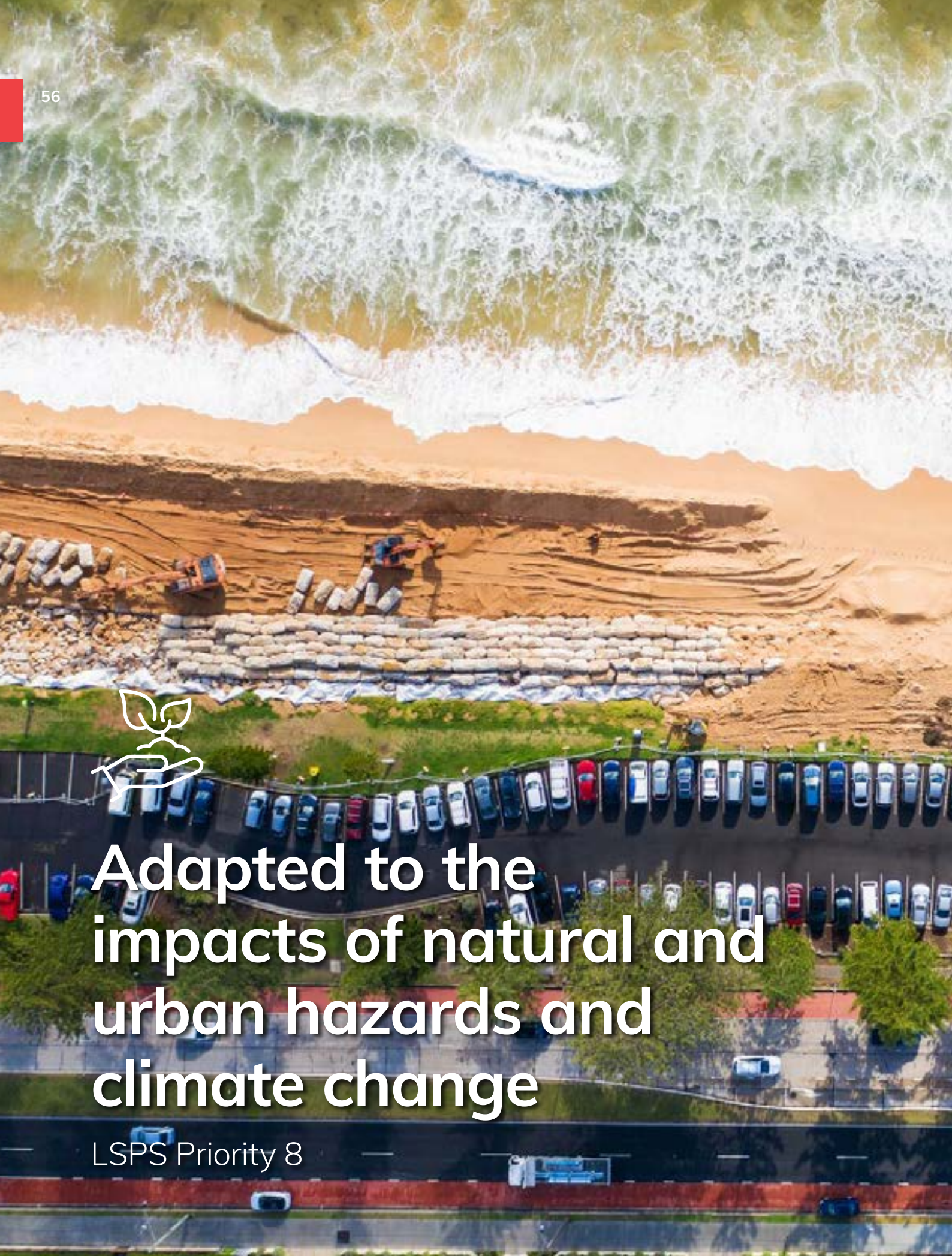


Adapted to the impacts of natural and urban hazards and climate change

LSPS Priority 8

6.0 Adapted to the impacts of natural and urban hazards and climate change

The proximity of urban areas to hazards such as waterways, coastal processes and bush fire prone vegetation places people, property and infrastructure at risk. This exposure will increase over time with population increase together with projected changes in intensity and/or frequency of these events as a result of climate change.

