Cardno
Shaping the Future

Brisbane Water Foreshore
Floodplain Risk Management Plan

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Gosford City Council
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GOV.185 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT PLAN - FOR ADOPTION (IR 10630517)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

2015/592 RESOLVED (Ward/Bowles) that:

A Council adopt the Brisbane Water Foreshore Floodplain Risk Management Plan.

B Council review the key management actions recommended in the Brisbane Water Foreshore Floodplain Risk Management Plan for implementation within the constraints of Council's available resources as part of Councils integrated planning framework.

Minutes of the Ordinary Meeting of Gosford City Council held in the Council Chamber, 49 Mann Street, Gosford on Tuesday, 8 December 2015.

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Cover photograph shows a view of Empire Bay from Cockle Channel (taken 30 June, 2008).

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Executive Summary

Overview and Purpose

This *Floodplain Risk Management Plan* (FRMP) for the Brisbane Water estuary foreshore floodplain has been prepared by Cardno for Gosford City Council in accordance with the New South Wales (NSW) *Flood Prone Land Policy* (NSW Government, 2001) and the principles of the *Floodplain Development Manual* (NSW Government, 2005).

The Brisbane Water FRMP has been developed to direct and co-ordinate the future management of flood prone land around the Brisbane Water Foreshore. It also aims to educate the community about flood risks so that they can make more informed decisions regarding their individual exposure and responses.

The preparation of this FRMP follows on from previous documents which have been prepared to assist in addressing flood risk for the Brisbane Water foreshores (namely the *Brisbane Water Flood Study* (Cardno, 2013b) and the *Brisbane Water Floodplain Risk Management Study* (Cardno, 2015)).

Study Area

The Brisbane Water estuary is a wave dominated barrier estuary and tidal tributary of the Lower Hawkesbury River system. It is located approximately 50km north of Sydney within the City of Gosford Local Government Area (LGA).

This FRMP relates primarily to the potential risk of floodwaters that rise up from the ocean (and into the estuary) and overtop seawalls and the foreshore. This type of flooding is referred to as *coastal flooding* and is often the result of severe coastal storm events. It is the dominant type of flooding affecting the majority of the foreshore and low lying areas of Brisbane Water (Cardno, 2013b). Major historical flood events at Brisbane Water include the severe ocean storm of 1974 and a more recent but less severe events in 2007 (when the *Pasha Bulker* ran aground in Newcastle) and April 2015.

This FRMP does not address the flood risk associated with the flooding of tributaries from catchment flows. This flood risk is dealt with in the relevant FRMPs for these catchments.

Floodplain Risk Management Study

The Brisbane Water FRMS (Cardno, 2015) was completed in March 2015. It assessed the flood risk across the Brisbane Water floodplain and identified, assessed and compared various management options to address the risk. It provided information and tools to allow strategic assessment of the impacts of management options for existing, future and continuing flood risk on flood behaviour and hazard. It also allowed for a robust assessment of the social, economic, environmental and cultural issues and costs and benefits of all options. The key findings of the FRMS were that the existing flood risk across Brisbane Water floodplain is relatively low and can be managed to an acceptable level primarily through the implementation of development controls, emergency response measures and minor works. Of key importance is the appropriate implementation of warnings and evacuation directions. It was also noted that the potential for increased flood risk as a result of sea level rise was identified as a significant concern. The uncertainty associated with this risk provided impediments to Council's ability to manage this risk. As such, the FRMS made recommendations for the development of detailed management strategies to adapt to the impacts of projected sea level rise on tidal inundation.

The outcomes of the FRMS form the basis for the Brisbane Water FRMP.

Since the completion of the FRMS, Gosford Council has resolved (March 2015) to adopt sea level rise planning levels based on projections for the Representative Concentration Pathway Scenario RCP 8.5 (Appendix B), utilising the medium sea level rise projection (see Figure 1 in April Council Agenda in Appendix B). This resolution has had implications for the outcomes of the FRMS and the recommendations in this FRMP have considered this revised position on sea level rise. It should be noted that the FRMS looked at the impact of 0.4m and 0.9m of sea level rise, however, the state policy (now repealed) from which this was derived was based upon an estimate of sea level rise from 1990 sea levels. The recent Council resolution has aimed to resolve this and has incorporated predictions of sea level rise from 2015 mean sea level (the full Council report is provided in Appendix B).

Flood Behaviour

Flooding behaviour around the Brisbane Water foreshore was investigated as part of the *Brisbane Water Foreshore Flood Study* (Cardno, 2013b). This study concluded that tidal / ocean flooding is dominant for the majority of the foreshore areas, i.e. severe ocean storms cause the highest water levels rather than catchment floods of the same average recurrence interval (ARI).

