

# PLANNING TO ADAPT – THE MARKS POINT AND BELMONT SOUTH LOCAL ADAPTATION PLAN

G Giles<sup>1</sup>, T Boyle<sup>1</sup>, H Stevens<sup>2</sup>

<sup>1</sup>Lake Macquarie City Council

<sup>2</sup> NSW Office of Environment and Heritage

## Introduction

Every day council staff, homeowners, developers, service providers and communities make planning decisions that have to meet needs and conditions for decades, even centuries, into the future. Planning for flood hazards has never been easy, as prediction of future floods is uncertain, and the choice of risk thresholds for flood planning is a balance between the benefits of being near the water and the costs of flood damage.

However, NSW and other jurisdictions have established a relatively consistent approach, setting planning thresholds using a rare but major flood (usually the 1% AEP) and adding a 'freeboard' to allow for modelling errors, and for unpredictable hazards such as flood debris and waves. Within this threshold, decisions can be made to exclude development in high hazard areas or allow development if homes and infrastructure are built above the predicted major floods.

Global warming has added new challenges to this approach. Due to shifting rainfall patterns and rising sea levels, the predicted flood level is not static, but changes over time. Uncertainty in prediction is increased, and responses cannot rely on experience of previous events. These changes to flood risk, and the new inundation risk from rising sea levels, cannot be ignored. Government policy, community expectations, and legal precedent make it clear that planners who continue with business as usual are in breach of their public duty of care.

Planning for future risks that are new and uncertain requires flexibility, an ability to keep options open for as long as possible, innovation – in short, adaptation. This paper outlines how Lake Macquarie City Council (LMCC) developed a local adaptation plan for the lakeside communities of Marks Point and Belmont South to manage the risks from lake flooding and rising sea levels.

## The planning context

### *The physical risk*

Lake Macquarie, just south of Newcastle, Australia, is one of the largest coastal lagoons on the NSW coast, covering 110km<sup>2</sup>. The narrow entrance to the ocean at Swansea Channel means the lake is subject to the same long-term rises in sea levels as the ocean, but the channel restricts the daily tidal range in the lake to about 0.10metres (MHL, 2015).

Heavy rain in the lake's catchments causes the lake to rise, flooding low-lying foreshores and homes. The highest recorded flood was on 18 June 1949 when the lake



rose to 1.25metres AHD. Flood modelling indicates a 1% AEP flood would reach 1.50metres AHD, and 2.32metres AHD with 0.90metres rise in sea levels (WMAWater<sup>1</sup>, 2012).

The *Lake Macquarie Waterway Flood Risk Management Study and Plan* estimates there are 7,500 properties around the lake that would be affected by a current 1% AEP flood, and this rises to 9,500 with 0.90metres rise in sea and lake. Homes affected by over-floor flooding would increase from about 875 to over 4000. The rise of 0.90metres in lake levels would permanently inundate some 400ha of residential land, affecting 7000 building footprints levels (WMAWater<sup>2</sup>, 2012). This makes the Lake Macquarie Local Government Area the most exposed in NSW to the risks from rising sea levels (Department of Climate Change, 2009).

Lake Macquarie City Council unanimously adopted the *Flood Risk Management Study and Plan* in 2012. The first high-priority action recommended in the *Plan* was to “undertake a detailed assessment (Local Area Adaptation Plans) for each foreshore management area, in consultation with each affected community, of the implications and adaptation measures available to plan for and mitigate the effects of sea level rise (flooding and tidal inundation)” levels (WMAWater<sup>2</sup>, 2012).

Preparation of the first Local Adaptation Plan (LAP) began at Marks Point and Belmont South in August 2013 and the draft is currently on public exhibition, prior to going to Council for adoption in early 2016. LAPs for other affected foreshore settlements around Lake Macquarie will be completed over the next few years. A full copy of the draft LAP and supporting documents can be found on the “Have Your Say” page of LMCC’s web-site: <http://haveyoursaylakemac.com.au/future-flood-planning> .

Marks Point and Belmont South are well-established settlements on the Pacific Highway, on the eastern shores of Lake Macquarie. It is a residential area, with a mix of bungalows and some newer two-storey unit and town house developments. The housing includes valuable waterfront properties, public housing, and a few remaining ‘fishing shacks’. There is a school and a small local shopping centre.



**Flooding at Marks Point: In 1949 (left) floodwaters reached 1.25metres AHD while in the June 2007 ‘Pasha Bulker’ storm they reached 1.05metres AHD.**





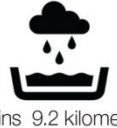

Much of the area is low-lying and poorly drained, having been built on reclaimed hind-dune and foreshore wetlands. This makes it vulnerable to lake flooding, with local



roads, the Pacific Highway, and foreshore areas frequently inundated by minor floods (<5% AEP).

With rising sea and lake levels, minor floods will become more frequent, major floods will become higher, and low-lying land will become permanently inundated.

