DISASTER RELIEF AUSTRALIA

PROJECT RESILIENCE

BIG MAP EXERCISE

CENTRAL COAST NEW SOUTH WALES

LOCAL GOVERNMENT AREA

Our Intent

"Project Resilience" is a system (like a community) which is used to monitor disturbance and still retain a basic function and structure. Building resilience means intentionally guiding the system's process of adaptation to preserve some qualities and allow others to fade away, all the while retaining the essence—or "identity"—of the system.

In a community, identity is essentially determined by what people value about where they live. However, what a community of people collectively value, is open to interpretation and subject to disagreement.

Although many resilience frameworks and tools for building community resilience are now available across Australia, no single approach will likely work for all communities and their varied social and economic contexts. Therefore, the Project Resilience Team has identified six foundations that, in our view, are essential—no matter where or how resilience-building efforts are undertaken, or which challenges are of most concern locally. The foundations support building community resilience, rather than achieving resilience as a fixed goal, to emphasise resilience building as an ongoing process.

How DRA Defines Resilience:

People: Resilient people are aware of situations, their own emotional reactions, and the behaviour of those around them. By remaining aware, they maintain control of a situation and think of new ways to tackle problems. In many cases, resilient people emerge stronger after such difficulties.

Making Sense: Making sense of a problem is essential for understanding the bigger picture. Making sense of things is a way to explore and develop effective future plans at a community level.

Bouncing Back: Resilient communities can bounce back from adverse situations. They can do this by actively influencing and preparing for economic, social and environmental change.

Striving Forward: As we look to the future, some challenges will be so big that it won't be possible for the community to simply adapt. Fundamental changes will be necessary, and the community will need to adapt.

Our Human Needs: A sustainable community is a place where people want to live and work, both now and in the future. The community needs of existing and future residents are sensitive to environment and contribute to a high quality of life. These communities are inclusive, well-planned, built and run, and offer equality of opportunity and good services for all.

Courage: Everyone within a community needs the courage to confront challenging issues and take responsibility for a collective future.

Based on: The Community Resilience Leader. Essential Resources for an Era of upheaval 2016

Executive Summary

Building resilient and adaptive communities in the context of a disaster event integrates prevention, preparation, response, and recovery which is a complex and continuous process, rather than a process with a definitive end point or 'destination.' The purpose of the 'Big Map' capability is to combine local knowledge with our disaster management expertise to better understand a community profile based on the community's exposure within an all-hazards environment[1]. There is widespread international recognition that engaging communities and supporting place-based solutions and approaches to disaster risk reduction generate system-wide benefits[2]. This will also allow for community input and buy in to their own disaster risk reduction and resilience.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management[3].

Disaster Relief Australia (DRA) in collaboration with the Minderoo Foundation's Resilient Communities Initiative and Allianz Australia Insurance conducted the Big Map exercise in the Central Coast Local Government Area, NSW 06 Oct 2023. Attendees included Local Government representatives, operational emergency management staff, key partners, and other stakeholders including representatives from community groups.

Within DRA, we believe a resilient community is one whose members are connected to one another and work together in ways that enable it to function, adapt, and thrive in the face of stress and trauma. A resilient community has the ability to adapt to changes in the physical, social, or economic environment, and the potential to learn from experience, build social capacity, and improve over time. A resilient community can also be self-sufficient, at least for a time, if external assistance is limited or delayed.

---

[1] https://disasterreliefaus.org/big-map/

2 National Action 20, Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf

[Retrieved 9 September 2023]

[3] Australian Disaster Resilience Glossary (aidr.org.au)

As communities are complex and dynamic social structures, levels of community resilience are not static. It is important that those utilising the concept of community resilience make efforts to regularly measure it. Everyone has a unique combination of capabilities and capacity to prepare, cope, and recover from disaster, which means they are vulnerable and resilient in different ways. Each level of society has aspects of resilience or vulnerability nested within it. Central to this is better understanding the systemic nature of risk and Australia's vulnerability[4].

The first step towards enhancing the resilience of a community involves understanding the community's strengths and vulnerabilities, as well as its physical characteristics (local infrastructure), procedural characteristics (e.g., disaster policies and plans) and social characteristics (e.g., level of community cohesion). Also involved in this process is the understanding of the hazards that the community or geographical area is most susceptible to, the risks that they create to the various environments, past events, and future hazard and climate forecast.

DRA Big Map in the National Strategic Setting

DRA Big Map is committed to working within the strategic context of Australia's overarching goals of achieving resilient communities and reducing disaster risk. Provided below is an outline of where we believe DRAs Big Map capability sits within, and meets the priorities, strategies, and outcomes of Australia's strategic level documents relating to the reduction of risk and the enhancement of resilience against the natural hazards that occur across our landscapes and impact communities.

By understanding first how the DRA Big Map can become a driver of these priorities, strategies, and outcomes, we can look to how to best utilise this capability in further assisting local communities to better play their own part in building a resilient Australia. This means building from the grass roots with everyday people, in their own backyard, to empower them to make their own difference from being informed, aware, and knowledgeable about what first makes them vulnerable and how this can be used to then build their capacity to not just cope, but thrive and adapt, in the face of adversity and change.

National Strategy for Disaster Resilience [5]

WHAT ACTION CAN WE TAKE?

As a nation we can lead change and coordinate effort, we must understand the risks and communicate them to all levels of the community; we must work with the people and organisations

---

[4] Risk reduction: A shared responsibility, The Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]
[5] National-Strategy-for-Disaster-Resilience (nema.gov.au)

that can implement the necessary changes and empower individuals and communities to exercise choice and take responsibility. This involves:

- Leading change and coordinating effort
- Understanding risks
- Communicating with and educating people about risks
- Partnering with those who effect change
- Empowering individuals and communities to exercise choice and take responsibility
- Supporting capabilities for disaster resilience

National Disaster Risk Reduction Framework[6]

National Priority 1: Understand disaster risk which relates to Sendai Framework priority 1: understanding disaster risk

STRATEGY A: Improve public awareness of, and engagement on, disaster risks and impacts

Greater awareness of the potential long-term and highly uncertain direct and indirect impacts of disasters on all sectors requires formal and informal education and community-driven engagement. An improved understanding of the systemic nature of disaster risk and what that means for all sectors, including communities, is critical.

National Priority 4: Governance, ownership and responsibility which relates to Sendai Framework priority 2: strengthening disaster risk governance to manage disaster risk

STRATEGY C: Support and enable locally led and owned place-based disaster risk reduction efforts

Where disaster risks are location-specific, governments and other relevant sectors should support local ownership and delivery of place-based disaster risk reduction and resilience measures.

Second National Action Plan [7]

Priority 1. UNDERSTAND DISASTER RISK

Outcome 1: An increased understanding of disaster risk across Australian society

National Action Plan: Create consistent, accessible information, tools, guidance and programs to help everyone better understand their disaster risk and responsibilities, prepare risk mitigation plans and take appropriate action to manage their risks.

Priority 2. ACCOUNTABLE DECISIONS

Outcome 4: More decision makers are informed, empowered and capable of reducing risk and building resilience

National Action Plan: Strengthen the capability and capacity of individuals and communities to become leaders and make informed risk reduction decisions relevant to their local contexts.

---

[6] National Disaster Risk Reduction (nema.gov.au)
[7] The Second National Action Plan to implement the National Disaster Risk Reduction Framework (nema.gov.au)

Priority 4: GOVERNANCE, OWNERSHIP AND RESPONSIBILITY

Outcome 8: Disaster management arrangements are inclusive, networked and aligned, supported by meaningful partnerships

National Action Plan: Form and encourage meaningful partnerships and support place-based, community-led, locally implemented, regionally coordinated approaches to disaster risk reduction, which ensure equity and inclusion across the system

Outcome 9: Increased recognition of shared ownership and responsibility for risk management

National Action Plan: Understand barriers and disincentives to risk reduction to ensure all in Australian society are empowered to exercise choice to reduce risk without disadvantage.

Disaster Relief Australia Resilience Process

The Disaster Relief Australia (DRA) Resilience Process comprises four stages, each of which are broken down into multiple steps. The DRA Resilience Process provides guidance to each Disaster Relief Team (DRT) across Australia. A future DRA Resilience Framework is currently being developed and will function to:

- Support Disaster Relief Team (DRT) Managers in the assessment and prioritisation of community-based resilience projects;

- Establish a consistent approach to recognising what levels of vulnerability may exist within the regional operating areas of each DRT;

- Guide, lead, and mentor the Minderoo Foundation in the development of strategic and detailed analysis of where future resilience projects may be required;

- With DRTs (Disaster Relief Teams) as the strategic lead, create a targeted approach to building resilience through clear principles for decision making and prioritisation of future resilience workshops and adaption that can be applied across the public, private and community sectors; and

- Recognise national and international disaster risk reduction, mitigation, and adaptation approaches, including the Sendai Framework for Disaster Risk Reduction.

The DRA Resilience Process

Increasing our knowledge and awareness of community vulnerabilities, strengthening our capability and capacity to provide relief when required, and tightening our community bonds are all key to DRA and the DRA Resilience Process. As an emerging area of culture and practice, DRA is leading the way in understanding, working with and empowering community-led discussions and community-based forums. For many DRA members, these forms of community-led discussions and forums are second nature due to their previous operational experience within the Australian Defence Force and consequent ability to assimilate risk and operational effectiveness on a battlefield. The Big Map discussion is based on a military wargame theory, serving as a tool for stimulating innovative thought. All the information utilised in the Big Map Capability is available through open sources.

