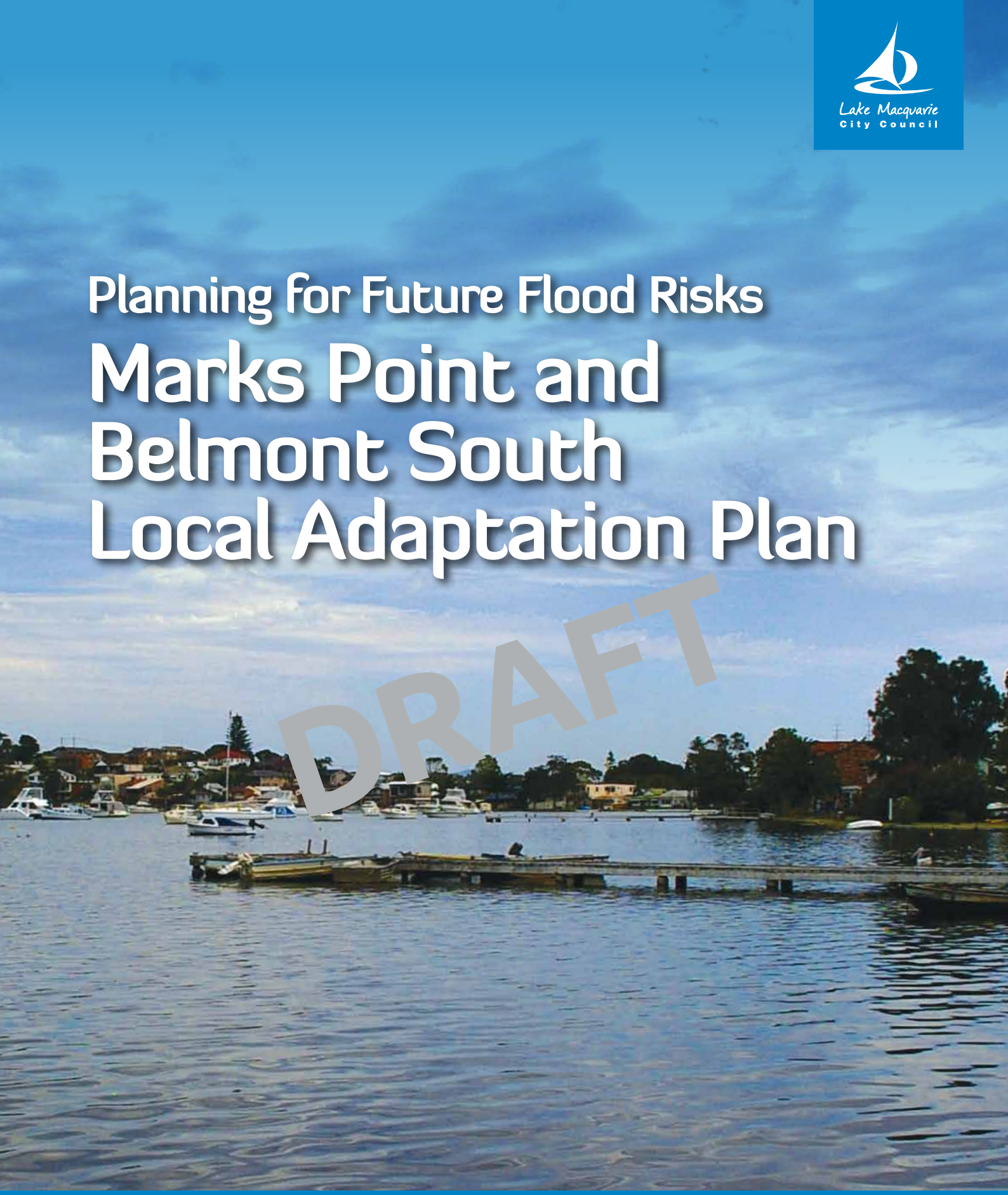
Lake Macquarie City Council

## Planning for Future Flood Risks

# Marks Point and Belmont South Local Adaptation Plan




A plan for Marks Point and Belmont South to adapt to changing lake and flood levels

Volume 1 : Summary

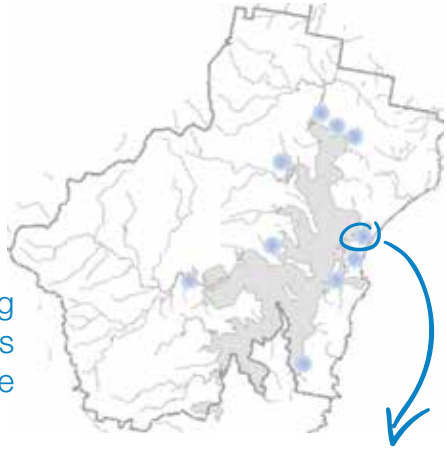
August 2015

# Contents

# How can we plan for an uncertain future?

Work with local communities …

… to identify local solutions to changing flood conditions in low-lying areas around Lake Macquarie



## Marks Point and Belmont South

### Now

2935 Residents

10 Commercial properties

1190 Homes

24km of roads

### At risk

… if lake levels rise by 0.9 metres

391 Homes

14ha of private land

4km of road

2km of drains

8ha of public land

Affected by permanent tidal inundation

Plus more assets affected by higher flood levels



## What is the plan?

| | |
|---|---|
| A | Construct revetments (sloping rock seawalls) to protect the foreshore from erosion |
| B | Fill land progressively to maintain ground levels around 0.5 metres above the lake |
| C | Raise and improve the design of infrastructure such as drains and roads to match the raising of land |
| D | Construct new floors of buildings above projected flood levels |
| E | Raise remaining old homes above projected flood levels (if required) |
| + | Plus additional complementary actions |

## How will we do it?

| | |
|---|---|
| 1 | Set "trigger points" for implementing actions and monitor lake levels |
| 2 | Review planning and development policies to reflect changes in the risk from flooding and tidal inundation |
| 3 | Design assets to withstand or be adapted to accommodate future hazards for the working life of each asset |
| 4 | Investigate and pursue funding to implement actions |
| 5 | Continue to collaborate with the local community |
| 6 | Review, plan and investigate new alternative options to manage risks |

# Planning for uncertainty

## Trouble in paradise

Lake Macquarie is a great place to live, and many residents enjoy a lifestyle on and around the water.

There are more than 7500 homes in low-lying lakeside suburbs that can be affected in a serious flood, and many experience poor drainage, periodic small lake floods and high tides, and are at risk from tidal inundation from gradually rising lake levels. If Council and the community do not plan ahead, the risks from flooding and inundation will increase, affecting property, infrastructure, natural assets, and community wellbeing.

In 2012 the Lake Macquarie Waterway Flood Risk Management Study and Plan recognised these problems, and recommended Local Adaptation Plans be prepared for these low-lying areas.

Over the last two years, residents of Marks Point, Belmont South, and the southern fringes of Belmont have worked with Council to prepare a plan to manage the risks to their community from lake flooding and rising sea levels. This plan is the result of that collaboration.

The Marks Point and Belmont South Local Adaptation Plan (LAP) will help guide future decisions, such as how to design and maintain roads and drainage systems, how to make buildings safe and durable, and how to manage foreshore erosion and maintain a healthy lake. The Plan will help Council and the community:

- manage the risk of current and future flooding and tidal inundation resulting from rising lake levels;
- provide certainty about future development in Marks Point and Belmont South; and
- address insurance affordability issues.

By managing the effects of tidal inundation, rising water tables and more frequent flooding, the Plan enables residents and businesses of Marks Point and Belmont South to continue to enjoy the benefits of living in a lakeside community, with the same level of services as other Lake Macquarie communities.

Marks Point and Belmont South are typical lakeside suburbs and this adaptation planning process is a pilot for other locations around the lake.

## Adapting the community

The Plan identifies actions over the next 10 years that reduce the risk to the community from flooding and tidal inundation, and that provide the foundations of a strategy for hazard management, land use planning and asset management to 2100.

Core adaptation actions include:

- Constructing revetments (sloping rock seawalls) to protect the foreshore from erosion caused by rising lake levels;
- Elevating low-lying land by progressively filling to maintain ground levels above rising lake levels;
- Raising and improving the design of infrastructure such as drains and roads to match the progressive raising of land and to keep them functioning as lake and groundwater levels rise;
- Constructing new buildings and additions with floors above projected flood levels to reduce flood damage; and
- Raising or renewing older low-lying homes to enable filling of the land beneath and to lift their floors above projected flood levels.

## Plan ahead, act when necessary

Some actions outlined in the Plan will not be necessary for many years, depending on the rate of sea level rise. Planning for these future actions is required now, however, to make sure the necessary land, money, and technical know-how is available when needed.

Other actions, such as constructing floor levels for new buildings above flood levels or raising infrastructure, are best done at the time of construction or renewal, thus minimising the cost and helping to "future-proof" new private and public assets that are likely to be around for 50 or 100 years.

Actions such as filling land and raising infrastructure will protect low-lying areas of Marks Point and Belmont South from the impacts of tidal inundation and a rising water table. The timing of these actions will be guided by lake levels: when a particular level is reached, actions will be set in motion ("triggered").