The impacts of wind and swell induced waves were found to have an impact beyond the flood levels identified in the Flood Study. Waves may have impacts up to 20 metres from the foreshore edge for the majority of the waterway, with some areas near the entrance to Brisbane Water potentially being impacted up to 40 metres from the foreshore edge due to the influence of ocean swell on these locations.

The focus of this Floodplain Risk Management Plan is to identify and address the existing flood risk. However, due to the nature of flooding and the urbanised nature of the foreshore of Brisbane Water, it is important to also consider the impacts of sea level rise on flooding. In general, most foreshore areas would be impacted by flooding more regularly, with more properties affected and greater flooding depths experienced in those locations already impacted by flooding under existing conditions.

Consultation

Consultation is an important element in the Floodplain Risk Management process. The program of consultation undertaken as part of the FRMS (Cardno, 2015) and this FRMP not only canvassed the community and stakeholders for information and opinions, it also sought to improve awareness and understanding of flooding risks within the local community, and to initiate commitments from the relevant stakeholders with respect to the subsequent stages of the process, being the implementation of the FRMP.

Council adopted a Community Engagement Strategic Framework in May 2014. The goals of this framework were to inform, consult, involve, collaborate and empower the community. Consultation with the community included (and will include) the following components:

- Resident brochure and survey;
- Consultation with the Catchments and Coast Committee (CCC);
- Public exhibition of the Draft FRMS and associated community engagement activities; and
- Public exhibition of the Draft FRMP and associated community engagement activities.

Outcomes and Recommendations

It is impractical to eliminate all flood risks from the Brisbane Water floodplain. Instead, the aim of the recommendations of this FRMP is to ensure that existing and future development is exposed to an 'acceptable' level of risk. Overall it is considered that existing risks to the floodplain can be managed appropriately through the implementation of development controls, emergency response measures and minor works. The effective implementation of development controls will be of key importance in reducing the damages and risk to life associated with flooding into the future through the construction of flood compatible buildings and assets.

Flood Planning Outcomes

Flood planning relates to the application of planning rules to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods. At the same time appropriate planning provisions also recognise the benefits from the use, occupation and development of flood prone land.

This FRMP provides planning recommendations for the Brisbane Water Foreshore Floodplain. The key planning recommendations made by the FRMP are outlined below.

Flood Planning Levels
The Flood Planning Levels within the floodplain are recommended to be set at 100 year ARI flood level + projection of sea level rise + 0.5m freeboard.
Sea level rise should be incorporated into the planning levels in accordance with Council's Resolution (March 2015 or any subsequent amendment). Sea level rise should be commensurate to the asset life and planning horizons of the development proposed. A minimum planning horizon of 35 years should apply to all development types.
Development Controls
In February 2014, Gosford City Council's Development Control Plan (DCP) came into effect. Development in the Brisbane Water floodplain is assessed in a manner consistent with the DCP. Whilst the DCP has common elements for the management of flooding with respect to development across the entire LGA, this FRMP has provided recommendations for development controls which are specific to the flood behaviour in Brisbane Water. These recommendations can be found in Action PM7 (Appendix C) and the DCP Matrix provided in Appendix A.
Some of the key recommendations include: • Allow filling on a lot-by lot basis within the Brisbane Water foreshore floodplain (but not within catchment floodways or catchment flood storage areas); • Restrict subdivision within the Brisbane Water flood planning area where the proposed subdivision does not have suitable emergency access or the development is likely to have adverse impacts on flood behaviour; • Make provisions for wave run-up protection designs for dwellings and infrastructure; and • Flood compatible design requirements for dwellings, garages, commercial buildings and other development types (e.g. flood levels, flood proofing and access).
Voluntary House Raising Program
The worst flood affected residential properties on the floodplain will be assessed for their suitability for voluntary raising so that the flood risk can be reduced. This action can only be applied to houses that are not of slab-on-ground construction and do not lie within a high hazard location. The following criteria have been established to identify properties potentially suitable for voluntary house-raising:

- Over floor flooding in the existing 5 year ARI event;
- Not located within a high hazard area; and
- Comprises a residential dwelling/building of construction type suitable for house-raising.

It is estimated that there are 38 properties that fulfil this criteria. These properties will be reviewed via ground truthing. Property owners will then be notified of their eligibility to apply for house raising subsidies. Allocation of subsidies will be dependent on availability of funding from OEH and a detailed assessment of the subject property.

Emergency Management Outcomes

One of the key considerations for the Brisbane Water Foreshore Floodplain is the issue of access during a flood event. The recommendations of the FRMP focus on ensuring effective flood access for dwellings, emergency services and other facilities in the floodplain.