Contents

Central Coast LGA Big Map – Understanding the Geographical Context

Drainage Division and River Region

The Australian continent is divided into topographical drainage divisions that are sub-divided into water regions and then into river basins (Figure 2). The data includes the name and number of each of the 245 basins / catchments, 77 regions, and 12 divisions. New South Wales (NSW) is divided into 45 river catchments, some of which encompass multiple Local Government Areas.
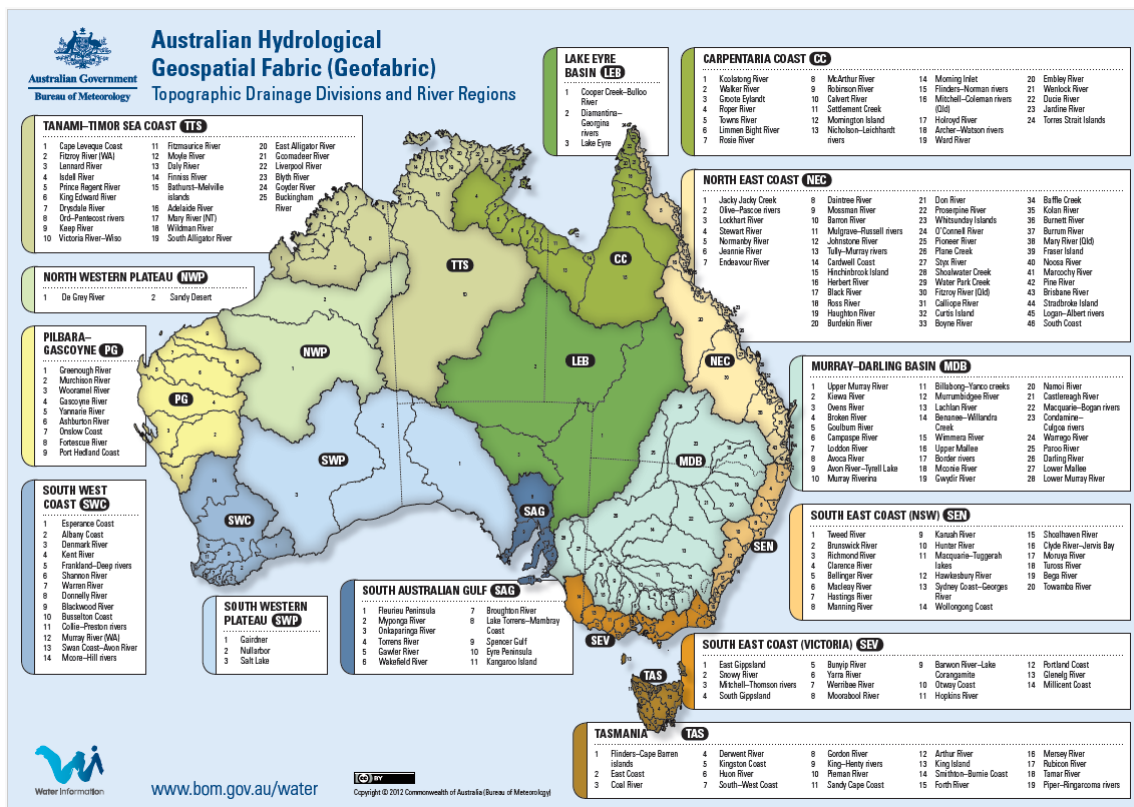
Figure 2: Topographic Drainage Divisions and River Regions of Australia

The Central Coast LGA is located in the South East Coast (NSW) Drainage Division Area 11 covering the Macquarie and Tuggerah Lakes. This area is bordered and influenced by both the Hunter and Hawkesbury River areas. The South East Coast Drainage Division is the very long, narrow area of southern Australia between the Great Dividing Range and the Coral and Tasman seas, and the Bass Strait. It includes the small part of south-eastern South Australia which lies to the east of the Murray-Darling Basin, and all coastal Victoria and coastal NSW. The distinguishing feature of the drainage division is the Great Dividing Range and the associated Australian Alps.

Bio-Region

New South Wales encompasses 18 unique bioregions across its landscape. The 18 bioregions found in NSW vary considerably in the types of natural values they contain, and although they all have some representation in protected areas, there is great variation in the extent of each reserved[8].

---

[8] Bioregions of NSW | NSW Environment and Heritage

The Central Coast is located within the Sydney Basin bioregion which covers a total of 3,622,939Ha (figure 3). It includes a significant proportion of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven River systems, all of the smaller catchments of Lake Macquarie, Lake Illawarra, the Hacking, Georges and Parramatta rivers, and smaller portions of the headwaters of the Clyde and Macquarie rivers. The climate is mostly temperate with warm summers and no dry season, with the coastal and Hunter regions being warmer than the higher plateaux and western edge.

Figure 3: The Sydney Basin bioregion.

There is more than 200 threatened animal and plant species in the Sydney Basin bioregion, including the critically endangered **Wollemi pine** (*Wollemia nobilis*) which only grows in a restricted part of the Wollemi National Park. National parks and nature reserves make up about 35% of the bioregion and the **World Heritage listed Blue Mountains** makes up over 1 million hectares of the Sydney Basin bioregion. The Ramsar-listed **Towra Point Nature Reserve** and **Hunter Estuary Wetlands** are in this bioregion.

Central Coast Local Government Area Context

Key Information Summary
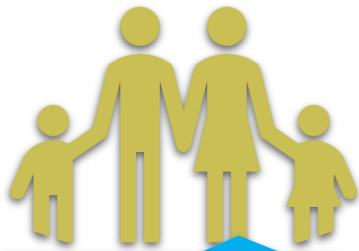
Population Estimate 343,180 with a 20% growth by 2035

Area of LGA - 1, 681km² Third largest urban area in NSW

Commercial Centres - Gosford, Wyong, Tuggerah, Lakehaven, The Entrance, Terrigal, Bateau Bay and Woy Woy

Climate Humid subtropical with warm summers and mild winters

Employment industries - Health Care Social Assistance, Construction, Retail Trade, Education Training, Accommodation, Food Services

Hazards Flooding - Flash, riverine, estuarine, tidal surge, Fire – Bushfire, urban fire, peri-urban interface fire, Extreme Heat events, Drought, East Coast Lows – potentially tropical lows

Major Connectors - Sydney - Newcastle Freeway (Pacific Motorway), Central Coast Highway, Northern Rail Line Corridor (Train Line)

The Central Coast is a peri-urban region in northern-eastern New South Wales, Australia. The region is situated about 90km north of Sydney. Covering 1, 681km², the LGA area is filled with subtropical national parks, forests and also encompasses the major coastal waterways of Brisbane Water, Tuggerah Lakes, and Southern Lake Macquarie. The main urban cluster of the region surrounds the northern shore of Brisbane Water and includes the Coast's largest population centre, Gosford, stretching east to the retail centre of Erina. Other major commercial "centres" on the Coast are Wyong, Tuggerah, Lakehaven, The Entrance, Terrigal, Bateau Bay and Woy Woy.

This region is the third-largest urban area in New South Wales and the ninth-largest urban area in Australia. Geographically, the Central Coast is generally considered to include the region bounded by the Hawkesbury River in the south, the Watagan Mountains in the west and the southern end of Lake Macquarie, lying on the Sydney basin.

Climate

The Central Coast has a humid subtropical climate with warm humid summers and mild winters. Rainfall is spread fairly evenly throughout the year but is slightly more frequent during autumn. Winter is the driest time, with often minimal to no rain.

Demographics

In 2021, the estimated population of this region was 343,180, with population forecasts projecting it will grow by more than 20 per cent to 415,050 by 2035.

Infrastructure

Health

The Central Coast has two large public hospitals with Emergency departments. Gosford Hospital is the largest with 460 beds, Wyong Hospital is located at Hamlyn Terrace and has 274 beds. Additionally, there is a small public hospital in Woy Woy and a Health Care Centre at Long Jetty.

The largest private hospital on the Central Coast is Gosford Private Hospital located at North Gosford. Brisbane Waters Private in Woy Woy, Tuggerah Lakes Private at Kanwal and Berkeley Vale Private are also major healthcare providers. The region has 21 aged care facilities. New South Wales Ambulance has seven ambulance stations on the Central Coast.

Transport

The Central Coast is serviced by an extensive and burgeoning road system. A combination of bus and rail provide limited public transport options for locals. Transport has been a constant issue for the region and has been cited as high a priority over the last 20 years in regional plans and priorities by local, state and federal government agencies, with incremental investments largely in road infrastructure.

Sydney - Newcastle Freeway (Pacific Motorway)

The main access to the Central Coast by road is by the Pacific Motorway.

Central Coast Highway

The roads that link Kariong with Doyalson (Pacific Highway, Dane Drive, Masons Parade, York Street, George Street, The Entrance Road, Oakland Avenue, Coral Street, Wilfred Barrett Drive, Budgewoi Road and Scenic Road) is the Central Coast Highway.