In the next few decades, planning will have to begin for the hazards of the next century. This Plan sets a strategic direction for the rest of this century, but keeps open the options for future planners and residents, and provides them the security and the time to work on a longer-term solution.

Lake flooding at Arthur Street
Belmont South 22 April 2015

## The cost of protection

The additional cost for core adaptation actions outlined in this plan are estimated at $1,070,000 over 10 years. These costs will be shared by those who manage the assets, own the assets, and enjoy the benefits of the assets. Most of the cost comes later, as the bulk of the proposed filling and protective works are not necessary until 2050 and beyond.

The cost-benefit analysis (Table 2) of the strategy to 2100 suggests the additional cost of protection is about equal to the additional benefits from the continued use and value of foreshore properties. However, under present arrangements, most of the costs would fall to public authorities such as Council and the State Government, while most of the benefits would be enjoyed by private landowners. The structure and sources of future funding is an issue for continued discussion and investigation.



## Breaking new ground

As one of the first Local Adaptation Plans in Australia, the Marks Point and Belmont South LAP has raised many new questions and challenges:

- How to manage and coordinate the progressive raising of land, roads, drains and other infrastructure;
- How to finance the extra costs in renewing infrastructure and who should pay; and
- How to support new development without adding to the risk from the increasing hazard?

These issues have been the subject of lively and extensive discussion during the preparation of this Plan, and will continue to be investigated, discussed and reviewed as the Plan is implemented.

# The lay of the land


Figure 1: Lake Macquarie



## Lake Macquarie

With a population of 202,000, Lake Macquarie City, south of Newcastle, is built around one of the largest coastal saltwater lakes in Australia (see Figure 1).

The lake forms the natural centrepiece of a catchment that includes the Watagan Mountains to the west, and a barrier of headlands and sandy beaches to the east, separating the lake from the Pacific Ocean.

In 2012 Council completed a study of lake flooding, that included the effects of projected sea level rise up to the end of this century. The study found that by 2100 up to 10,500 lakeside properties – including more than 7500 private residences - could be affected by a severe lake flood by 2100, and properties already affected by flooding would be flooded more often. Some essential infrastructure such as roads and drains could become unusable as rising lake levels and groundwater inundate low-lying areas.

The communities of Marks Point and Belmont South, built on the low-lying eastern sand barrier between Lake Macquarie and the Pacific Ocean (Figures 1 and 2), are typical of many lakeside settlements built around the Lake.

Modern planning and construction has seen the gradual demise of the original timber and fibro fishing shacks that dotted the suburbs, with unit blocks, town houses, public housing developments and grand free-standing homes emerging in recent decades to give the area a diversity of design and character.


Figure 2: Marks Point and Belmont South Local Adaptation Plan area


Swan Bay at Marks Point

## Lake flooding

When heavy rain falls on the lake and in the surrounding catchments, the level of the lake rises. The highest flood recorded in Lake Macquarie since European settlement was on 18 June 1949, when the lake level was measured at 1.25 metres AHD*. In more recent storm events the lake reached 1.05 metres AHD during the severe east-coast low referred to as the Pasha Bulker storm on 9 June 2007, and 1.01 metres AHD on 22 April 2015.

Flood modelling shows that a 1% AEP (Annual Exceedance Probability) flood in Lake Macquarie could reach 1.5 metres AHD. This is a serious but rare flood that has a 1% chance of occurring in any year. Fortunately, the lake hasn't experienced such a flood since records have been kept.

Many flat low-lying foreshore areas are poorly drained, and heavy rain can also cause localised nuisance flooding as stormwater pipes and gutters back-up and overflow.

* 'AHD' stands for 'Australian Height Datum'. It is similar to the old measure of 'above sea level'.

## Sea levels are rising

Since the 1970s, scientist have been reporting that increased greenhouse gases in the atmosphere are causing global warming and increased sea levels. Sea levels are rising as the warmer water expands, and as land-based ice sheets and glaciers melt.

Measurements from tide gauges and satellites show global sea level rise has accelerated over the last few decades from about 1.7 millimetres a year over most of the 20th century, to 3.2 millimetres a year since the 1990s. Using global climate and oceanographic models, scientists project that, if we continue to emit high levels of



Lake flooding at Marks Point in 1949 (top left), 1990 (top right), and 2007 (left).

greenhouse gases, sea level rise will accelerate to more than 10 millimetres a year by mid-century.

Lake Macquarie is connected to the ocean through Swansea Channel, so lake levels will rise by as much as ocean levels. In 2008 Lake Macquarie City Council adopted a policy that required future sea level rise to be considered when planning for lake flooding and coastal erosion. Based on measured rises and the projections of Australian scientists from organisations such as the CSIRO and Bureau of Meteorology, Council adopted a sea level rise benchmark of 0.9 metres by 2100.

As lake levels rise, the level of future floods will also rise. The Lake Macquarie Waterway Flood Study found that, with an increase of 0.9 metres in the lake level, the level of a 1% AEP flood will increase from 1.5 metres AHD to 2.32 metres AHD. Higher lake levels will also inundate low-lying areas around the foreshore, permanently covering land below 1.0 metres AHD with water (Figure 3).

## Local hazards

There are three hazards addressed in the LAP (Tables 3 & 4).

Lake flooding which is infrequent but causes major damage when it is high enough to enter home.

Permanent inundation when daily lake tides cover the land, making it unsuitable for human use. This is currently a negligible hazard, but it will become a significant hazard in low-lying areas as lake levels rise due to global warming.

Nuisance flooding caused by pooling of stormwater run-off in low-lying areas due to poor drainage. This is a frequent hazard but rarely causes major damage.

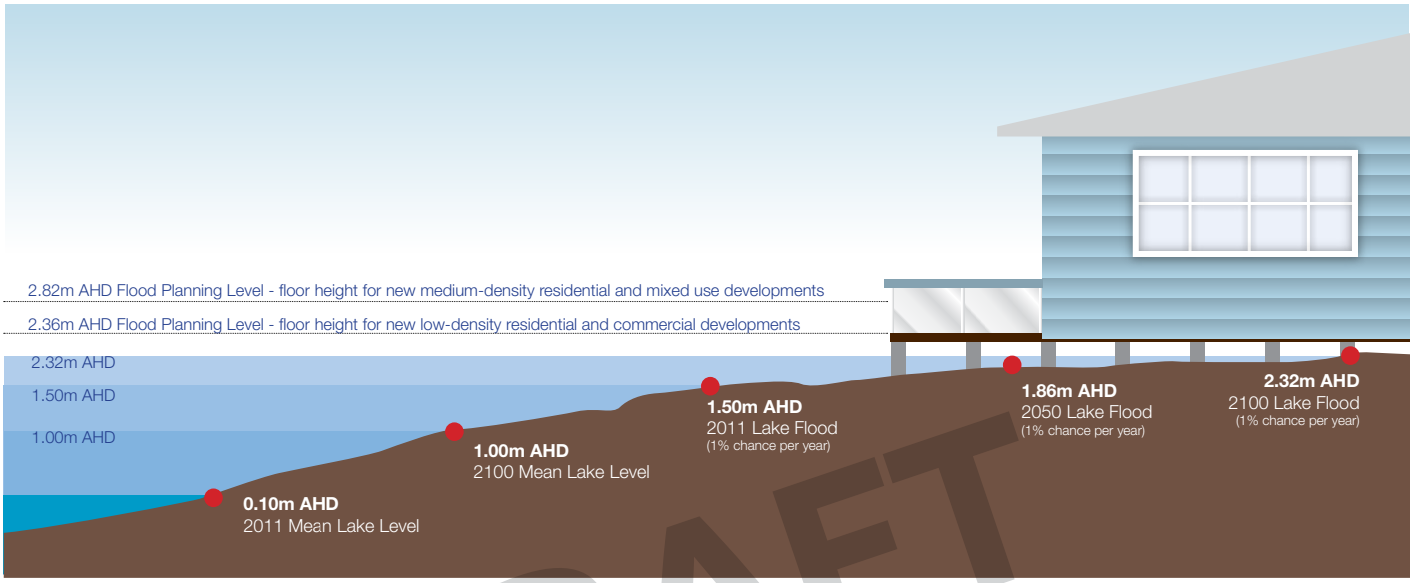



Figure 3: Projected lake levels and flood levels in Lake Macquarie and planning levels designed to keep new buildings above major floods



## Homes and community at risk

There are about 1190 residential properties in the Marks Point-Belmont South LAP area. In a current 1% AEP flood, 237 homes (20%) would experience over-floor flooding. If no action is taken, with a 0.9 metre increase in lake levels, 939 buildings (80%) would be flooded.

As well as increased flooding, rising lake and groundwater levels will permanently inundate some low-lying areas. More than eight hectares of public reserve and 14 hectares of private land, affecting 391 buildings, would be permanently under water unless preventive action is taken. Recreational access to the foreshore would be lost, as would the use and value of some private waterfront land.

## Public infrastructure at risk

With a 0.9 metres rise, 4 kilometres of roads, including some sections of the Pacific Highway, and 1.8 kilometres of stormwater pipes would be permanently under water. Sewer lines and pumping stations, water mains, and telecommunication lines would all be affected.

