

Planning for coastal and flood hazards in a changing climate:

Lake Macquarie City Council action

<b>Council Name</b>	<b>Lake Macquarie City Council</b>
<b>Web Address</b>	<a href="http://www.lakemac.nsw.gov.au">www.lakemac.nsw.gov.au</a>
<b>Size</b>	648 sq. km
<b>Population</b>	195,559 (June 2008)
<b>Awards</b>	National Climate Change Adaptation Research Facility (NCCARF) <i>Climate Adaptation Champion</i> 2011

## 1. Background

### 1.1 Council profile

Lake Macquarie is the fourth most populous Local Government Area (LGA) in NSW. Lake Macquarie is located on the NSW Central Coast and holds Australia's largest saltwater coastal lake, covering 110 sq km. The lake has an area and volume twice that of Sydney Harbour, with 174 km of foreshore, of which 75% is modified or developed. The population of the Lake Macquarie LGA, nearing 200,000, is expected to grow by 60,000 – 70,000 people over the next 25 years. The Lower Hunter Regional Strategy (NSW Department of Planning (DoP), 2006) projects that over 25 years, 36,500 additional dwellings will be required in Lake Macquarie LGA, of which 21,000 will be accommodated in existing urban areas and 15,000 in new release area.

The LGA hosts nine main town centres surrounding the 170 km perimeter of the lake. The varied demographics of the lake communities means that there are differing levels of understanding regarding the potential effects of sea level rise on private properties and community infrastructure.

Lake Macquarie City Council was one of the first local governments in Australia to adopt a sea level rise (SLR) policy and action plan (adopted August 2008).

### 1.2 Coast and flood hazards

The highest recorded flood level was a rise of 1.25m Australian Height Datum (AHD) in 1949. The modelled 1% Average Exceedance Probability (AEP) flood level for the lake is 1.38m AHD. The LGA has close to 7,000 addresses along the lake foreshore with an elevation below 2.5m AHD, which is the likely height of a 1% AEP flood combined with a 0.91m sea level rise (NSW DoP, 2008)<sup>1</sup>. Little or no development has been permitted on coastal dunes, so there is no immediate threat to property due to coastal erosion or ocean inundation.

## 2. Council's approach to planning for coastal hazards

### 2.1 Building an evidence base

#### i) Implementation of hazard and risk assessments

Lake Macquarie City Council has prepared an assessment of environmental risks to the LGA (Cardno, 2010), which costs the effect of environmental damage on the community. This has been used to rank environmental risks for each decade between 2010 and 2100. The study considered the effects of climate change which indicated that the risks from inundation, flooding, and severe storm damage all rose relative to other environment risks over the period to 2100.

#### ii) Lake flooding and the effects of sea level rise

<sup>1</sup> Note that the NSW Government's Sea Level Rise benchmarks of 0.4m by 2050 and 0.9m by 2100 were adopted in 2009 and the Lake Macquarie City Council (LMCC) assessment of 0.91m predated this. Benchmarks for sea level rise used by LMCC are consistent with the NSW benchmarks, however the NSW benchmarks have been rounded. Both figures are derived from Intergovernmental Panel on Climate Change projections in the Fourth Assessment Report.

The views expressed in this case study do not necessarily represent the views of the NSW Office of Environment and Heritage and NSW Local Governments and Shires Associations



The nature of lake flooding means that water seepage causing property and infrastructure damage is the most common type of impact. The low velocities of lake flooding mean that injury and loss of life is rare. The Cardno (2010) study estimated the 2010 annualised cost of flood damages at approximately \$15 million p.a. across the LGA. Assuming a rise in sea level of 0.9m by 2100, the annualised cost of flood damages rises to more than \$26 million p.a. over the period 2010 – 2110.

To more fully understand the effect of SLR on lake levels and lake flooding, Lake Macquarie Council commissioned studies on:

- The likely changes in the lake entrance at Swansea Channel and the influence this will have on lake tides (Worley Parsons, 2010)
- The loss of foreshore saltmarsh and wetlands and the potential for ecosystem adaptation and retreat (Ecological, 2010)
- The effect of rising water levels on foreshore erosion in the lake (LMCC eShorance, 2010)

*iii) Review of coastal hazard zones*

Council has undertaken a first-pass review of coastal hazard areas incorporating predicted SLR. This indicated there was little increased risk to property from coastal recession and storm surge, at least up to 2050. Council is currently undertaking a more detailed study and risk assessment of the effect of sea-level rise on the ocean coast.