Wyong railway station

The western suburbs of the Central Coast are on the Main Northern railway line. The rail line is primarily used to provide mass transport for those that commute to Sydney and as such services are most frequent during peak commuter times.
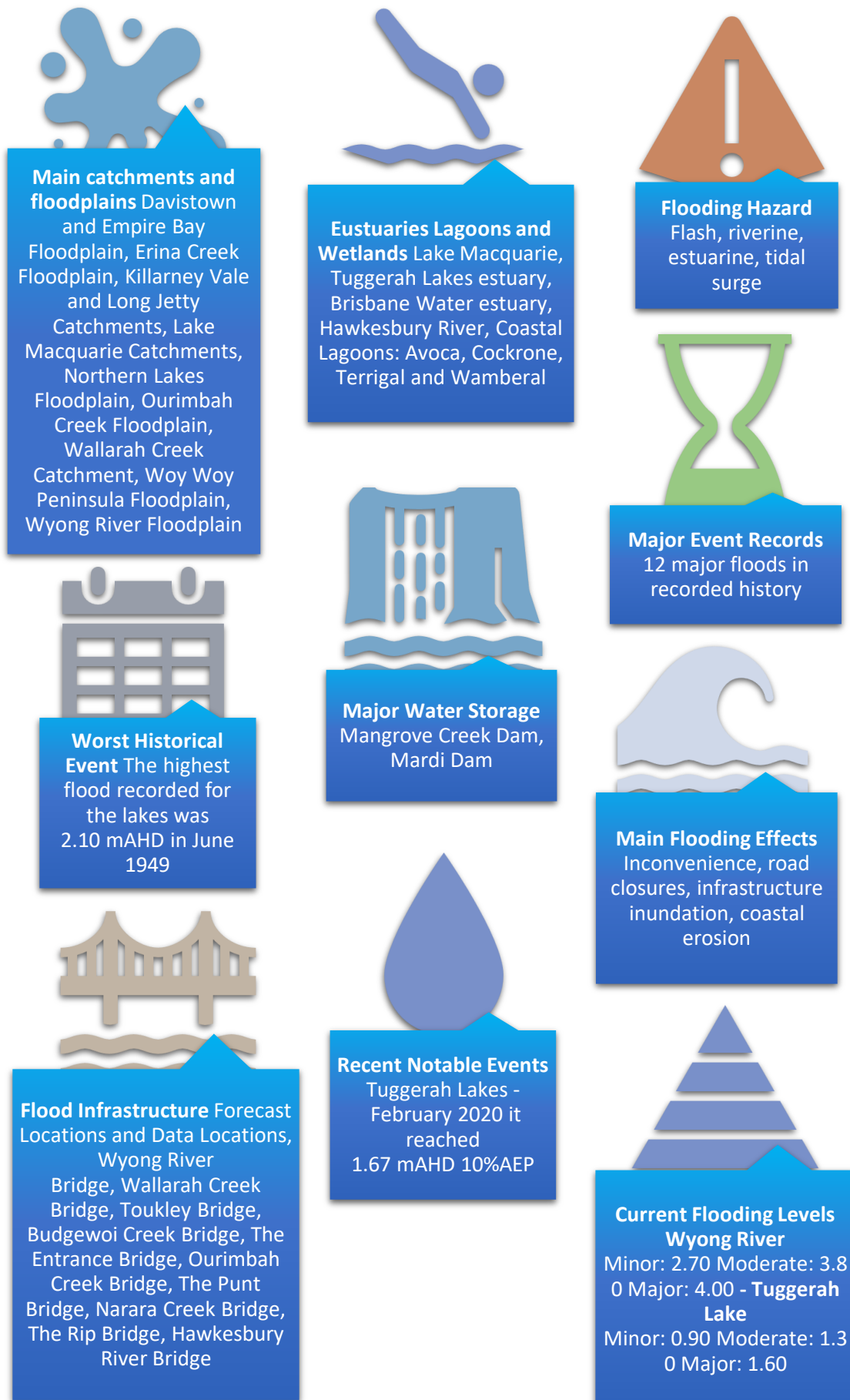
Bus

Bus services in the region are operated by Busways which has depots at Kincumber and Charmhaven, Red Bus Services and Coastal Liner.

Telecommunications

3G, 4G, and 5G mobile services are available from Optus, Telstra and Vodafone, though numerous black spots exist due to the topography and remoteness of some parts of the region.

Central Coast LGA Flood Context

Key Information Summary

Main catchments and floodplains Davistown and Empire Bay Floodplain, Erina Creek Floodplain, Killarney Vale and Long Jetty Catchments, Lake Macquarie Catchments, Northern Lakes Floodplain, Ourimbah Creek Floodplain, Wallarah Creek Catchment, Woy Woy Peninsula Floodplain, Wyong River Floodplain

Eustuaries Lagoons and Wetlands Lake Macquarie, Tuggerah Lakes estuary, Brisbane Water estuary, Hawkesbury River, Coastal Lagoons: Avoca, Cockrone, Terrigal and Wamberal

Flooding Hazard
Flash, riverine, estuarine, tidal surge

Major Event Records
12 major floods in recorded history

Worst Historical Event The highest flood recorded for the lakes was 2.10 mAHD in June 1949

Major Water Storage
Mangrove Creek Dam, Mardi Dam

Main Flooding Effects
Inconvenience, road closures, infrastructure inundation, coastal erosion

Flood Infrastructure Forecast Locations and Data Locations, Wyong River Bridge, Wallarah Creek Bridge, Toukley Bridge, Budgewoi Creek Bridge, The Entrance Bridge, Ourimbah Creek Bridge, The Punt Bridge, Narara Creek Bridge, The Rip Bridge, Hawkesbury River Bridge

Recent Notable Events
Tuggerah Lakes - February 2020 it reached 1.67 mAHD 10%AEP

Current Flooding Levels Wyong River
Minor: 2.70 Moderate: 3.8 0 Major: 4.00 **- Tuggerah Lake**
Minor: 0.90 Moderate: 1.3 0 Major: 1.60

Catchments and Floodplains[9]

Brisbane Water Floodplain/Foreshore

The Brisbane Water estuary is a wave dominated barrier estuary and tidal tributary of the Lower Hawkesbury River system. It is located approximately 50km north of Sydney within the City of Gosford Local Government Area (LGA).

Davistown and Empire Bay Floodplain

Davistown and Empire Bay catchments are sub-catchments of the Brisbane Water Estuary, which connects to Broken Bay, and are located in the Central Coast Council local government area (LGA).

Erina Creek Floodplain

Erina Creek has a catchment area of approximately 32 square kilometres to its confluence with Brisbane Water which exits into Broken Bay. Flood levels in the lower reaches of Erina Creek are influenced by flood levels in Brisbane Water. It is one of the major tributaries entering Brisbane Water at East Gosford.

Killarney Vale and Long Jetty Catchments

The Killarney Vale and Long Jetty catchments are located on the Central Coast of New South Wales and occupy a combined area of 8.8 km2. The catchments include the suburbs of Bateau Bay, Shelley Beach, Long Jetty, Killarney Vale and sections of The Entrance. The catchments drain into Tuggerah Lake. Killarney Vale and Long Jetty catchments as prone to overland flooding across the following suburbs:

- Killarney Vale
- Bateau Bay
- Shelly Beach
- Long Jetty
- The Entrance

Flooding has been experienced across both catchments on a number of occasions in the past including 1981 as well as more recently in 2007 and 2010.

Lake Macquarie Catchments

The area consists of a series of catchments within the northern end of the Central Coast Local Government Area that each drain into Lake Macquarie. These contributing catchments have a combined size of approximately 30km2 and include the suburbs of:

- Mannering Park
- Doyalson
- Doyalson North

---

[9] Strategies, Plans and Masterplans | Central Coast Council (nsw.gov.au)

- Kingfisher Shores

- Chain Valley Bay

- Lake Munmorah

- Crangan Bay

- Summerland Point

- Gwandalan

- Point Wolstoncroft

Northern Lakes Floodplain

The Northern Lakes catchments are located on the Central Coast of New South Wales and occupy a combined area of 33.5km2. The catchment is subject to overland flooding across suburbs immediately surrounding Lake Munmorah, Budgewoi Lake and the northern part of Tuggerah Lake, from Tuggerawong and Norah Head in the south to Lake Munmorah in the north

Ourimbah Creek Floodplain

The Ourimbah Creek catchment covers a total area of 160 km2.

Ourimbah Creek generally flows in an easterly direction through state forest and rural properties before passing beneath the Pacific Motorway and Pacific Highway near Palmdale. It continues to flow in a northern and then easterly direction, before passing beneath the Main Northern Railway Line and Wyong Road, eventually discharging into Tuggerah Lake at Chittaway Point.

Wallarah Creek Catchment

The Wallarah Creek catchment is located within the Central Coast Council LGA and occupies an area of 33 km2. The catchment comprises a mix of urbanised and rural land uses and includes the suburbs of Blue Haven, Wallarah and Bushells Ridge as well as part sections of Doyalson, San Remo, Charmhaven and Woongarrah. The catchment is drained by two major watercourses (Spring Creek and Wallarah Creek) as well as a number of unnamed tributaries which carry runoff in an easterly direction into Budgewoi Lake. The catchment is also home to major infrastructure including the Charmhaven wastewater treatment works.

