

0.9 METRES IS A LONG WAY TO TRAVEL: THE JOURNEY FROM HAZARD TO HOME

ABSTRACT

H Stevens¹, G Giles¹, A Howe¹, S Pope¹

¹Lake Macquarie City Council

The length of a baseball bat. The arm span of a child. The distance of an average stride forward. It doesn't seem of much consequence, but a 0.9metre increase in sea levels could impact the 23% of the world's population who live in the coastal zone. This paper looks at the journey one council has taken from realizing the hazard of sea level rise, to realizing solutions.

In 2008 Lake Macquarie City Council (LMCC) was one of the first coastal Councils in NSW to adopt a sea level rise policy and apply it to planning and development. In 2012 LMCC adopted a lake flood plan that recommended standard flood risk management measures such as raised floor heights in new developments.

However, new issues such as more frequent tidal inundation and minor flooding, foreshore inundation and recession, and rising groundwater require local risk assessments, and solutions tailored for specific communities. To deal with these strategic issues, Council is developing 'local adaptation plans' in collaboration with affected communities, with an 18-month pilot project at Marks Point and Belmont South beginning in July 2013.

Council is well prepared, with flood hazard studies, foreshore recession studies, groundwater studies, topographical LiDAR mapping, asset registers, floor height surveys, property market assessments, wetland mapping, engagement strategies and more. Despite this information about the hazard and its effects, many in the community are fearful of engaging with Council in the planning process, especially when management options such as development controls and planned retreat are included. Framing the discussion to calm these fears, while maintaining an honest assessment of the risk, is critical to the success of local adaptation planning.

Lakeside residents, communities and Council all wish to protect and preserve values such as the enjoyment of living safely beside a healthy natural waterway. By focussing on this common ground, collaboration to manage future threats becomes a shared goal.

0.9 metres is a long way to travel: the journey from hazard to home

H Stevens¹, G Giles¹, A Howe¹, S Pope¹

¹Lake Macquarie City Council

Introduction

Lake Macquarie City Council (LMCC) unanimously adopted a new [Lake Macquarie Flood Study and Risk Management Plan](#) that incorporated LMCC's sea level rise benchmarks for 2050 and 2100 of 40 and 90cm respectively. This identified the number of houses at risk from flooding during a 1 in 100 year flood event would increase from 5741 to 7803 (LMCC, 2012a), an increase of around 36%.

LMCC has taken a range of steps to incorporate these revised flood levels into LMCC's policies and procedures, including:

- Adopting a '[Flooding and Tidal and Inundation Policy](#)' which covers current and future flood planning levels, hazard categories and subdivision guidelines (LMCC, 2012b);
- Amendments to the [Development Control Plan \(DCP\)](#), relating to floor heights and limitations on subdivision in low lying areas;
- A proposal to include draft '[Development Guidelines for Resilient Housing for Lake Macquarie](#)' within the [Development Control Plan](#); and,
- Applying flood risk notations on Section 149 certificates to properties with a current and/or future flood risk.

These city-wide strategies are valuable in creating consistency across the local government area (LGA). However, there is also a need for localised assessment, at the suburb scale, that can provide more accurate risk and opportunity assessments, and tailor adaptation responses to the local environment. Within the City of Lake Macquarie, the risks from sea level rise can vary, largely depending on topography, erosion hazard and groundwater levels. There are also a range of assets types in different locations, such as parks, roads, drains or houses, each requiring a different assessment of risk, and adaptation options. The population and community in each suburb also vary greatly, and what works for one community may not work for another.

One of the recommendations of LMCC's recent Lake Macquarie Waterway Flood Risk Management Plan was the development of specific Local Adaptation Plans for each discreet foreshore area affected by current and future flooding. These Plans are suburb-specific assessments of the risks and opportunities of sea level rise, and will result in strategic planning responses to deal with long-term risks to public infrastructure, private property, and coastal ecosystems. Community involvement in the development of these plans is a core requirement of LMCC's approach.

This paper examines why and how LMCC has commenced development of the first Local Adaptation Plan in the City, the corresponding community engagement, and the challenges and opportunities that have arisen.

Beyond benchmarks - triggers and threshold based risk assessment

Moving beyond LGA wide land use planning that relies solely on time-related benchmarks can help reduce the uncertainty surrounding sea level rise. Although Walsh *et al.* (2004) found that projections of global mean sea level change can be made with more confidence than many other aspects of climate change science, the amount, timing, locations and nature of sea level rise impacts cannot be predicted with precision (Brooks *et al.*, 2009).

Local Adaptation Plans are a move towards a more flexible approach that works to identify both 'thresholds' and 'triggers' required to adapt to increases in sea level. Thresholds and triggers support adaptation strategies that maintain an acceptable level of risk and only implement action when actual change in risk is expected to occur (Stevens and Kiem 2013).

A threshold is a point or minimum level at which a possibly irreversible change, response or specified effect would happen or cease to happen. The threshold defines a point or level when a certain risk has reached an unacceptable level and an objective can no longer be achieved without intervention and implementation of adaptation options (Marsden Jacob, 2012). For example, a critical threshold may be if a road has become permanently inundated by sea water and is no longer usable. The trigger however is the incident or occurrence that initiates other events (Marsden Jacob, 2012). A trigger could be a 'red flag' to indicate that action to mitigate the change in risk associated with the approaching threshold should be commenced e.g. the lead-time required to reconstruct the road at a higher elevation. Figure 1 shows how over time the impact of sea level rise may increase, leading to impact thresholds and actions required.