There are several locations within the floodplain where critical infrastructure, access routes or properties may become isolated as a result of rising floodwaters. These locations have been identified and liaison with the SES is important to ensure these areas are managed appropriately during a flood event.

In addition, several recommendations have been made to improve effective access during flood events. These include:

- Installation or deployment of flood related signage at key locations (EM2);
- Enhance road evacuation through the forward planning of alternative routes (EM8);
- Review evacuation centre locations to ensure that they are appropriate located outside of the floodplain and provide effective access to those dwelling requiring evacuation (EM7); and
- Relocate Critical Infrastructure and Facilities out of the floodplain (this may be done via the use of temporary facilities during a flood event) (PM6).

It is also the recommendation of this FRMP that Council should coordinate with the SES to ensure all of the relevant flood information from the Flood Study (Cardno, 2013b), FRMS (Cardno, 2015) and this FRMP are incorporated into Flood Plans and response arrangements (EM3). This would include not only flood extents, but duration of inundation, road flooding and any known locations of people with special needs that might hinder evacuation or appropriate response to flooding conditions. This information can also be utilized to ensure that SES and emergency services are located out of the floodplain for current and future sea level rise scenarios.

Communication of Flood Risk

A crucial component of the floodplain risk management process is ensuring that the outcomes of the Flood Study (Cardno, 2013b), FRMS (Cardno, 2015) and FRMP are communicated to the community. This has been and will be achieved through the following:

- Public exhibition of the FRMS and FRMP draft documents and the associated community engagement programs;
- S149 Certificates will be updated in accordance with the outcomes of the FRMS and FRMP;

- Council's website provides flood information and will be updated as required based on the outcomes of the FRMS and FRMP;
- Council can provide property specific flood information upon request; and
- Flood education programs will be implemented as per relevant management actions (EM1 and PM4).

Flood Modification Outcomes

Although the key findings of the FRMS were that the existing flood risk across Brisbane Water floodplain is relatively low and can be managed to an acceptable level primarily through the implementation of development controls and emergency response measures, there are some minor works that can effectively be implemented to reduce the impacts of flooding on properties and infrastructure.

Wave run-up can increase the impacts associated with flooding from ocean storm events. In addition, some properties around the periphery of the floodplain are not identified as flood affected. However, depending on swell and wind conditions, these properties may be impacted by wave run-up. This FRMP recommends the preparation of wave run-up management guidelines to assist foreshore property owners in understanding the risks to their property from waves and providing guidance on appropriate management strategies to reduce the impacts on their property.

Some low-lying areas are protected from direct coastal flooding due to a naturally higher portion of land that lies along the foreshore (between the location of interest and the estuary, basically functioning like a natural levee). However, many of these locations are connected to Brisbane Water by the stormwater system. As estuary water levels rise, the stormwater system is inundated and effectively 'backs up' into the previously unaffected areas and inundates them. Flap-type valves or small floodgates fitted to the outlets of stormwater pipes can be used in these instances to minimise surcharge of the stormwater system in a flood event. This action is floodplain-wide, as required. One area that may be of particular note is East of Lemon Grove Park, Ettalong. The foredune at Ettalong is likely to provide protection from the direct impacts of coastal flooding in this area. However, stormwater surcharge may be an issue for properties on low-lying land behind the dune.

Seawalls do not necessarily provide protection in large flood events (due to their generally discontinuous nature) but may assist in reducing the impact of smaller flood events and wave run-up. This action does not propose the introduction of additional seawalls around Brisbane Water but rather the maintenance, and in some areas raising, of existing seawalls to improve flood protection. It is noted that an investigation of the existing quality of seawalls (e.g. construction type, evidence of slumping or other failures) was not undertaken and further investigation is necessary prior to implementation. Seawall maintenance and raising could be done in conjunction with or instead of wave run-up protection works outlined above.

Future Flood Risk Management Outcomes

A key outcome of the FRMP is the identification of the potential increase in flood risk as a result of sea level rise. Some management actions are therefore geared towards preparing for the potential impacts of sea level rise. It is important to consider the potential impacts of sea level rise at an early stage so that planning and some degree of readiness can commence prior to any impacts occurring.

To address the tidal and flooding risks associated with sea level rise this FRMP recommends that that Climate Change Adaptation Plans (CCAPs) are prepared to ensure an integrated approach to dealing with the risks associated with climate change. These CCAPs would seek to establish a framework for

the management of projected climate change, subject to funding resources available to Council. Tidal inundation in addition to storm events would be considered as a component of the CCAPs. Recommendations set out in the CCAPs would then flow into the periodic review of the Brisbane Water FRMS and FRMP documents, Gosford City Council policy, Local Environmental Plans and Development Control Plan documents.