Woy Woy Peninsula Floodplain

The Woy Woy Peninsula (the Peninsula) urban area is bounded by Brisbane Water to the north and east, Broken Bay to the south, and Brisbane Water National Park to the west. The Peninsula, including the Kahibah Creek Catchment, is generally a flat sand-plain
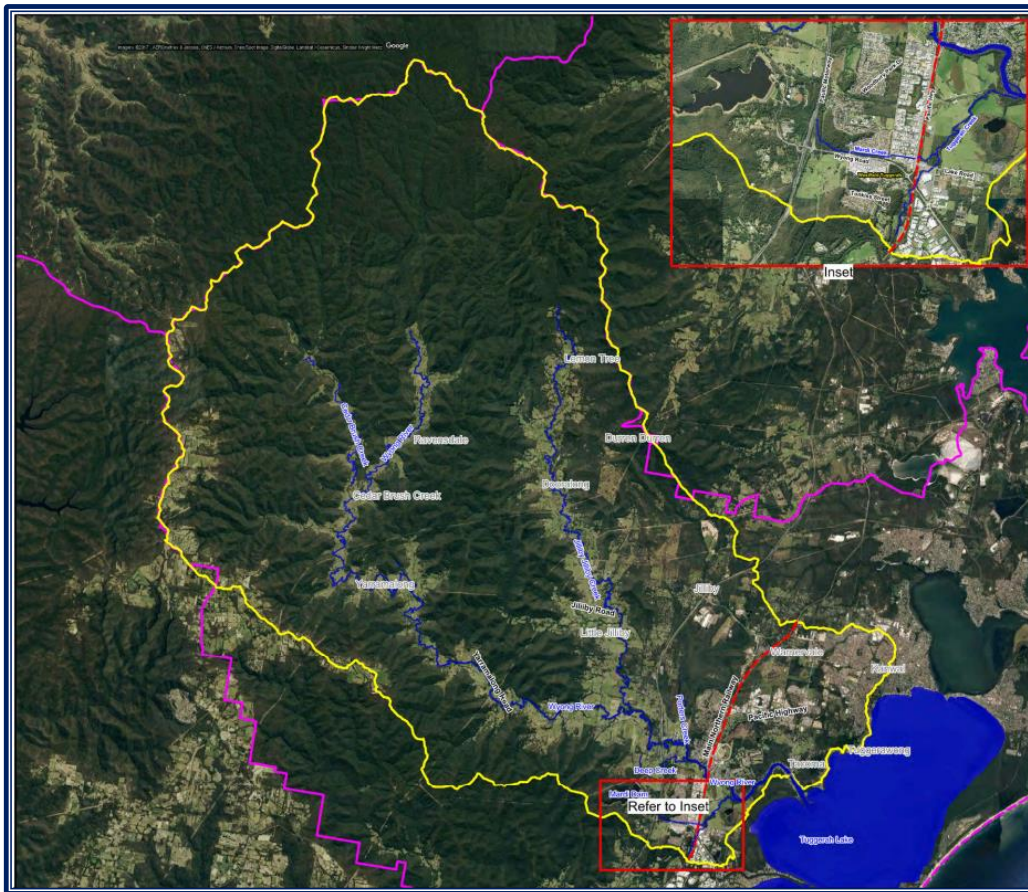
Wyong River Catchment[10]

Figure 4: Wyong River Catchment

The Wyong River catchment occupies a total area of 440 km2.

The catchment is drained by a network of rivers and creeks including Wyong River, Cedar Brush Creek, Jilliby Creek, Porters Creek, Mardi Creek and Deep Creek, which ultimately drain into Tuggerah Lake. Tuggerah Lake, in turn, discharges into the Pacific Ocean via a single outlet at The Entrance.

Estuaries, lagoons, and wetlands[11]

Within the Central Coast it is estimated there are about 870 hectares of mangroves, 190 hectares of saltmarsh and 1,780 hectares of seagrass. The Central Coast contains and is surrounded by a number of differing estuaries and coastal lagoons, from Lake Macquarie in the north to the Hawkesbury River in the south. Each system contains important ecosystems and is unique in terms of its ecology, biodiversity and management requirements.

Lake Macquarie

Lake Macquarie is a natural estuarine lake with an area of some 110 square kilometres and a catchment of about 600 square kilometres. Approximately 15% of the catchment is located within the Central Coast Council area including the suburbs of Mannering Park, Kingfisher Shores, Chain Valley Bay, Summerland Point, Gwandalan, Point Wolstonecroft and Crangan Bay.

---

[10] Floodplain management | Your Voice Our Coast
[11] Estuaries, lagoons and wetlands | Central Coast Council (nsw.gov.au)

Tuggerah Lakes estuary

The Tuggerah Lakes estuary is a unique environment rich in biodiversity. Over the years, the natural function and condition of the estuary has been influenced by many different human activities around the foreshores and throughout the catchment.

Coastal Lagoons

There are four lagoons on the Central Coast which discharge directly into the Pacific Ocean -Avoca, Cockrone, Terrigal and Wamberal.

The lagoons are characterised by sand berms that naturally control the entrance conditions.

The Central Coast's four coastal lagoon systems (Wamberal, Terrigal, Avoca and Cockrone) are a significant geographic feature of the region. They are a highly valued natural resource and support a network of significant ecological communities as well as a diverse range of recreational uses.

Brisbane Water estuary

Brisbane Water is a wave-dominated barrier estuary. The water has its origin at the confluence of the Narara and Coorumbine Creeks, to the south–east of Gosford, and travels for approximately 18 kilometres in a southerly direction to its mouth at Broken Bay, about seven kilometres from the Tasman Sea, at Barrenjoey Head.

Hawkesbury River

The Lower Hawkesbury Estuary Management Plan provides strategic management for the estuary from Wisemans Ferry to Broken Bay, excluding Pittwater and Brisbane Water. Collaboratively developed by Hornsby Shire Council and the former Gosford City Council, the plan includes timeframes, costs, responsibilities, measurables and other information related to each of the strategies.

Flood Terminology and Information

River Guage Information

Forecast location is a location for which the Bureau provides a forecast of future water level either as the class of flood that is predicted (minor, moderate or major) or as a level and class

Information location is a location at which flood classifications are defined and observations of water level data are provided.

Data location is a location for which just the observed water level data is provided.

Flood Extents

Annual Exceedance Probability (AEP)

The probability of a specified magnitude of a natural event being exceeded in any year. The likelihood of a flood reaching or exceeding a particular magnitude. A 1% (AEP) flood has a 1% (or 1 in 100) chance of occurring or being exceeded at a location in any year.

Probable Maximum Flood (PMF)

The most severe flood that is likely to occur at a particular location. Such a flood would result from the most severe combination of critical meteorological and hydrological conditions

Flood Warnings

Flood Watch issued to advise of possible future flooding if the rain forecast suggests it may happen in the next few days.

Flood Warning issued when flooding is expected in a particular location or catchment.

Flash flooding happens less than six hours after rainfall. When flash flooding is expected, we issue a Severe Weather Warning.

Flood Classifications

Minor flooding causes inconvenience. Low-lying areas next to water courses are inundated.

Moderate flooding in the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may be affected above floor level.

Major flooding extensive areas are inundated. Many buildings may be affected above floor level. Properties and towns are likely to be isolated and major rail and traffic routes closed.

## Flood and Water Data Collection

The Bureau of Meteorology

The Bureau of Meteorology (the Bureau) provides generalised, qualitative or quantitative flood predictions for agreed flood forecast locations across Australia. Information on flood conditions, heights and classifications are provided as per the 'Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13.[12]

The Bureau's flood forecasting, and warning services are provided within the context of the Total Flood Warning System as defined in the 'Australian Emergency Manuals Series, Manual 21 Flood Warning' (Australian Government, 2009 and illustrated below)[13]:

---

[12] http://www.bom.gov.au/nsw/NSW_SLS_Current.pdf
[13] https://knowledge.aidr.org.au/media/1964/manual-21-flood-warning.pdf
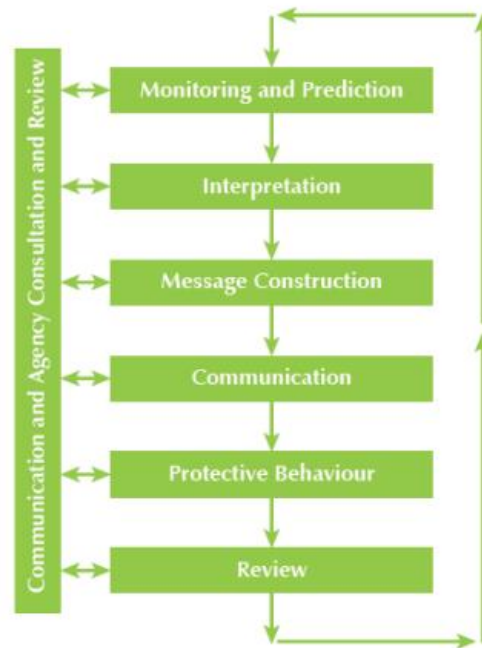
The components of the Total Flood Warning System (Australian Emergency Manual Series, Manual 21 Flood Warning, Australian Government 2009)

Figure 5: Total Flood Warning System components.

The collection and publishing of rainfall and river level data is an important component of the overall service. Apart from use by the Bureau for data analysis and its hydrological modelling for flood predictions, the data is also used by the emergency service agencies, numerous operational agencies, businesses, and the public to monitor rainfall and river conditions. To assist in describing the service, the locations where river height; dam, weir, or lake level; and tidal observations are made are categorised into three types; namely forecast location (Schedule 2), information location (Schedule 3a and 3b) and data location (Schedule 4).

The Bureau monitors the catchments and rivers within the Central Coast LGA through several different monitoring stations and publishes this information on its website[14]. The below figures show the river gauge monitoring stations with the Central Coast and the information that they display.

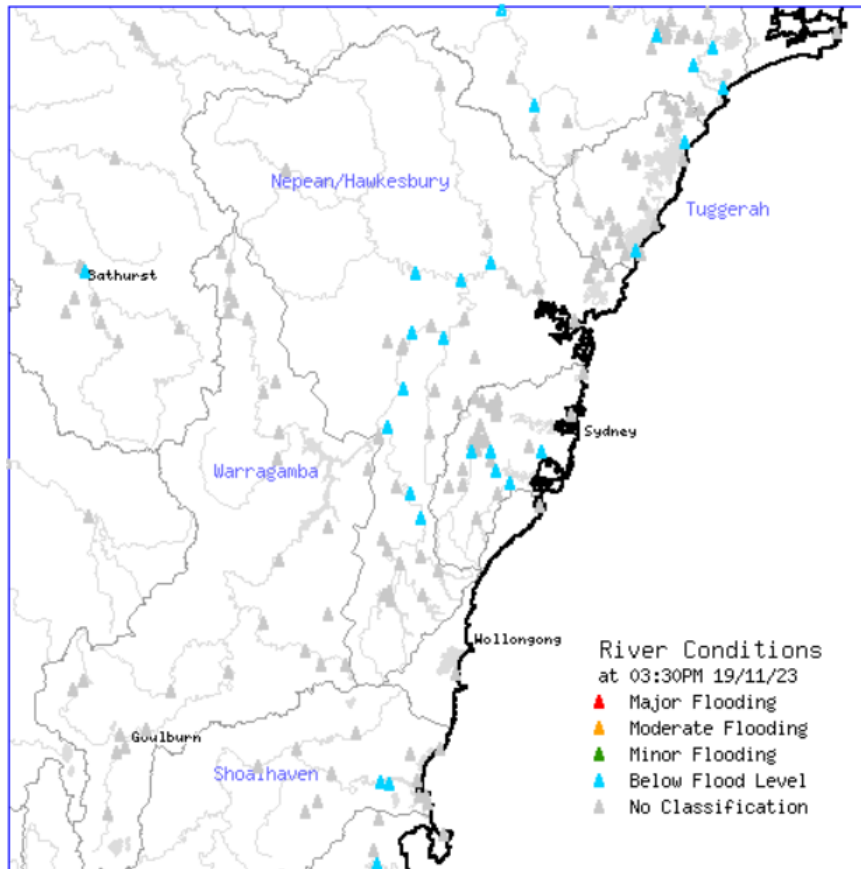[14] Central Coast Rainfall and River Conditions (bom.gov.au)

Figure 6: Flood height locations within the Central Coast LGA.