The Towards 2040 principles for Priority 8 will guide the future planning framework and include:

- Minimise risk to public health and safety from urban hazards and natural hazards.
- Reduce risk to life and property.
- Support initiatives that respond to climate change.
- Avoid intensification of development, inappropriate development and incompatible land uses in areas exposed to natural and urban hazards.
- Within high risk areas, avoid developments that rely on performance-based solutions, are difficult to evacuate or would be occupied by at risk members of the community.
- Mitigate exposure to UV radiation, the UHI effect and extreme heat.
- Improve resilience to climate change in both natural and built assets.
- Balance urban tree canopy programs and bushland restoration with natural hazard risk.
- Manage risks associated with sea-level rise for coastlines and beach landscapes.
- Minimise water, air and noise pollution, soil and groundwater contamination and its discharge to the environment.
- Minimise adverse impacts from development in environmentally sensitive areas.

The Northern Beaches is exposed to significant natural hazard risk with a track record of events, including the 1966 storms; 1974 coastal erosion; 1994 bush fires impacting Terrey Hills, Ingleside and Elanora Heights; significant flash flooding events and the 2016 east coast low which brought flooding and coastal erosion. These natural occurrences will continue as the climate changes and are likely to intensify. Our collective exposure to natural hazard risk has, and will continue, to shape how we live in this dynamic environment.

Flooding, coastal erosion and bush fire hazards are among the most frequently experienced events.

22,454

Properties exposed to flood hazard

20,039

Properties exposed to bush fire hazard

455

Properties exposed to coastal hazard

6.1 Natural Hazards

6.1.1 Flood

The Northern Beaches is characterised by a series a plateaus and steep escarpments draining to coastal floodplains before discharging directly to the ocean or through a number coastal lagoons. This topography creates a risk of flash flooding or longer duration flooding from coastal lagoons. Both types of flooding can create a risk to life and property.

Rainfall conditions required to produce peak flooding conditions vary across the Northern Beaches with intense thunderstorms critical in small steep catchments, and longer east coast lows responsible for the worst flooding in Narrabeen and Manly Lagoons.

Around 22,000 properties on the Northern Beaches are identified as being at some risk of flooding. This is approximately 20% of all properties on the Northern Beaches.

The areas with the highest flood exposure tend to be those surrounding the major coastal lagoons, Narrabeen, Dee Why, Curl Curl and Manly. This Lagoon flooding occurs when creeks and stormwater networks drain into the lagoon and water cannot escape quickly enough. This generally occurs during major storms with high rainfall runoff, where the escape of floodwaters is impeded by the build-up of sand at the entrance and/or high ocean levels, resulting in flooding on the surrounding floodplain. Tide, storm surge, wave movement and the state of the entrance berm can all have a significant impact on flooding. Council manages the entrances of Narrabeen, Dee Why, Curl Curl and Manly Lagoons to reduce the risk of flooding, however the risk can still remain high.

Flooding in Narrabeen Lagoon

A number of the Northern Beaches commercial centres are also located within low lying floodplains and are at risk of flash flooding. These include Avalon, Newport, Dee Why, Brookvale and Manly Vale.

Council maintains and operates the Northern Beaches Flood Information Network, which includes rain fall, water level and flow gauges with the data published on a public webpage. Specific gauges have threshold levels which if exceeded trigger SMS alerts to key Council staff and emergency response agencies.

6.1.2 Coastal processes and hazards

The coastline of the Northern Beaches is iconic however it also comprises stretches of beach which rate among the highest risk locations in Australia. Collaroy-Narrabeen Beach is exposed to a range of complex coastal processes, as well as coastal hazards. The complexity of this hazard, coupled with flood risk, places the Narrabeen Peninsula in a complex situation which requires an appropriate land use response that reflects the compounding nature of risk exposure in this location, into the future.

Natural coastal processes which occur along the Northern Beaches coastline include both offshore and nearshore wave climates and wave run-up, elevated water levels due to astronomical tides, storm surge and wave setup and sediment transportation.

Coastline hazards can include damage from storm events involving beach erosion, beach rotation, shoreline recession, slope instability and coastal inundation.

6.1.3 Coastal Inundation

Coastal inundation is a coastline hazard that particularly impacts estuarine areas of the LGA. Coastal inundation is one aspect of coastal hazard as defined by the NSW *Coastal Management Act 2016*. Inundation of the coastal zone can be caused by large waves and elevated water levels associated with a range of coastal and oceanographic process responses to severe storms.