**Table 1: Some of the assets at Marks Point and Belmont South at risk from lake flooding and permanent lake level rise**

Assets	Assets at risk from hazard		
	Major (1%AEP) flood	0.9 metres rise in lake levels (permanent tidal inundation)	Major (1%AEP) flood and 0.9 metres rise in lake levels
 Homes 1190	237 homes with over-floor flooding	391 properties with water lying beneath the building	939 homes with over-floor flooding
 Public land 19.83 hectares	13.18 hectares	8.17 hectares	14.75 hectares
 Private land 97.19 hectares	42.91 hectares	14.07 hectares	73.0 hectares
 Roads 23.91 kilometres	10.1 kilometres	4.0 kilometres	17.6 kilometres
 Drains 9.2 kilometres	4.5 kilometres	1.8 kilometres	7.6 kilometres
 Wetlands 234 hectares	126.1 hectares	73.7 hectares	155 hectares

### ***The governance settings***

The NSW Government requires Local Governments to consider climate change in their land-use planning, natural resource management, and risk management.

Management of oceanic hazards such as beach erosion and storm surge, are covered under the *Coastal Protection Act* (1979). Local Governments implement the provisions



of the Act via Coastal Zone Management Plans (CZMPs) which assess the hazards and provide options for risk management.

The *NSW Floodplain Development Manual* provides guidelines for Local Governments and other floodplain management agencies for the assessment and management of flood risk (DIPNR, 2005). In urban and coastal areas, its legal basis is the requirement under the *NSW Environmental Planning and Assessment Act (1979)* to consider flood risks, among other things, in land use planning and development assessment.

There are various guidelines on the process and content of risk management plans for coastal and flooding risks. They all require that projected climate change hazards be considered and included in risk management. For example, the *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* sets out six principles, including incorporating sea level rise in risk planning, avoiding intensification of development in high-risk coastal areas, and making allowances for adaptation and retreat, if necessary, in forward planning for coastal land use and development (NSW Department of Planning 2010).

Similarly, the *NSW Floodplain Development Manual* includes provision for “recognition of the potential implications of climate change on flooding behaviour” (DIPNR, 2005). The supplementary *Flood Risk Management Guide – Incorporating sea level rise benchmarks in flood risk assessments* “assists local councils, the development industry and consultants to incorporate sea level rise...in floodplain risk management planning and flood risk assessments for new development” (DECCW, 2010).

Significantly, if councils follow the processes in the *Floodplain Development Manual* and the more recent up-dates and guidelines, they are provided with protection from liability relating to the development of flood liable land under section 733 of the *Local Government Act 1993*. The nature of the hazards at Marks Point and Belmont South, the clear and tested NSW guidelines for flood risk management, and the protection from liability under Section 733 led LMCC to choose this legislative and regulatory framework for its adaptation planning. Adaptation actions are also integrated into coastal zone management plans and statutory planning instruments.

Despite these established frameworks, changing policies and politics of State and Federal governments have made governance for Local Governments affected by sea level rise uncertain. Lack of action from the NSW Government, despite several years of lobbying from local government and coastal planners forced many councils, including LMCC in 2008, to adopt their own sea level rise planning levels. Eventually the NSW Government adopted the *NSW Sea Level Rise Policy Statement* in October 2009, setting consistent and scientifically credible planning benchmarks for sea level rises – 40cm above 1990 levels by 2050, and 90cm above 1990 levels by 2100.

The *Statement* and the benchmarks were withdrawn in September 2012, once again shifting responsibility back to councils. The NSW Minister for the Environment advised Council that “in determining appropriate sea level rise benchmarks, councils should consider information on historical and projected future sea level rise, which is widely accepted by competent scientific opinion” (correspondence 10 December 2012).

In the light of this requirement, and following the favourable review of the NSW benchmarks by the Chief Scientist that found the “approach used by OEH (to calculate the benchmarks) is considered to be adequate...”, LMCC adopted the NSW benchmarks for use in coastal and flood planning (Chief Scientist & Engineer, 2012).

A recent internal Council review of the benchmarks, using new data and analysis from the IPCC Fifth Assessment Report (IPCC5), concluded that, although the IPCC5