As seen in figure 6, the blue triangles identify minor, moderate, and or major flood heights at set locations within the catchment.

The river height data is real-time operational data from automated telemetry systems as seen in figure 7. Most river height data is provided to the Bureau by other agencies.
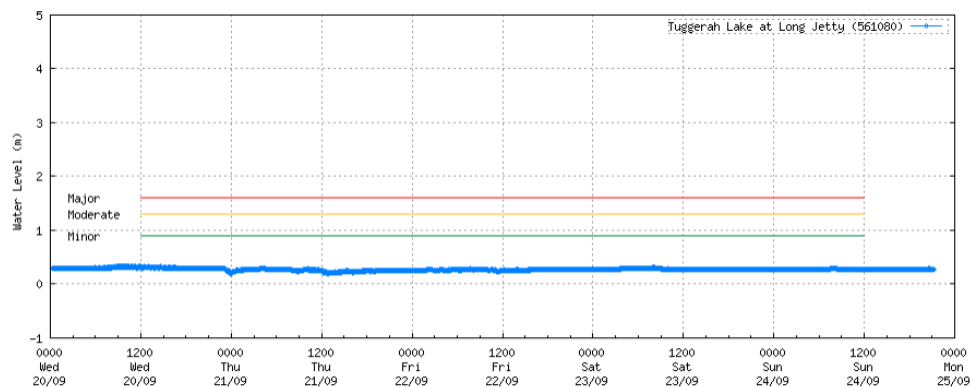

Figure 7: River height data displaying minor, moderate, and major flood levels.

Government and Stakeholders Involvement in Flood Management

Flooding results in significant risk to many communities across New South Wales. This risk stems from human interaction with flooding through the occupation and use of floodplains.

Since 1984 the NSW Flood prone land policy (the policy) has set the direction for flood risk management (FRM) in New South Wales. In 1986 the NSW Government released the first Floodplain Development Manual to support policy implementation. The policy and manual have since evolved in response to significant flood events, reviews, and improvements in national and international flood risk management practice.

On 30 June 2023, the NSW State Government Department of Planning and Environment released the newly revised Flood Risk Management Manual[15]. This Manual provides for the development and implementation of sustainable strategies for managing human occupation and use of the floodplain, in accordance with section 733 of the *Local Government Act 1993* (LG Act). It provides for the evaluation of strategies and formulation of plans that achieve effective flood risk management outcomes accounting for social, economic, ecological, and cultural factors, together with community aspirations for the use of flood prone land.

The new Manual (including the policy) replaces the Floodplain Development Manual (DIPNR 2005) as the NSW Government's manual relating to the management of flood liable land. This provides councils, statutory authorities, and state agencies and their staff, with indemnity for decisions they make and information they provide in accordance with the manual.

Other related documents include:

- Administration Arrangements guideline AG01
    - This guideline provides supplementary advice to the Flood Risk Management Manual. It outlines the current guidance and tools in the flood risk management toolkit to support councils to understand and manage flood risk through the flood risk management framework. It also provided advice on current state agency flood risk management roles and responsibilities, relevant legislative links and a glossary of additional terms used in guides in the toolkit.
    - https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-guide-administration-arrangements

- Delivery under the flood risk management framework FG01
    - This guideline describes delivery of the flood risk management framework as well as key steps in undertaking flood risk management projects under the flood risk management process and identifies how other flood risk management guides and tools can assist.
    - https://www.environment.nsw.gov.au/research-and-publications/publications-search/delivery-under-the-flood-risk-management-framework

- Understanding and Managing Flood Risk FB01

---

[15] 2023 Flood Risk Management Manual, https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual

- o This guideline provides advice on how the flood risk management process can assist in understanding and managing existing, future, and continuing risk to reduce the residual risk to the community.
  - o https://www.environment.nsw.gov.au/research-and-publications/publications-search/understanding-and-managing-flood-risk

- Flood Function FB02
  - o This guideline provides advice on the categorisation of areas of the floodplain into floodways, flood storage areas and flood fringe based on their flood function. This information can inform flood risk management, emergency management and land use planning.
  - o https://www.environment.nsw.gov.au/research-and publications/publications-search/flood-function

- Flood Hazard FB03
  - o This guideline provides advice on flood hazard categorisation so this information can inform flood risk management, emergency management and land use planning.
  - o https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-hazard

- Flood Risk Management Measures MM01
  - o This guideline aims to support effective consideration and decision-making for recommendation of flood risk management measures as part of the flood risk management process.
  - o https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-measures

- Support for Emergency Management Planning EM01
  - o This guideline provides advice on how the flood risk management process can provide advice to support flood emergency management planning by the NSW SES.
  - o https://www.environment.nsw.gov.au/research-and-publications/publications-search/support-for-emergency-management-planning

- Flood Impact and Risk Assessment LU01
  - o This guideline provides advice on the scope and scale of a flood impact and risk assessment. It does not replace the processes or requirements of the consent authority. It should be read in conjunction with and address any other assessment requirements for the development proposal/application.
  - o https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-impact-and-risk-assessment

The management of flood risk in NSW is a partnership across governments, with local government generally leading FRM in their LGA. The NSW Government provides councils with technical and financial support for eligible FRM activities under the FRM framework under funding programs. Funding applications are considered on a statewide priority basis. The NSW Government may consider taking on an expanded role in high priority areas.

The NSW Government also has an expanded FRM role in regional planning and in specific rural areas of the Murray–Darling Basin, as outlined in Section 5.2.3. The development of rural floodplain

management plans in these specific areas is led by the NSW Government. It generally follows a process similar to the FRM process but differs in focus.

Central Coast LGA Fire Context

Key Information Summary

Vegetation Types Dry sclerophyll forest (shrubby), dry sclerophyll forest (shrub/grass), wet sclerophyll forest (shrubby), wet sclerophyll forest (grassy), with pockets of rainforest, heathlands, forested and saline wetlands

Ignition Types Illegal burning activity, Escapes from legal burning, Arson & Incendiarism, Ignition of abandoned/stolen motor vehicles, Lightning, Arching electrical power lines

Average Fire Incidents Per Year 843 bush and grass fire incidents per year

Major Incidents Per Year 6 to 8 on average per year can be considered to be major fires

Last Major Incident 2019-20 Bushfires – 10% of the LGA was burnt

Problem Areas An increase in construction within the peri-urban interface

Main bushfire body Central Coast Bushfire Management Committee - Bushfire Risk Management Plan Current as at 2020

Under the Rural Fires Act 1997 the Bush Fire Coordinating Committee (BFCC) must constitute a Bush Fire Management Committee (BFMC) for each area in the State, which is subject to the risk of bush fires. Each BFMC is required to prepare and submit to the BFCC a draft Bush Fire Risk Management Plan (BFRMP)[16]. A BFRMP is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency treatments to reduce the risk of bush fire to the assets. Treatments may include such things as hazard reduction burning, grazing, community education, fire trail maintenance and establishing community fireguard groups.

The Central Coast BFMC area is located on the coast of New South Wales, north of the Sydney and south of the Newcastle. The Central Coast BFMC includes the combined Local Government Areas (LGA) of Central Coast Council and Lake Macquarie City Council. There are considerable State Forest and National Parks within the BFMC area.
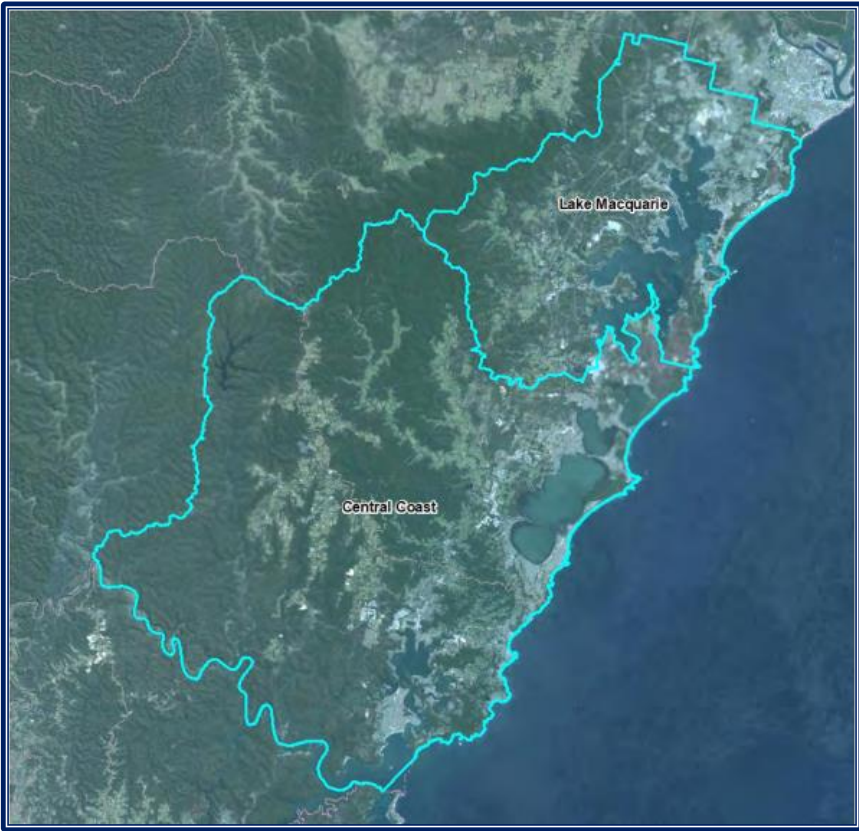

Figure 8: Central Coast BFMC

The total area covered by the Central Coast BFMC is 243,800 hectares (2,438km2). The area covered by the Central Coast Council LGA is approximately 168,100 hectares (1681km2).