The report *High resolution terrain mapping of the NSW Central and Hunter coasts for assessments of potential climate change impacts* (Department of Planning, 2008) provided high-resolution terrain mapping using Light Detection And Ranging (LiDAR) technology to examine the implications of SLR on land use planning in the Central and Hunter Coast region.

*iv) Information gaps addressed via expert research partnerships*

Council has partnered with the Sydney University Architecture Faculty to develop a vision for 2100 for adaptable urban and building design in communities vulnerable to SLR (University of Sydney, *Sustainable Studio 2009: Rising Tides*). While this project was largely experimental, it has contributed to a continuing discussion among professional architects and urban designers and the local community about adaptable communities and buildings.

## **2.2 Climate change policy**

In 2008 Council released the *Lake Macquarie Sea Level Rise Preparedness Adaptation Policy* which incorporates climate change projections out to 2100 and outlines commitments to risk assessment, policy development, community engagement and further studies. In conjunction with the policy, Council adopted a *Schedule of Actions Leading to Preparedness for Sea Level Rise*, setting out 40 actions and associated timeframes, and responsibilities within Council. To assist with implementation, Council established an internal SLR Task Force involving staff from Sustainability, Integrated Planning, Development Assessment, Community Planning, Asset Management and Legal Services departments.

As of July 2011, nearly 90% of the actions in the *Schedule* are completed or are near completion.

In 2010, Council developed a *Climate Change Risk Assessment and Adaptation Plan* with insurers Echelon-Statewide Mutual. The plan assesses risk to Council's organisation and functions from climate change to 2030. A consolidated table of 'high' and 'extreme' risks, and actions to manage those risks was adopted by Council and has been incorporated in Council's corporate risk and operational plans. Actions include assessing the impact of SLR on Council assets such as roads, surf clubs, boat ramps, and foreshore reserves.

Also in 2010, Council participated in the Hunter & Central Coast Regional Environmental Management Strategy (HCCREMS) *Climate Change Risk Assessment* which identified issues from Council plans that required regional coordination or response. Key regional issues included



provision and coordination of emergency services, public health issues such as heat stress, and the long-term provision and maintenance of infrastructure in areas affected by SLR and increased flooding.

### 2.3 Proactive community engagement

In 2006 Council established a new Sustainability Department which incorporates Environmental Planning, with a specific focus on climate change mitigation and adaptation.

In 2007 Council held a Councillor briefing in conjunction with an Al Gore *Inconvenient Truth* presentation to inform Councillors about climate change prior to introducing the *Sea Level Rise Policy* and *Climate Change Policy*.

In 2008 Council implemented a *Sustainable Neighbourhoods Program* to work with some of the most vulnerable communities in the LGA to SLR, such as Dora Creek and Swansea.

With Council support, the Dora Creek community established a Sustainable Neighbourhood Group, *Climate-Ready Dora Creek* in 2008 and produced the *Draft Dora Creek Climate Change Adaptation Plan* which is now incorporated in the *Dora Creek Sustainable Neighbourhood Action Plan* (SNAP, 2009). More than a dozen communities are active in the program, with new communities added each year.

### 3. Planning options to reduce coastal and flooding risks

After the adoption of the *Lake Macquarie Sea Level Rise Policy* (2008), Council developed interim development assessment procedures for proposed development in areas vulnerable to SLR and increased flooding, based on a predicted SLR of 0.91 metres by 2100. These interim procedures are now integrated into the draft Development Control Plan (DCP), soon to go on exhibition. The key elements of this interim procedure are:

#### i) Requirements for new development to identify and design for risk

Floor height for habitable rooms in new residential and commercial development must be designed using the 100-year Average Recurrence Intervals (ARI) design flood level, a 'climate change factor' that includes sea level rise and increased rainfall, and 0.3m freeboard buffer.

Council adopted a notional 'linear increase' (approx 1cm/yr) to allow applications to be assessed across various asset planning horizons (e.g. 50 yrs for domestic dwellings, commercial, and industrial buildings; 100yrs for larger mixed-use development and medium to high density residential). This means new homes and large additions have floors at 2.27 metres AHD and for larger developments at 2.85 metres AHD.

In some particularly low-lying areas identified by LiDAR studies, developers are required to construct dwellings on pier-and-joists rather than slab-on-ground.

New development must be designed and located to reduce the risk from potential sea level rise, inundation, flooding, coastal and foreshore recession. Development proponents must demonstrate risk reduction measures, such as siting the development on the highest part of the lot and/or as far back from the foreshore as possible. Development proponents may propose innovative solutions to deal with the risk, such as adaptable buildings, relocatable buildings, and flood-proofing buildings (see Swansea case study).