The foreshore estuarine areas around Sydney Harbour, Pittwater and Cowan Creek are subject to coastal inundation. Council currently has defined estuary planning levels for the Pittwater estuary that incorporates projected sea level rise. Council is currently undertaking technical studies to define estuary planning levels for Sydney Harbour and Cowan Creek areas within the LGA. These studies have been undertaken in accordance with the methods used in the adopted Pittwater Estuary Planning Levels study.

Coastal erosion

6.1.4 Bush fire

Bush fire is a frequent occurrence in parts of the LGA, and whilst this is of higher risk in the areas associated with our national parks, the Northern Beaches is home to a large number of bushland reserves and corridors which can give rise to increased risk profiles within urban areas.

Bushland areas in the upper reaches of the catchment are bush fire prone, with vegetation connectivity potentially enabling the transition of fire toward urban areas at Elanora Heights and Warriewood, as well as throughout the Belrose and Oxford Falls Valley areas and towards Cromer. Ember attack under extreme conditions could also see bush fire impact well into urban areas and more isolated reserves.

Council manages bush fire risks on Council land in accordance with any Bush Fire Risk Management Plan prepared by the Northern Beaches Bush Fire Risk Management Committee. This risk planning ensures that appropriate treatments are in place to manage bush fire risks across the landscape irrespective of tenure.

Council has also prepared a Bush Fire Prone Land Map (BFPLM) which was certified by the NSW Rural Fire Service in 2020. This map identifies land that is potentially at threat from bush fire attack with more than 20,000 homes exposed to bush fire prone land throughout the LGA. It also triggers additional planning and development controls on bush fire prone land for new development or building work.

New development or building work on land identified as bush fire prone must comply with the requirements of the NSW Rural Fire Service's Planning for Bush Fire Protection (2019). This document outlines bush fire protection measures that may be required for new development, such as construction standards, asset protection zones, infrastucture and emergency access. Further details regarding construction standards are detailed in Australian Standard AS 3959-2009 'Construction of buildings in bush fire prone areas.

However, the Australian landscape is not only prone to fire, but requires it to regenerate. Whilst bush fire protection policy articulates how development can occur within certain bush fire prone areas, there remain strategic considerations which also must be identified. These include the potential impact of land clearing on sensitive environments and threatened ecological communities, and the cascading risk of landscape erosion, poor water quality and exacerbated weed and feral animal incursion into sensitive environments. The ability for whole-of-community evacuation is also a necessary strategic consideration.

Figure 3 illustrates at a strategic level, those areas of the Northern Beaches where resilience to natural hazard events may be a particular focus. This includes hazards such as flood, bush fire, coastal impacts (storm surge, coastal erosion, etc), as well as exposure to urban heat and climate-related events.

6.1.5 Geotechnical hazards

The Northern Beaches is characterised by a variety of underlying geological conditions with a large coastline comprising of stretches of beach separated by coastal cliff zones, rising up via steep slopes to the rocky plateaus and crests all with different inherent risks and hazards. Risks include subsidence, landslip, hydrological risks and rock falls all of which pose a serious threat to life and property if not managed effectively.

It is important to note that it is ultimately the land owners responsibility to manage geotechnical risks that are present on their site, however Council has a responsibility to ensure that development within the LGA takes into consideration the geotechnical risks associated with the applicable site and surrounding area. The primary method of geotechnical risk management in the Northern Beaches LGA is through the application of geotechnical conditions and controls as set out in a Geotechnical Report supporting a Development Application. Council is currently undertaking a study and preparing a map to provide a geotechnical classification to all parcels of land within the LGA that reflect the underlying geotechnical conditions and will provide the requirements that need to be submitted with a Development Application so as to ensure adequate due diligence is undertaken and ongoing risk mitigation measures are implemented.