It is envisaged that a LGA-wide CCAP would be prepared in the first instance as an overarching document for subsequent plans. Projected sea level rise priority areas would then be identified (based on both flood affectation and the relevance of strategies and plans) and more location-specific plans would be formulated.

The projected impacts of sea level rise on the following assets could be incorporated into the investigations:

- Residential areas, both existing and proposed (i.e. identified growth areas) and the long term viability of these areas for development both with and without adaptation strategies.
- Public infrastructure – investigate the long term viability of the infrastructure servicing potentially affected areas. Strategies should be identified for works to protect these assets from the impacts of sea level rise and how this may be incorporated into the existing maintenance regime. Trigger levels should be identified when infrastructure is no longer viable (e.g. tidal levels at which road surfaces need to be upgraded / raised due to increasing frequent inundation).
- Heritage items and places – Investigate the impacts of future flooding and emergency response arrangements on heritage buildings, structures, items and places This should include a field survey of historic infrastructure and archaeological items and review of known heritage database records for both Aboriginal and non-Aboriginal heritage. Recommendations for the mitigation of negative impacts on heritage items should also be formulated.
- Flora, fauna and other natural resources – Investigate the impacts of projected sea level rise on flora and fauna, with particular emphasis on changes in foreshore vegetation. Reference can be made to Appendix D of Cardno (2010b) Sea Level Rise and the Estuarine Intertidal Zone – Discussion Paper.

Flood risk mitigation works should be assessed within the context of the findings of these studies. This may include reviewing some of the options presented in the FRMS which resulted in minimal flood benefits under existing sea levels but that may provide flood benefits for flooding conditions as a result of sea level rise.

Implementation and Funding

In order to achieve the implementation of relevant recommendations of this FRMP, a program of implementation has been developed. The steps in progressing the floodplain risk management process from this point onwards are:

- The Catchment & Coasts Committee (CCC) will consider and support relevant recommendations of this Plan for adoption by Council;
- Council will consider the CCC's recommendations;
- The draft FRMP will placed on public exhibition and community comment will be sought;
- Public comment will be considered, the FRMP will be modified if required, and the final Plan will be submitted to Council;
- Council will adopt the final Plan and submit applications for funding assistance to relevant State and Commonwealth agencies, as appropriate;

- The prioritisation and implementation of the management actions will be considered as part of Council's Integrated Planning and Reporting Process.
- As funds become available from OEH, the Commonwealth, other state government agencies and/or from Council's own resources, recommended management actions will be implemented in accordance with the established priorities.

Each of the recommended actions (outlined in **Section 6**) has been given a relative implementation timing (immediate or staged) and priority (high, medium or low).

The estimated costs of implementing the Plan by Council and relevant State Agencies include approximately $1.5 Million is capital costs and $350,000 in recurrent costs for four years. Some actions would require ongoing funding beyond the first five years of the Plan implementation (e.g. periodic analysis of sea level rise) and others may be fully complete after only one year.

Several options also identify potential works that could be undertaken by private land owners (e.g. upgrades to private seawalls). The costs associated with these options have not been included in the implementation strategy, but are referenced in Appendix C.

Table of Contents

List of Tables

List of Figures

Appendices

Glossary

Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
Average Recurrence Interval (ARI)	The long-term average number of years between the occurrence of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
BoM	Australian Bureau of Meteorology
Catchment	The area draining to a site. It always relates to a particular location and may include the catchments of tributary streams as well as the main stream.
Catchment flooding	The overtopping of creek banks causing flooding, usually associated with heavy or prolonged rainfall events in the catchment.
CCC	Catchments and Coast Committee, established by Gosford City Council to oversee the FRMS. The CCC includes community members, NSW State Emergency Service representatives and OEH representatives. The CCC has direct involvement and assisted in guiding the direction of the FRMS.
Coastal flooding	Flooding along the coastal foreshores due to an increase in ocean or estuarine water levels and associated with storm surge.
DCP	Development Control Plan
Design flood	A significant event to be considered in the design process; various works within the floodplain may have different design events e.g. some roads may be designed to be overtopped in the 1 year ARI or 100%AEP flood event.
Design Still Water Level (DSWL)	The modelled water surface elevation for a design flood events, excluding local variation due to waves and wave set-up, but including the effects of tides, storm surges and long period seiches.
Development	The erection of a building or the carrying out of work; or the use of land or of a building or work; or the subdivision of land.
Discharge	The rate of flow of water measured in terms of volume over time. It is to be distinguished from the speed or velocity of flow, which is a measure of how fast the water is moving rather than how much is moving.
OEH	Office of Environment and Heritage
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or overland runoff before entering a watercourse and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.
Flood hazard	Potential risk to life and limb caused by flooding.

