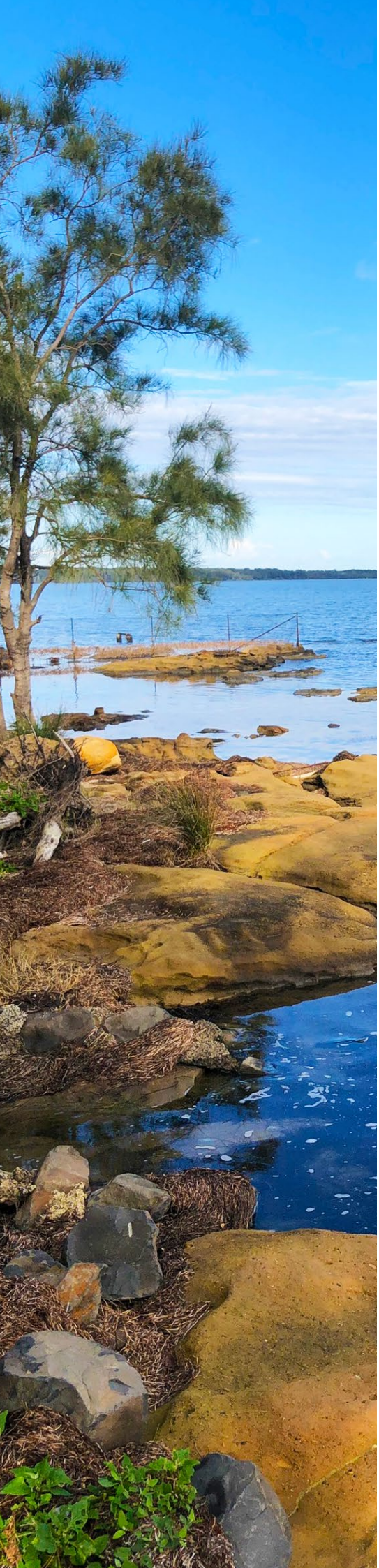
Tuggerah Lakes Expert Panel Review

Summary report

Department of Planning and Environment

NSW GOVERNMENT



Foreword

The Tuggerah Lakes estuary has a rich cultural history and natural beauty. It is a central focus for thousands of people who live, work and play on the Central Coast.

Over many decades, the estuary has come under pressure from significant population growth and urban development around the catchment. This has impacted the health of the lakes, as well as their public amenity.

Multiple studies and reports have been undertaken on the water quality of Tuggerah Lakes. Hundreds of on-ground actions have also been carried out.

The Tuggerah Lakes Expert Panel was appointed in 2019, by the NSW Minister for the Environment. Its focus was to review water quality issues in the estuary and recommend actions to address them. (This did not include flooding or recreation issues.)

The expert panel comprised 8 independent experts including engineers and scientists. Their expertise related to catchment management, water quality, stormwater management, ecology, groundwater, water-sensitive urban design, coastal estuaries and community engagement. I was pleased to chair this panel.

Our review was to be based on data from scientific literature and technical reports, expert knowledge and stakeholder input.

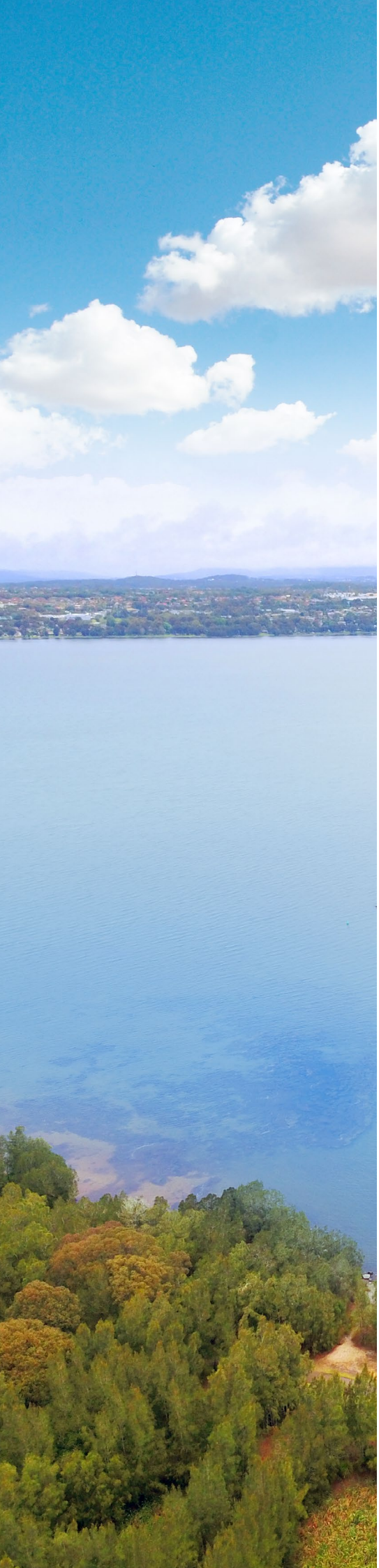
Our first job was to consult with community members and other stakeholders to learn what people believed were the main issues facing Tuggerah Lakes. From there we focused on:

- the estuary channel and its connection to the ocean
- water quality and ecology
- influences from the surrounding catchment.

The following pages provide a summary of the panel's findings. They review key issues, outline recommendations and identify some next steps.

This was no simple task, and I want to thank my fellow panel members for their knowledge and commitment throughout this process – A/ Prof Katherine Dafforn, Sian Fawcett, Dr Angus Ferguson, Dr Damian Maher, Nicole Ramilo, Dr David Wainwright and Stuart Waters.

Associate Professor Will Glamore
Chair, Tuggerah Lakes Expert Panel



Contents

The Tuggerah Lakes system

The Tuggerah Lakes system comprises 3 interconnecting waterways: Tuggerah Lake, Budgewoi Lake and Lake Munmorah. Together they cover an area of 80 km².

The 3 lakes are classified as 'lagoons' due to their large, shallow expanses of water. They are also collectively referred to as an 'estuary' because they receive both saltwater and freshwater inflows.

1. **Tuggerah Lake** is the largest and southernmost lake or lagoon and is 58 km². It is up to 2.5 m deep in the basin but very shallow closer to the foreshores. It connects to the ocean at The Entrance.
2. **Budgewoi Lake** is located in the middle of the estuary and is 11.2 km². It is about 2 m deep in some places but very shallow in others. It connects to Tuggerah Lake under Toukley Bridge.
3. **Lake Munmorah** is the smallest but deepest lake, is 7.9 km² and up to 3 m deep in some places. It sits north of the other 2 and connects to Budgewoi Lake via Budgewoi Creek.

The lakes play a central role in the local community. Many people derive their business from the water while others spend recreation and leisure time around the lakes.

Did you know?

- The surrounding catchment of the lakes is 790 km².
- Fresh water flows in from Wyong River, Ourimbah Creek and Wallarah Creek.
- The average lake level is higher than the average sea level.

Nearshore areas

The nearshore areas of Tuggerah Lakes refer to the shallower, outer areas of the estuary. The basin areas are the deeper, central areas. Basin water is generally healthy and of good quality, while some nearshore areas need improvement.

Strong winds and floods can help to mix the nearshore and basin waters together by temporarily raising water levels and moving it around.

Problems occur when water levels remain unnaturally stable (due to the way we artificially manage the estuary channel) and this mixing does not occur.

Without this mixing, stormwater and other pollutants can become trapped in the shallow nearshore areas behind seagrass beds. This can lead to higher temperatures, algal blooms, black ooze and odours.