#### ii) New development must avoid high risk areas

Under the *Procedure for the Assessment of Sea Level Rise Affected Development Applications* new houses on land located adjacent to the Lake Macquarie waterway that is below 3.0m AHD must meet the new floor height requirements or demonstrate they can meet the increased risk from flooding and sea-level rise in other ways.

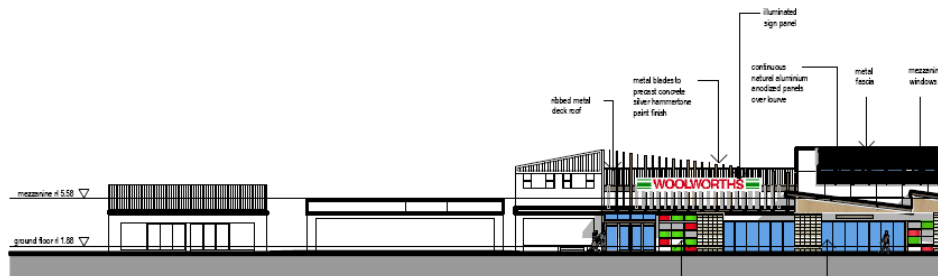
Subdivision proposals for lots below 3m AHD will not be approved in green-field areas and in-fill subdivisions will only be approved if new lots all have sufficient footprint above 3m AHD to allow for development permitted by the zone.

### Case study

*Council has taken a flexible approach to the development of a new Woolworths Supermarket at Swansea. Under the interim sea-level rise development guidelines, the floor level in the Supermarket would have to be constructed at 2.27 metres AHD.*

*However, the raised floor level would have resulted in a lengthy blank wall to the main street, and difficulties in providing ramp access. It was not possible to overcome the grade difference between the footpath and shop floors at the sea level rise floor height. The proponents also argued the development (a tilt-slab construction) had an expected asset life of less than 50 years.*

*In order to provide an active and attractive street frontage, Council explored overseas examples of flood protection, and identified a flood barrier system that could be used to block flood waters from entering the shops and supermarket. The barriers are deployed across doorway openings to seal the building. The development was approved, with floor levels less than required, but on the condition that flood barriers were installed and a flood response plan developed.*



### iii) Controls on existing development in high risk areas

Under the *Procedure for the Assessment of Sea Level Rise Affected Development Applications*, alterations to existing houses on Lots below 3m AHD adjacent to the Lake Macquarie waterway may be required to meet the new floor levels, depending on the extent of the renovation and the practicalities of matching it to the existing building fabric and services.

### iv) Mandatory disclosure of coastal and estuary risks

In 2009 Council placed a SLR notification on Section 149 Certificates for all coastal and foreshore residential properties below 3m AHD. This was to notify owners, developers, and prospective buyers that there may be development restrictions on the property arising from Council's *Sea Level Rise Policy* and the interim *Procedure for the Assessment of Sea Level Rise Affected Development Applications*.

Council is expecting the interim *Procedure* and Section 149 notifications will be reviewed and updated with the completion of a revised Lake Flood Plan and Coastal Hazard Plan, incorporating SLR. Hazard areas and corresponding planning and development restrictions will be incorporated in the Local Environment Plan (LEP) and DCP, replacing the interim provisions that are based on adding a 'climate change factor' (including sea-level rise) to existing flooding and coastal hazard provisions.



#### 4. Key Drivers

- Active consideration and use of robust scientific information from credible sources such as the Intergovernmental Panel on Climate Change, the CSIRO, the NSW and Australian Governments.
- Dedicated internal funding for a Sustainability Department (established 2006) with a specific mandate to consider climate change adaptation and mitigation. Council has a dedicated full time position to develop climate change adaptation options and coordinate an internal inter-departmental SLR Task Force.
- Support from the Council and community who were enquiring about action to prepare for the impacts of climate change and SLR. Council resolution to adopt the *Lake Macquarie Sea Level Rise Policy* was unanimous.
- Recognition of Council's corporate risks and duty of care and responsibilities and a strong commitment to the precautionary principle to achieve social, economic and environmental sustainability for the LGA as stated in the *Local Government Act 1993*. Council noted external and internal legal opinion, such as the Environmental Defenders Office report to the Sydney Coastal Councils Group (2008) that councils may face future liability if decisions were not based on the best available scientific information.
- Demand from Council development assessment staff for guidance on how to assess developments with 50-100 year asset life whilst being aware that conditions affecting those developments will change within that time.