## Natural areas at risk

Wetland areas around Swan Bay and Belmont Lagoon would become permanently covered by water. Mangrove, saltmarsh, and paperbark communities, important to maintaining a healthy fish and prawn population in Lake Macquarie, would be lost unless there is room for them to retreat landward as lake levels rise.

## Coastal areas at risk

The impacts of storm erosion and recession due to sea level rise on the ocean beach and dunes is assessed, separately from this LAP, in the draft Lake Macquarie Coastal Zone Management Plan (CZMP). The CZMP recommends that protection and rehabilitation of the dunes, and beach nourishment, should be sufficient to protect built and natural assets up to 2100.

Table 1: Built and natural assets at risk from flooding and tidal inundation

| Assets | Assets at risk from hazard | | |
|---|---|---|---|
| | 1% AEP flood | 0.9 metres rise in lake levels (tidal inundation) | 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 |

# Sharing the dilemma

## A wicked problem

Adapting to climate change and rising sea levels is a "wicked" problem – complex, with no single technical solution, and involving multiple interests and stakeholders. Solving wicked problems requires a high degree of collaboration between stakeholders, the best technical advice, and an understanding that the available solution may only be temporary or partial.

Council and the community became aware of the significance of this wicked problem from the Lake Macquarie Waterway Flood Study. Since then Council have shared the dilemma with the those likely to be directly affected - what can we do about it, together?

## Lake flood planning and consultation

During the preparation of the Lake Macquarie Waterway Flood Risk Management Study and Plan, more than 7500 owners of flood-affected properties were contacted and asked to comment on the issues and proposals in the draft Plan. They were invited to one of six community workshops held around the lake in November 2011. More than 300 people attended the workshops, and another 50 filled in the on-line survey.

When asked to rate eight factors to be considered when making decisions about managing future flood risks, the highest-rating factor was "Council should involve local residents in decisions about managing flooding and sea level rise in their communities".

Other factors that rated highly were:

- use of small-scale measures such as building foreshore revetments to protect against rising lake levels; and
- protecting property values and foreshore amenity such as parkland and public access.

Acting on this strong community view, the Flood Risk Management Plan recommended that Council should "Undertake a detailed assessment (Local Adaptation Plan) … with each affected community, of the implications and adaptation measures available to plan for and mitigate the effects of sea level rise [on] flooding and tidal inundation".

## Community collaboration

Lake Macquarie City Council has a strong commitment to engaging its community in the decision-making process. Council have seen success using public participation principles. In developing this LAP, Council sought to create a better sense of ownership and deeper involvement by co-designing the consultation process with the local community.

The approach reflected Council's belief that those who are affected by its decisions have the right to be involved in the decision-making process. Acting on this belief, Council and the community worked together throughout each stage of local adaptation planning for Marks Point and Belmont South.

Over more than two years, Council staff, Councillors, local residents, property owners, businesses, and service providers worked together to develop develop this LAP (see Figure 4).

The collaboration began with some internal capability building with Council personnel. In April 2013, 60 residents from flood-affected areas all around the lake, Councillors, and agencies such as Crown Lands and Hunter Water, attended a series of two workshops to agree to principles for a successful community consultation. These principles included:

- all members of affected communities should be given the opportunity to be involved;
- activities should include local workshops with residents and agencies, regular newsletters and surveys, and on-line access to information and forums; and
- expert advice should be available to all participants and solutions should be innovative and flexible.

The Marks Point and Belmont South collaboration began with an invitation to all residents and property owners to attend information booths and workshops to learn more about the hazards from lake flooding and rising sea levels.

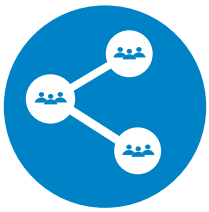
Residents were asked to volunteer for further workshops to develop and assess management options. A group of 30 people stepped up. A community group of 30 people stepped up to work on the plan together but it quickly became clear to all that working in a large group was going to be challenging. It was members of the community who suggested a subcommittee be formed, tasked with collaborating closely with Council staff on the development of the plan. Over 12 months, the subcommittee met regularly with Council staff, co-defining and co-designing as they went, exploring the issues and co-creating solutions.

# Planning for Future Flood Risks

## Who collaborated?


**1300** households and property owners in Marks Point and Belmont South received 4 project newsletters during the consultation period from 2013-2015

A call for nominations saw **31** residents join a Community Working Group



**11** members of the Community Working Group formed a sub-committee to assess management options

## How did we collaborate?

**37** residents took part in two community workshops in November 2013

**31** residents volunteered to participate in a community working group

**3** community workshops held

**4** Working Group meetings held

**15** sub-committee meetings

**6** drop-in sessions and information stalls

**3** postal surveys

**23,115** project web visits

**6827** people took some action online to learn more about the project

**136** people took part in the online surveys and forums

**3** site tours

**1** insurance information night

**20** agencies and service providers invited to public workshops and informed of progress

**1** real estate agents' workshop

**1** valuers' workshop

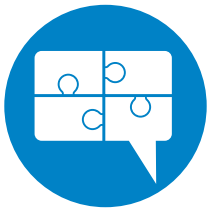


## What did we find out?

Residents had ongoing concerns about **drainage**

**Property values** and property insurance were a big concern for residents


There was a lot of local **knowledge** that people wanted to share



Local people wanted to **be involved** in designing the process and the planning

Access to the water and the **lifestyle** of those who live around the lake was important to residents

Figure 4 Community collaboration process for the development of the Marks Point and Belmont South LAP

## Proposed management actions and 'showstopper' criteria

The first round of community surveys and workshops suggested 39 actions that could be used to manage the risks from future flooding and tidal inundation. A group of residents was delegated to assess if these actions were effective and acceptable. They began by setting some objectives for the plan (Figure 5) and establishing some criteria to judge if the proposed actions would meet the objectives. They decided to assess the proposed actions against four 'showstopper' criteria (Figure 5). If a proposed action failed to meet these criteria it was recommended as "not warranting further consideration".

A total of 23 of the proposed actions were assessed as warranting further consideration, with six of these being the key actions at the centre of the adaptation strategy (Table 2). The other actions may be useful to improve or support the key actions in the strategy. All the actions that met the criteria are included in the LAP (Table 4).

The remaining 16 actions did not warrant further consideration, based on assessment against the 'showstopper' criteria. A full list of the original 39 actions and the assessment is in Volume 2 - Appendix 3.



## Objectives of the Plan

| | |
|---|---|
| LIVEABILITY | Protect private property and community infrastructure and assets from flood risk and inundation |
| HEALTHY ENVIRONMENT | Protect the environment of the lake and foreshore |
| LIFESTYLE | Maintain the lifestyle of residents |
| VIABLE | Implement flood management options that are affordable and cost effective |
| TRANSPARENT | Provide more certainty for the community about how actions will be implemented and when actions will be required |
| COLLABORATIVE | Maximise opportunities for residents to participate in implementing, monitoring and reviewing the Plan |
| INFORMED | Make use of and act on the best professional and expert advice, and to review actions if and when advice changes |

Show-stopper criteria

- Will it help maintain community lifestyle?
- Will it work to reduce the risk from flooding and inundation?
- Are the environmental effects manageable?
- Do the benefits outweigh the costs?

Figure 5: The four 'showstopper' criteria used to assess if the proposed management actions meet the objectives of the Plan

## Costs and benefits

One of the 'showstopper' criteria for actions is that the "benefits outweigh the costs". To test this criteria, a concept level cost-benefit analysis was undertaken on the core adaptation actions, and on alternative proposals.

The cost-benefit analysis identifies the relationship between the cost and benefits of a proposed project, and the cost benefit ratio details the relationship between possible benefits and costs. To calculate the cost-benefit ratio, the total discounted benefits is divided by total discounted costs. For example, an action that could cost $3 million and accrues $8 million in benefits, has a cost benefit ratio of 2.67 ($8 million divided by $3 million). A benefit-cost ratio of 2.67 means policymakers can expect

$2.67 in benefits for every $1 in costs. A cost benefit ratio greater than 1 means the benefits outweigh the costs and the investment should be considered.
If the ratio is less than 1, the costs outweigh the benefits.
If the cost-benefit ratio is 1, the benefits equal the costs.

The cost-benefit ratio of 1.05 shows the benefits of the core adaptation actions outweigh the costs, although it is close to the break-even ratio of 1.0.

Additionally, the proposed actions provide the best cost-benefit compared to other options, such as 'business as usual' or building a flood levee. A full explanation of the cost-benefit analysis and the comparison of different adaptation strategies is in Volume 2 - Appendix 2 of the LAP.

The costs used in the analysis are for the construction and maintenance of the adaptation measures – building revetments, filling land and raising floor levels, for example. The benefits are that damages avoided – that is, filling land will prevent it becoming inundated, avoiding the loss in value that would result if it was under water.

The costs and benefits used in the analysis are additional to "business as usual". For example, Council already allocates resources to renew old and damaged roads and drains. The cost-benefit analysis only considers the cost of any additional road and drainage works required to manage rising lake levels and floods. A summary of the cost-benefit analysis is shown in Table 2.