Flood planning area	The area of land below the flood planning level and thus subject to flood related development controls.
Flood planning levels	Flood levels selected for planning purposes, as determined in floodplain management studies and incorporated in floodplain management plans. Selection should be based on an understanding of the full range of flood behaviour and the associated flood risk. It should also take into account the social, economic and ecological consequences associated with floods of different severities. Different FPLs may be appropriate for different categories of land use and for different flood plains. As FPLs do not necessarily extend to the limits of flood prone land (as defined by the probable maximum flood), floodplain management plans may apply to flood prone land beyond the defined FPLs.
Floodplain	Area of land which is subject to inundation by floods up to the probable maximum flood event, i.e. flood prone land.
Floodplain management options	The measures that might be feasible for the management of a particular area.
Flood prone land	Land susceptible to inundation by the probable maximum flood (PMF) event, i.e. the maximum extent of flood liable land. Floodplain Risk Management Plans encompass all flood-prone land, rather than being restricted to land subject to designated flood events (such as the 100 year ARI).
Freeboard	A factor of safety that is usually expressed as the difference in height between the level of the floodwaters and the adopted flood planning level. Provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain such as wave action and localised hydraulic behaviour.
FPA	Flood Planning Area
FPL	Flood Planning Level
FRMP	Floodplain Risk Management Plan
FRMS	Floodplain Risk Management Study
GCC	Gosford City Council
High hazard	Flood conditions that pose a possible danger to personal safety; evacuation by trucks difficult; able-bodied adults would have difficulty wading to safety; potential for significant structural damage to buildings.
Hydraulics	The term given to the study of water flow in a river, channel or pipe, in particular, the evaluation of flow parameters such as stage and velocity.
IPCC	Intergovernmental Panel on Climate Change
LEP	Local Environment Plan
LGA	Local Government Area
Low hazard	Flood conditions such that should it be necessary, people and their possessions could be evacuated by trucks; able-bodied adults would have little difficulty wading to safety.

Management plan	A document including, as appropriate, both written and diagrammatic information describing how a particular area of land is to be used and managed to achieve defined objectives. It may also include description and discussion of various issues, special features and values of the area, the specific management measures which are to apply and the means and timing by which the plan will be implemented.
Model (e.g. hydraulic model)	The mathematical representation of the physical processes involved in flooding. These models are often run on computers due to the complexity of the mathematical relationships.
MSL	Mean Sea Level
NSW	New South Wales
Planning horizon	The period of time into the future over which factors associated with a development are considered at the present time.
Probability	A statistical measure of the expected frequency or occurrence of flooding.
Probable maximum flood (PMF)	The flood calculated to be the maximum that is likely to occur.
RCP - Representative Concentration Pathways	Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes Special Report on Emissions Scenarios (SRES) projections published in 2000.
RCP8.5	This RCP is characterized by increasing greenhouse gas emissions over time, representative of scenarios that lead to high greenhouse gas concentration levels.
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. For this study, it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
RMS	NSW Roads and Maritime Services
Sea wall	Wall built parallel to the shoreline to assist in protecting the shoreline from erosion.
SEPP	State Environmental Planning Policy
SES	State Emergency Service
SLR	Sea Level Rise
Stormwater	Urban stormwater is mainly rainfall that runs off roofs, roads, footpaths and car parks. Rainfall run-off also occurs from gardens, parks and other open space areas in larger storms. Stormwater has been traditionally collected by stormwater drains and transported through pipes and channels to creeks, rivers, the harbour and ocean.

Storm Surge	The increase in coastal water level caused by the effects of storms. Storm surge consists of two components: the increase in water level caused by the reduction in barometric pressure (barometric setup) and the increase in water level caused by the action of wind blowing over the sea surface (wind setup).
Topography	A surface which defines the ground level of a chosen area.
Tides	The regular rise and fall of the sea level in response to the gravitational attraction between the sun, moon and Earth.
Tidal inundation	Inundation of coastal areas in alignment with the tidal cycle. Currently, this type of inundation occurs once or twice a year, during spring or king tides. This inundation mechanism is likely to increase in severity with projected sea level rise
Wave Run-Up and Overtopping	Wave run-up is the maximum vertical extent of wave uprush on a beach or foreshore structure above the design still water level. Wave overtopping is the distance over which the wave will extend beyond the foreshore. This is limited by the wave behaviour and the topography of the land. Wave run-up and overtopping for the Brisbane Water foreshore identifies the height and extent of impacts of waves beyond the design still water level.