Land Manager	% of BFMC area
National Parks & Wildlife Service	25%

---

[16] Model Bush Fire Risk Management Plan 2008 (nsw.gov.au)

Forests NSW	17%
Department of Lands	3%
Local Government	5%
Private	47%
All other	3%

Table 1: Land Tenure – Central Coast Council LGA

Bushfire climate, season, landscape, and history

The climate overall is cool temperate with predominately summer rainfall. The coastal strip is dominated by local coastal weather patterns (predominant coastal winds) and the western areas can be slightly warmer, drier and less humid, often influenced by wider wind systems. The bush fire season generally runs from August to March. Prevailing weather conditions associated with the bush fire season in the Central Coast BFMC area are associated with coastal conditions, and more generally north-westerly winds accompanied by high daytime temperatures and low relative humidity. There are also occasional dry lightning storms occurring during the bush fire season.

Central Coast and Lake Macquarie LGAs contain natural bushland surrounds, State Forests and National Parks. The vegetation in the Central Coast BFMC area dominant vegetation types are: dry sclerophyll forest (shrubby), dry sclerophyll forest (shrub/grass), wet sclerophyll forest (shrubby), wet sclerophyll forest (grassy), with pockets of rainforest, heathlands, forested and saline wetlands.
The area contains key significant economic infrastructure such as electricity power stations and transmission lines, gas pipelines, telecommunication towers, agriculture, coal mines, and industrial spanning across the area. The area contains key State and Federal transport infrastructure including the M1 Pacific Motorway (127km) and northern rail line corridor, used primarily as a transport route from Sydney to Brisbane. Population growth has driven migration patterns and residential expansion into the region due to demand from metropolitan Sydney and housing affordability. Tourism is an increasing contributor to the area, with visitors seeking recreational activities at local beaches, lakes, parklands and National Parks.

The Central Coast BFMC area has on average 843 bush and grass fire incidents per year, of which 6 to 8 on average per year can be considered to be major fires. The main sources of ignition in the Central Coast BFMC area are:

- Illegal burning activity
- Escapes from legal burning
- Arson & Incendiarism
- Ignition of abandoned/stolen motor vehicles

- Lightning
- Arching electrical power lines.

Why do bushfires occur?

Bushfires can be started by natural causes, such as lightning strikes, or by people (accidentally or on purpose). Weather conditions and fuel conditions play a part in bushfires happening.

Materials such as leaf litter, bark, small branches and twigs, grasses and shrubs can provide fuel for bushfires. The type of fuel that is available to burn, how much of it there is, and how dry or moist it is will influence bushfire conditions. Dry fuel is more likely to catch fire and burn easily; damp or wet fuel may not burn.

Hot, dry and windy weather can contribute to fire danger. Specifically, weather-related factors that contribute to an increased risk of bushfire danger include:

- High temperatures
- Low humidity
- Little recent rain
- Abundant dry vegetation
- Strong winds
- Thunderstorms

What are the risks?

Bushfires can cause serious property and infrastructure damage and lead to loss of life. The fire itself is only one element of the danger. Other impacts from bushfires include the effects of radiant heat and smoke.

- Fire embers can spread many kilometres from the location of a large bushfire, causing smaller spot fires to break out.
- Radiant heat can be felt more than 100 metres away from a large bushfire and has the potential to melt or fracture objects including parts of cars, glass windows, etc.

Toxic fumes and heavy smoke produced from bushfires can impair vision and impact on air quality and create difficulties in breathing. Due to the unpredictable nature of fast-moving fires, people are likely to be encouraged to evacuate from their homes as quickly as possible to ensure they are able to reach safety. It is important to follow any local alerts and warnings.

The Big Map Exercise

Purpose:

Building resilient communities in the context of a disaster event integrates prevention, preparation, response, and recovery is a complex and continuous process, rather than a process with a definitive end point or 'destination.' The purpose of the 'Big Map' capability is to combine local knowledge with our disaster management expertise to better understand a community profile based on the community's exposure within an all-hazards environment[17]. There is widespread international recognition that engaging communities and supporting place-based solutions and approaches to disaster risk reduction generate system-wide benefits[18].

By understanding how, when and where this region is impacted by flood and fire is vital to those who live here; not just for safety, but for protecting livelihoods, property, and people. Businesses operating within the region also need to know how their business might be impacted, to make risk-informed investment and operational decisions in line with future Local Council objectives.

Managing flood and fire risk is a cooperative and coordinated effort between all sectors of the community including individuals, businesses, non-government organisations and governments. The Big Map Capability aligns with steps contained in the 'Second National Action Plan to implement the National Disaster Risk Reduction Framework', aimed at increasing inclusive and diverse community representation, participation, and access to the disaster management system.

Method:

Disaster Relief Australia (DRA) in collaboration with the Minderoo Foundation's Resilient Communities Initiative and Allianz Australia Insurance conducted the Big Map exercise in Macleay Catchment, NSW on 27 and 28 July 2023. Attendees for 27 July 2023 included Local Government representatives, operational emergency management staff, key partners, and other stakeholders. A second Big Map exercise was conducted on 28 July 2023 and members of the community were invited to attend.

The DRA End state:

Locally led and regionally coordinated resilience solutions will always address recent and emerging disaster risks and provide pathways for improving community resilience over time. Flood waters do not respect boundaries. Therefore, it is critical to investigate ways we can better prepare for the future and keep our communities safe by coordinating efforts, sharing knowledge and capability, and setting a proactive agenda for improving resilience over time. It is important to integrate undervalued or non-traditional forms of knowledge and ways of knowing, including traditional knowledge, local knowledge, community feedback, lived experience and transdisciplinary approaches such as sociology, and support the use of scenarios which extend the imagination.[19]

---

[17] https://disasterreliefaus.org/big-map/

[18] National Action 20, Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf
[Retrieved 9 September 2023]

[19] The Second National Action Plan to implement National Disaster Risk Reduction Framework, August 2023 https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf

05 October 2023 – Central Coast Council and local emergency service stakeholders

The discussion on the map commenced with talking about what community resilience looks like, and what the characteristics of a resilient community were. General answers included connected communities, understanding risk, knowing what can happen allows for planning, how a community bounces back, range of information access, and social capital.

In the National Strategy for Disaster Resilience[20], they offer the following characteristics of a resilient community, which was presented to the stakeholder group:

- functioning well while under stress
- successful adaptation
- self-reliance, and
- social capacity.

Resilient communities also share the importance of social support systems, such as neighbourhoods, family and kinship networks, social cohesion, mutual interest groups, and mutual self-help groups.

This was talked about as being the foundation for which the map discussion would be conducted, from the perspective of community, and community members, and how the information can be collected and shared. This will assist in developing an informed and aware community environment.

Also spoken about in the group was the compounding nature of natural hazard events and the cascading effects they have had on the community. This has left members exhausted with a heightened sense of anxiety along with awareness of the damage natural events can cause to homes and other infrastructure.

The bigger picture of where the discussion on the Big Map was also presented. By outlining where the Big Map sat within and met the strategies, policies, and outcomes from the National Strategy for Disaster Resilience, National Risk Reduction Framework, and the Second National Action Plan for Risk Reduction allowing participants to gain an understanding of how the Big Map can assist them doing the same.

Climate Discussion

A conversation around the climate outlook was had prior to discussing the two main natural hazard threats of flood and fire. The main points were made around the declaration of the El Nino as well as the negative Indian Ocean Dipole that has been forecasted by the BoM. Discussions from this highlighted that the coming seasons, particularly summer, was going to be warmer and drier than most previous years on record and the implications of this to the Central Coast LGA. Some of these implications related to east coast lows (possible tropical lows), coastal erosion, storm surge with outward river flows, and increased high fire danger days being potentially exacerbated in severity, frequency, extent, and duration. Also spoken about was extreme heat events, what the implications were to prolonged and higher than normal day and nighttime temperatures meant and those events, namely fire, that proceed heatwaves of various intensities.

---

[20] National-Strategy-for-Disaster-Resilience (nema.gov.au)

Discussion then moved to how the local landscape looked, what changes had been observed in the last 12 months, and also compared to the 2019/20 fire season and 2020 flood events. It was noted in particular there was a higher landscape fuel load.

Other general discussion points were related to new members of the community who do not have local knowledge, which diminishes social capacity, communications across the LGA in emergency events is poor due to half not having access to radios, and that external emergency management assistance also causes issues with community members.

Figure 9: Walking the Big Map during the flood discussion.