Community engagement

Communications and engagement resulted in:

36,000
people reached

4,637
comments, reactions, shares and responses

389 survey responses

23
comments to an online discussion forum

18
participants in online meetings

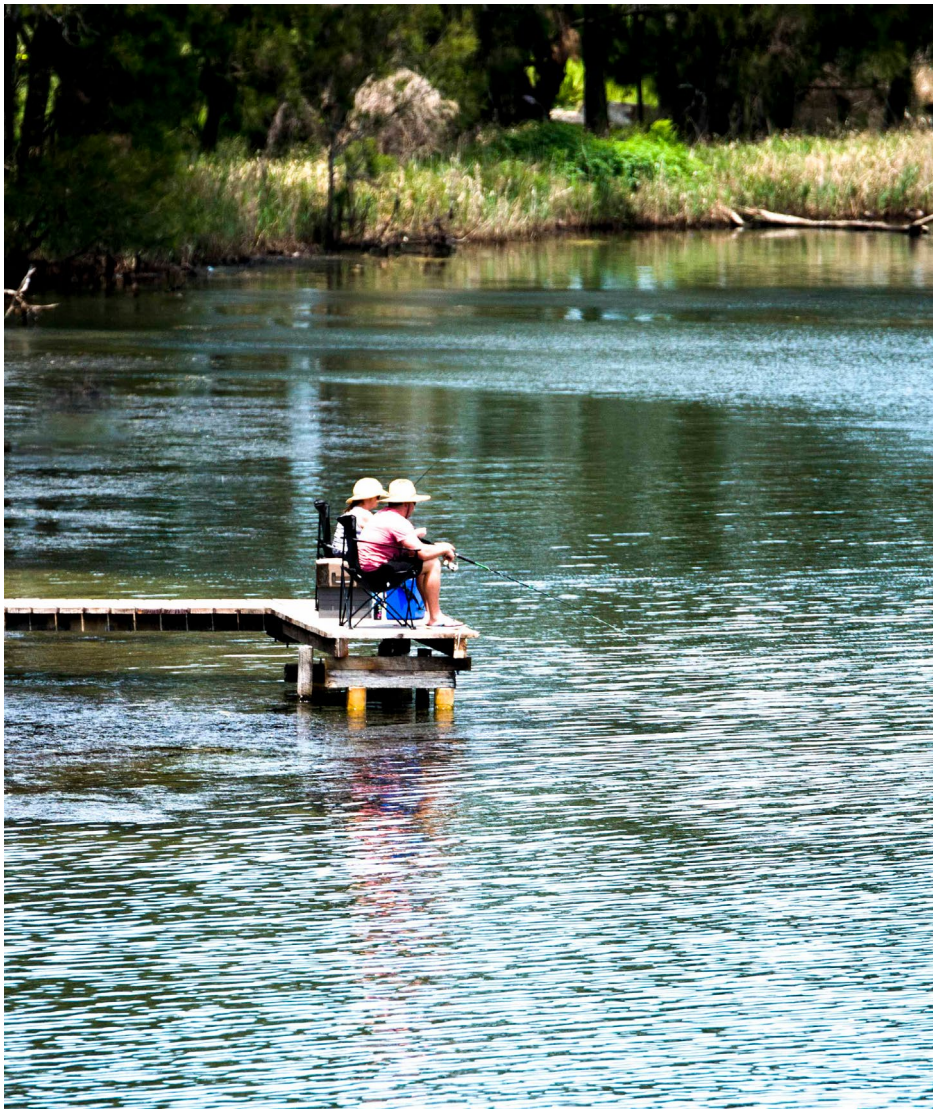
18 written submissions

445 people reached and 719 reactions through the online interactive map

The Tuggerah Lakes Expert Panel consulted with community, business and government stakeholders to gauge their views on key issues, challenges and ideas. From here it was clear that people care deeply about their lakes and are concerned about their health and future.

A range of consultation tools were used to gain feedback on the estuary. These included an online interactive map where people could post location-specific comments, a dedicated Facebook page with comments, an online survey, online video meetings, direct phone calls, direct emails and a briefing with local councillors. Media releases and posters were also distributed to help raise awareness of the process.

Consultation revealed there are many passionate opinions, beliefs and assumptions about the estuary. It also showed that many community members do not have a holistic understanding of the multiple challenges facing the estuary and the need to tackle issues in multiple ways.