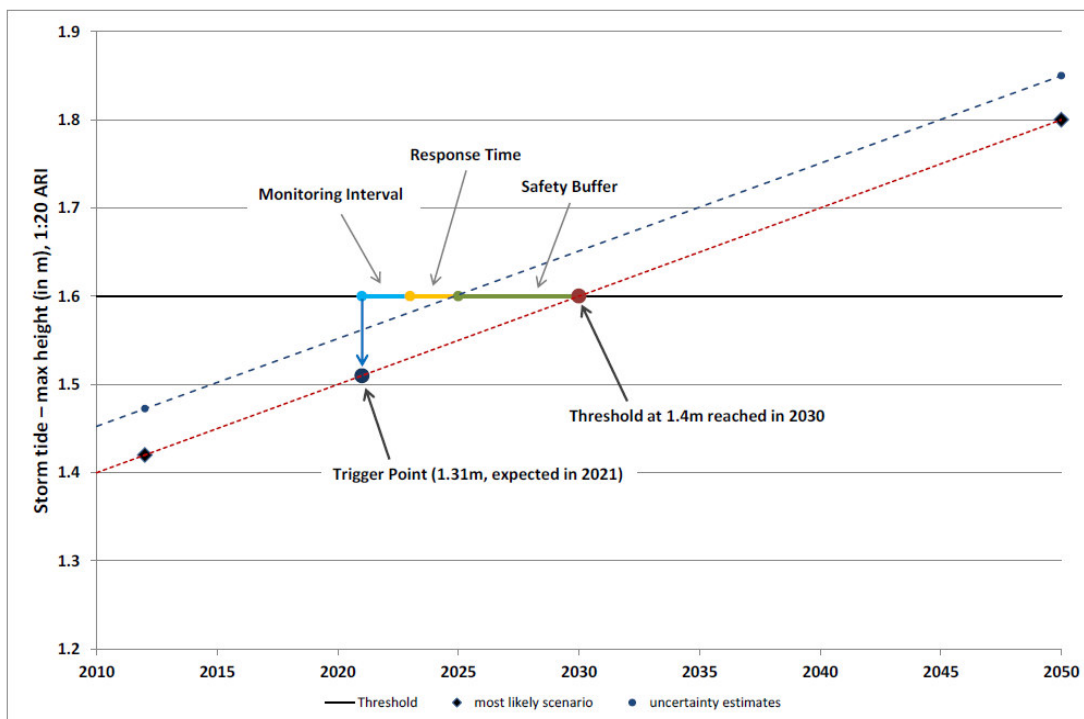


Figure 1: Determining the trigger point and threshold for a storm tide over time (Marsden Jacob, 2012)

Research by Dobes (2008) has put forward the theory of 'real options', that is, building in the option to increase adaptation actions when it is needed. This can accommodate the uncertainty in the effects of sea level rise into the future. An example of using real options in

adaptation planning may be to allow space between the foreshore and private property for constructing foreshore protection, but then not building the protection works until required.

Local Adaptation Planning

IPCC (2007) defines adaptation as an “*adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*”

For coastal decision makers, the threat of future flooding leads to three broad coastal responses— protection, accommodation and retreat (Bijlsma et al., 1996; Few et al., 2007; Klien et al., 2001). Protection aims to protect land from inundation so that existing land use can continue. For cities and other areas of high significance, there is likely to be an increased reliance on built defences, either soft or hard (IOC, 2009; Nicholson-Cole and O’Riordan 2009, Boateng, 2008). Accommodation implies that people continue to occupy the land but make some adjustments to properties and activities such as moveable buildings or buildings on stilts (Boateng, 2008; IOC, 2009). A third option is that of retreat, involving little or no attempt to protect the land, in some cases allowing ecosystems to shift landward (McGranaham et al., 2007; Nicholson-Cole and O’Riordan, 2009).

LMCC began designing the first Local Adaptation Plan for a foreshore area of the City in 2012. This involved LMCC bringing together a representative group of stakeholders in a process to define the community engagement approach to be applied in development of Local Adaptation Plans across the City. During that process, a Local Adaptation Plan was defined as:

... a location-specific strategy that identifies the problems and opportunities that may arise from an increase in flooding and mean sea levels, and then identifies actions that communities and Council could take to reduce or remove the adverse impacts. Local Adaptation Plans will guide future decisions, such as how we design and maintain roads and drainage systems, what is required to make buildings safe and durable, emergency responses during floods, how we manage erosion, and maintaining a clean and healthy lake.

LMCC also defined that a Local Adaptation Plan:

- Acknowledges that risks are location specific and are best addressed at the local level;
- Recognises that being prepared requires input from landowners, business owners, residents, special interest groups and organisations, Council, and state government agencies;
- Is timed so the actions are implemented to accommodate increases in risk, as they are required; and
- Provides a level of certainty for decision-making by the public, Council and others, yet is flexible enough to change with changing information (LMCC, 2013).

Local Adaptation Planning is emerging worldwide as an appropriate approach to managing climate change risks. In 2013, Michael Bloomberg, on behalf of The City of New York released ‘PlaNYC, a stronger, more resilient New York’. With the memory of Hurricane Sandy still in mind, the report utilised funding allocated to repair and upgrade infrastructure that had been damaged by Sandy. Within the report are several ‘Community Rebuilding and Resiliency Plans’ that look at the current vulnerabilities and how that vulnerability may increase from climate change in the future. The resilience plans include local community engagement, and conclude with a list of initiatives for that region to reduce risk, such as installing flood protection measures and improving regulations for flood resilience of new

buildings (The City of New York, 2013). These resilience plans are innovative because they have specific actions and timelines and estimated costs for adaptation options. Other notable international coastal flood policies that incorporate some element of adaptation planning include California's Climate Adaptation Strategy which incorporates State Wide Adaptation Plans (Cayan *et al.*, 2008), Holland's Water Act (2009) and National Water Plan which includes the Delta Programme to assess adaptation options (Good, 2011).

Case Study – Marks Point / Belmont South Local Adaptation Plan

LMCC is currently developing an Adaptation Plan in the low-lying lake side suburbs of Marks Point and Belmont South

Figure 2). Other areas identified within the Flood Plan will follow.