Image credit: Fire & Rescue NSW

6.2 Challenges and Opportunities

6.2.1 Climate change

The impact of climate change is likely to be a significant challenge on the Northern Beaches, but also represents an opportunity to adapt and do things differently. Australia's climate has warmed by over 1.44 ± 0.24 ^{O}C since 1910 (BOM and CSIRO, 2020 State of the Climate 2020) and national climate projections indicate that Australia's climate will change further over the coming decades. As a result, Australia is expected to experience:

- Further increase in temperatures, with more hot days over 35 ^{O}C
- Ongoing sea level rise
- More intense heavy rainfall throughout Australia, particularly for short-duration extreme rainfall events
- A decrease in cool-season rainfall across many regions of southern Australia, with more time spent in drought
- An increase in the number of high fire weather danger days and a longer fire season for southern and eastern Australia
- Fewer tropical cyclones, but a greater proportion of high-intensity storms, with ongoing large variations from year to year.

One of the foremost climate-related issues is the impact of coastal hazards into the future. The Northern Beaches coastline may be impacted in the future as the sea level rises, beach erosion increases and the impact of severe storms places pressure on coastal environments and development. Planning now for these impacts is essential and provides the opportunity to embark upon new processes and approaches to protect our coastal environments.

Sea level rise will impact ecosystems, such as mangroves and saltmarsh, which will need to migrate upslope to remain within the ranges to which they are adapted. Seagrass may also be affected, as it is also adapted to a certain range in water depth. These species will be sustained at higher water levels where foreshore land is available to migrate into.

There are potential impacts of sea level rise upon future development and re-development including the construction or reconstruction of foreshore structures such as seawalls, marinas, jetties and boat ramps. Groundwater tables which are likely to rise as sea levels rise will need to be considered in future development.

Whilst rainfall is predicted to lessen into the future, the incidence of severe storms leading to flash flooding may increase. Currently, flood risk is one of the major hazards experienced across the Northern Beaches and the impact of climate change may increase the number of properties affected by flooding.

The challenge for planning is to build a resilient Northern Beaches, by adopting risk-based approaches. There is a significant role for land use planning in providing effective protection to existing urban areas, whilst also ensuring that new development is not exposed to unacceptable levels of risk, does not create new risk and considers future climate changes.

6.2.2 Urban expansion

The expansion of urban areas into locations where hazards are present has led to an increased level of exposure across Australia and internationally.

The pressure of growth, growing populations, and the desire to live in scenic and iconic locations can drive urban expansion and development into sensitive environments, and increase residents, property and infrastructure to the impact of hazards

Urban expansion is one of the core drivers of increased hazard exposure, loss and damage in Australia.

6.2.3 Natural processes

Natural hazards are in fact natural processes. Floodplains have been carved along lagoon systems and waterways over millennia. In fact, waterways and their ecosystems play a pivotal role in helping to protect the landscape and the built environment from natural hazards such as flooding and storm surge.

When considering the impact of climate change, focus should also include protecting and maintaining the ecological function of waterways and the coast to enhance the resilience and capacity of natural waterways to adapt to climate change and protect people, infrastructure and biodiversity from the impacts. This can include the re-introduction or enhancement of natural systems and processes which offer hazard attenuation.

Well-managed ecosystems can reduce the impact of many natural hazards, such as flooding, landslides and storm surges. The extent to which an ecosystem can buffer against extreme events depends on the ecosystem's health and the intensity of the event. According to the World Bank (2004), investments in preventative measures, including in maintaining healthy ecosystems, are seven times more effective than the costs incurred by disasters (Australian Government website).