Key themes

Key themes which emerged during the consultation process include:

- a desire for clear information about the estuary, including how it is defined and what community expectations are for recreation and water quality.
- a lack of trust in the management process and a need for more transparency from Council and government.
- views on how best to manage the channel entrance and whether it should be kept permanently open with breakwalls and/or regular dredging.
- views on whether a 'second entrance' could be opened between the ocean and Budgewoi Lake.
- a belief that good water quality means people can safely swim, fish and kayak in the estuary.
- a perception that a healthy estuary means clear water, a sandy bottom and no wrack.
- an understanding that a healthy estuary supports diverse and abundant bird life and aquatic life.
- an understanding that the surrounding catchment has a significant influence on the health of the estuary, including pressures from population growth, urban development, stormwater runoff, sewerage pollutants and other human behaviours.

Following its community consultation, the expert panel's recommendations are to:

- work collaboratively with all stakeholders to build trusted relationships and open communication
- engage with the community to build a shared understanding of the estuary, including its broad range of issues and preferred outcomes
- use citizen science and the Waterwatch program to identify pollution hotspots and encourage collective learning
- run a local raingarden-building workshop and show water-sensitive urban design projects at a community education space
- expand The Lakes Festival to celebrate community successes, such as with 'waterway warriors' awards.

The estuary channel – hydrodynamics

The estuary channel, which opens to the ocean, has been the subject of numerous studies, reports, opinions and ideas for many decades.

The expert panel reviewed community comments and technical reports into how the estuary connects to the ocean and how the channel could be managed. Options reviewed included:

- larger scale dredging of the channel
- construction of one or 2 training walls (breakwalls) along the channel, and/or
- opening a 'second entrance' to the ocean from Budgewoi Lake.

Technical studies confirm the estuary channel is naturally variable. It is subject to daily and fortnightly tides. It is also impacted by floods, droughts and coastal storms.

The tides have very little impact on water quality in the estuary as they only result in about 1% of the total water volume being mixed from the ocean.

The channel has never been officially 'navigable' and has been closed many times in recorded history. It usually widens during major floods then narrows back down when floodwaters recede and sand is drawn back through.

The build-up of sand does not directly affect water quality in the estuary, although it can cause some lakeside flooding. A rock groyne at the northern end of The Entrance Beach is designed to maintain sand on South Entrance Beach (not to keep the channel open).

Larger scale dredging

Central Coast Council has regularly dredged the channel since 1993. This helps to maintain a more free-flowing opening to the ocean.

Council currently spends about $700,000 a year to move up to 80,000 m^3 of sand. If it spent $30–50 million and dredged a longer and larger channel (down to about 3 m), studies indicate the tidal exchange would still only be 3% of total water volume mixing with the ocean.

Deeper dredging would not necessarily improve water quality. In fact, it could lead to lower water levels in the estuary causing more exposed mud flats and more polluted groundwater seeping in.

Construction of breakwalls

Single or twin breakwalls have often been put forward as an option to permanently open the channel between the estuary and the ocean, while also benefitting local recreation and tourism activities.

However, technical studies indicate a single breakwall is unlikely to keep the channel open, while twin breakwalls could lead to:

- a deeper channel which could increase the impacts of high tides and coastal storms which could then flood local properties
- extensive scouring of the entrance bed which could destabilise local structures such as the Memorial Park seawall and The Entrance Bridge
- lower overall water levels in the estuary which will expose more mudflats and odours.

Building twin rock breakwalls could cost $50–100 million. Ongoing maintenance and dredging could also be needed.

Building breakwalls from geotextile bags (instead of rock) could be a cheaper alternative (costing about $1 million) but these are unlikely to be strong enough to withstand the high tides and coastal storms.

Using jet pumps to regularly pump sand from the channel to other beach areas has also been considered but the pumps could have blockage and maintenance issues which could make them ineffective.

A single breakwall constructed at Lake Illawarra in 2000 failed to stop sand from moving into its channel. A second breakwall was then built in 2007 but this offered limited benefits for water quality and also destablised foreshore structures.

A ‘second entrance’ at Budgewoi

Historical and geological evidence indicates there was once an opening between Budgewoi Lake and the ocean. However, this is considered to have closed more than 1,500 years ago.

Waves were also reported to have crashed over the sand dunes between Budgewoi Lake and the ocean prior to about 1960. This likely coincided with sand mining in the area when the sand barrier was much lower than it is now.