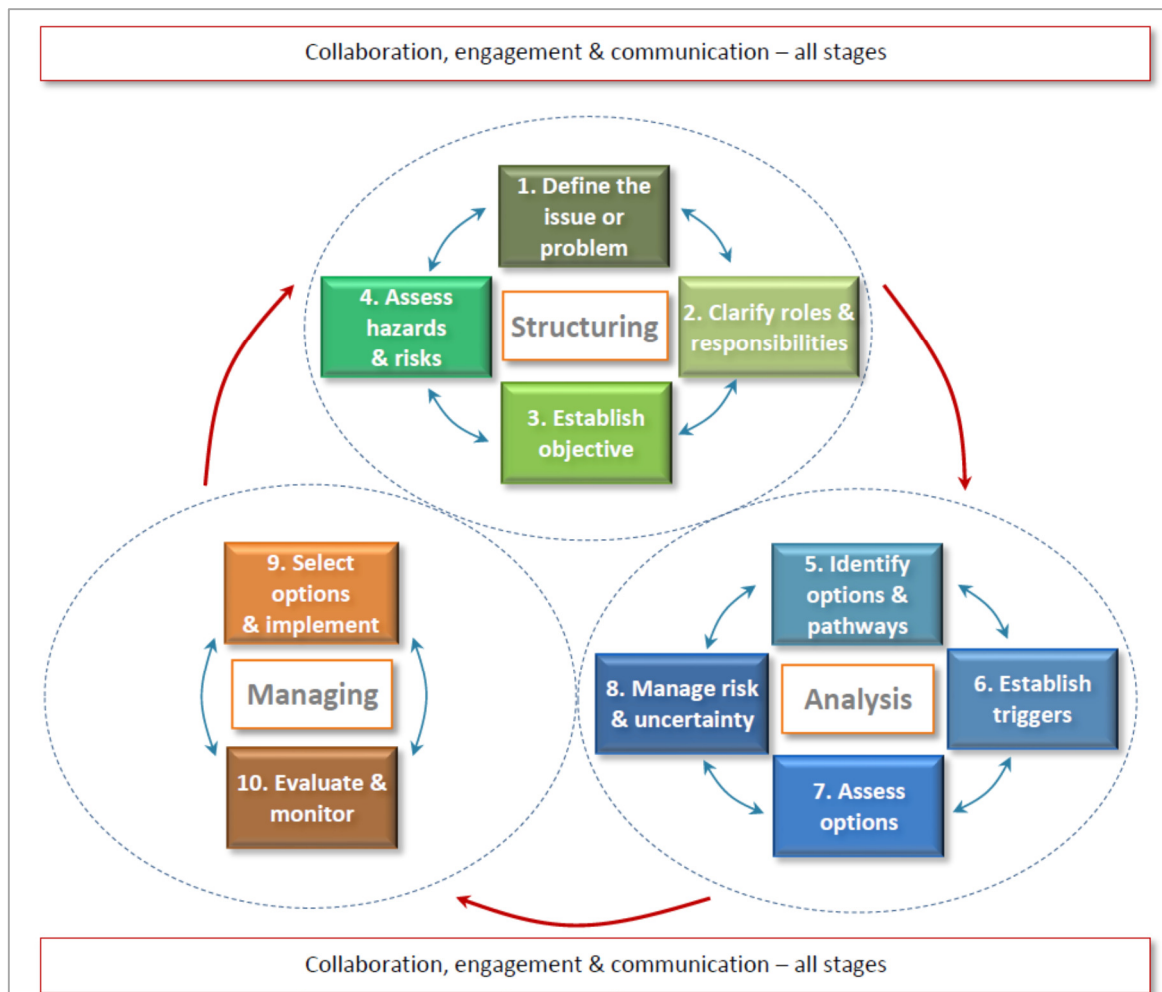
projected levels were a little lower for 2050 and a little higher for 2100, there was insufficient change to warrant revising the current benchmarks. However, the lack of consistent sea level rise benchmarks at State and National levels continues to undermine the credibility of local planning in the eyes of the community, and creates inconsistency in planning and development controls between adjoining local government areas.

### ***The decision making framework***

Hazard and uncertainty are a dangerous combination in any community, especially when mixed with climate change. In anticipation of community concerns at choosing Marks Point and Belmont South for a 'pilot project' to plan for adaptation to rising sea levels, LMCC committed to an evidenced-based, highly collaborative approach to local adaptation planning.

As residents have frequent experiences of lake flooding, there is a basic understanding in the community of the consequences of and possible management responses to flooding. This supported Council's choice of the NSW floodplain management guidelines as the basis for risk assessment and planning.

**Figure 1: The decision making framework used as a framework for the Marks Point and Belmont South Local Adaptation Plan (Marsden Jacob 2012)**





The local adaptation planning process followed a decision-making framework developed by Hunter Councils (Figure 1) to ensure a rational and transparent decision (Marsden Jacobs 2012). The elements from this framework that proved most helpful were the establishment of thresholds and triggers for actions, the methods for assessment of options, and the bundling of options to develop adaptation pathways.

Finally, LMCC committed to developing the LAP in collaboration with the community, as recommended for complex problems by the International Association for Public Participation's 'public participation spectrum' (IAP2, 2014).

Despite these commitments, early interactions with the community were met with outrage and anxiety. The community believed, rightly or wrongly, that LMCC's approach to flooding and sea level rise was responsible for a collapse in property values and increases in the cost of flood insurance. They believed alarming and inaccurate reports in the media that Council had "demolition in mind – thousands of houses to be part of 'retreat'" (Newcastle Herald 29 April 2013). One month before the first LAP community workshop, the community organised a meeting and collected 800 signatures condemning LMCC for their decision to plan for sea level rise, and calling on them to withdraw from the LAP process.

While this was, and continues to be, a significant issue between Council and some community members, the high level of interest led to strong participation of the community in the collaboration process.

## **Preparing the Local Adaptation Plan**

### ***Community engagement***

Before LMCC engaged directly with residents at Marks Point and Belmont South, all affected foreshore residents in the LGA, as well as infrastructure and service providers, were invited to participate in a series of workshops to develop their preferred engagement process. The workshops agreed that collaboration with all stakeholders, and particularly with affected residents, was required. While there was considerable scepticism and resistance from residents towards planning for sea level rise, mainly based on fears of the possible consequences for property owners, there was also recognition that some level of action and pre-planning was prudent in the face of uncertainty about future sea levels.