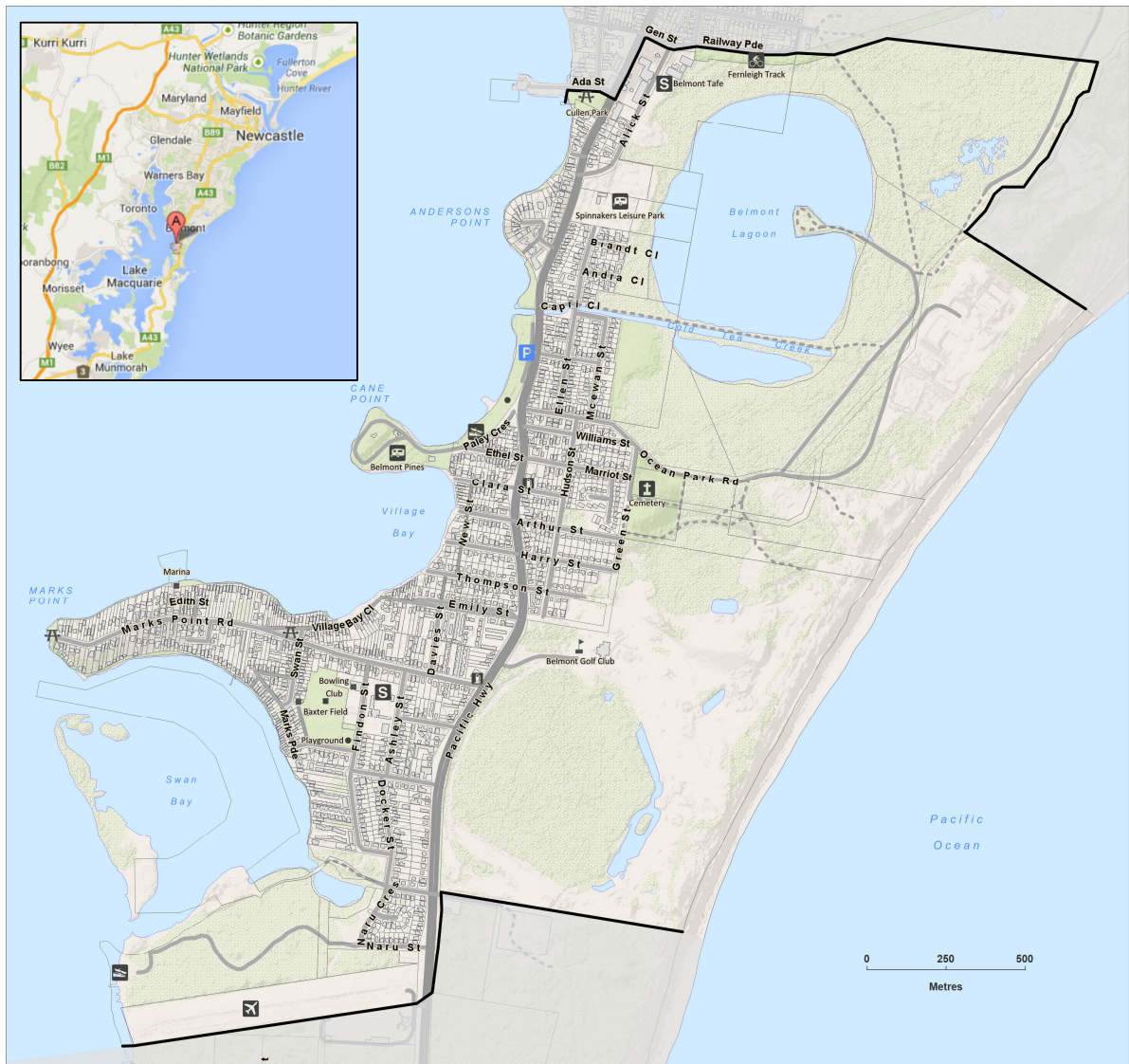


Figure 2: Study area for the Marks Point Belmont South Local Adaptation Plan

The population of the study area is approximately 3000 people and 1500 households. The median age is between 40-45. The study area has a higher proportion of households renting (42%) than the Lake Macquarie average (23%). 38% of these households are either public or community housing. Of those who are home owners, 30% are fully owned without a mortgage (ABS, 2011)

Decision-making process

Adaptation is not a 'one-size-fits-all' approach, but rather will require a combination of tools, dependant on factors such as the local environment, current and potential land use, the legal decision-making framework and importantly, community attitudes and values. Combined with the uncertainties surrounding coastal flooding, it is not easy for coastal managers to make decisions. Dessai and Hulme (2007) note that adaptation decisions must be robust, that is, ones that will work well to achieve the goals even with the inclusion of various uncertainties. Klein et al. (2000) argue that successful coastal adaptation embraces more than just selecting one of the technical options to respond to sea level rise but is rather a complex and iterative process with a series of policy cycles.

As such, research is emerging into 'frameworks' for decision making. A comprehensive definition of such a framework is described by Toth (2000) who reviewed frameworks for the IPCC Third Assessment Report. Toth defined these frameworks as "*analytical techniques aimed at synthesising available information from many (broader or narrower) segments of the climate problem in order to help policy makers assess consequences of various decision options in their own jurisdictions.*" A more concise summary from Masden Jacob (2012) is "*a structure or logic for guiding decision makers through a process of best practice in decision making.*"

A notable founding framework for coastal adaptation is by Klein and Nicholls (1999), as shown in Figure 3. This framework identifies uncertainties from both the natural system as well as the socio-economic system.