Flood Discussion

From the start of the first activity, facilitators highlighted the importance of a 'catchment response' to flood preparation, monitoring, and response events. The catchment response sees all partners and stakeholders working together to prepare for flood events, with appropriate mitigations to prevent damage to infrastructure and loss of life, monitoring for the likelihood of a flood event, and then taking evacuation actions accordingly.

Floods are a natural part of the Australian landscape. Floods vary greatly in size, extent, duration, and frequency. No two floods are the same and as such, can have different impacts. Sudden, heavy, and intense rainfall can cause floods to quickly rise in the minutes or hours that follow. These are known as flash floods and are typically associated with small catchment areas. Floods can occur slowly in large catchment areas, where rainfall can build up over hours, days, or weeks. The runoff from this rainfall may create significant floods that inundate large areas of land for days, weeks or months.

Through data collection and analysis, council administrators, hydrologists, engineers and planners identify and delineate those areas likely to be exposed to flood waters and where possible mitigate the impacts of future floods. Therefore, a flood prediction and or warning is of little value unless the community understands what it means with regards to the impact and what they need to do in response to their individual situation.

The flood discussion commenced by getting situated on the map, with attendees invited up to walk on the map and orientate themselves. The main creeks and rivers were outlined and identified from the creeks that empty into the northern lakes and Brisbane Water, thought to the lower lakes and lagoons, followed by the Hawkesbury River bordering the LGA to the south.

Flood infrastructure such as Mangrove Creek Dam, which last reached capacity in 2022 for the first time in its history and Mardi Dam, used to augment water supply back to Mangrove Dam as required along with bridges and gauging locations were located and spoken about. Different flood event types such as catchment flooding, coastal flooding, flash flooding, and a combination of these events were spoken to along with past effects and how they were planned for and managed.

Also discussed were the last major flooding events in the LGA in 2020 and the implications of these events to the wider community. From this discussion points raised by attendees included the following:

- Mangrove Creek and Hawkesbury River communities who although have a small population size were heavily impacted by the flooding;
- The main impacts were caused from the back waters backing up, not necessarily the water from the creek itself;
- Trusted sources of information during a flooding event were from the BoM, NSW SES, and news radio;
- The council admitting that although communications need improving, they are getting better at being timely and accurate with public info and warnings;
- Community expectations of the emergency services such as the NSW SES are high and it is expected that they will be there when needed, however it needs to be better communicated that this cannot always be the case;
- Emergency services augmented from out of the region need to rely on local knowledge better, which needs to become a larger part of information sharing and induction when they first report for their duties;
- It was highlighted that both the BoM, and the SES do fail sometimes in what is expected of them and this was in large due to constraints put upon them by outside influences;
- Lessons learned need to be collated, analysed, interpreted, and form part of future planning for flood events.

A lot of time during the flood discussion was based around the lower Mangrove Creek, Hawkesbury River, and Spencer. Issues and points raised by the representative of that local area were heavily discussed between all stakeholders, particularly council and SES representatives with an agreement that a closer working relationship and collaboration on planning and information sharing was required for best outcomes for the largely elderly and isolated community located in this area.

Flood Scenario Exercise

A flood scenario exercise was undertaken on the Big Map, with a number of injects that were discussed as they were added with actions on, response mechanisms, and information sharing all brought up by the stakeholders present. The scenario first started with an east coast low becoming stationary over the main catchment areas of the Wyong River and Ourimbah Creek. These falls were predicted to cause major flooding effects through these areas and into Tuggerah Lakes. Roles and responsibilities for stakeholders were discussed and trigger points for the enactment of local plans and public warnings and info. The next inject surrounded the low-pressure system moving into the

Mangrove Creek Dam area where there were reports of water up to six metres above the spillway flowing into Upper, Middle, and Lower Mangrove Creek and what that could mean for the community in those areas considering the previously discussed elderly demographic that is remote and can become quickly isolated. Moving back up to the northern area of the LGA an M1 closure was the next inject and discussion was made around alternative supply routes and transport corridors and how this was to be communicated to the wider public. Other injects included utilities failure, localised flooding, power failure and evacuations of urban areas and the Wyong Public Hospital.

Overall, the stakeholders in attendance were able to talk through all of the scenario injects, identify roles and responsibilities, draw on previous lessons learned, and the plans that would be required to be enacted and followed during the various compounding events. There were aspects of discussion during the scenario that raised some unknowns and identified some gaps that require further stakeholder engagement post the Big Map exercise.

Fire Discussion

Fire is an integral part of our environment. It is essential for the growth and reproduction of many natural systems and the health of Country but altered fire regimes are a threat to ecosystem health.[21]

Fire has been present on the Australian continent for millions of years and is a key factor in the dynamics of plant and animal populations in most NSW ecological communities. Many Australian plants and animals have evolved to not only survive but also benefit from the effects of fire. Much of the flora of NSW depends on fire to assist in its reproduction and growth.

The fire discussion commenced with a talk from the regional NSW RFS Commander who provided an in-depth and informative break down of the regions fire threats, what has and continues to be done in bushfire mitigation and preparedness, future outlooks and projects, implications from past events, and forecasted fire conditions moving into the months ahead.

Also spoken to was the fire history regarding the 2019/20 fire season where 10% of the LGA was burned, the recently released AFAC seasonal outlook highlighting an increased bushfire risk compared to previous seasons, and further discussion regarding the change in climate and landscape over the last few years.

Fire behaviour and how plant and vegetation type influence its intensity was a topic raised and related back to the knowledge of what plant and vegetation types people have in their own yards, what is in their neighbours' yards, and also what is located at an increasingly growing peri-urban interface.

The main talking points and concerns raised by attendees were as follows;

- Fire trails are challenging, after three years and a lot of rain most of the file trails are degraded and it will cost millions of dollars to fix and manage this issue;
- Access is an issue with gates stolen and damaged, stolen gates allow entry to people who use these areas for illegal dumping which causes its own risks;

---

[21] https://www.soe.epa.nsw.gov.au/all-themes/land/fire#:~:text=Fire%20has%20been%20present%20on,from%20the%20effects%20of%20fire.

- There needs to be a change in the behaviour and mindset of communities and there needs to be collaboration with First Nations to educate and cultural burning;
- There needs to be education around the difference between Cultural Burns and hazard reduction burning; and
- Community seems to have forgotten what fire can do, i.e., in the Fagans fire the M1 motorway will not stop extreme fires.

Fire Scenario Exercise

After these main points were discussed, a fire scenario exercise was conducted. This was undertaken by inputting catastrophic fire weather conditions in the NSW RFS Pocketbook mobile application and a fire breaking out in the bushland near the Coorumbine Fire Trail and threatening the residential area immediately to the east of the point of ignition and main fire front as resulted from the pocketbook app outputs of rate of spread, flame height, and spotting distance. From this point a response scenario with NSW RFS, NSWPOL, NSW SES, and local government was discussed. Major risks to the community were highlighted and how these risks could be reduced with further mitigation and prevention activities were spoken about. Points of access and egress, ember attack hazards, public information and warnings, expectation management, evacuations, and recovery aspects were also discussed. This highlighted the importance of this exercise whilst being able to step it through on the Big Map, giving a bigger picture perspective of such an incident that would be classed as a major bushfire event for the area.

Critical Infrastructure Exercise

A central part of the Big Map exercise is the identification of key infrastructure. Local Government and key stakeholders were asked to place a white sticker on what they believe to be is key infrastructure within the LGA as seen in figure 10. In relation to this, it is important to also understand the interconnectedness of all things within the community environments. Figure 11 below highlights the interdependencies of critical infrastructure post an event impact. Any number of isolated events can quickly cascade into others, compounding the effects of an event.

The following infrastructure groups were identified by the participants as outlined in the table below.

Landfill	Gas Plant	Charmhaven Depot
Fire Control	Wyong Hospital	Sewerage Treatment Plant
Power Station	Mardi Dam	Water Treatment Plant
Main Transport Corridors	Police	SES HQ
Animal Evacuation Point	Flood Gauge	Gosford Hospital
Erina Depot	Woy Woy Road	Railway
Bridges	Ferry Service	Schools
Medical Centres	Pharmacies	Cultural/Historical Landmarks
Electrical Grid/Substations		

Table 2: Critical infrastructure identification exercise results.

Once this was completed, the attendees were then given a situation where it is now 24 – 72 post an event impact where response was still occurring and recovery was underway. They were then tasked to place red dots on those pieces of infrastructure/important places on the Big Map. It was of note that for the most part the red dots matched the white dots that were already on the map from the first part of the exercise. There were minor discrepancies as far as there was like infrastructure within

the LGA, such as wastewater treatment plants, that were originally identified, but not all locations. As such these were identified in the post impact part of the exercise.