The workshops agreed that an adaptation plan should:

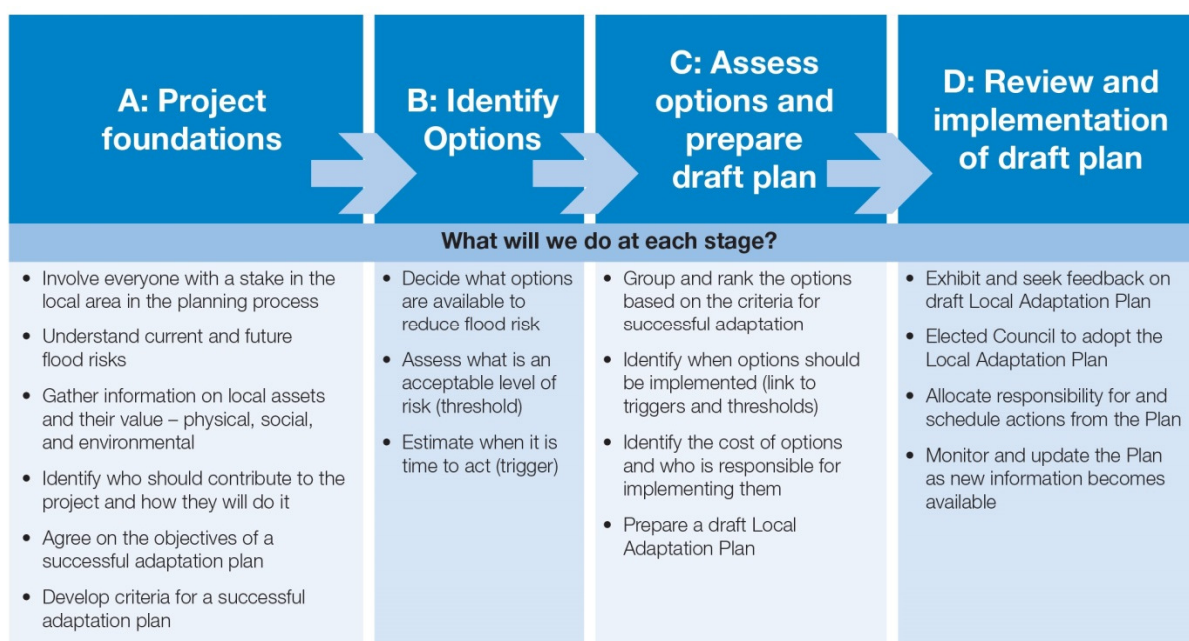
- Acknowledge that risks are *location specific* and are best addressed at the local level.
- Recognise that being prepared *requires input* from landowners, business owners, residents, special interest groups, community organisations, Council, and state government agencies.
- *Be timed* so the actions are implemented when they are required to accommodate increases in risk.
- Identify the *criteria for a successful outcome* (economic, social, environmental)



- Provide a level of *certainty* about how and when future actions will be required, yet be *flexible* enough to change with changing information (LMCC<sup>1</sup>, 2013).

The participants adopted a four-step program for the development of the plan and the collaboration process (Figure 2). In practice, the program was more iterative in its application than the linear flow in the diagram indicates, with the participants later in the process often revisiting and revising actions taken earlier on.

**Figure 2: The community engagement process for adaptation planning, agreed between residents, Council and other agencies (LMCC<sup>1</sup>, 2013)**



## ***Project Foundations***

LMCC prepared a large number of background studies, in addition to the flood study, prior to engaging the community. These included:

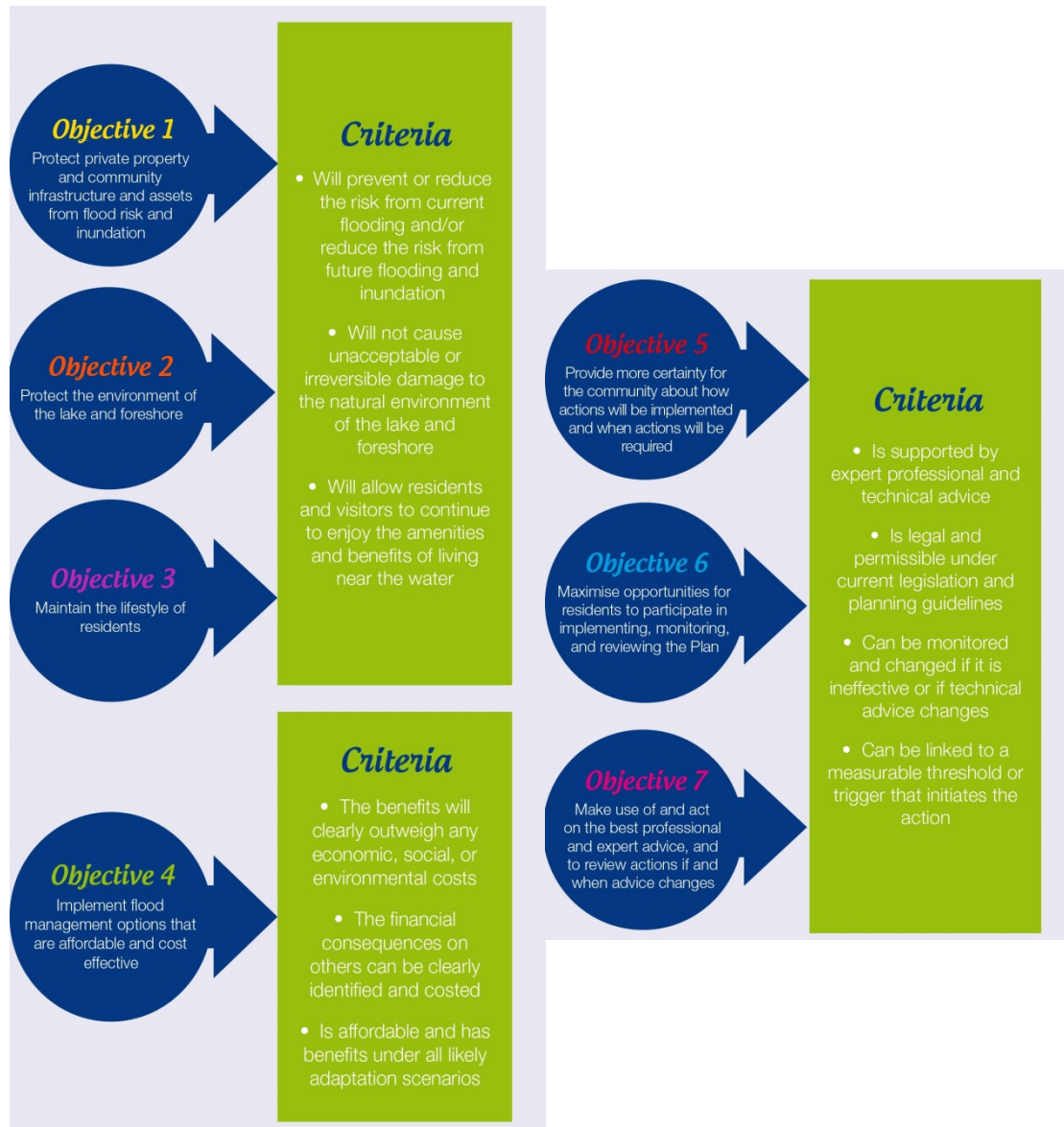
- Wave run-up, overtopping, and foreshore recession assessment
- Groundwater response to sea level rise
- Wetland retreat assessment
- Guidelines for adaptable flood-resilient housing
- Resilience of housing stock to natural disaster and the impact on insurance premiums
- Design for adaptable foreshore protection works
- Historic changes in lake levels
- Effect of sea level rise on the tidal range in the lake
- Monitoring of improved and unimproved property values