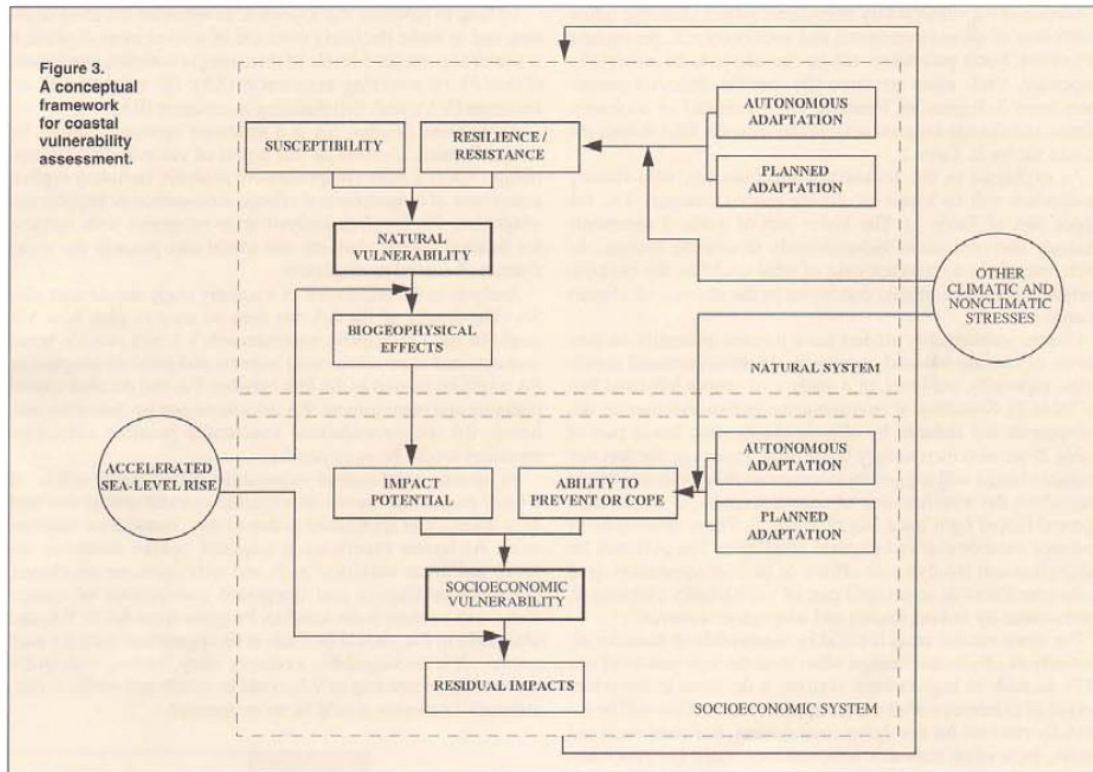


Figure 3: A conceptual framework for coastal vulnerability (Klein and Nicholls 1999)

Other international adaptation frameworks of note include the South West Catchment's NRM Climate Change Risk Assessment Toolkit, which includes the stages of scoping, vulnerability analysis and risk assessment, as well as guidelines for facilitation, workshop design and a template for use either during workshops or as a recording mechanism for information arising from workshops. The UKCIP have also developed an 'Adaptation Wizard' which is a comprehensive adaptation planning framework including elements of vulnerability and risk assessment (UKCIP, 2010).

Within Australia, a useful contribution to decision making is the National Standard, Australian Risk Management Framework (AS/NZS 4360), as shown in Figure 4.

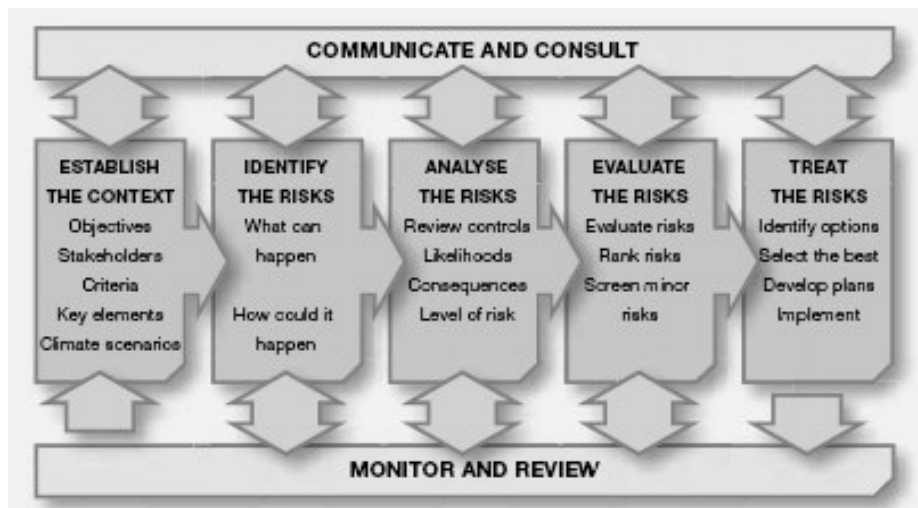


Figure 4: An overview of the Australian Standard AS/NZS 4360 Risk Assessment

Australia also has a National Climate Change Adaptation Framework, which is relevant to the coastal zone, and is the foundation for the 'National Coastal Vulnerability Assessment (NCVA) or 'First Pass' assessment (DCC, 2009), which updated coastal vulnerability mapping and described several risk assessment case studies. Although called a Framework it was not a decision support system as defined in this literature review.

LMCC has been involved with the Hunter and Central Coast Regional Environment Management Strategy (HCCREMS) project, funded by the Federal 'Coastal Adaptation Pathways Initiative', to develop a decision support for adaptation action in the coastal zone. An outcome of this project was to develop a set of principles of the developing a framework for coastal decision making. They are (Marsden Jacob, 2012a):

- Consistency and transparency: Consistent and transparent approaches to decision-making on coastal adaptation;
- Comprehensiveness: Applicable to a range of different issues;
- Scalability: Can be applied at different scales and over different timeframes; and
- Adaptiveness: Enable risk and uncertainty to be addressed through adaptive decision-making processes..

LMCC aims to incorporate these principles when developing Local Adaptation Plans for parts of the City and has drawn from the accompanying [handbook](#) (Marsden Jacob, 2012b) when progressing through stages of the Local Adaptation Plan.

Community engagement strategy

Embedded within LMCC's Local Adaptation Planning is a strong emphasis on community engagement. Following an exhibition and consultation period of the Lake Macquarie Waterway Flood Study, Risk Management Study and Risk Management Plan (LMCC 2012a and 2012b) , which incorporated the sea level rise benchmarks into flood planning levels, it became clear that sea level rise was a sensitive issue within the community. As a consequence, and consistent with LMCC's commitment to community involvement in decision making, LMCC decided to take time to carefully develop a 'strategy', in consultation with a representative group of residents and other stakeholders, to describe how Adaptation

Plans would be developed and how local communities could participate in their development.