Community members suggest a channel between Budgewoi Lake and the ocean could be reopened. While no clear modelling has yet been done on the viability of this option, some technical reports indicate a new channel, or ‘second entrance’, would have limited water quality benefits for the estuary. It could also cause major ecological changes due to more salt water entering Budgewoi Lake.

A second entrance at Budgewoi, north of Lakes Beach, could cost about $100 million to create.

Following its review of reports and studies into the estuary channel, the expert panel's recommendations are to:

- not build single or twin breakwalls along the channel as these could increase the impacts of flooding from high tides and coastal storms, cause extensive scouring, and lower overall water levels in the estuary
- undertake a socio-economic and tourism study to understand and quantify the benefits of a clear and flowing channel
- install a permanent water level recorder in the channel to inform future management activities
- analyse dredging history and assess its impacts and benefits
- prepare a detailed dredging management strategy that outlines where, when and why dredging is undertaken in the channel; and implement a transparent monitoring program with improved dredging triggers
- integrate dredging information with council's flood risk management procedures
- ensure council and the NSW Government work together to agree on a clear and reliable funding structure for future dredging
- work collaboratively with the community to investigate the feasibility of a 'second entrance' between the ocean and Budgewoi Lake.

Sand dunes and wetlands between Budgewoi Lake and the ocean

Water quality and ecology

Technical studies and reports indicate that water quality in the estuary is primarily driven by weather patterns and human activities.

The expert panel reviewed several key issues outlined below.

Stormwater nutrients

Urban stormwater contains high levels of nutrients and sediment which can impact water quality, especially in the nearshore areas.

Nutrients were particularly high during the 1960s and 1970s when many homes still used septic sewerage systems which leaked into surrounding waterways. When the region's reticulated sewerage system was installed the level of sewerage nutrients leaking into the waterways was significantly reduced.

Despite the improvements, modelling indicates that nutrient levels around urban developments are up to 400% higher compared to natural catchment conditions.

Groundwater

Groundwater can contain nutrients and other pollutants which may have come from old septic tanks, sewerage overflows, old farming practices or stormwater runoff. These pollutants can leak from the groundwater into the nearshore areas, adding to the problems of ooze and odour.

Groundwater is known to discharge around Budgewoi, Canton Beach, Berkeley Vale and Chittaway Bay.

Berkeley Vale is a particular hotspot for algae and black ooze. It is likely that groundwater nutrients from the 1990 foreshore restoration project (which saw dredged mud and ooze used to extend parts of local foreshore land) are leaching into the local nearshore areas.

Seagrass wrack

Seagrasses grow naturally in Tuggerah Lakes and provide important ecological benefits, including food and habitat for many fish and crustaceans.

When seagrasses shed their leaves and break away from their roots, they start to decompose and become known as wrack. This wrack continues to provide food and habitat for birds and aquatic life.

Floating wrack ideally gets washed onto the banks where it can dry out and decompose in fresh air. However, human changes to shoreline alignments and unnaturally stable water levels mean the wrack stays caught along the nearshores and decomposes in the water.

Biodiversity

Water quality in Tuggerah Lakes is closely linked with its biodiversity. Many birds, fish and macroinvertebrates depend on seagrasses and seaweed for food and habitat.

There is still sufficiently good water quality in many parts of the estuary to sustain this biodiversity; however, some areas do need improvement.

- Many local fish species are caught in the estuary, including bream, snapper, flathead and jewfish. Fishing businesses have reported a reduction in landings since the 1970s.
- Some 32 macroinvertebrates have been recorded in the estuary, including prawns, crabs, mussels and clams. Pipefish and the endangered White's seahorse have also been reported.
- The estuary is recognised as a globally important bird area with 63 recorded bird species, including the little tern, black swan, eastern osprey, white-bellied sea eagle, and some migratory shorebirds from Asia and North America. Bird numbers have reportedly reduced over the years due to impacts from urban development and habitat loss.
- Saltmarsh is a threatened ecological community that can help wrack to naturally decompose and thereby reduce ooze formation. Saltmarsh areas have declined around the fringes of Tuggerah Lakes by about 85% over the past century. Council has been working to restore or rehabilitate about 30 ha of saltmarsh since 2008 and this work is ongoing.
- Porters Creek Wetland is a state significant wetland which helps to naturally filter excess nutrients from water flowing into the estuary. Increased urban development with high volumes of stormwater runoff has put continuing pressure on the effective functioning of the wetland.