Overall, the stakeholders present had a particularly good situational awareness of what is critical within their community when it comes to pre-impact, impact, and post impact hazardous events.
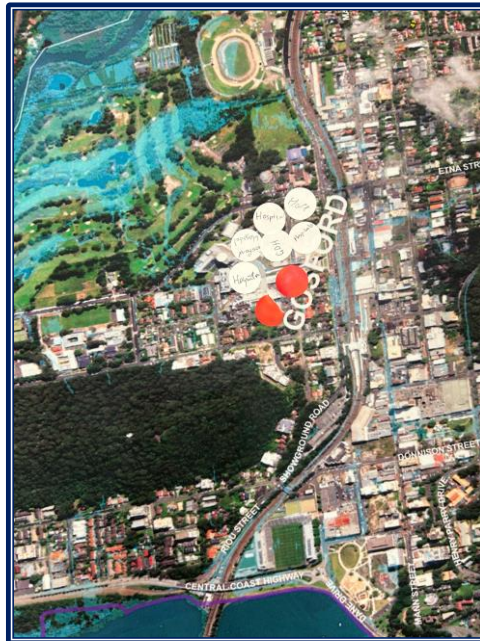

Figure 10: Critical Infrastructure Exercise – Pre and post event impact
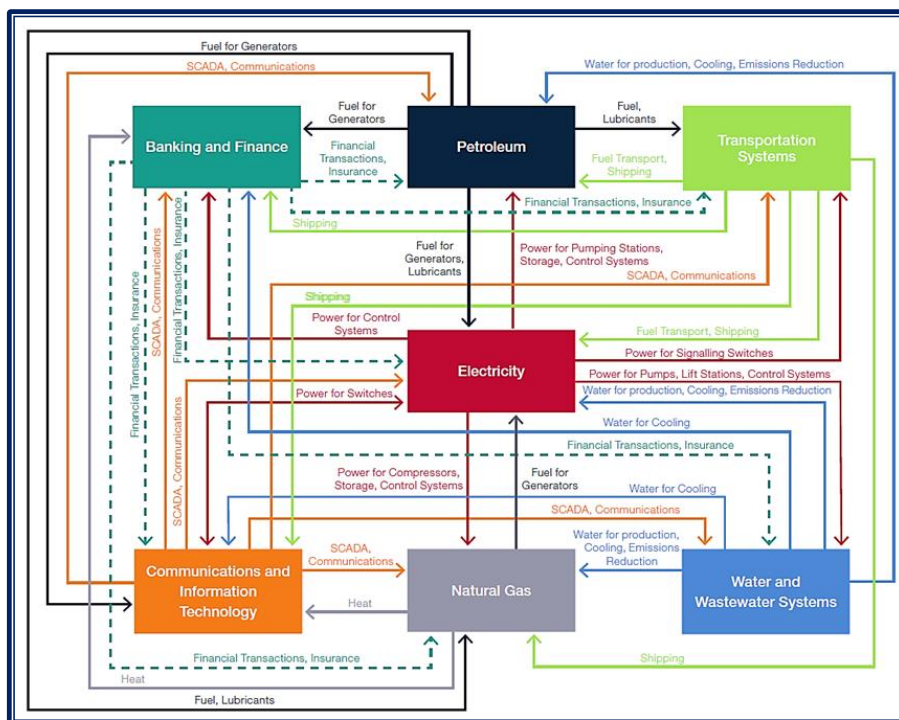

Figure 11: Examples of interdependencies post event impact[22]

22 https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-09

Systemic Disaster Risk

When discussing the importance of infrastructure pre, during, and post impact, understanding the interconnectedness of systems and processes and the influence one system plays on the other, is extremely important.

Disaster Risk
The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity[23].

When assessing risks from any hazard, both natural and man-made, we cannot look at it hazard-by-hazard, as we now live in an era of both greater uncertainty and more complexity. Systemic risk reduction represents a change from traditional risk assessment processes.

Disaster Risk Reduction
Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. [24].

Systemic risks emerge from the interactions of climate change and natural hazards, with the complex, interdependent and interconnected networks of social, technical, environmental, and economic systems[25]. These risks are not necessarily obvious using traditional hazard-by-hazard risk assessments and revealing them requires an understanding of the degree of magnitude of failure across these systems that could suddenly or gradually exceed society's capacity to cope.

It is now harder to anticipate where and how disasters will strike with efforts to be resilient to impacts and mitigate the potential for harm is of the utmost importance. This means drawing on, adapting, or creating risk tools and methods, calibrated to the reality of increasing uncertainty and with a sense of urgency to work together. To do this, risk assessment needs to evolve beyond current approaches and institutional structures; disasters are not natural and should no longer be considered only an emergency management issue.

Continually dealing with disasters is an iterative and adaptive process and a global challenge. It highlights the need to build capacity and capability to integrate systemic risk and resilience assessments into existing risk management frameworks. By embracing uncertainty, acting locally, undertaking place-based capacity building approach, and establishing long-term sustainability goals, communities can build social capital and increase levels of resilience and capacity.

---

[23] Australian Disaster Resilience Glossary (aidr.org.au)
[24] Australian Disaster Resilience Glossary (aidr.org.au)
[25] handbook_systemic_disaster_risk_2022-03-17_v11.pdf (aidr.org.au)

Acting Locally

Is best exercised by well informed and included communities. Acknowledge community expertise and support meaningful engagement. Trust is critical to reducing disaster risks, building resilience and everything in between (including planning and responding).

Utilising the DRA Resilience Framework

In the last decade, resilience has evolved from a specialist term used largely in materials science and environmental studies, to become a concept employed frequently and passionately by policymakers, practitioners, and academics in various disciplines. The concept has become embedded in laws, government, doctrines, and plans; and universities across the world have established resilience centres, institutes, and research programs.

Within DRA, we believe a resilient community is one whose members are connected to one another and work together in ways that enable it to function in the face of stress and trauma. A resilient community has the ability to adapt to changes in the physical, social, or economic environment, and the potential to learn from experience and improve over time. A resilient community can also be self-sufficient, at least for a time, if external assistance is limited or delayed.

As communities are complex and dynamic social structures, levels of community resilience are not static. It is important that those utilising the concept of community resilience make efforts to regularly measure it. Everyone has a unique combination of capabilities and capacity to prepare, cope and recover from disaster, which means they are vulnerable and resilient in different ways. Each level of society has aspects of resilience or vulnerability nested within it. Central to this is better understanding the systemic nature of risk and Australia's vulnerability[26].

The first step towards enhancing the resilience of a community involves understanding the community's strengths and vulnerabilities, as well as its physical characteristics (local infrastructure), procedural characteristics (e.g. disaster policies and plans) and social characteristics (e.g. level of community cohesion).

Key Concepts – Moving Forward

The underlying theme contained within the nationally strategic documentation speaks to the importance of understanding risks, communication and education of these risks, and empowering individuals and communities. The importance of having and informed and aware community who have an increased awareness and understanding of the hazards that affect them is now more important than ever. It is only through the forming of strong information and collaboration communications between local government, emergency management and services, business and industry, and all community members that these themes can occur and become normalised and successful.

---

[26] Risk reduction: A shared responsibility, The Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf

DRA is not about telling, directing, or dictating to communities and stakeholder groups how they should go about their business. We can make observations and provide some key concepts that may be of use and could be contextualised to your community processes and undertakings.

Communication and coordination are required for successful pre-disaster planning and post-disaster recovery. This needs to occur across residents, stakeholders, and multi-levels of government. Through the sharing of people's needs, experiences, and realities pre and post natural hazard events, social resilience can be built. This creates a systemic nature of resilience that relates to the interdependency of establishing a community core across the various resilience environments.

It is from learning during disaster planning and recovery that new knowledge through new experiences of affected communities is acquired. As such, by taking into account the levels of community adaptive capacity, coupled with the evolution of disaster governance, new resilience strategies can be developed.

A six-part grass roots resilience strategy is provided for consideration below. This will encompass an emergency management approach, focussed on the individual, in order to enhance their own capacity for resilience and awareness of disaster risk aligned with strategic national guidelines.

Self-education. Education is key to building knowledge in emergency management practices that strengthens learned experiences from previous disaster planning and recovery. Through understanding the key concepts of the emergency management framework, a foundation of knowledge can be built. This will include the practical outputs of prevention/mitigation, preparedness, response, and recovery activities. Each individual or household can become their own emergency managers on a scale that is suited to them and meets their needs. This in turn gives insight to the larger context of emergency management governance frameworks put in place at local through to national government levels.

Leading change. Through self-education and the use of social memory to know that individuals, groups, and communities can lead and drive their own change is a cornerstone for resilience building. This is evident through both existing and organically emerging civil projects that enhance the planning and recovery processes from within the community. Leadership through these projects assists in driving improvements and shares responsibility both vertically and horizontally. This starts at the grass roots level and, if effective, is pivotal in disaster preparation and strengthening disaster resilience for the community to build back better.

Knowing your hazards and reducing your risks. By knowing your hazards, you can reduce their known risks. Through the adaptive capacity built from previous disaster events the risks that natural hazards pose to individuals and communities are known. The outputs of the prevention/mitigation phase of the EM framework will allow a clear understanding of how to build resilience against hazard and community environment interactions. Familiarisation with local and national risk management frameworks and assessments will aid in personal and community prevention/mitigation activities within economic constraints.

Partnering with your neighbours. Know your neighbours and ensure they know you. Individuals and households are unique and carry their own differences. These differences include religious, cultural, and ethnic factors. Culturally and linguistic diverse groups, first nations peoples, and other

perceived vulnerable demographics all have their own unique form of earned resilience through lived and learned experiences. Through diversification and cultural understanding, connections can be made that will transcend these fundamental differences in community groups, strengthening communities in times of disaster.

Self-empowerment. Governance frameworks and national legislative acts can provide provision to allow the self-empowerment of individuals, households, and community groups. By having a strong representation of community collaboration, communication, and engagement with government departments and agencies will increase holistic resilience levels. Allowing all stakeholders to have a voice in their own recovery, empowers them with increased responsibility and the bias to act in times of disaster. Self-empowerment incorporates all of the previous principles of this strategy and is critical in the mobilisation of community action.

Reach across. For there to be effective resilience levels in disaster recovery, all stakeholders must be united in their action and approach. By individuals reaching across to public and government departments and emergency services agencies, a common operating picture can be produced. By knowing what the different levels of government can offer in times of disaster events increases the depth of public knowledge of what is available to them. Likewise, by knowing what emergency services can offer across the emergency management framework, particularly in hazard education and response capacities, increases community knowledge.

The use of the DRA Big Map can assist in the facilitation of undertaking exercises and information sessions that will aid in achieving this proposed strategy to build and strengthen community resilience. This can be achieved across multiple and diverse community groups including schools, business, youth groups, and culturally and linguistically diverse communities. This will allow for a greater understanding of the bigger community picture, improved messaging and information sharing, and building local connection and trust.