This is tricky because of flood slopes.

The diagram below shows potential flood heights along the length of the Hawkesbury River from Yarramundi to Brooklyn. Each line represents a potential flood. If you follow the 1 in 20 chance per year (yellow) flood line, you'll see that the peak flood level falls from about 14m above sea level at Windsor, to about 10m at Sackville, about 8m at Lower Portland, and about 5m at Wisemans Ferry. Happy Holidays Ski Park is located between Sackville and Lower Portland, so the flood height there will be in-between the heights at Sackville and Lower Portland.

Remember that flood slopes vary from flood to flood depending on the size of inflows from different tributaries.

Figure: Flood profiles along Hawkesbury River

Source: Hawkesbury-Nepean Valley Regional Flood Study (2019) Figure 40 and supplementary information. Flood profiles are subject to revision with further studies.



Scenario 1 – what does a Flood Watch for minor flooding mean for Happy Holidays Ski Park?

The Bureau of Meteorology issues a Flood Watch for minor flooding in the Hawkesbury River downstream of Windsor.

Using **Appendix E**, this means that if the anticipated rain falls, flooding higher than 4.6m at the Sackville river gauge could happen. Using **Appendix C**, we can see that based on current flood models, 4.6m at Sackville falls between a 1 in 2 and 1 in 5 chance per year flood size, though closer to 1 in 2.

This means that flooding at least as high as a level between 3.3m (1 in 2) and 5.7m (1 in 5 chance per year) is likely at the hypothetical park, Happy Holidays Ski Park (using **Appendix C**).

Scenario 2 – what does a Flood Warning mean for Happy Holidays Ski Park?

The Bureau of Meteorology issues a Flood Warning for the Hawkesbury River to peak near 7.0m at Sackville river gauge around 6pm on Tuesday. Based on current flood models, 7.0m at Sackville falls between a 1 in 5 and 1 in 10 chance per year flood size, though closer to 1 in 5 (using **Appendix C** to work this out).

This means that a peak flood level between 5.7m (1 in 5) and 7.7m (1 in 10 chance per year) is expected at Happy Holidays Ski Park (using **Appendix C**).

Scenario 3 – at what river gauge height is Happy Holidays' evacuation route cut?

Maps showing ground levels indicate that the evacuation route from Happy Holidays Ski Park is cut at about 4.1m. Based on current flood models, this ground level falls between a 1 in 2 and 1 in 5 chance per year flood level, though closer to 1 in 2 (using **Appendix C** to work this out).

This corresponds to a level of 3.7m (1 in 2) to 6.4m (1 in 5 chance per year) at the Sackville river gauge upstream (using **Appendix C**).

So if the Bureau of Meteorology issues a Flood Watch for minor flooding of the Hawkesbury River downstream of Windsor (i.e. higher than 4.6m at Sackville from **Appendix E**), we know that the evacuation route from the park is likely to be cut.

Scenario 4 – at what river gauge height are structures at Happy Holidays flooded?

Maps showing ground levels indicate that fixed structures at Happy Holidays Ski Park are located at about 6.0m. Using **Appendix C** to work this out we can see that based on current flood models, this ground level falls between a 1 in 5 and 1 in 10 chance per year flood level, though closer to 1 in 5.

This corresponds to a level of 6.4m (1 in 5) to 8.6m (1 in 10 chance per year) at the Sackville river gauge upstream (using **Appendix C**). So if the Bureau of Meteorology issues a Flood Warning for the river to peak near 7.0m at Sackville river gauge, we know that flooding of these structures is likely.

SETTING TRIGGERS

Imagine that Happy Holidays Ski Park has two staff available to doorknock its 20 sites to direct patrons to evacuate. This is estimated to take about 30 minutes. It is estimated it will then take 60 minutes for people to prepare themselves and pack their vehicles to leave.

It was identified that the evacuation route is cut at a flood level of about 4.1m, so staff will need to start doorknocking at least 1.5 hours before that level is reached. Using the highest rate of rise for Sackville in **Appendix D** (0.7m/hr), the latest trigger to commence doorknocking is approximately 3m.