Table 2: Concept level cost-benefit analysis for the core adaptation actions to 2100

**Costs**

| Core adaptation actions | Total cost 2015 - 2100 | Net present value* |
|---|---|---|
| Construct revetments to protect the foreshore from tidal inundation and erosion | $3,593,000 | $578,000 |
| Fill land to maintain ground levels above the lake and groundwater | $17,690,000 | $1,666,000 |
| Raise and improve the design of stormwater roads and drains to match landfilling and maintain function as lake levels rise | $3,681,000 | $331,000 |
| Construct new buildings with floor levels above projected flood levels | $8,600,000 | $1,520,000 |
| Raise homes with floors below inundation and filling levels | $7,080,000 | $427,000 |
| Total costs of construction and maintenance | $40,644,000 | $4,522,000 |

**Benefits**

| Avoided damage and losses | Total cost 2015 - 2100 | Net present value* |
|---|---|---|
| Value of land protected from permanent inundation | $44,965,000 | $2,880,000 |
| Value of buildings protected from permanent inundation underneath the building | $7,670,000 | $208,000 |
| Value of prevented flood damage to houses | $20,952,000 | $1,886,000 |
| Total value of avoided damage and loss | $73,587,000 | $4,974,000 |
| Benefit Cost Ratio | 1.05 | |

* Net present value (NPV) applies a 'future discount' for costs or benefits that that will not be realised for some years. Costs or benefits that occur immediately (2015) are calculated at full cost. If the same costs or benefits are not going to occur until, say, 2050 then the value is discounted to allow for inflation, the advantage of having the money to invest in other things in the meantime, and the delay in realising the benefits. This analysis uses a future discount rate of 7% as recommended by NSW Treasury. The results using lower and higher rates are available in Appendix X Volume 2 of this Local Adaptatiton Plan.

# An adaptation strategy
## for Marks Point and Belmont South

## A local strategy for a global problem

Choosing from the many management suggestions made by the community, Council and the Marks Point and Belmont South Community Working Group developed a strategy to adapt to lake flooding and rising lake levels. The strategy identifies some core actions that, in combination, will protect property and infrastructure from the increasing hazards (Table 1).

As well as these core actions, there are 16 additional management actions to reduce current and future lake flooding, local nuisance flooding and rising lake levels (Table 4).

Residents and Council staff discuss the options at a meeting of the Working Group Sub Committee

Table 3: Overview of core adaptation actions for Marks Point and Belmont South

| Core adaptation actions | Hazard | | |
|---|---|---|---|
| | Current and future lake flooding | Permanent tidal inundation from rising lake levels | Local nuisance flooding from stormwater |
| **Construct revetments to protect the foreshore from tidal inundation and erosion** | Does not provide protection against major floods | Prevents foreshore erosion resulting from rising lake levels<br>When combined with filling, prevents tidal inundation of foreshore land | Does not prevent or reduce the risk from local nuisance flooding |
| **Fill land to maintain ground levels above the lake and groundwater** | Does not provide protection against major floods | Land is raised progressively above the rising lake levels, preventing tidal inundation | Will change stormwater drainage and, with good design, could improve local drainage |
| **Raise and improve the design of stormwater drains to match landfilling and maintain function as lake levels rise** | Does not provide protection against major floods | Maintains the function of stormwater infrastructure as lake and groundwater levels rise | Re-design and relocation of stormwater infrastructure could improve local drainage |
| **Raise and improve the design of roads to match landfilling and maintain function as lake and groundwater levels rise** | Will not protect local roads from major floods<br>Some major roads may be upgraded to ensure emergency access during major floods | Maintains the safety of roads as lake and groundwater levels rise | Re-design and raising of roads (including kerbing and guttering) could improve local drainage |
| **Construct new buildings with floor levels above projected flood levels** | Prevents over-floor flooding in most major floods<br>Provides temporary safe refuge for residents during major floods | Does not prevent permanent inundation affecting the land surrounding and beneath buildings | Does not prevent or reduce the risk from local nuisance flooding |
| **Raise homes with floors below inundation and filling levels** | Prevents over-floor flooding | Enables filling to prevent tidal inundation | Enables land filling and raising of infrastructure to improve local drainage |

Figure 7: Marks Point and Belmont South adaptation strategy

# Marks Point and Belmont So

## Actions to be taken over time

**A**

Construct revetments (sloping rock seawalls) to protect the foreshore from tidal inundation and erosion

*Rock revetment protecting filled foreshore land at Speers Point*

**B**

Fill land to maintain ground levels above the lake and groundwater

*Units built on filled land at Haddon Crescent, Marks Point*

**C**

Raise and improve the design of infrastructure such as drains and roads to match landfilling and to maintain their function

*A stormwater drain at Swansea filled with lake water at high tide. Rising lake levels will make draining low-lying areas more difficult*

**D**

Construct new buildings with floor levels above projected flood levels

*A new home at Belmont South with floors built above the 1-in-100-year flood level including an allowance for the projected rise in lake levels*

**E**

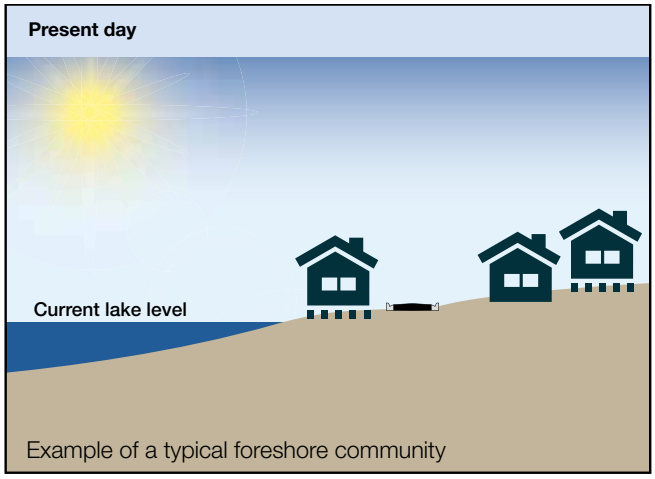
Raise remaining old homes above projected flood levels (if required)

*An old home raised above flood levels in Townsville, Queensland*

There are 16 additional management actions to reduce current and future hazards from lake flooding, local nuisance flooding, and rising lake levels.

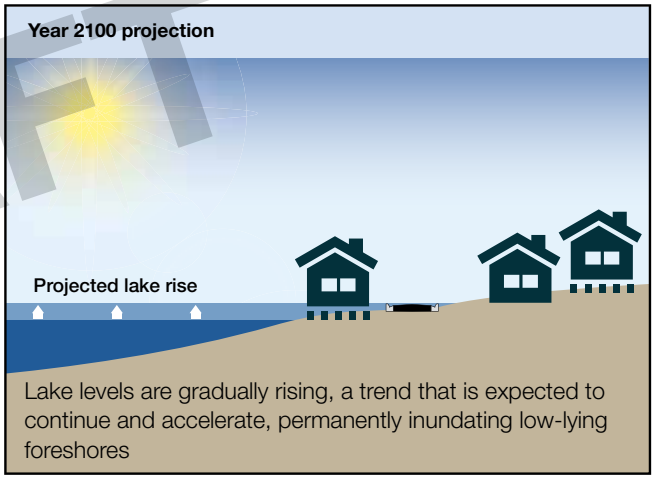
Actions to reduce current and future hazards from coastal erosion and storms are addressed separately in the draft Lake Macquarie Coastal Zone Management Plan.

## How it



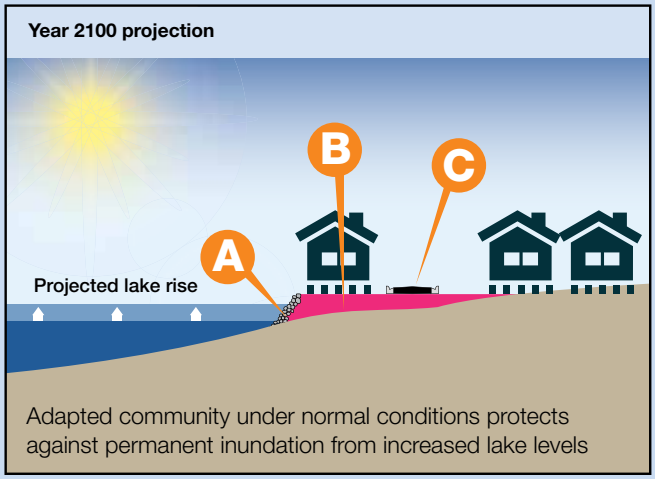

Example of a typical foreshore community

**If we do**




Lake levels are gradually rising, a trend that is expected to continue and accelerate, permanently inundating low-lying foreshores