Objectives for the LAP, and criteria to assess the objectives, were developed in conjunction with the community (Figure 3). In practice, these objectives and guidelines



were not fully developed until later in the process, when there was a clearer understanding of the likely management options.

**Figure 3: Objectives of the Marks Point and Belmont South Local Adaptation Plan and the criteria used to assess if proposed management actions met the objectives (LMCC, 2014)**



### **Identifying the options**

Through surveys and workshops, the community was asked to suggest ways the risks from flooding and rising lake levels could be managed. The 39 options suggested by the community covered proposals ranging from flood mitigation using big engineering works, such as modifying the lake entrance, to incremental changes to accommodate the risk, such as using more flood-resilient materials in house and infrastructure construction. The options suggested by the community included all the options already recommended in the *Lake Macquarie Flood Risk Management Study and Plan*.



## ***Assessing the options***

The decision framework developed by Hunter Councils suggests options should be 'filtered' or 'screened' using a relatively coarse assessment, so a short-list of options is created prior to more detailed assessment (Marsden Jacob, 2012). The community participants in the LAP collaboration arrived at this realisation independently of the decision framework. They advised Council that assessing 39 options against seven objectives and 10 criteria was not practical.

Instead, they suggested the options could be screened using four 'showstopper' criteria:

- Will it work?
- Will it help maintain community lifestyle?
- Will the environmental impacts be acceptable and manageable?
- Will the benefits outweigh the costs?

Twelve community volunteers worked for nearly a year to review the options against these criteria. In some cases, specialist external advice was requested, on the effectiveness of enlarging the entrance channel for example (it will make flooding and sea level rise in the lake worse). In other cases, new research was necessary, to assess the effectiveness of stormwater drainage and possible modifications to maintain function as lake levels rise, for example.

Twenty-two of the proposed options were assessed as "warranting further consideration", with the remaining 17 failing to meet the showstopper criteria.

While there are many examples of options to manage flooding, there are few precedents for managing the new hazard of permanent inundation. The three main strategies considered were:

1. Retreat – relocate or abandon assets as they become affected by rising water levels
2. Protect – prevent the land from becoming inundated by building levees, dykes or filling land
3. Accommodate – by adapting buildings and services to function even when they are sitting above water

The first two options were assessed for the LAP: retreat as the consequence of 'business as usual'; and protection. Accommodation of inundation was not considered further, as a 'coarse filter' showed the expense and disruption required to adapt to living over water was prohibitive, particularly as alternative solutions are available.

The protect strategy was preferred over retreat. It met, in particular, the criteria to maintain community lifestyle and wellbeing, and that benefits should exceed costs. The business as usual/retreat option was disruptive to lifestyle and the costs outweighed benefits due to the high value of land and assets abandoned or damaged.

The Hunter Councils framework recommended 'bundling' of options that are inter-dependent or that reinforce each other (Marsden Jacob, 2012). This task was assigned to a specific community workshop. A group of actions that involved protecting the foreshore, filling land, and raising infrastructure were found to be inter-dependent. These actions were proposed to manage the hazard of permanent inundation of low-



lying land and infrastructure as lake levels rose. The increased flooding hazard was addressed using 'business as usual' - constructing floors in new buildings above the projected 1% AEP flood over the life of the asset. This suite of actions was 'bundled' to form one adaptation pathway.