Black ooze

Black ooze is only present along the urbanised nearshores of Tuggerah Lakes where there is more stormwater runoff.

It is made up of stormwater pollutants, fine sediment, leaves and grass, algae, phytoplankton and decayed seagrass wrack. Together, these settle and smother the bed of the lagoon and, without oxygen, turn into black ooze.

The ooze gives off hydrogen sulphide gas which smells like 'rotten eggs'.

Following its review of reports and studies into water quality and ecology, the expert panel's recommendations are to:

- establish water quality targets based on a shared vision for Tuggerah Lakes
- compile all relevant reports and studies relating to the estuary into one central repository which is accessible to everyone
- consider realigning some shorelines back to their natural gradient to improve natural ecological processes
- introduce a community wrack monitoring program and provide more community education about wrack management
- introduce a strategic wrack harvesting program which is less reactive and more proactive, is driven by science, and involves the local community
- allow wrack to accumulate in areas where it can dry in the open air
- continue to rehabilitate and restore saltmarsh areas and wetland habitats
- conduct further studies into possible seepage of groundwater nutrients into the estuary so that site-specific solutions can be considered and implemented
- investigate the feasibility of using bioreactors to help breakdown nutrients from groundwater hotspot areas
- ensure ongoing monitoring and evaluation of all activities and use this data to make program adjustments as needed.

Catchment management

The Tuggerah Lakes catchment has undergone significant change since European settlement.

Widespread land clearing for rural, urban and industrial uses, ongoing population growth and urban development have had major impacts on water quality in the estuary.

Scientific studies have identified that urban stormwater is a key contributor to the current poor water quality in parts of Tuggerah Lakes. This is particularly significant where stormwater runs directly into the shallow nearshores without first mixing in with catchment rivers which flow into the deeper basins.

Rural land use, town water supplies, unsealed roads, sewerage overflows and larger industries have also had an impact.

The expert panel reviewed a number of factors as outlined below.

Population growth

While ongoing development has already had a major impact on the water quality of Tuggerah Lakes, more growth is on the way.

The Central Coast Regional Plan 2036 predicts an additional 75,500 people (or 41,500 households) will live in the region by 2036.

This target (set by the NSW Government) will lead to further impacts on the estuary.

Development is planned around Tuggerah, Wyong, Warnervale, Bushells Ridge and Lake Munmorah. More infill housing is planned around Toukley, The Entrance and Long Jetty.

The increased population will lead to a higher demand for town water supplies (leaving less water flowing in the rivers and creeks), more overflow risks for local sewerage systems, more hard surfaces causing less natural infiltration into the ground, more stormwater pollutants and loss of natural bushland.

While some controls are already in place to manage erosion, nutrients, sediment and gross pollutants (for example litter) flowing into our waterways, more could be done to manage private development and public infrastructure sites.

The Central Coast Regional Plan 2036 predicts an additional **75,500 people** (or 41,500 households) will live in the region by 2036.