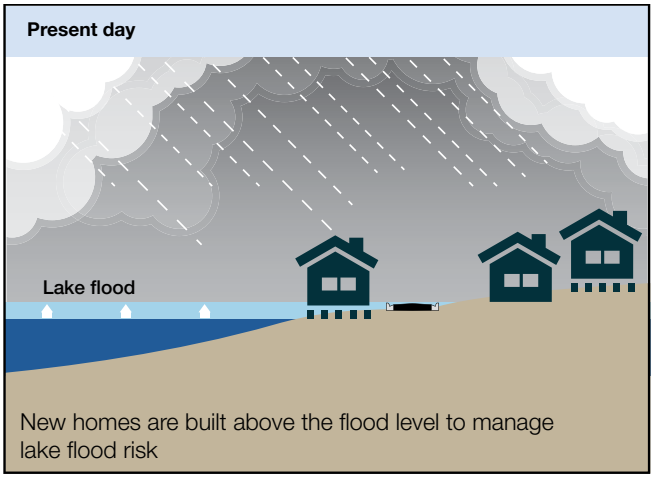
**If we follow the proposed Marks Point**




Adapted community under normal conditions protects against permanent inundation from increased lake levels

# uth core adaptation actions

## will work

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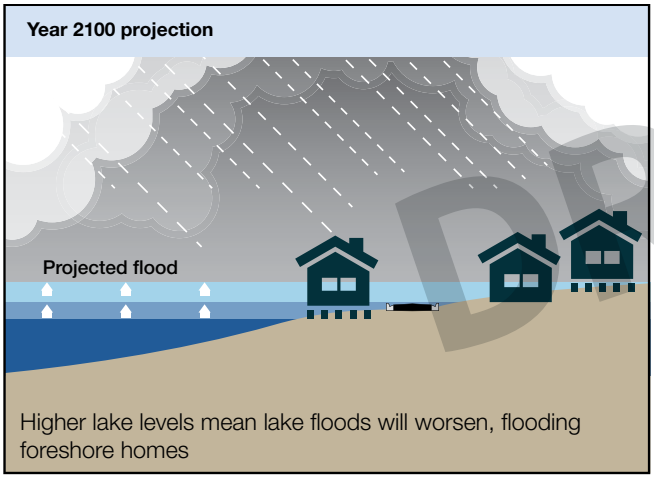
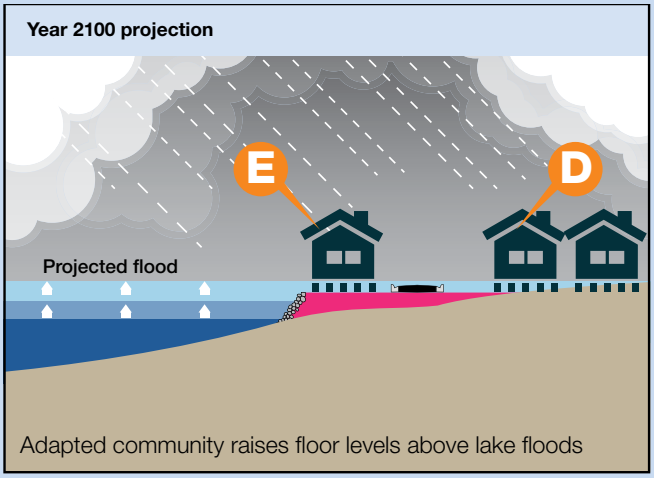



**and Belmont South adaptation actions...**




## Adaptation essentials

The Community Working Group identified seven essential elements to the Marks Point and Belmont South adaptation strategy.

**Protection is viable**
Protecting the foreshore and filling low-lying land is the best option to prevent inundation from rising lake levels.

**Retreat is not warranted**
"Business as usual" results in unplanned retreat, which is not warranted at Marks Point and Belmont South.

**Plan ahead**
Plan for the worst, but only act when necessary.

**An adaptive approach**
Setting the triggers for future actions ("act when necessary") is a work in progress.

**We've got time**
Assets (houses, roads) are likely to be renewed twice in 100 years, so action can be taken at the time of rebuilding - when it's cheapest and most convenient.

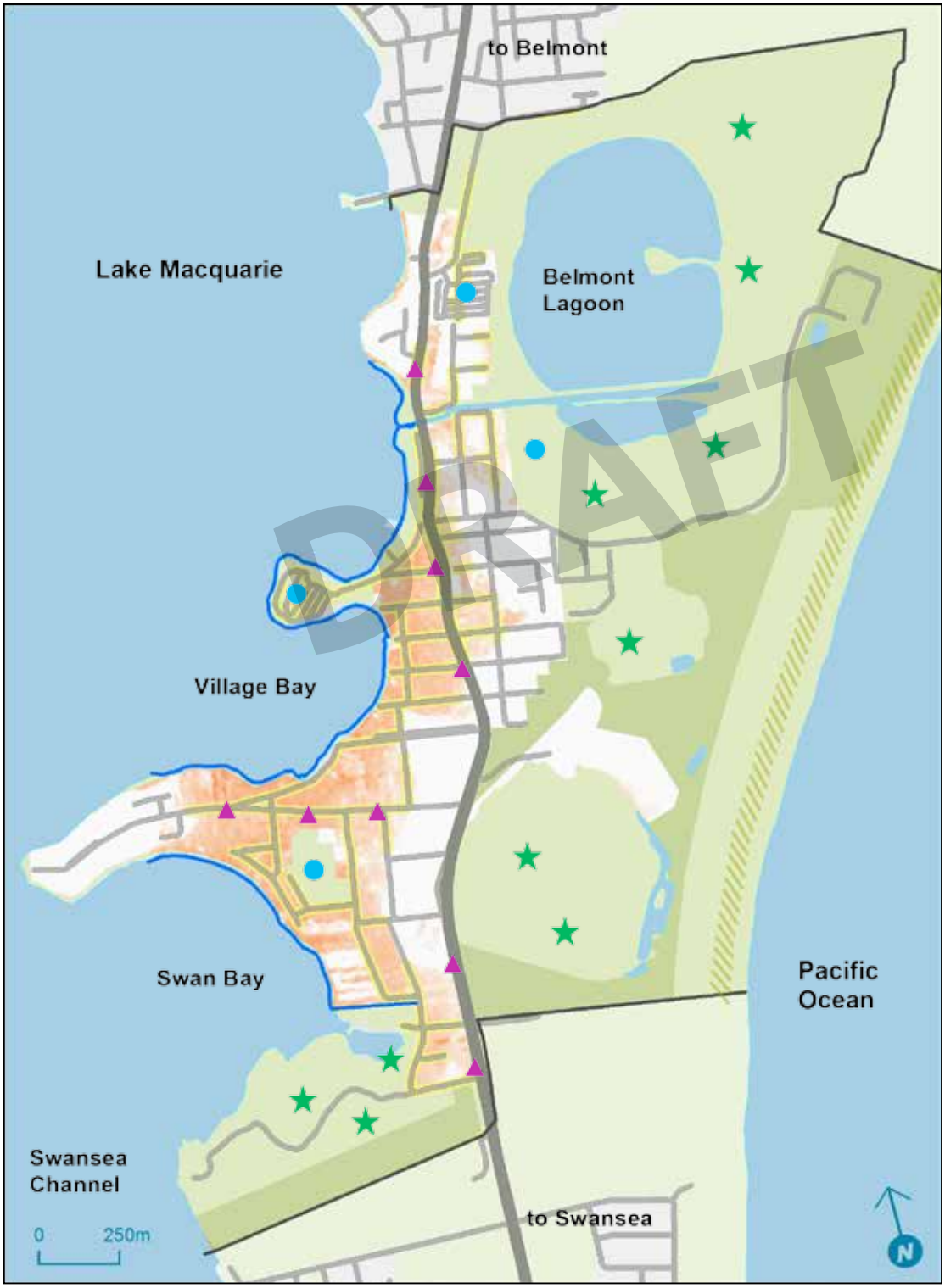
**When you're ready**
People won't have to act until they are ready – no change to existing homes is required.

**Collaboration is key**
Start preparing for future actions now, with continued collaboration between local residents, business, Council, and other agencies to resolve outstanding issues and implement actions.



## Adapted community

The Marks Point and Belmont South community can be adapted to an increase in lake levels by building a revetment for protection, filling to prevent tidal inundation, raising drains and roads to match landfilling, and building houses with floors above projected flood levels.




Revetment (sloping seawall) to prevent foreshore erosion and tidal inundation

Land progressively filled to protect against tidal inundation. In the lowest areas some older homes may have to be raised to allow filling.

Roads and drains raised to match filling

Public reserves, recreational land, and environmental land

ALL New houses in flood-prone areas built with floor above projected flood levels

Sections of roads to be raised to provide safe access during floods

Wetlands allowed to adjust and retreat

Recreational facilities progressively filled and raised

Coastal hazards are addressed in the draft Coastal Zone Management Plan and are to be managed by dune protection and rehabilitation, and beach nourishment (see p10)

Special use areas: airport, golf club and wastewater treatment plant.

Figure 6: Indicative locations of adaptation actions.

## Triggers for action

Some actions, such as raising house floor levels or road levels, are done most easily and cheaply when a building or a road is scheduled for replacement or major reconstruction.

Other actions will only be necessary when increased flooding or rising lake levels makes the risk unacceptable. The timing of these actions will vary according to changes in measurements and projections of lake levels. For example, revetments (sloping rock seawalls) which protect the lake foreshore from erosion and inundation will only need to be constructed or raised before lake levels rise sufficiently to threaten low-lying foreshore land.