One of the 'showstopper' criteria was that the benefits of actions should outweigh the cost. The bundled adaptation actions of the preferred 'protect and raise' strategy (Figure 4) were subject to a cost-benefit analysis, against a 'business as usual' case. Two other bundled 'protect and raise' options suggested by the community were also assessed.

The cost of any adaptation strategy is essentially the cost to implement management actions plus the cost of any damages due to the residual risks. The tangible benefits are the damages avoided – flood damage to assets and the loss of land and assets that become permanently inundated.

The analysis prepared for the Marks Point and Belmont South LAP is based on 'industry norms' rather than real local construction costs. Any biases as a result (mainly towards underestimating) are likely to occur in both the calculation of costs and benefits, so the analysis should give a general indication of the relative benefits.

The preferred adaptation strategy showed a benefit-to-cost ratio of 1.05. A similar bundle of actions, but including a levee to prevent flooding, showed a ratio of 0.34, as the cost of building a levee is high and the benefits minimal if homes have floors already built above flood levels. A third option suggested by the community, to fill up to the projected 2100 1% AEP flood level, showed a ratio of 0.32, for similar reasons as the levee.

A further 16 actions complemented this strategy or provided additional benefits.

### ***The draft Plan***

The draft Marks Point and Belmont South LAP addresses two main hazards as lake levels rise: lake flooding, which will increase in frequency and severity; and the permanent inundation of low-lying land and assets.

The strategy to manage the increased flood risk is 'business as usual', using measures adopted across the LGA following the 2102 flood study, including:

- construction levels for new assets based on the increased flood hazard over the life of the asset;
- avoid significant increase of new assets in high hazard areas; and
- encourage innovative, adaptable, and flood- resilient asset design.

Permanent inundation is managed by the 'protect and raise' strategy, designed to raise land levels and infrastructure roughly in step with increases in mean lake levels, ensuring there is no increase in risk despite the progressive increase in hazard.

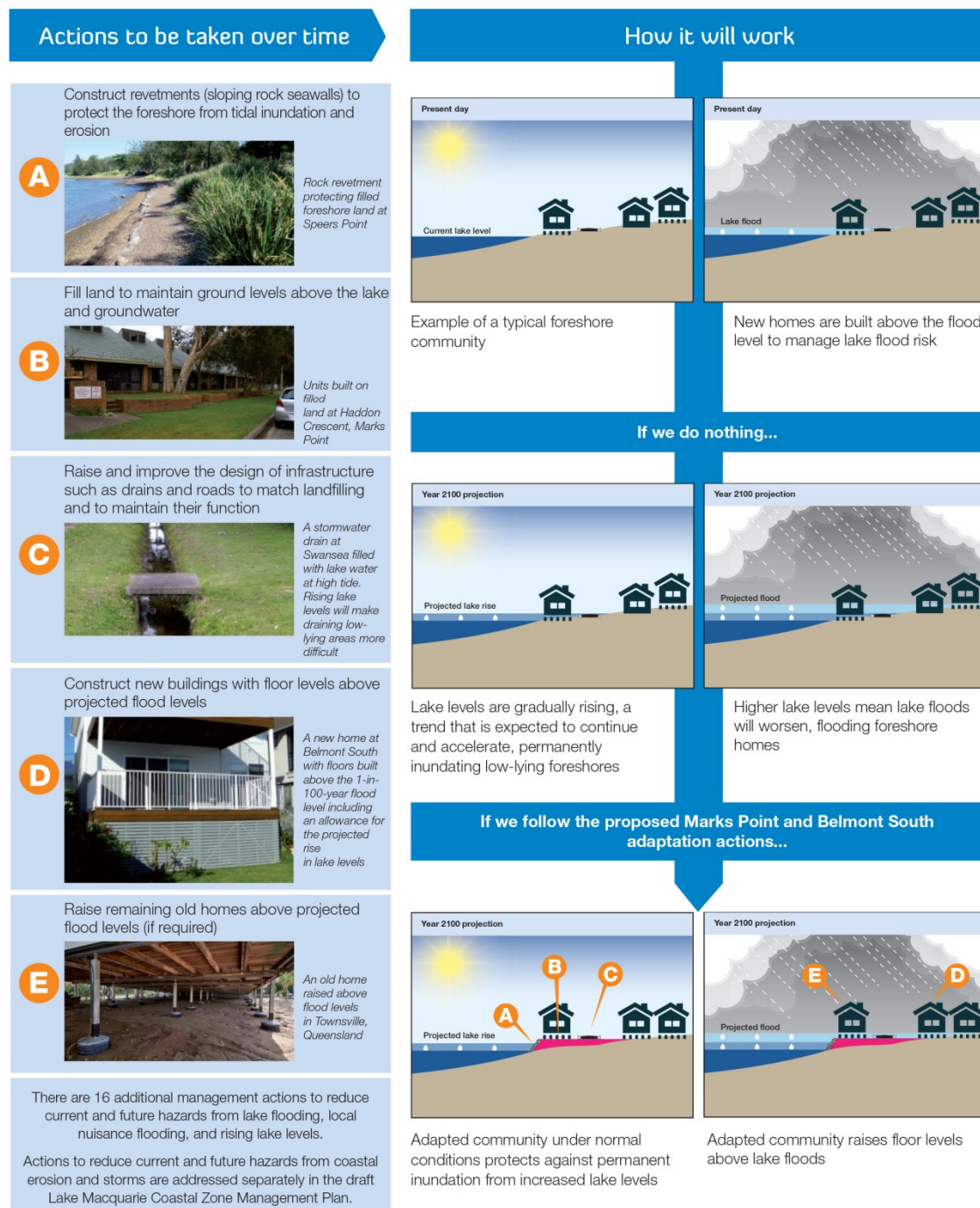
### ***Timing and triggers***

Actions to manage the risks from changing lake and flood levels are best delayed until they are required – 'plan for the worst, but only act when necessary' is one of the



'adaptation essentials' identified by the community and included in the LAP. This has the added advantage of addressing some of the uncertainty, and even disbelief, around the threat from sea level rise - if levels don't rise as fast or as far as projected, then the actions won't be necessary.