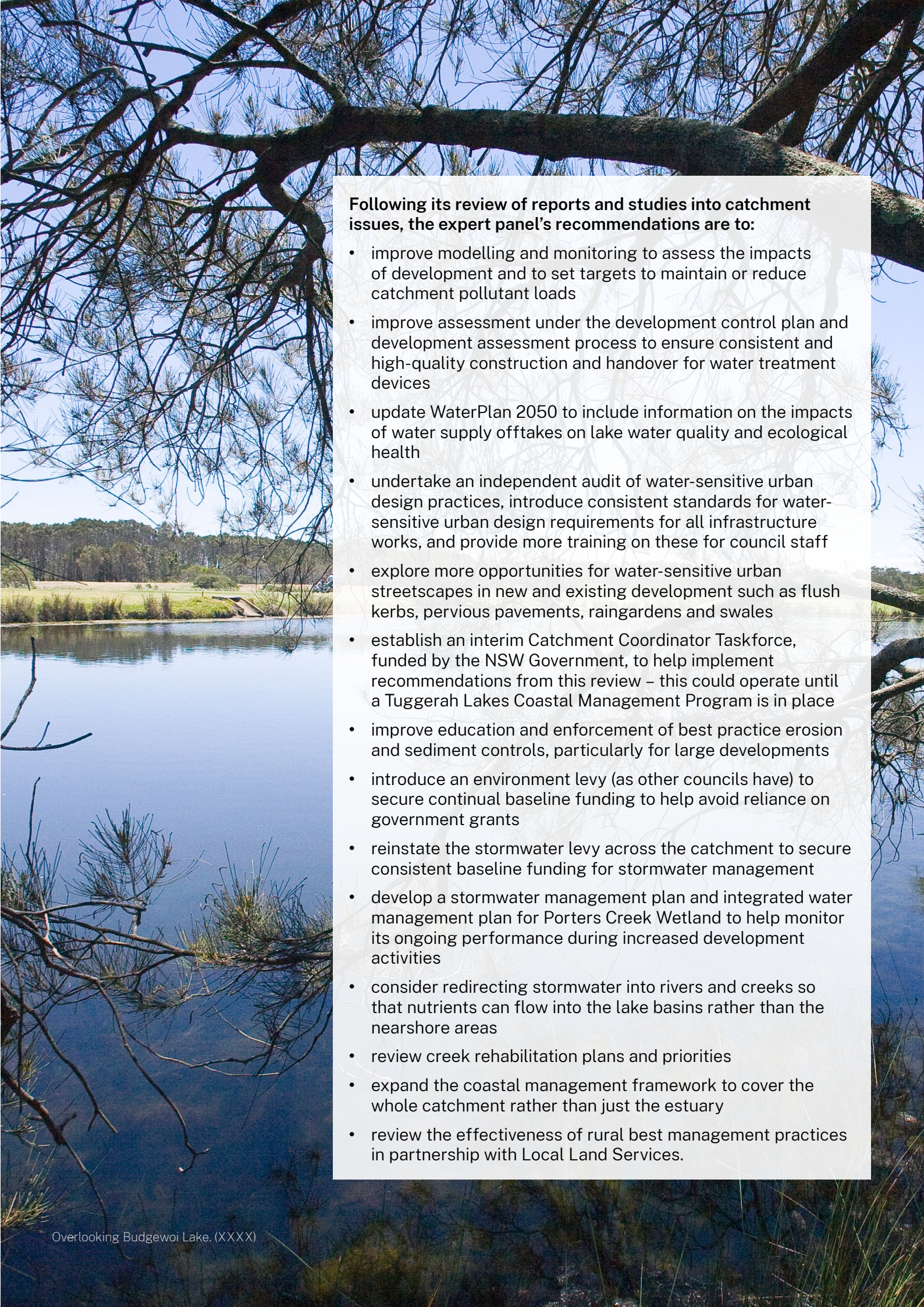
Other land uses

Other land uses in the catchment have also had an impact on water quality in the estuary.

- Historical clearing of agricultural land has altered stormwater flows and reduced ground infiltration. Stock have previously eroded riverbanks, although most properties are now fenced. Fertilisers and pesticides have also been known to pollute waterways.
- Munmorah Power Station operated from 1967 to 2010. It drew water from Lake Munmorah and discharged it into Budgewoi Lake near San Remo, leading to minor temperature and salinity changes. During power station operations, sediment in Lake Munmorah contained 12% more ash content than in the other 2 lakes.
- Residual boiler ash from burning coal at Munmorah Power Station was previously disposed of in the Munmorah Ash Dam (Colongra Lake). This dam was not lined, and contaminants could have leaked into local groundwater and adjacent lakes. The Munmorah Ash Dam is currently regulated by the Environment Protection Authority.

There are also community concerns about the potential impact of future coalmining operations on the catchment.