The timing or suitable triggers for specific actions are set out in the Plan.



- Establish "trigger points" for actions
- Review planning and development policies to reflect changes in technology or in the risk from flooding and tidal innundation
- Include allowance for adaptation to future hazards in the design and construction of new assets
- Investigate and assess new and alternative options to manage risks from flooding and todal innundation
- Investigate and pursue funding to implement actions
- Continue to engage local residents in implementing and reviewing the strategy and finding solutions to community issues such as property values and insurance costs
- Complete drain audit and modelling and include proposed drainage improvements into Council's forward works register

Figure 7: Actions identified during the community collaboration that should begin when the Plan is adopted

- Based on the upper range of scientific projections (scenario 1 see right), the height of the foreshore revetment would have to be raised sometime before 2030
- However, if lake levels continue to rise at their current rate (scenario 2), action is only necessary sometime before 2080

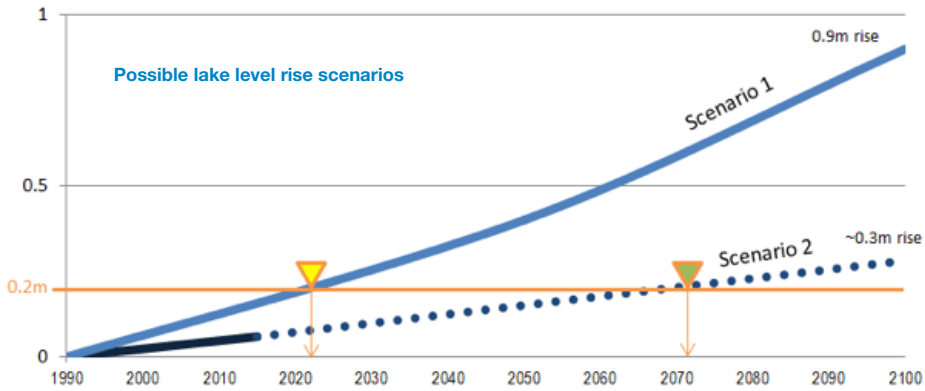



Figure 8: How lake levels act as a trigger, using the construction or raising of foreshore revetments as an example

Table 4: Summary of actions required (Core adaptation actions) to implement the adaptation strategy (Figure 7) and other actions that may assist (Potential Additional adaptation actions).

## Core adaptation actions

| Management Action | Hazard managed: Permanent inundation | Hazard managed: Lake flooding | Hazard managed: Nuisance flooding | Implementation Action | Tasks | | 10 year plan (2015 – 2025) ● Commenced ● Planned □ Continuing | 10+ years Actions guided by changes in lake level |
|---|---|---|---|---|---|---|---|---|
| **MA 1** Construct revetments to protect the foreshore from tidal inundation and erosi | Primary purpose | | | IA 1.1 Prepare design guidelines for foreshore protection works that are adaptable to rising lake levels | T 1.1.1 | Prepare design guidelines | | |
| | | | | | T 1.1.2 | Set triggers for when revetments will be required | | |
| | | | | | T 1.1.3 | Review guidelines to assess effectiveness of design and construction methods | | |
| | | | | IA 1.2 Prepare plans for future footprint of foreshore protection works and identify suitable land-use zoning, environmental protection, development controls, and land ownership | T 1.2.1 | Identify land requirements for foreshore protection and to allow adjustment and retreat of wetlands | | |
| | | | | | T 1.2.2 | Include land use zoning and development controls in LEP and DCP to protect land within the footprint (partially complete) | | |
| | | | | IA 1.3 Construct new public and private foreshore protection works to provide protection up to 0.9 metres of lake rise | T 1.3.1 | Construct networks to manage eroding foreshores using new design guidelines | | |
| | | | | | T 1.3.2 | Construct to keep foreshore levels above rising lake levels (see T 1.1.2) | | |
| | | | | | T 1.3.3 | Construct to match filling and raising of foreshore infrastructure (see T 2.1.1; T 2.1.2) | | |
| | | | | | T 1.3.4 | Raise existing revetments to keep foreshore levels above rising lake levels (see T 1.1.2) | | |
| **MA 2** Fill land to maintain ground levels above the lake and groundwater | Primary purpose | | Secondary benefit | IA 2.1 Initiate a project to review current development controls on land filling and develop a process to coordinate land filling, and raising of infrastructure such as roads and drains on public and private land | T 2.1.1 | Develop a process to coordinate land filling and raising of infrastructure | | |
| | | | | | T 2.1.2 | Set triggers for when land will have to be filled to keep it above rising lake and groundwater levels | | |
| | | | | | T 2.1.3 | Prepare new development controls and modelling tools to coordinate land filling | | |
| | | | | | T 2.1.4 | Identify future fill requirements and potential sources of fill across LGA | | |
| | | | | IA 2.2 Trial and review the process and controls for land filling and raising infrastructure | T 2.2.1 | Begin land filling using the new guidelines and controls in the DCP | | |
| | | | | | T 2.2.2 | Review and revise process and development controls | | |
| | | | | IA 2.3 Progressively fill public and private land based on lake level thresholds (T2.1.2) | T 2.3.1 | Apply revised process and controls to fill land (see T 2.2.2) | | |
| | | | | | T 2.3.2 | Continue to refine process to ensure it will work up to 0.9m rise and revise if necessary | | |

# Adaptation Plan – summary

| | | | | | | |
|---|---|---|---|---|---|---|
| **MA 3**<br>Raise and improve the design of stormwater drains to match landfilling and maintain function as lake levels rise | Primary purpose | | Secondary benefit | IA 3.1 Review the existing stormwater drainage system to identify and rectify problems | T 3.1.1 | Prepare comprehensive inventory of drainage infrastructure and develop stormwater model |
| | | | | | T 3.1.2 | Use community drain audit and service request data to help callibrate stormwater modelling |
| | | | | | T 3.1.3 | Test ability of 2D stormwater modelling to detect problem areas and attribute cause and report back to the community |
| | | | | | T 3.1.4 | Use community drain audits and service requests to help set works priorities and add priority drainage repairs and improvements to LMCC works program |
| | | | | IA 3.2 Investigate the optimal design for stormwater systems in low-lying areas, that allows adaptation to rising lake and groundwater levels | T 3.2.1 | Determine effects of more frequent inundation on maintenance and replacement schedules of drainage infrastructure |
| | | | | | T 3.2.2 | Commission research and prepare design guidelines for leading-practice design of new drainage infrastructure in low-lying areas affected by rising lake levels |
| | | | | IA 3.3 Initiate a project to review current development controls on land filling and develop a process to coordinate land filling, and raising of infrastructure such as roads and drains on public and private land (see IA 2.1) | T 3.3.1 | Develop process to coordinate raising drainage infrastructure with process for land filling (see IA 2.1; T 2.1.1) |
| | | | | | T 3.3.2 | Set triggers for when drains will have to be raised to keep them above rising lake and groundwater levels |
| | | | | IA 3.4 Construct new and up-graded drainage works to meet design guidelines and to ensure function over the asset life | T 3.4.1 | Upgrade stormwater drainage to meet new design guidelines at time of scheduled asset upgrade or renewal |
| | | | | | T 3.4.2 | Construct new stormwater drainage to meet new design guidelines when triggered by rising lake levels and/or land filling (see IA 2.1) |
| **MA 4**<br>Raise and improve the design of roads to match landfilling and maintain function as lake and groundwater levels rise | Primary purpose | | Secondary benefit | IA 4.1 Develop designs for roads to allow adaptation to rising lake and groundwater levels, and evaluate the use of new construction materials and technologies | T 4.1.1 | Determine effects of more frequent inundation on maintenance and replacement schedules of roads |
| | | | | | T 4.1.2 | Commission research and prepare design guidelines for leading-practice design of new road infrastructure in low-lying areas affected by rising lake levels |
| | | | | IA 4.2 Initiate a project to review current development controls on land filling and develop a process to coordinate land filling, and raising of infrastructure such as roads and drains on public and private land (see IA 2.1) | T 4.2.1 | Develop process to coordinate raising roads with process for land filling (see IA 2.1; T 2.1.1) |
| | | | | | T 4.2.2 | Set triggers for when roads will have to be raised to keep them above rising lake and groundwater levels |
| | | | | IA 4.3 Construct new and up-graded roads to meet design guidelines and to ensure function over the asset life | T 4.3.1 | Upgrade roads to meet new design guidelines at time of scheduled asset upgrade or renewal |
| | | | | | T 4.3.2 | Construct new roads to meet new design guidelines when triggered by rising lake levels and/or land filling (see IA 2.1) |
| | | | | | T 4.3.3 | At time of upgrade or renewal, raise Pacific Hwy and Marks Point Road to provide flood-safe access |