1 Introduction

This *Floodplain Risk Management Plan* (FRMP) for the Brisbane Water estuary foreshores has been prepared by Cardno for Gosford City Council. This document has been prepared in accordance with the New South Wales (NSW) *Flood Prone Land Policy* (NSW Government, 2001) and the principles of the *Floodplain Development Manual* (NSW Government, 2005).

1.1 Purpose of the Plan

The objectives of this Floodplain Risk Management Plan are to:

- Provide a practical framework and implementation plan for managing existing, future and continuing flood risk within the study area;
- Formulate a cost effective Plan for the study area based on the findings of the *Floodplain Risk Management Study* (Cardno, 2015);
- Provide a priority program for implementation of the recommended works and measures in accordance with Appendix H of the *Floodplain Development Manual* (NSW Government, 2005);
- Provide governance and leadership direction for floodplain risk management that is in accordance with the *Gosford 2025 – Community Strategic Plan* vision for the community;
- Ensure that intergenerational equity is maintained through achieving a balance between reducing flood vulnerability for the current and future generation, without overly burdening the current generation with costs and avoiding the transfer of costs or risk to future generations;
- Disseminate the outcomes of the Plan to state agencies including those directly impacted by the decisions identified e.g. police and emergency services; and
- Provide for the management of flood risks to public assets (such as services and utilities) and private property.

1.2 Plan Context

The Brisbane Water estuary is a wave dominated barrier estuary and tidal tributary of the Lower Hawkesbury River system. It is located approximately 50km north of Sydney within the City of Gosford Local Government Area (LGA). In the past, flooding of the Brisbane Water foreshore has caused property damage, restricted property access and has been a general inconvenience to the community. These flooding issues have prompted Gosford City Council, through an established Catchment and Coast Committee to prepare a comprehensive and integrated *Floodplain Risk Management Plan* for the Brisbane Water foreshore area.

The preparation of this FRMP follows on from the *Foreshore Flood Study* (Cardno, 2013b) and the *Floodplain Risk Management Study* (Cardno, 2015) and forms the fifth stage of the floodplain risk management process as defined by the *Floodplain Development Manual* (NSW Government, 2005):

1. Establish a Floodplain Risk Management Committee (now called Catchments and Coast Committee);
2. Data Collection;
3. Flood Study;
4. Floodplain Risk Management Study;
5. **Floodplain Risk Management Plan**;
6. Plan Implementation; and
7. Review of Plan.

The preceding fourth stage, the *Floodplain Risk Management Study* (FRMS), was prepared by Cardno as a separate document (Cardno, 2015). It assessed the flood risk across the Brisbane Water floodplain and identified, assessed and compared various management options to address the risk. It provided information and tools to allow strategic assessment of the impacts of management options for existing, future and continuing flood risk on flood behaviour and hazard. It also allows for a robust assessment of the social, economic, environmental and cultural issues and costs and benefits of all options. The key findings of the FRMS were that the existing flood risk across Brisbane Water floodplain is relatively low and can be managed to an acceptable level primarily through the implementation of development controls, emergency response measures and minor works. However, the potential for increased flood risk as a result of sea level rise was also identified as a significant concern. The uncertainty associated with this risk provided impediments to Council's ability to manage this risk. As such, the FRMS made recommendations for the development of detailed management strategies to adapt to the impacts of projected sea level rise on tidal inundation.

The outcomes of the FRMS form the basis for the Brisbane Water FRMP. The FRMP also reflects policy changes subsequent to the exhibition of the Study. This FRMP is to be utilised in conjunction with the FRMS (Cardno, 2015).

1.2.1 Related Plans of Management and Strategies

In addition to those documents associated with the floodplain risk management process, a number of relevant plans and strategies were considered during the preparation of this Plan. These include:

- Brisbane Water Estuary Management Study (Cardno 2011);
- Brisbane Water Coastal Zone Management Plan (Cardno, 2013a);
- Gosford 2025 – Community Strategic Plan (GCC, 2013a);
- Resource Strategy Gosford 2011/12 (GCC, 2011);
- Delivery Program 2013/14 - 2016/17 incorporating the Operational Plan 2014/15 (GCC, 2014a);
- Gosford Development Control Plan (GCC, 2013b);
- Gosford Local Environment Plan (GCC, 2014b);
- Gosford City Centre Local Environment Plan (GCC, 2007);
- Gosford Planning Scheme Ordinance (GCC, 2013c); and
- Gosford City Displan (Gosford LEMC, 2009).

1.3 Document Structure

This Plan covers the following:

- Study Area (**Section 2**);
- Flood Behaviour, Issues and Management Objectives (**Section 3**);
- Flood Planning (**Section 4**);
- Consultation (**Section 5**);
- Floodplain Risk Management Actions (**Section 6**);
- Implementation Program (**Section 7**); and
- Conclusions (**Section 8**).