#### 5. Key Challenges and Responses

- The potential scale of inundation in the Lake Macquarie LGA is a key challenge. The LGA has been identified as the most vulnerable in NSW to SLR impacts (DCC, 2009). Broad infrastructure upgrades and measures to adapt individual houses may provide a potential response, however this is unlikely to have a wide community benefit.
- Ad hoc, site-by-site-basis adaptation action to address inundation creates issues of non-conformity with existing properties, aesthetics and drainage. Individual responses such as raising the floor level/pavement level for a new development or building extension creates an issue if adjoining areas are not raised. There are currently few tools available for retro-fitting existing developments.
- Individual LGA approaches can lead to inconsistencies and uncertainty in the community, particularly where zoning allows for greater development intensity or is situated near to service hubs. Regional strategic action plans and responses such as that being undertaken by regional council networks like HCCREMS will allow a more comprehensive response.
- There is a disparity between community expectations of local government service provision in coastal protection and management and the resources that are available to Council. Increased investment or alternative funding models to adequately identify and reduce long-term coastal risks to the community, such as long-term monitoring of flood and SLR, and standardised educational materials that can help the public to understand SLR and adaptation issues could assist in managing expectations.
- Flood management responses for areas and/or infrastructure that may be permanently inundated could be improved through better alignment and assistance of NSW planning policy and guidelines for coastal adaptation and early engagement with councils regarding changes to planning policies and regulations.
- Lake Macquarie Council has found the Standard Instrument LEP template is not sufficiently flexible to accommodate local conditions in relation to zoning and development controls for coastal / estuary hazards and bushfire management.





- Council planning controls to reduce risk can impose unavoidable additional costs at the initial building stage, however requiring developers in low-lying areas to construct dwellings on pier-and-joists rather than slab-on-ground for example, will be significantly offset by potential later costs.
- Complying development is not considered appropriate in 'high hazard' flood and coastal erosion areas. Careful consideration ought to be made of how to control and manage individual developments in low hazard areas vulnerable to the effects of climate change.
- Council suggests more legislative protection is required regarding potential legal claims against Council land use planning decisions, such as back-zoning of land from development as a result of new information on climate change impacts. The *Local Government Act (1993)* provides liability exemption for council actions undertaken in good faith (*LGA Act 1993, s.733*).
- Threats to ecosystems by climate change highlights that strategic planning needs to increasingly address ecosystem protection to allow for better consideration of biodiversity retreat areas and refuges in land use planning and development assessment.
- Uncertainty relating to future climate change impacts could be addressed by establishing climate change parameters for some development requirements, or by government and industry bodies revising these to allow for uncertainty e.g. rainfall and run-off tables, wind maps, urban heat sinks etc.

## 6. Future priorities and next steps

Council is focussing on the following priorities:

- Updating the *Lake Macquarie Flood Study* and *Lake Macquarie Floodplain Management Plan* to further take into account the impacts of SLR and rainfall intensity, and more accurately map local flooding and hazards.
- Reviewing coastal hazards more comprehensively to incorporate the effects of sea-level rise and other climate changes is underway.
- Identifying of a range of development options for areas vulnerable to SLR, particularly to deal with permanent inundation e.g. increased foreshore setbacks and relaxed rear-street setbacks, adaptable and relocatable buildings, time-limited or trigger value consents and protection.
- Developing a decision-making framework for climate change adaptation planning, particularly SLR, and use this to prepare Area Plans for communities most vulnerable to SLR. This should then be considered for inclusion in the DCP and/or to inform zoning changes in the LEP.
- Exploring physically-based thresholds or triggers for areas likely to be permanently inundated; financial cost or rate of change triggers which could be explored with other LGAs; private vs public cost and responsibility thresholds; property safety and environmental values; state and local responsibilities.
- Investigating possible financial models to begin making provisions now for changes that may be needed in future (post-2050) such as protection works, compensation for relocation, land-banking for ecosystem retreat etc.
- Assessing SLR impacts on ecosystems, such as saltmarsh and coastal wetlands, and modifications to land use planning to allow for ecosystem adaptation and retreat.