# Marks Point and Belmont South Adaptation Plan - summary

| Management Action | Hazard managed: Permanent inundation | Hazard managed: Lake flooding | Hazard managed: Nuisance flooding | Implementation Action | Tasks | | 10 year plan (2015 – 2025) ● Commenced ● Planned ☐ Continuing | 10+ years Actions guided by changes in lake level |
|---|---|---|---|---|---|---|---|---|
| **MA 5** Construct new buildings with floor levels above projected flood levels | | Primary purpose | | IA 5.1 Apply development controls to ensure new buildings meet flood planning levels<br>See also: MA14 | T 5.1.1 | Include controls based on flood planning levels in the Lake Macquarie Development Control Plan | ● | |
| | | | | | T 5.1.2 | Review permitted building height limits to account for need for raised floor levels. | ● | |
| | | | | | T 5.1.3 | Inform owners and buyers of property about the application of development controls on the Property Certifcate and on flood certificates | | |
| | | | | | T 5.1.4 | Review and refine development controls based on local experience and changes in standards (e.g. BCA) | ● ● | ● |
| | | | | IA 5.2 Review flood planning levels and periodically adjust planning periods to match asset life for new buildings | T 5.2.1 | Review benchmarks for sea and lake levels when new scientific measurements and projections become available; when flood risk and coastal management plans are up-dated; or at least every 10 years | ● ● ● | ● |
| | | | | | T 5.2.2 | Monitor relative lake levels and compare them to projected sea levels and trends | ● ● ● ● | ● |
| | | | | | T 5.2.3 | Periodically adjust flood planning levels based on review of sea levels and (see T 5.2.1) and changed planning periods | ● ● ● | ● |
| | | | | IA 5.3 Monitor rate of new construction for homes with floor levels below current 1:100 flood level and examine feasibility of incentive scheme if necessary | T 5.3.1 | Establish and maintain a comprehensive database of floor levels for buildings in flood-prone areas | ● | |
| | | | | | T 5.3.2 | Monitor rates for replacement of flood-prone properties and report anually in the State of Environment Report | | |
| | | | | | T 5.3.3 | Set targets for the rate of home replacement and the rate of lake level rise to ensure there is no overall increase in risk to lakeside property as the hazard increases | ● | |
| | | | | | T 5.3.4 | Investigate and, if feasible, implement incentive schemes to increase the rate of replacement, if triggered (see T 5.3.2) | | |
| | | | | | T 5.3.5 | Work with the insurance industry to ensure homes raised above flood levels recieve reduced flood premiums | ● | |

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| **MA 6**<br>Raise homes with floors below inundation and filling levels | Primary purpose | Secondary benefit | Secondary benefit | IA 6.1 Investigate the feasibility of and demand for voluntary house raising for foreshore properties | T 6.1.1 | Prepare feasibility study of a voluntary house raising scheme for high-risk foreshore properties |
| | | | | | T 6.1.2 | Depending on results of the feasibility study, prepare a funding proposal to share costs between owners, Council, State and Federal Governments |
| | | | | IA 6.2 Monitor the rate of renewal of homes with floors below the level of tidal inundation, filling, or frequent flooding to assess the need for incentives | T 6.2.1 | Monitor rates for replacement of flood-prone properties with floors close to levels of tidal inundation or frequent flooding (in conjunction with T 5.3.1) and report anually in the State of Environment Report |
| | | | | | T 6.2.2 | Monitor land filling (MA 2) to assess effect on low-lying houses and develop a process to ensure floor levels of old homes are not over-topped by filling (see T2.2.1) |
| | | | | IA 6.3 Provide incentives to encourage voluntary house raising of old homes with floors below the level of tidal inundation, filling, or frequent flooding | T 6.3.1 | Implement incentive schemes to raise older homes and increase the rate of replacement, if feasible (see T 6.1.1) |
| | | | | | T 6.3.2 | Work with the insurance industry to ensure homes raised above flood levels enjoy reduced flood premiums (see MA 22) |

# Potential additional adaptation actions

| Management Action | Hazard managed: Permanent inundation | Hazard managed: Lake flooding | Hazard managed: Nuisance flooding | Implementation Action | Tasks | | 10 year plan (2015 – 2025) ● Commenced ● Planned □ Continuing | 10+ years Actions guided by changes in lake level |
|---|---|---|---|---|---|---|---|---|
| **MA 7** Build a levee around flood prone areas | Secondary benefit | Primary purpose | | IA 7.1 Ensure land-use planning and development controls protects foreshore land that may be required for levee construction and maintenance | T 7.1.1 | Obtain expert advice on design standards and footprint requirements for flood levee, if it is required in future | ● | |
| | | | | | T 7.1.2 | Prepare zoning and development controls to ensure land that may be required for a levy is not permanently alienated | ● | |
| | | | | IA 7.2 Monitor rate of building renewal and renovation to assess residual risk of over floor flooding in older buildings | T 7.2.1 | Monitor rates for replacement of flood-prone dwellings and report anually in the State of Environment Report (see T 5.3.1) | ● | |
| | | | | | T 7.2.2 | Assess residual flood risk by tracking rates of building replacement against changes in lake levels and flood hazard | ● | |
| | | | | IA 7.3 Construct levee to protect older homes from over floor flooding if and when justified by increased risk | T 7.3.1 | Use cost-benefit analysis and other assessment tools to determine if and when a flood levy may be justified | ● ● ● | ● |
| | | | | | T 7.3.2 | Construct a flood levee if justified by increasing risk and if benefits outweigh costs and environmental effects | | ● |
| **MA 8** Build flood detention basins in creek catchments | | | Primary purpose | IA 8.1 Build flood detention basins where reduction in flood risk warrants cost of construction and maintenance | T 8.1.1 | Apply controls to all new developments to ensure there is no increase in the volume of run-off | | |
| | | | | | T 8.1.2 | Use high-resolution modelling to assess the usefulness of detention basins to manage local stormwater flows and prevent nuisance flooding (see T 3.1.3) | ● | |

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|---|---|---|---|---|---|---|
| **MA 9**<br>Install rainwater tanks to reduce stormwater flows | | | Primary purpose | IA 9.1 Review DCP provisions for on-site stormwater detention to optimise the stormwater detention capacity of domestic rainwater tanks | T 9.1.1 | Use stormwater modelling (see T 3.1.3) to assess the effectiveness and optimum sizing for rainwater tanks to reduce nuisance flooding |
| | | | | | T 9.1.2 | Work to amend and apply DCP requirements to improve detention capacity of tanks in line with results of assessment (see T 9.1.1) |
| | | | | IA 9.2 Investigate incentives to encourage retrofit of water tanks in established homes | T 9.2.1 | Use results of stormwater modelling (see T 9.1.1) to assess suitable incentives to increase on-site stormwater detention in established homes |
| **MA 10**<br>Direct more stormwater east towards the golf course and Belmont Lagoon | | | Primary purpose | IA 10.1 Investigate directing more stormwater eastward when considering function and design of stormwater systems | T 10.1.1 | Use high-resolution modelling to assess the effect on local nuisance flooding of directing stormwater to wetlands east of the Pacific Highway |
| | | | | | T 10.1.2 | Assess the environmental effects on wetlands of changing stormwater flows |
| | | | | IA 10.2 Construct new stormwater infrastructure if supported by investigation and modelling | T 10.2.1 | Include recommendations from modelling asessment in choice of receiving basins when constructing or up-grading stormwater drains |
| **MA 11**<br>Install tidal flaps or valves on stormwater outlets | Primary purpose | | | IA 11.1 Install flow valves/tidal flaps where reduction in flood and inundation risk warrants cost of construction and maintenance | T 11.1.1 | Establish thresholds for 'acceptable' frequency of tidal inundation of low-lying land and roads and use this to identify high-priority management areas |
| | | | | | T 11.1.2 | Trial different designs and placement of tidal valves in high priority areas to assess their effectiveness in managing tidal inundation of low-lying areas |
| | | | | | T 11.1.3 | Install valves in high priority areas if their effectiveness is supported by trials |
| **MA 12**<br>Set new houses back from the foreshore | Primary purpose | | | IA 12.1 Establish development controls to implement setbacks if required for foreshore protection works and levee (see T1.2.2 and T 7.1.2) and to encourage new development to be sited on the safest part of the Lot | T 12.1.1 | Include set-back requirements in LEP and DCP and apply to new developments and major renovations |
| | | | | | T 12.1.2 | Require risk assessment for flooding, inundation, and foreshore erosion to be considered when siting new development |
| | | | | | T 12.1.3 | Adjust 'standard' road and boundary set–backs to make allowance for set-backs from the foreshore in low-lying areas |