- Wallarah 2 Coal has planning approval to extract 1.2 billion tonnes of thermal coal from a longwall mine under Dooralong and Yarramalong valleys.
- The project was originally rejected due to subsidence concerns, water quality impacts, ecological impacts and heritage impacts. It was later granted NSW Government approval in January 2018 subject to a number of conditions.



Following its review of reports and studies into catchment issues, the expert panel's recommendations are to:

- improve modelling and monitoring to assess the impacts of development and to set targets to maintain or reduce catchment pollutant loads
- improve assessment under the development control plan and development assessment process to ensure consistent and high-quality construction and handover for water treatment devices
- update WaterPlan 2050 to include information on the impacts of water supply offtakes on lake water quality and ecological health
- undertake an independent audit of water-sensitive urban design practices, introduce consistent standards for water-sensitive urban design requirements for all infrastructure works, and provide more training on these for council staff
- explore more opportunities for water-sensitive urban streetscapes in new and existing development such as flush kerbs, pervious pavements, raingardens and swales
- establish an interim Catchment Coordinator Taskforce, funded by the NSW Government, to help implement recommendations from this review – this could operate until a Tuggerah Lakes Coastal Management Program is in place
- improve education and enforcement of best practice erosion and sediment controls, particularly for large developments
- introduce an environment levy (as other councils have) to secure continual baseline funding to help avoid reliance on government grants
- reinstate the stormwater levy across the catchment to secure consistent baseline funding for stormwater management
- develop a stormwater management plan and integrated water management plan for Porters Creek Wetland to help monitor its ongoing performance during increased development activities
- consider redirecting stormwater into rivers and creeks so that nutrients can flow into the lake basins rather than the nearshore areas
- review creek rehabilitation plans and priorities
- expand the coastal management framework to cover the whole catchment rather than just the estuary
- review the effectiveness of rural best management practices in partnership with Local Land Services.

Overlooking Budgewoi Lake. (XXXX)

Next steps

The expert panel's review highlighted a need to address a broad range of land-based catchment issues as well as improving the resilience of the estuary itself.

There is no single universal solution for improving water quality in Tuggerah Lakes and no 'quick fix'. Instead, there needs to be a combination of multiple actions which work together in a holistic approach over time.

Many recommendations from the review will be addressed through a new Tuggerah Lakes Coastal Management Program (CMP). This will deliver a coordinated, strategic and integrated management approach for the estuary over the short and medium term, as well as looking at vision for the longer term.

The CMP will address issues relating to dredging, wrack management, community engagement, water-sensitive urban design, groundwater investigations, wetland rehabilitation and other studies.

It will offer further opportunities for community engagement and will consider social, environmental and economic outcomes.

Delivering the CMP involves all levels of government working together, along with the local community. Everyone has a part to play.

The NSW Government provides ongoing technical advice and research data for managing the Tuggerah Lakes system and has contributed more than $600,000 to initiate the CMP. Central Coast Council is committing $300,000 towards the CMP process, and will coordinate and deliver key actions. The Australian Government also continues to invest in priority actions for Tuggerah Lakes, such as wetland restoration.

In addition, a number of other expert panel recommendations have already been implemented. These include:

- protecting and restoring an additional 16 ha of coastal saltmarsh and an additional 274 ha of wetland habitat since 2020
- continuing to monitor and evaluate water quality issues through the annual Waterways Report Card
- installing a permanent water level recorder at the channel entrance, attached to The Entrance Bridge, to inform future management activities
- developing an entrance management study and interim entrance management procedure to inform future channel operations
- increasing communications and engagement relating to the new Coastal Management Program and other estuary activities
- developing a Tuggerah Lakes estuary education and communication strategy.

More information

For more information on the Tuggerah Lakes Coastal Management Plan process, visit Central Coast Council's Our Coast, Our Waterways webpage and click on the Tuggerah Lakes tab.

Department of Planning and Environment (2016) 'Central Coast regional plan 2036', NSW Government.

Manly Hydraulics Laboratory (2021) Tuggerah Lakes entrance management study: stage 1 review of previous studies [PDF 18MB], report prepared for Central Coast Council.

WaterNSW (n.d.) NSW water strategy: towards 2050 – our priorities and implementation plan, WaterNSW website.

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