LMCC began by drawing from the International Association for Public Participation (IAP2) framework to consider what level of engagement with the community the project required. From the IAP2 scale, the level of involvement was decided to be to “partner with stakeholders to receive advice and formulate solutions” (LMCC, 2013).

LMCC engaged consultants to help develop the strategy. The key component was a two-part workshop, held in April 2013, with 260 residents and stakeholders including infrastructure and service providers invited. The aims of the workshop were to help define the dilemma facing the Council and community over planning for future flooding and sea level rise, and to assist with the design of a suitable process to involve the community in development of Local Adaptation Plans.

The workshops sought information from people with different preferences and perspectives, whether they were residents, businesses, community groups or service providers, on what they think successful engagement looks like.

At the conclusion of this process, LMCC developed the following 4-stage methodology for developing a Local Adaptation Plan with a foreshore community (Figure 5).

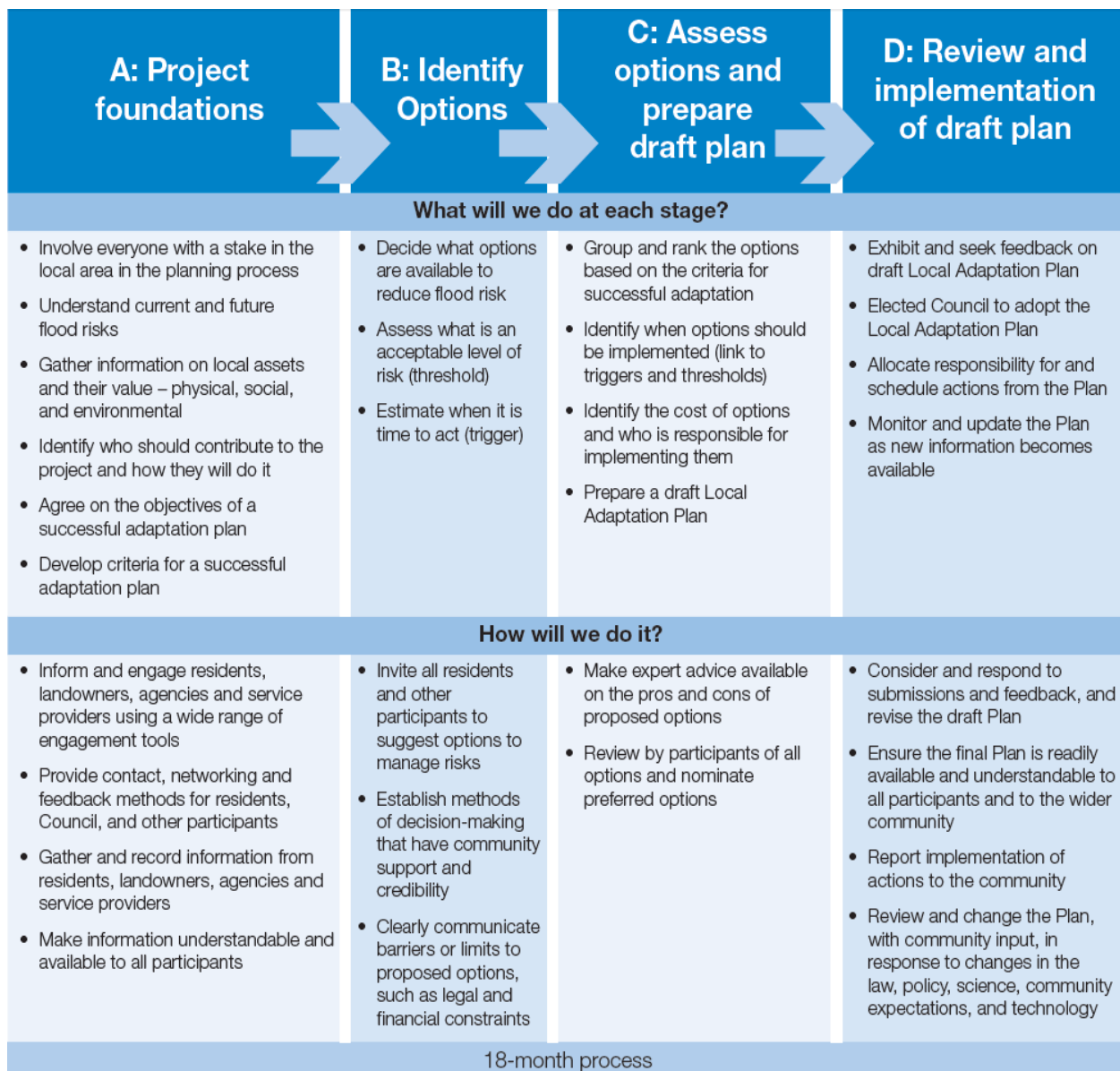


Figure 5: Four stage methodology for developing a Local Adaptation Plan with Lake Macquarie Foreshore Communities

Several videos of the Community Engagement process was developed, one a publicly available [5 minute video](#) for the community, the second an inhouse ‘training’ video in how using a collaborative method can aid in managing a complex issue.

An [on-line portal](#) was also established to provide a central point for information to be shared, and a way for the community to ask questions or post their comments. LMCC used an online community engagement template software as it provided an easily modified front end and backend contact tracking..