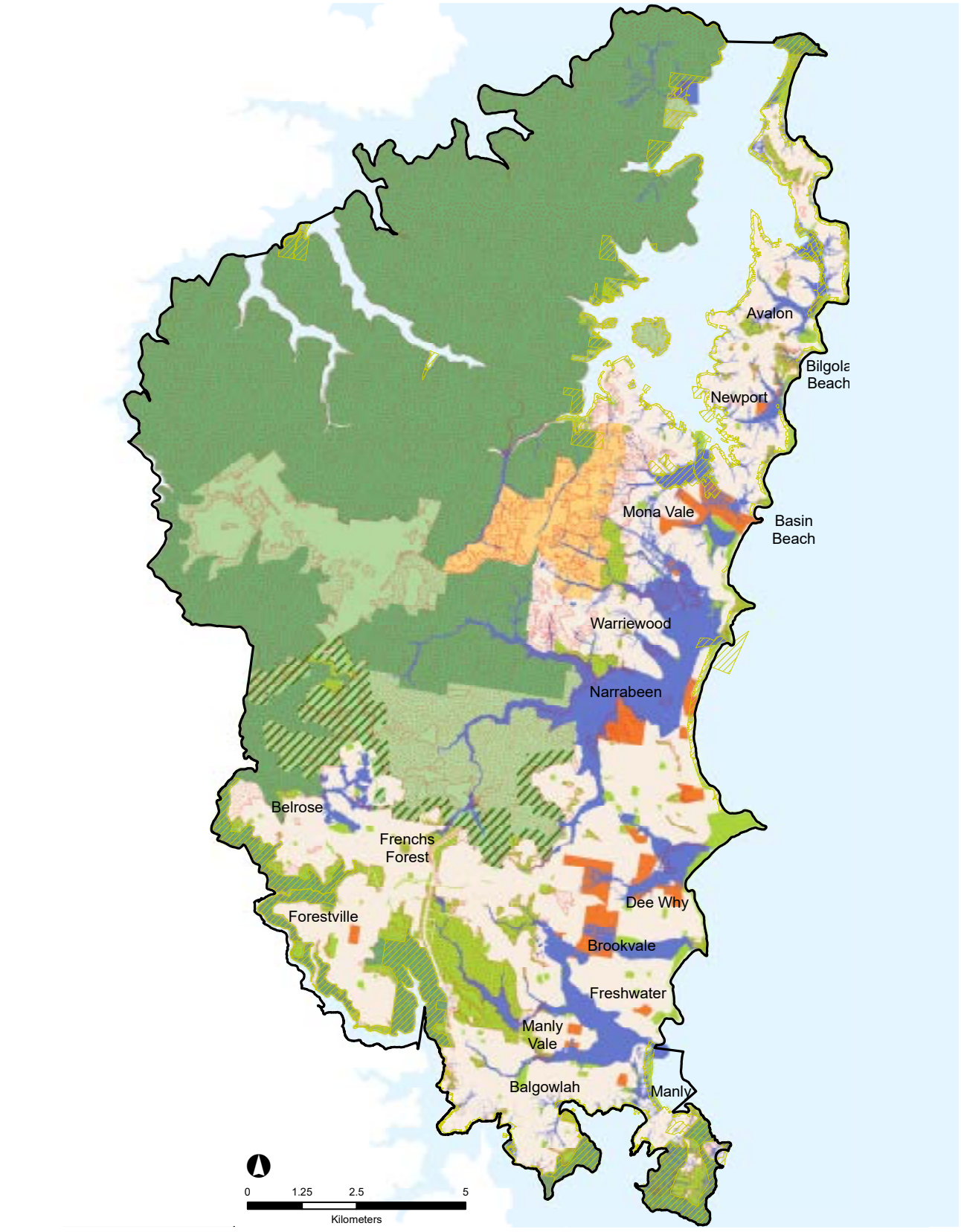
Coastlines are also dynamic. They are a function of many different processes including wave and tide processes, sediment movement and beach rotation. Protection of and maintaining coastal vegetation across dunes and coastal headlands, and mangrove and riparian rehabilitation, through planned and community-led bush regeneration activities will enhance flora and fauna habitat connectivity, as well as enhance resilience to hazards and climate change.

Shallow wetland areas, particularly the Careel Bay wetlands, will face increasing competition for space within surrounding urban areas, as saltmarsh and mangrove species attempt to migrate upslope to remain within their tidal limits.

Fire is essential to many landscapes in the LGA. One of the key approaches in managing bush fire is the inclusion of buffer areas, as well as fuel load reduction, or prescribed burning. However, whilst some of our plants require fire to germinate their seeds, too frequent fire, or not frequent enough, prevents them growing to flower and setting seed, which could significantly alter our natural bushland and diminish the diversity of fauna it supports.

A resilient community and environment embrace these processes and adapts to them. Through shared responsibility across the community and in conjunction with resilience measures and construction that is planned to be more resistant there will be an increase in the collective ability to endure, withstand and 'bounce forward' from natural hazard shocks can be enhanced.