# Marks Point and Belmont South Adaptation Plan - summary

| Management Action | Hazard managed: Permanent inundation | Hazard managed: Lake flooding | Hazard managed: Nuisance flooding | Implementation Action | Tasks | | 10 year plan (2015 – 2025) ● Commenced ● Planned ☐ Continuing | 10+ years Actions guided by changes in lake level |
|---|---|---|---|---|---|---|---|---|
| **MA 13** Avoid non-adaptable slab-on-ground construction to allow for fill during the life of the asset | Primary purpose | Primary purpose | Primary purpose | IA 13.1 Review development controls in areas likely to require filling during the life of the new asset | T 13.1.1 | Include consideration of the effect of slab-on-ground construction on the process to manage and coordinate land filling, raising of infrastructure, and foreshore protection (see IA 2.1) | | |
| | | | | | T 13.1.2 | Determine areas where slab-on-ground construction is likely to increase future risk from flooding and/or curtail ability to fill | | |
| | | | | | T 13.1.3 | Where required in areas subject to filling, include controls on slab-on-ground construction in the DCP | | |
| **MA 14** Encourage use of flood resilient building materials and adaptable housing design in line with technological developments | | Primary purpose | | IA 14.1 Prepare develoment controls and guidelines that allow use of adaptable and innovative designs and materials to manage the risk from flooding and inundation | T 14.1.1 | Prepare design and performance guidelines for flood-adaptable buildings and include in development controls | | |
| | | | | | T 14.1.2 | Include BCA standards and guidelines for buildings in flood prone areas in development controls | | |
| | | | | | T 14.1.3 | Review leading practice in design, construction and materials for buildings in flood-prone areas and up-date guidelines and controls | | |
| | | | | | T 14.1.4 | Work with insurers to obtain premium reductions for buildings that adopt adaptable and flood-resilient design, construction and materials | | |
| **MA 15** Review land use planning and development controls, in collaboration with the community, to ensure they are appropriate for the level of risk | Primary purpose | Primary purpose | | IA 15.1 Review lake flooding and tidal inundation provisions in planning instruments such as the LEP and DCP to ensure they reflect any change in long-term risk as a result of changing hazards, and from applying the Local Adaptation Plan | T 15.1.1 | Review land use zones and development controls in Marks Point and Belmont South to assess development densities - including medium density housing, in-fill subdivison, seniors housing, small lot housing, and dual-occupancies – against the change in future flood risk arising from applying the Local Adaptation Plan | | |
| | | | | | T 15.1.2 | Review land use zones and development controls to ensure natural areas and processes are protected and can adjust to rising lake levels | | |
| | | | | | T 15.1.3 | Develop a Local Area Plan or similar planning instrument to include development controls specific to the Marks Point and Belmont South Local Adaptation Plan in the Lake Macquarie Development Control Plan | | |

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|---|---|---|---|---|---|---|
| MA 16<br>Re-route roads if required to maintain access to property and facilities | Primary purpose | | | IA 16.1 Identify if and where the re-routing of roads may be required and ensure land is kept available | T 16.1.1 | Obtain independent expert assessment of need and advantages, if any, of re-routing local roads, and the triggers to take such action |
| | | | | | T 16.1.2 | Assess the expert advice and, if re-routing of roads is considered likely, apply planning and development controls to maintain access to potential road corridors |
| | | | | IA 16.2Construct new roads above areas affected by inundation and frequent flooding | T 16.2.1 | Construct new roads if required to maintain access to properties affected by tidal inundation |
| **MA 17**<br>Investigate use of water-resilient road surface and sub-grade materials such as no-fines | Primary purpose | Primary purpose | Primary purpose | IA 17.1 Initiate research into availability and suitability of water-resilient materials for road construction | T 17.1.1 | Obtain expert advice on materials, construction techniques, and maintenance regimes for roads in areas subject to frequent inundation and rising groundwater |
| | | | | | T 17.1.2 | Obtain information on leading practice examples of use of water-resilient road materials and construction techniques in Australia and overseas |
| | | | | IA 17.2 Use appropriate materials in road construction and maintenance in flood-prone areas | T 17.2.1 | Develop road construction guidelines for flood-prone areas that includes use of flood-resilient materials and construction techniques and apply to all new road construction and up-grades |
| **MA 18**<br>Require new utility infrastructure to be installed above predicted level of tidal inundation | Primary purpose | | | IA 18.1 Liaise with infrastructure providers such as Hunter Water to set design threshold for new infrastructure | T 18.1.1 | Work with infrastrucutre providers (such as sewer, water, communications, gas, electricity, public transport) to establish design thresholds and asset life for different infrastrucutre types |
| | | | | | T 18.1.2 | Apply design thresholds to all new and replacement infrastructure |
| **MA 19**<br>Raise sewer access covers above frequent floods | Primary purpose | Primary purpose | Primary purpose | IA 19.1 Agree design thresholds for sewer access points with Hunter Water and retro-fit if necessary | T 19.1.1 | Work with Hunter Water to reduce sewage discharge from pipeline inspection/access points into the lake during heavy rain and floods |
| | | | | | T 19.1.2 | Support Hunter Water to obtain funds to retrofit sewer lines to reduce surcharges and inflows |

| Management Action | Hazard managed: Permanent inundation | Hazard managed: Lake flooding | Hazard managed: Nuisance flooding | Implementation Action | Tasks | | 10 year plan (2015 – 2025) ● Commenced ● Planned ☐ Continuing | 10+ years Actions guided by changes in lake level |
|---|---|---|---|---|---|---|---|---|
| **MA 20** Provide information about current and future risk on property certificates to alert owners and buyers | Primary purpose | Primary purpose | | IA 20.1 Update information on Section 149(2) certificates as hazard and risk information changes, and to comply with NSW legislation | T 20.1.1 | Review information on property certificates if legislation changes or if flood risk and tidal inundation risk changes | | |
| | | | | | T20.1.2 | Ensure information about the Local Adaptation Plan is freely available and its availability is notified on property information | ● | |
| | | | | IA 20.2 Make flood and inundation hazard information, and risk management information available on-line | T 20.2.1 | Establish and maintain a comprehensive database of floor levels for buildings in flood-prone areas ( see T 5.3.1) | ● | |
| | | | | | T 20.2.2 | Make flood, tidal inundation, land level, and floor level data available on-line | ● | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MA 21** Improve emergency warning and response | | Primary purpose | | IA 21.1Establish an integrated flood warning system for Lake Macquarie to improve timeliness and accuracy of warnings | T 21.1.1 | Design a suitable monitoring system and communication network to provide accurate and timely warnings of lake flooding | ● | | | | | | | |
| | | | | | T 21.1.2 | Install and up-grade monitoring equipment (water level gauges, rain gauges etc) in lake catchments | | ● | | | ● | | | |
| | | | | | T 21.1.3 | Work with BoM to develop and test improved predictive models to forecast lake flooding | | ● | | | ● | | | |
| | | | | IA 21.2 Prepare a flood response plan for Marks Point and Belmont South | T 21.2.1 | Work with SES and other emergency services to develop a flood response plan for eastern Lake Macquarie, including Marks Point and Belmont South | | ● | | | | | | |
| | | | | | T 21.2.2 | Conduct community briefings and education campaigns on the flood response plan | | | ● | | | ● | | ● |
| | | | | | T 21.2.3 | Identify roads required for emergency access during floods and up-grade the to ensure they meet flood risk thresholds, in particular Marks Point Road and the Pacific Highway | | ● | | | | | | |
| | | | | IA 21.3 Develop emergency evacuation and response plans for caravan parks (Belmont Pines, Spinakers | T 21.3.1 | Ensure caravan parks comply with NSW legislation and have emergency management plans for flooding | | | | | | | | |
| **MA 22** Improve take-up of flood insurance and maintain insurance affordability | | Primary purpose | | IA 22.1 Work with the insurance industry to understand how they assess flood risk in Lake Macquarie and how Council and homeowners can take steps to reduce the risk | T 22.1.1 | Cooperate with the insurance industry to trial new risk assessment techniques in Lake Macquarie | ● | | | | | | | |
| | | | | | T 22.1.2 | Work with the insurance industry to make their risk assessment and risk pricing more transparent and consistent | | ● | | | | | | |
| | | | | IA 22.Provide accurate flood information and accurate information on the vulnerability of individual properties to residents, owners, insurers and others | T 22.2.1 | Prepare and maintain a database of floor levels of buildings in flood-prone areas and make the information publicly available (see T 5.3.1) | ● | | | | | | | ● |
| | | | | | T 22.2.2 | Make information on flooding, land levels, and floor levels available on-line (see T20.2.2) | ● | | | | | | | |
| | | | | | T 22.2.3 | Review flood planning levels when new scientific measurements and projections become available; when flood risk and coastal management plans are up-dated; or at least every 10 years (see T5.2.1) | ● | | | ● | | | ● | ● |

# Review and reporting

Council tasks in the LAP will be reviewed as a normal part of Council's annual operational accounting and reporting. The annual State of the Environment Report will provide an overview of progress. Many of the actions in the LAP already include a specific requirement for community consultation (Volume 2: Appendix 1) in their development and implementation.

There will be at least one major review of the whole plan in the first 10 years. The plan will also be reviewed if required by significant changes to scientific information, legislation, or policy on flood risk management and climate change adaptation. It is a requirement of the NSW Government that flood risk management plans and coastal zone management plans should be reviewed and up-dated every 10 years, and these would involve a review of the LAP.

Changes to the LAP can be made at any time by a decision of Council, and community members are free to raise issues and concerns with staff, with Councillors, and through the community representatives on Council committees.



# Volume 2 index





# Notes


## For more information about planning for future flood risks:

Visit www.lakemac.com.au/future-flood-planning
Call Council on 4921 0333
Email council@lakemac.nsw.gov.au
Box 1906 Hunter Region Mail Centre 2310

Lake Macquarie City Council

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