LMCC has now completed Stage 1 of the Plan preparation process, and is moving into Stage 2. It is anticipated that this first Local Adaptation Plan will be submitted to the elected Council for consideration by December 2014.

a. Physical risk studies

The Lake Macquarie Waterway Flood Study incorporated sea level rise benchmarks into flood mapping. However, it was identified over time a range of other studies that would be required in order to better understand the physical risk of the area. Other studies prepared by LMCC to inform Local Adaptation Planning include:

- Behaviour of groundwater in response to rises in sea and lake levels;
- Lake foreshore recession due to erosion and inundation;
- Effects of wave run up and overtopping on lake foreshores;
- Wetland change and loss as a result of rising water levels, and opportunities for wetland retreat;
- Changes in entrance channel morphology and hydrology in response to sea level rise;
- Survey of floor level and construction type of existing dwellings;
- Designs for foreshore protection that can adapt to changing lake levels;
- Options and design standards for flood-resilient and flood-adaptable buildings;
- Asset inventories of public infrastructure, the effects of more frequent inundation and rising groundwater on maintenance costs and replacement intervals; and asset adaptation options.

Many of these studies are available from the [Council website](#), or are available [on request](#).

b. Infrastructure, utilities and assets

Local Adaptation Planning requires a focus on public infrastructure, as infrastructure is often located lower in the landscape and therefore is exposed to the impacts of sea level rise earlier than private assets. This infrastructure can have lengthy asset lives, and failure can have significant impacts on private assets as well as the level of service able to be provided to the affected community.

LMCC has liaised with providers of road, telecommunication, sewer, power and gas services in the Marks Point / Belmont South area. Discussions have focused on;

- What assets or utilities are currently managed within the area, or may be into the future;
- The current condition and expected life of those assets;
- The frequency of asset maintenance, renewal and/or replacement for assets within the area;
- If and how these assets may be at risk from an increase in mean sea levels of 0.4 metres and 0.9 metres, and associated increases in groundwater elevation and flood frequency (for example, are there specific thresholds for flood frequency or

groundwater elevation that would lead to failure of the assets, or a need to substantially upgrade them); and,

- How Council and the provider can work together to identify management options for these assets under increasing sea level conditions.

LMCC is also undertaking an internal review of Council assets including roads, stormwater systems, parks and buildings.

The asset classes (e.g. roads, drains, structures) were assessed against a range of scenarios such as the 1 in 100 year flood event for 0.2m, 0.4m and 0.9m of sea level rise. For each scenario, it was asked:

- Would the asset be permanently or periodically inundated under these scenario?
- How would the asset be affected by these scenario, or reversing the question, to what extent could the asset be inundated before it was no longer operational?
- What would be the increased maintenance requirements under these scenarios (i.e would the asset need special maintenance as a result of the lake water level rise) to ensure that current levels of serviceability was maintained?

For each asset class, a scenario of 'do nothing', 'modify/retrofit' or 'replace' was developed based on the scenarios.

Discussion

Community issues and concerns

Stage 1 of the Local Adaptation Plan preparation process has identified a range of issues that are important to community. Figure 6 shows a graph of the most commonly cited issues during Stage 1. These include the importance of maintaining the current lifestyle, managing drainage and stormwater, uncertainty about climate change science, impact on property values and costs of insurance. Issues within the 'other' category include access to foreshore, financial institutions and lending policies, floor levels, flood signs, rates and development restrictions.

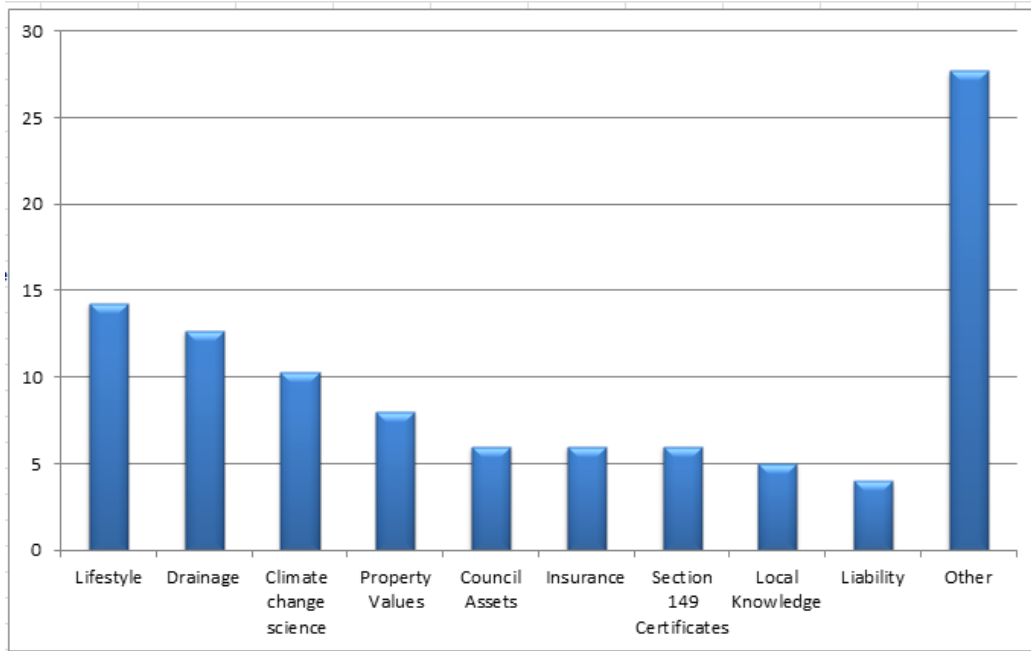


Figure 6: Summary of top 10 issues raised in Stage 1 of development of the Marks Point / Belmont South Local Adaptation Plan

Some examples of comments relating to these issues from the survey respondents:

Issue	Example of comments received
Uncertainty of science	I am concerned that the Council's benchmark water levels are set at an extreme rate, unfounded by any local physical evidence.
Drainage	Complete lack of maintenance by LMCC of street gutters and drains and silting in the lake.
Insurance	...my insurance...has risen from \$3,179.38 last year to \$7,562.48 this year. When questioned [they] told me directly that the rise is due to revised Lake Macquarie Council flood mapping
Local Knowledge	It flooded in the 60's and does the same in this current time
Liability	If people buy houses in a flood area they should already know the risks.
Floor heights	[Drainage problems are now] compounded by raising the level of ... floors... interfering with the natural flow of surface water by creating dams.
149 Notations	My concern is that this planning is bureaucratic nonsense and ... that Council has arbitrarily implemented these certificates on properties without sufficient public consultation.