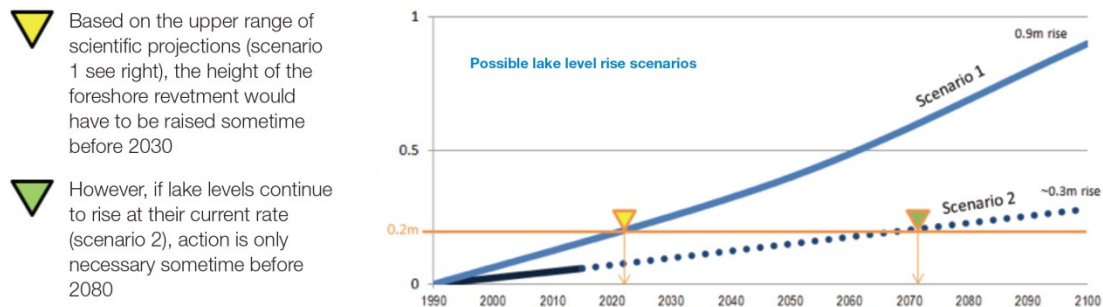
**Figure 4: The 'protect and raise' adaptation strategy adopted at Marks Point and Belmont South**





Of course, management action is required in advance of the hazard threshold being reached. Land needs to be filled before it is inundated. Floor levels need to be raised before they become prone to frequent flooding. This is illustrated in Figure 5, using the example of foreshore revetments.

**Figure 5: How lake levels will be used to set thresholds for the construction of foreshore revetments. The trigger for construction will be sometime before the threshold is crossed.**



However, in practice there is another common trigger for implementing adaptation actions – the renovation or renewal of existing assets. Homes, roads, schools, drains, revetments, and playing fields are all managed on the basis that they will need major renewal or replacement at some time – at the end of their ‘asset life’. Most common assets have asset lives of between 30 and 100 years. Over the planning period of the LAP – 85 years – most of the assets in the planning area are likely to be replaced or upgraded. This is ‘business as usual’, so the only additional cost arises with the increased construction standards required for new assets.

### ***Planning and development controls***

The Lake Macquarie Development Control Plan (DCP) contains controls specific to areas affected by lake flooding and sea level rise (LMCC, 2014). These include floor height requirements for new buildings, filling and foreshore setback guidelines, and controls on new and in-fill subdivision.

These controls were designed to manage the assessed risks from flooding and permanent inundation. Some of this risk arose from uncertainty about the long-term ability to maintain access and infrastructure in some low-lying areas. To some extent, the Local Adaptation Plan reduces that uncertainty, at least for the foreseeable future. The LAP therefore includes an action to review planning and development controls once the Plan has been adopted.

It is expected that Council will include specific elements of the LAP in its statutory planning instruments, most probably as an Area Plan in the DCP.



## **Issues remaining and lessons learnt**

### ***Climate change science***

One of the most common and persistent issues raised by the community was concern about the credibility of climate change science and sea level rise projections. This ranged from uncertainty about levels and timing, to straight out disbelief and denial. Over the course of developing the LAP Council position on the science was:

- Council does not do scientific research and takes its advice on from the experts in the field. If there is concern or doubt about the validity of the science it needs to be raised with them.
- Council is monitoring local lake levels and beach recession and reports the results regularly to the community, although changes are not exclusively the result of sea level rise.
- Council will review their sea level rise benchmarks in the light of new scientific information or changes in Government policy, and at least every five years.
- Where possible, triggers for adaptation actions will be related to the rates and levels of sea level rise so, if the projections are not correct, the timing of actions will change accordingly

This approach seemed to improve community acceptance of adaptation planning, even when they weren't convinced about climate change. However, our personal observation would indicate there is a strong link between opposition to particular management actions (such as planning controls) and denial of the science. It is difficult to determine which one leads to which.

### ***Future discounting***

Future discounting allows for the fact that unrealised future benefits or costs are valued less than those that are immediately available. There are two aspects of future discounting that have arisen in the preparation of the LAP.

First is the psychological effect - immediate decisions and experiences are seen as more important than ones that may arise in the future. For example, many community members see the issue of poor stormwater drainage, something they experience often, as more important than permanent inundation, which they have never experienced and won't become a serious problem for many years. Poor drainage causes almost no tangible damages, and no permanent loss of land use or amenity, while permanent inundation has the potential to cause losses of >\$50million. Yet, the effect of discounting the more remote hazard, combined with short funding and political cycles, mean the allocation of resources to address inundation, especially if it seen to be at the expense of drainage maintenance or other immediate concerns, will be politically difficult.