Figure 3: Northern Beaches snapshot of natural hazards including impacts of climate change



Legend

- Urban area
- Ingleside - Under investigation
- National park
- Major public parkland/bushland
- Metropolitan Rural Area (MRA)
- Potential Future MRA
- Populations vulnerable to urban heat
- Flood prone area
- Bush fire prone land
- Draft LEP coastal hazards
- LGA boundary

Environmental Planning Actions
LSPS Priority 8

Adapted to the impacts of natural and urban hazards and climate change

The following environmental planning actions have been developed to deliver the LSPS planning priorities. These will also help to achieve the outcomes of the ECC Strategy.

LSPS Action	ECC Strategy	Environmental Planning Actions	Timeframe
Identify where to limit the intensification of development in areas exposed to hazards including bush fire prone areas for both risk minimisation and environmental protection. Identify where to limit the intensification of development in areas exposed to hazards including bush fire prone areas for both risk minimisation and environmental protection. Undertake studies including constraints, coastal hazards and flood mapping and develop LEP and DCP controls to restrict development in high-risk hazard areas. Prepare a climate change action plan for the LGA and a climate change adaptation plan for Frenchs Forest Strategic Centre.	Continue to identify properties affected by natural hazards to ensure strategies are in place to reduce their impact. Continue to identify properties affected by natural hazards to ensure strategies are in place to reduce their impact. Continually incorporate best available climate change and natural hazard knowledge and practices, including innovative solutions, into our strategic land use planning, development controls, construction and operations.	8.1 Deliver resilient precinct plans and place plans that are designed with adaptive capacity to respond to shocks, chronic stresses and climate change. This could be achieved, for example, through ensuring the precinct incorporates resilient design and / or construction materials. In addition, incorporate high levels of resilience by ensuring continuous energy, water, data supply even during extreme events like drought, heat waves or storms. Advocate to the NSW State Government to ensure the Design and Place SEPP delivers resilient precincts that can respond to shocks, stresses and climate change.	Ongoing
		8.2 Current and future natural hazard risks such as bushfire (including evacuation, egress or accessibility out of an area in an evacuation), flooding, coastal erosion and geotechnical risk must be considered early in the strategic planning process, including planning proposals, precinct and place plans. Future natural hazard risks will be determined by incorporating climate change projections as described by Adapt NSW, CSIRO or other peer reviewed projections in studies.	Short Term
		8.3 Undertake a risk-based assessment and develop maps for estuary planning levels for North Harbour, Middle Harbour and Cowan Creek in accordance with the Coastal Management Act that identifies areas subject to current and future estuary inundation risk as consistent with those undertaken for the Pittwater Waterway. Develop planning controls that mitigate current and future risk. For example, no impact to coastal processes, minimum floor levels, and use of inundation compatible materials and design.	Short Term
		8.4 Continue to identify flood prone land in accordance with the NSW Governments Flood Prone Land Policy and Floodplain Management Manual (2005) and permit development that is compatible with the flood hazard and flood function of land considering the projected changes as a result of climate change.	Ongoing
		8.5 Develop and integrate planning controls into the new planning framework using existing coastal hazard studies, such as the Coastal Zone Management Plans (Coastal Management Programs from Jan 2022) and the Identification of Coastal Hazard Risk Areas to Projected Sea Level Rise for the Manly Local Government Area.	Short Term
		8.6 Develop and integrate planning controls into the new planning framework that ensures all asset protection zones are contained within property boundaries as per Planning for Bushfire Protection, 2019.	Short Term
		8.7 Ensure that the ecological function of natural ecosystems is maintained and protected to enhance resilience to natural hazards and a changing climate. For example, through maintaining coastal vegetation, creek rehabilitation or best practice fire management.	Ongoing

The Study was prepared to inform the development of the Northern Beaches LEP and DCP and will help Council to deliver five sustainability planning priorities and Councils vision for the future of the Northern Beaches.

The Study has described the natural environment from the coastline, estuaries and coastal lagoons to the native vegetation and bushland corridors. These areas support an extensive variety of flora and fauna and contribute to the open space of the area. The Study has also demonstrated that the area is exposed to significant natural hazard risk and these are likely to intensify as the climate changes. This and other challenges such as development, land clearing and recreation will put pressure on the natural environment of the Northern Beaches.

The environmental planning actions recommended within the Study will guide the development of the new planning framework to address the challenges on the environment of future growth. In addition, the actions also provide opportunities to enhance and protect the environment, create better connections between the urban and natural environments and build and develop with consideration for sustainable and resilient outcomes.