Insurance

Residents have raised concerns about significant increases in the cost of flood insurance in Lake Macquarie. For example, a resident from Valentine complained to Council that the premium for their Home Buildings and Contents Insurance Policy, with Flood Cover, had risen from \$927.29 in 2011 to \$3,104.26 in 2012 - a 334% increase.

Many residents have linked the insurance increases to the new Lake Macquarie Waterway Flood Study, and particularly the inclusion of projected sea level rise benchmarks, and the associated changes to flood information on Section 149(2) property certificates.

LMCC, in order to better understand these increases in insurance premiums, has met with and/or corresponded with The Insurance Council of Australia (ICA), Risk Frontiers (a research organisation funded by the insurance industry to prepare risk information and advice); retail insurers active in the local market; and Geosciences Australia who is coordinating the national collection and standardising of flood data into a National Flood Information Database.

The main points arising from these discussions have been:

Federal Government's Natural Disaster Insurance Review

The Federal Government's *Natural Disaster Insurance Review*, commissioned to examine insurance for flood and other natural disasters following the 2010 and 2011 summer floods, made 47 recommendations encompassing flood risk management, insurers' claims handling and dispute resolution processes, and the provision of flood insurance. The recommendations include a standard definition of 'flood', which will be used if the insurer offers flood cover in their home building, home contents, small business and strata title insurance policies. The definition is:

Flood means the covering of normally dry land by water that has escaped or been released from the normal confines of:

- a) any lake, or any river, creek or other natural watercourse, whether or not altered or modified; or*
- b) any reservoir, canal, or dam.*

While the recommendations have not yet been adopted, many insurers, in anticipation, are already using them; The 2011 review also recommended it be mandatory for insurers to offer flood insurance cover to consumers, and most insurers now do, but consumers have the right to 'opt-out' of cover;

Insurance data collection

The insurance industry uses data and maps from Council flood studies and elsewhere to prepare its own risk assessments and maps, and it does not use notations from Section 149 Certificates to estimate flood risk.

Insurance is about risk. While premiums for flood cover may continue to increase, premiums will increase less where local governments and individual owners can provide reliable information about the level of flood risk and where effective flood risk management measures are in place.

If localities or individual properties can demonstrate they have made a reasonable assessment of their flood risk and/or have taken measures (such as raised floor heights) to reduce flood damage then they may be able to benefit from reduced premiums. The industry is still working towards better methods to assess the exposure of individual properties e.g. through developing a 'building resilience index'.

Premiums and sea level rise

Retail premiums are based on claims history and only cover risk for the coming 12 months, so are not affected by future events, such as projected future increases in flooding due to sea level rise. The recent increases are mainly due to the large claims from disasters such as Cyclone Yasi and the 2011/12 Queensland floods;

Different retailers offer different products and prices, so consumers are encouraged to shop around. Some companies offer flood coverage in their standard premium, spreading the cost across all their customers, while others price according to assessment of risk to localities, or even to individual properties; and

LMCC intends to continue to engage with the insurance industry with the aim of containing premium increases for Lake Macquarie residents related to natural disasters, particularly flooding. By making the most up-to-date and reliable information on flood risk and flood mitigation measures available to residents, businesses, developers, lenders, and insurers (via Risk Frontiers), it is expected that premium increases will be more realistically priced, and directly linked to the level of risk to individual properties.

Property prices

Another key concern to residents was the impact of Council's actions on property prices. Local media articles titled 'Sea-Level rise policy blamed for property sales' (The Newcastle Herald, 2013a) and "Fears sea-level policy may slash \$1bn off property values" (The Newcastle Herald, 2013b) alleged that LMCC's Local Adaptation Planning was devaluing the property market.

In order to assess the possible effect of flood related development controls and Section 149(2) notations on property valuations and prices, Council gathered information on unimproved land valuations, based on the Valuer General's estimates used for Council rating, and on property sales from the Estate Agents Cooperative (EAC) 'Red Square' database.

Information was provided for suburbs where a large proportion of residential properties are on land identified as a flood hazard in the Lake Macquarie Waterway Flood Risk Management Study and Plan (e.g. Marks Point and Swansea). These suburbs were then compared with waterfront suburbs where few properties are affected (e.g. Eleebana and Coal Point), and against all properties in the LGA. This comparison helps eliminate factors such as economic conditions, interest rates, and general trends in the housing market, and may indicate if low-lying foreshore areas are behaving any differently to the rest of the property market.

For capital growth, it was found that Marks Point and Swansea experienced a small drop in capital growth in 2010, and Swansea saw a large decrease in 2008 (before the LMCC sea level rise policy was adopted in 2009 and around the time of the Global Financial Crisis). In 2011 and 2012 capital growth in these suburbs was at or above the LGA.

For annual sales, it was hard to discern a consistent pattern, although it seemed that the trends in all suburbs roughly followed the LGA trend, with a high volume of sales in 2007 and 2010, and a flattening in 2011 and 2012.

For unimproved land value, Marks Point land value increased by 0.05% between 2007 and 2010. All other land values decreased over that period (-21.48% at Coal Point, -3.07% at Swansea, -1.82% at Eleebana, and -0.38% for the LGA).

The biggest drop in unimproved land valuation is in Coal Point, which is largely unaffected by lake flooding. This may indicate a slow market for top-end real estate. Changes in the other suburbs were close to the LGA average.

Political context

LMCC staff work under policies and guidelines approved by the elected Councillors, as well as under the statutory directions of the NSW and Federal Governments. In formulating and applying public policy, Councillors must take into account community values, community expectations, and community response, in addition to considering the technical and legal merits of a policy.

Although there is large majority in the community who acknowledge the evidence of anthropogenic climate change, and support action to mitigate its effects, several studies have shown this support diminishes when people are asked to take actions they perceive as damaging to their immediate interests (Barnett et al, 2013).