Second is the technical application of future discount rates to the cost benefit analysis. The NSW Treasury recommends a rate of 7%, which makes both costs and benefits realised beyond about 2050 count for little (NSW Treasury, 2010). This makes the timing of any large capital mitigation or adaptation works (such as seawalls or flood



levees) critical – if the construction cost is realised a long time before the benefits then the costs will nearly always outweigh the benefits due to the effect of the discount rate.

The Marks Point and Belmont South LAP does not include any major capital works or, rather, the capital works are staged over an extended period, so they are not overly sensitive to the effects of the future discount rate. When the assumed rate is reduced to 4% or raised to 10%, the benefit-to-cost ratio for the LAP remains >1.

### ***Benefits, costs, and who pays?***

The cost benefit analysis is a work in progress, and it is expected that improvements in the methodology and data will affect the calculation. However, the sensitivity of the analysis was tested by changing some of the underlying assumptions and data, such as raising or lowering the future discount rate and changing the commencement date and timing of protection works. The ratio was not strongly affected by these changes, indicating the current assumptions and methodology is robust.

The analysis did not take account of intangible costs and benefits, such as loss of public access to the foreshore, or the environmental and aesthetic values of natural beaches.

The effect of costs and benefits not only depends on the ratio of one to the other, but also on who pays the costs and who enjoys the benefits. Current arrangements and expectations are that Council and other public authorities will provide the foreshore protection works and infrastructure improvements. While this provides some public benefit, the main beneficiaries are the private owners of foreshore properties.

Implementing the Marks Point and Belmont South Plan and future local adaptation plans requires more work to be done to analyse the distribution of costs and benefits, the social effects of costs that fall on people who are unable to pay, and financial models to allow councils and other public agencies meet increased maintenance costs and future capital costs of adaptation works. State and Federal Government will be important partners in this discussion.

### ***Property values and insurance affordability***

The community formed a direct link between local adaptation planning and perceived falling property values and issues of insurance affordability.

While Council monitoring of unimproved land values and real estate sales figures in affected areas showed no clear trend, local agents reported that some individual property sales have been affected by buyers scared off by talk of future sea level rise, or discouraged by flood-related development controls. By providing some certainty and consistency about the management of the hazard from rising lake levels, at least for the next 80-100 years, it is hoped the LAP will help alleviate these concerns.

Similarly, the community attributed increases in the cost of flood insurance to maps of future (2100) flood extents and believed insurers use information on Section 149 certificates to determine which houses are at risk from flooding. All the information LMCC and the community received from the insurance industry is that this is incorrect, but the view persists.

Currently, most retail insurers do not assess flood risk on the individual property but, rather, assign the risk across all homes in particular flood areas. However, this is set to



change, with a move to base flood insurance premiums on assessment of individual properties (Productivity Commission, 2014). While this may send a price signal that encourages owners to make their homes more resilient, there have to be schemes in place to ensure home modification is available and affordable to all members of the community. Often the oldest and most vulnerable homes are owned or rented by the poorer and most vulnerable members of the community.

In addition, the price signal will only work if the insurance risk assessment and pricing process is more transparent to the consumer. The current 'commercial-in-confidence' secrecy that surrounds the pricing of retail insurance masks any connection between flood-safe houses and more affordable insurance.

### ***Considering retreat***

Much of the community hostility to local adaptation planning arose from a fear of retreat. Some in the community demanded Council rule this out before they would consider participating in adaptation planning. To maintain the integrity and transparency of the assessment process, Council insisted all management options should be properly considered and assessed on their merits.

The assessment showed that unplanned retreat was not justified at Marks Point and Belmont South, although the LAP does allow the planned retreat of local wetlands. However, having communities engage in a structured assessment process that may support an option for retreat, with its implied social dislocation and loss of property value, remains a significant obstacle to future collaborations.

### ***Beyond 0.9metres***

The elephant in the room during the adaptation planning process was that sea level rise is projected to continue for several hundred years, by up to 3.3metres by 2300, even with a low emissions scenario (IPCC5, 2013). However, the uncertainties about climate change and sea level rise projections increase with time, and the usefulness of planning for far-distant possibilities decreases accordingly. The asset and functional life of the developments covered by local government planning rarely extend beyond 100 years, except perhaps for those councils responsible for water and sewerage infrastructure.

The relative certainty provided to residents by the Marks Point and Belmont South LAP, up to a 0.9 metre increase in sea levels, provides them with the security and time to plan beyond 0.9 metres as the projections become more certain, and adaptation options become more sophisticated.

Critically, none of the adaptation options proposed in the LAP are likely to limit or prevent the community from choosing different options or strategies in future.

## **Conclusion – adapting to adaptation planning**

Whether the Marks Point and Belmont South Local Adaptation Plan is a good or bad solution to the wicked problem of rising sea levels will not become clear for many years. However, reflecting on the experience of developing the LAP may provide some



useful guidance for those that follow. From the authors' experience with the Marks Point and Belmont South LAP, good adaptation planning requires:

- close collaboration with those affected
- good planning frameworks and decision-making frameworks
- consistent political support
- good science, hazard and risk information – although this is not sufficient on its own
- flexibility and patience
- new knowledge and new planning and financial frameworks but, until LAPs are developed, it is hard to identify and argue for these.

## Acknowledgements

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