2 Study Area

The study area encompasses the foreshores of Brisbane Water and is defined as the land that is affected by coastal flooding up to the PMF event. Sea level rise of up to 0.9m has also been considered as a part of the study area. The study area is shown in **Figure 2.1**.

2.1 Study Limits

This FRMP relates primarily to potential floodwaters that rise up from the ocean (and into the estuary) and overtop seawalls and the foreshore. This type of flooding is referred to as *coastal flooding* and is often the result of severe coastal events such as storm surge. This FRMP considers the management of risks associated with coastal flooding because it is the major type of flooding that affects the foreshores of Brisbane Water (Cardno, 2013b).

This FRMP does not relate to floodwaters that originate from heavy or prolonged rain causing stormwater to travel downslope towards the estuary. This type of flooding is referred to as *catchment flooding,* which is associated with increased creek and stormwater channel flows. This flooding mechanism is not dominant in the study area. The Brisbane Water Flood Study (Cardno, 2013b) undertook some limited modelling of catchment events. A comparison of this modelling with the floor level data collected for the Floodplain Risk Management Study (Cardno, 2015) show that very few properties on the foreshore of Brisbane Water are likely to experience over floor flooding as a result of catchment flooding alone. However, some inundation of property outdoor areas along the immediate foreshore could be expected.

The hydrological investigations for the FRMS covered the whole of the Brisbane Water Estuary catchment, however hydraulic modelling was limited to cover the body of the estuary and the foreshore areas. While the effects of catchment flooding on tributaries have not been included in the study, the downstream end of some of the tributaries and some low lying areas beyond the immediate foreshore have been included in the hydraulic model to assess the impacts of storm surge only on these areas. The Hydraulic model limits are shown on **Figure 2.1**.

It should also be noted that the hydraulic model does not include hydraulic structures such as culverts and pipes. As such, some areas not shown as being impacted by storm surge may in fact experience inundation as a result of the stormwater system “backing up”. For example the culverts under the railway bridge at Tascott have not been included in the modelling and as such the area to the west of the railway line in Tascott is only shown to experience inundation in events when the railway line is overtopped by the water level within Brisbane Water. In reality the impact of Brisbane Water levels on this area will be driven by the functionality of the culverts (design and blockage) and catchment flows. No catchment flows were assessed at this location.

The estimation of flood behaviour in the tributaries beyond the main body of the estuary (such as Kincumber Creek, Woy Woy Creek, Erina Creek and Narara Creek) was not addressed in the *Brisbane Water Foreshore Flood Study* (Cardno, 2013b), and consequently the FRMS *(Cardno, 2015)* and this FRMP are also confined to the estuary foreshore areas. Separate management studies have been prepared for these tributaries and can be found on Council’s website (currently http://www.gosford.nsw.gov.au/environment-and-waste/water-and-sewer/floodplain-risk-management-planning).