This level at Happy Holidays corresponds to a flood level of 3.4m at Sackville (using **Appendix C** to estimate this).

The park manager/s will need to monitor the Sackville gauge closely and also be ready to evacuate themselves within the limited time available.

An alternative trigger would be to start the evacuation process as soon as a Flood Watch for minor flooding is issued. This size of flooding is likely to cut the evacuation route to Happy Holidays Ski Park.

COMPLETING THE FLOOD EMERGENCY RESPONSE PLAN

This is the key deliverable of this workbook.

Note that the example for Happy Holidays Ski Park is not prescriptive. There are some features of (the hypothetical) Happy Holidays Ski Park, and the way floods impact this park, that may not fit your park.

It is just an example of how to draw on all the information to plan for a response to flooding that addresses the key objectives set out in the introduction:

- To ensure people's safety
- To protect property
- To reduce the risk to the environment.

There's a few things to notice:

- It's staged. Lots of things need to happen at the Flood Watch / Severe Weather Warning stage.
- It allows for a 'Plan B' in case not everyone evacuates before the road access is lost, as well as a 'Plan C'

HAPPY HOLIDAYS SKI PARK FLOOD EMERGENCY RESPONSE PLAN – HYPOTHETICAL EXAMPLE

Avoid driving, riding, walking, boating or playing in floodwaters – these are the main causes of death during floods

TRIGGERS	CONSEQUENCE	ACTIONS	
Bureau of Meteorology Flood Watch for minor flooding of Hawkesbury River issued OR **Bureau of Meteorology Severe Weather Warning** for heavy rain issued OR **Emergency Warning – Evacuate before/now** issued (whichever happens first)	Flooding probable in coming days, likely to cut vehicular evacuation route	Communicating with site occupants and visitors	• Contact all upcoming bookings and owners of moveable dwellings to direct them to defer travel to park • Doorknock all site occupants and visitors and direct them to prepare to evacuate • Direct site occupants and visitors planning to use road ferry services, or with identified vulnerabilities, to evacuate promptly
		Site management	• Call on casual staff to assist with flood emergency • Relocate any hazardous chemicals (e.g. boat/mower fuel) to offsite storage area • Prepare park office and residence for evacuation • Raise items in cabins/annexes to higher levels (if permission previously given)
		Communicating with authorities / sourcing information	• Contact road ferry operators and Council re status of evacuation routes • Inform NSW SES unit re status at park • Monitor BoM, SES, river heights, tides
Bureau of Meteorology Flood Warning of 4.6m or higher at Sackville gauge OR **Sackville gauge** reaches 3.7m and rising OR **Emergency Warning – Evacuate before/now** issued (whichever happens first)	Vehicular evacuation route expected to be cut Vehicular evacuation route expected to be cut within ~90 minutes	Communicating with site occupants and visitors	• Doorknock all park occupants and direct them to evacuate immediately (and indicate best route, reminding them to never drive through floodwater)
		Site management	• Render assistance to any persons requiring help • Check to see sites are vacated • Secure loose objects (e.g. bins, gas cylinder) • Block floor wastes and toilets • Turn off power to sites, and gas appliances • Relocate office/residence essentials off-site
		Communicating with authorities / sourcing information	• Contact road ferry operators and Council re status of evacuation routes • Inform NSW SES unit re status at park • Monitor BoM, SES, river heights, tides
Vehicular **evacuation route flooded** (4.1m locally, 4.6m Sackville), **and flood rising**	Caravan park isolated by road	Communicating with site occupants and visitors	• Direct any remaining persons to evacuate on foot up designated overland escape route
		Site management	• Render assistance to any persons requiring help • Check to see sites are vacated • Evacuate yourself and all staff • Secure park
		Communicating with authorities	• Inform NSW SES unit re status at park
Overland escape route flooded (4.9m locally, 5.5m Sackville)	Caravan park isolated by foot	Site management	• If evacuation has failed, and no local boats available, move to highest ground or building
		Communicating with authorities	• Call 000 for rescue
Sites begin to flood (6.0m locally, 6.7m Sackville)	Caravan park flooding	Communicating with authorities	• Call 000 for rescue