### Further information contact:

**Name** Greg Giles

**Position** Climate Change Adaptation Officer

**Phone** 4921 0365

**Email** [ggiles@lakemac.nsw.gov.au](mailto:ggiles@lakemac.nsw.gov.au)



## References

- Department of Climate Change - see Department of Climate Change and Energy Efficiency  
<http://www.climatechange.gov.au/>
- Department of Climate Change, 2009, *Climate Change Risks to Australia's Coast: A first pass national assessment*,  
<http://www.climatechange.gov.au/~media/publications/coastline/cc-risks-full-report.pdf>
- Department of Environment, Climate Change and Water – see Office of Environment and Heritage  
[www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)
- Department of Planning and Infrastructure, 2006, *Lower Hunter Regional Strategy 2006-2031*,  
[http://www.planning.nsw.gov.au/regional/pdf/lowerhunter\\_regionalstrategy.pdf](http://www.planning.nsw.gov.au/regional/pdf/lowerhunter_regionalstrategy.pdf)
- Department of Planning and Infrastructure, 2010, *NSW Coastal Planning Guideline: Adapting to Sea Level Rise*,  
<http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=VYjmQirQIAk%3d&tabid=177&language=en-US>
- Department of Planning and Infrastructure, 2008, *High resolution terrain mapping of the NSW Central and Hunter coasts for assessments of potential climate change impacts*,  
[http://www.planning.nsw.gov.au/plansforaction/pdf/terrainmapping\\_central\\_hunter\\_coasts\\_report.pdf](http://www.planning.nsw.gov.au/plansforaction/pdf/terrainmapping_central_hunter_coasts_report.pdf)
- HCCREMS – Hunter & Central Coast Regional Environmental Management Strategy  
<http://www.hccrems.com.au/Home.aspx>
- Lake Macquarie City Council, 2010, *Lake Macquarie Wetlands Climate Change Assessment*, Ecological, available from LMCC on request
- Lake Macquarie City Council, 2007, Case Study: *Councillor Workshop Presentation on Climate Change, Global Warming and Sea Level Rise*, [http://www.lgsa-plus.net.au/resources/documents/CCAP\\_lake\\_macquarie\\_climate\\_change\\_global\\_warm\\_sea\\_level\\_220807.pdf](http://www.lgsa-plus.net.au/resources/documents/CCAP_lake_macquarie_climate_change_global_warm_sea_level_220807.pdf)
- Lake Macquarie City Council, 2008, *Lake Macquarie Sea Level Rise Preparedness and Adaptation Policy*,  
<http://www.lakemac.com.au/page.aspx?pid=109&vid=10&fid=1454&ftype=True>
- Lake Macquarie City Council, 2008, *Table of Actions Leading to Preparedness for Sea Level Rise*,  
<http://www.lakemac.com.au/page.aspx?pid=109&fid=1555&ftype=File&vid=1&dip=True>
- Lake Macquarie City Council, 2009, eShorance web-tool, <http://www.lakemac.com.au/eshoreance/>
- Lake Macquarie City Council, 2009, *Dora Creek Climate Change Adaptation Plan*,  
<http://www.lakemac.com.au/downloads/DoraCreekSNAP02.pdf>
- Lake Macquarie City Council, 2010, *The Hydraulic and Morphological response of a Large coastal Lake to Rising Sea Levels*, Worley Parsons, <http://www.coastalconference.com/2010/papers2010/Evan%20Watterson%20full%20paper.pdf>
- Lake Macquarie City Council, 2010, *Lake Macquarie Environmental Security Assessment*, Cardno,  
[http://www.lakemac.com.au/downloads/2011\\_05\\_16\\_attach\\_4.pdf](http://www.lakemac.com.au/downloads/2011_05_16_attach_4.pdf)
- Office of Environment and Heritage, 2009, *NSW Sea Level Rise Policy Statement*,  
<http://www.environment.nsw.gov.au/resources/climatechange/09708sealevrisepolicy.pdf>
- Sydney University Faculty of Architecture 2009, *Sustainable Studio 2009: Rising Tides*,  
[http://sydney.edu.au/architecture/CS/postgrad/student\\_works/sustainable\\_design09sem02.shtml](http://sydney.edu.au/architecture/CS/postgrad/student_works/sustainable_design09sem02.shtml)
- The Sydney Coastal Councils Group and Environmental Defenders Office, 2008, *Coastal Councils and Planning for Climate Change: an assessment of Australian and NSW legislation and government policy provisions relating to climate change relevant to regional and metropolitan coastal councils*,  
<http://www.sydneycostalcouncils.com.au/sites/default/files/coastalcouncilsplanungforclimatechange.pdf>
- The Land and Environment Court of New South Wales, 2007, *Walker v Minister for Planning*, NSWLEC 741, Biscoe J. 27 November 2007, 40240 of 2007, *Jill Walker v Minister for Planning and Ors Judgment*,  
<http://www.lawlink.nsw.gov.au/lecjudgements/2007nswlec.nsf/00000000000000000000000000000000/03dbc0a7b81845efca2573a60020290d?opendocument>