This behaviour became evident when, in implementing NSW Coastal Planning Guidelines (NSW Planning, 2010), several NSW coastal Councils applied risk warnings on Section 149 property certificates of properties within the coastal erosion hazard zone, including the increased hazard from projected sea level rise. In several areas, including Byron Bay, Lake Cathie, and Gosford, residents organised opposition to this risk warning, primarily motivated by the fear it would affect the value and future viability of their properties. The demands of many of these groups quickly moved from changes in hazard classification and property notations, to calls to drop any consideration of future changes in sea levels or climate more generally in coastal risk and flood risk planning.

The withdrawal of the NSW Sea Level Rise Policy in September 2012 shifted the technical and political responsibility for determining appropriate risk thresholds for sea level rise planning back to local government. It caused a misconception with some members of the public that Councils had been directed by the NSW Government not to consider sea level rise in their flood and coastal hazard assessments, or that they were free to select sea level rise benchmarks more-or-less as they pleased.

Conclusion

Local Adaptation Plans have the benefit of allowing for locally specific risk and opportunities of sea level rise to be assessed. It also allows for a more in-depth community engagement process. However, challenges lie in what methodology to use, how to best liaise with asset and utility providers, meeting community concerns over property values, insurance and liability. Stage 1 of the Adaptation Plan has provided LMCC with some excellent learning outcomes and strong foundations for moving into Stage 2.

References

ABS 2011, Census of Population and Housing for the Marks Point and Belmont South region.

Barnett, J., Waters, E., Pendergast, S., & Puleston, A. (2013). Barriers to adaptation to sea level rise. *National Climate Change Adaptation Research Facility, Gold Coast*.

Bijlsma, L., Ehler, C.N., Klein, R.J.T., Kulshrestha, S.M., McLean, R.F., Mimura, N., Nicholls, R.J., Nurse, L.A., Pérez Nieto, H., Stakhiv, E.Z., Turner, R.K. and Warrick, R.A.: 1996, 'Coastal zones and small islands', in R.T. Watson, M.C. Zinyowera and R.H. Moss (eds), *Climate Change 1995- Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, pp. 289-324.

Boateng, I. (2008). *Integrating Sea-Level Rise Adaptation into Planning Policies in the Coastal Zone*. Integrating Generations FIG Working Week. Stockholm, Sweden.

DCC (2009). *Climate Change Risks to Australia's Coast: A first pass national assessment*. Canberra, Australia, Department of Climate Change (DCC).

DECCW (2009). *NSW Sea Level Rise Policy Statement*. Sydney, Australia. Department of Environment, Climate Change and Water (DECCW).

Dessai, S. and M. Hulme (2007). "Assessing the robustness of adaptation decisions to climate change uncertainties: A case study on water resources management in the East of England." *Global Environmental Change* 17: 59-72.

Dobes L.2008 Getting real about adapting to climate change: using 'real options' to address the uncertainties Agenda 15 55-72

Few, R., K. Brown and E. L. Tompkins (2007). "Public participation and climate change adaptation: avoiding the illusion of inclusion." *Climate Policy* 7: 46-59.

Good, M. (2011). *Technical Report: Government Coastal Planning Responses to Rising Sea Levels, Australia and Overseas*. Hobart, Tasmania, Antarctic Climate & Ecosystems Cooperative Research Centre.

IOC (2009). Hazard awareness and risk mitigation in integrated coastal area management. . *Manuals and Guides Number 50*. Paris, France, Intergovernmental Oceanographic Commission (IOC).

IPCC, Ed. (2007). *Summary for Policy Makers*. Climate Change 2007: Impact, Adaptation and Vulnerability. Contributions of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA, Cambridge University Press.

Klein, R. and R. J. Nicholls (1999). "Assessment of Coastal Vulnerability to Climate Change." *Ambio* 28(2): 182-187.

Klein, R. and R. J. Nicholls (1999). "Assessment of Coastal Vulnerability to Climate Change." *Ambio* 28(2): 182-187.

LMCC (2012a). Lake Macquarie Waterway Flood Study. Speers Point, Australia, Lake Macquarie City Council (LMCC).

LMCC 2012b. Lake Macquarie Waterway Flooding and Tidal Inundation Policy. Lake Macquarie City Council, Speers Point.

Marsden Jacob, 2013. Decision Support for Adaptation - the Workbook. Hunter and Central Coast Regional Environment Management Strategy HCCREMs

McGranaham, G., D. Balk and B. Anderson (2007). "The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones" *Environment and Urbanization* 19(1): 17-37.

Nicholson-Cole, S. and T. O'Riordan (2009). *Adaptive Governance for a Changing Coastline: Science, Policy and Publics in Search of a Sustainable Future*. Cambridge, Cambridge University Press.

Stevens HS, Kiem AS 2012. Developing hazard lines in response to coastal flooding and sea-level rise. Peer reviewed conference paper for the Climate Change 2012: Water and Climate: Policy Implementation Changes; Proceedings of the 2nd Practical Responses to Climate Change Conference, 1-3 May 2012, Canberra

The City of New York, (2013) PlaNYC. A Stronger, More Resilient New York, in: Bloomberg, M. M. R. (Ed.). New York: The City Of New York.

Toth, F. (2000). *Decision analysis frameworks*. Guidance papers on the cross cutting issues of the Third Assessment Report of the IPCC. R. K. Pachauri, T. Taniguchi and k. Tanaka. Geneva, Intergovernmental Panel on Climate Change: 53-68.

UKCIP (2010) The UKCIP Adaptation Wizard v 2.0.Cited 01/03/2012. URL: <http://www.ukcip.org.uk/wizard/>. UKCIP, Oxford.

Walsh, K. J., H. Betts, J. A. Church , A. B. Pittock, K. L. McInnes, D. R. Jackett and T. J. McDougall (2004). "Using Sea Level Rise Projections for Urban Planning in Australia. ." *Journal of Coastal Research* 20(2): 586-598.