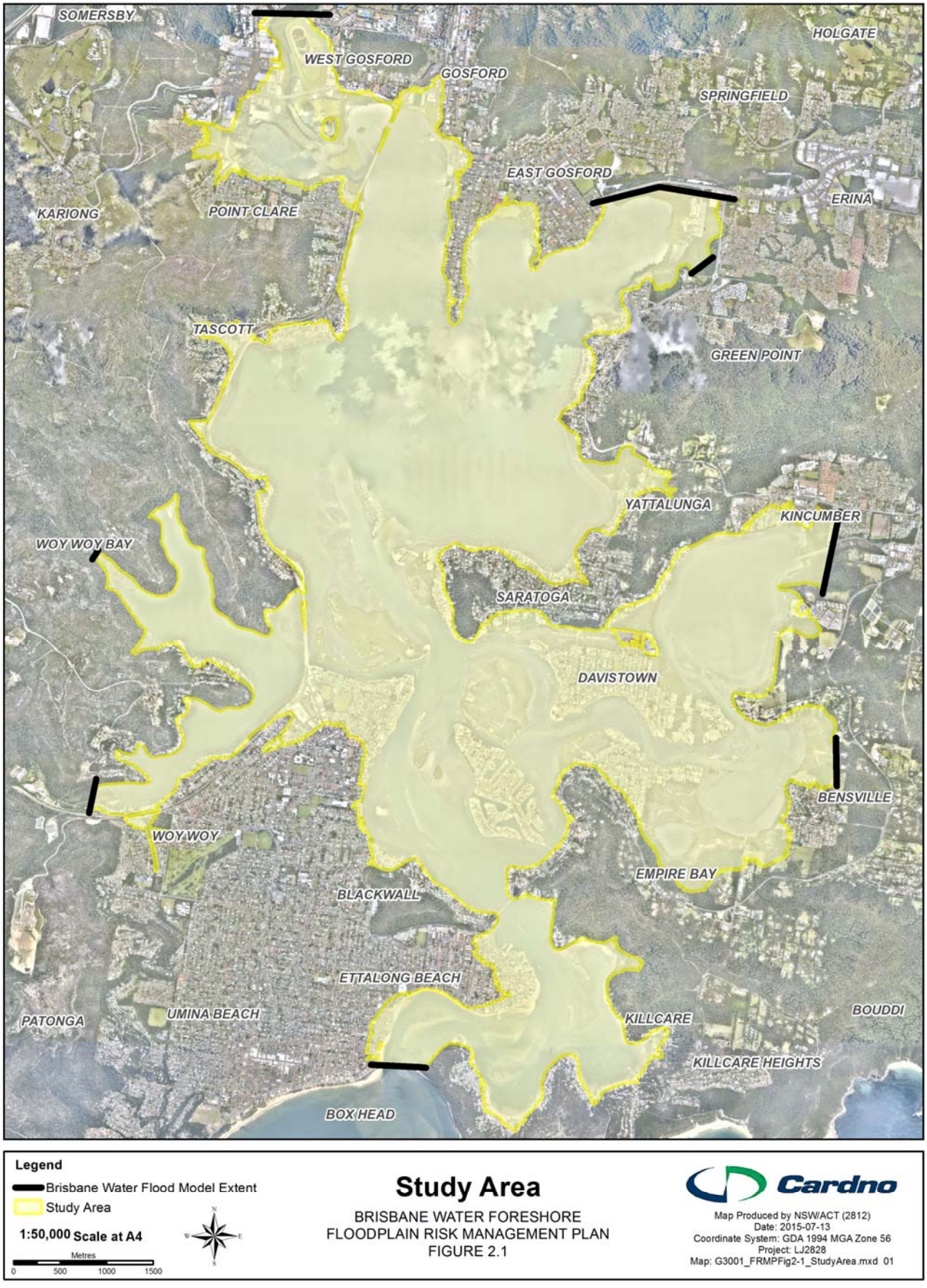


Figure 2.1: Study Area showing Hydraulic Model Extents

3 Flood Behaviour, Issues and Objectives

3.1 Flood Behaviour

Flooding behaviour around the Brisbane Water foreshore was investigated as part of the *Brisbane Water Foreshore Flood Study* (Cardno, 2013b). This study concluded that tidal / ocean flooding is dominant for the majority of the foreshore areas, i.e. severe ocean storms cause the highest water levels rather than catchment floods of the same average recurrence interval (ARI). The exception was found to be within Fagans Bay, which is dominated by catchment flooding in less frequent events. This is due to large catchment flows from Narara Creek and the local hydraulic control (the northern railway bridge) which reduces the rate of discharge of catchment flows into the estuary.

Flood levels were found to vary across the floodplain as a result several factors including the distance from the ocean, the influence of catchment flows in the upper reaches, the hydraulic influence of the entrances to embayments, the local wind effects and losses across the estuary bed.

The impacts of wind and swell induced waves were found to have an impact beyond the flood levels identified in the Flood Study (Cardno, 2013b). Waves may have impacts up to 20 metres from the foreshore edge for the majority of the waterway, with some areas near the entrance to Brisbane Water (Management Areas 11 and 12) potentially being impacted up to 40 metres from the foreshore edge due to the influence of ocean swell on these locations.

3.1.1 Historical and Existing Flood Behaviour

Past flooding of the Brisbane Water foreshore has caused property damage, impeded emergency access and inconvenienced residents. Major historical flood events at Brisbane Water include the severe ocean storm of 1974 and a more recent but less severe events in 2007 (when the Pasha Bulker ran aground in Newcastle) and April 2015. The April 2015 event was estimated to be between a 5 and 10 Year ARI event, depending on the location within the floodplain (photos of this event are shown below). The variation in levels around the foreshore was primarily due to the wind direction. A comparison of the Flood Study (Cardno, 2013b) results and the recent events, shows that the Flood Study provides a good representation of flood behaviour within Brisbane Water.

20 – 21 April 2015 Coastal Storm Event

Woy Woy Public Wharf

Brisbane Water Drive Koolewong

Gosford Waterfront

A summary of the existing key flooding issues on a location-by-location basis is provided in **Table 3.1**. To assist the management process, the floodplain has been separated into 15 management areas which were established in the FRMS. Flood behaviour varies across the floodplain and as such, each management area contains locations with similar flood characteristics. Management areas are shown in **Figure 3.1**.

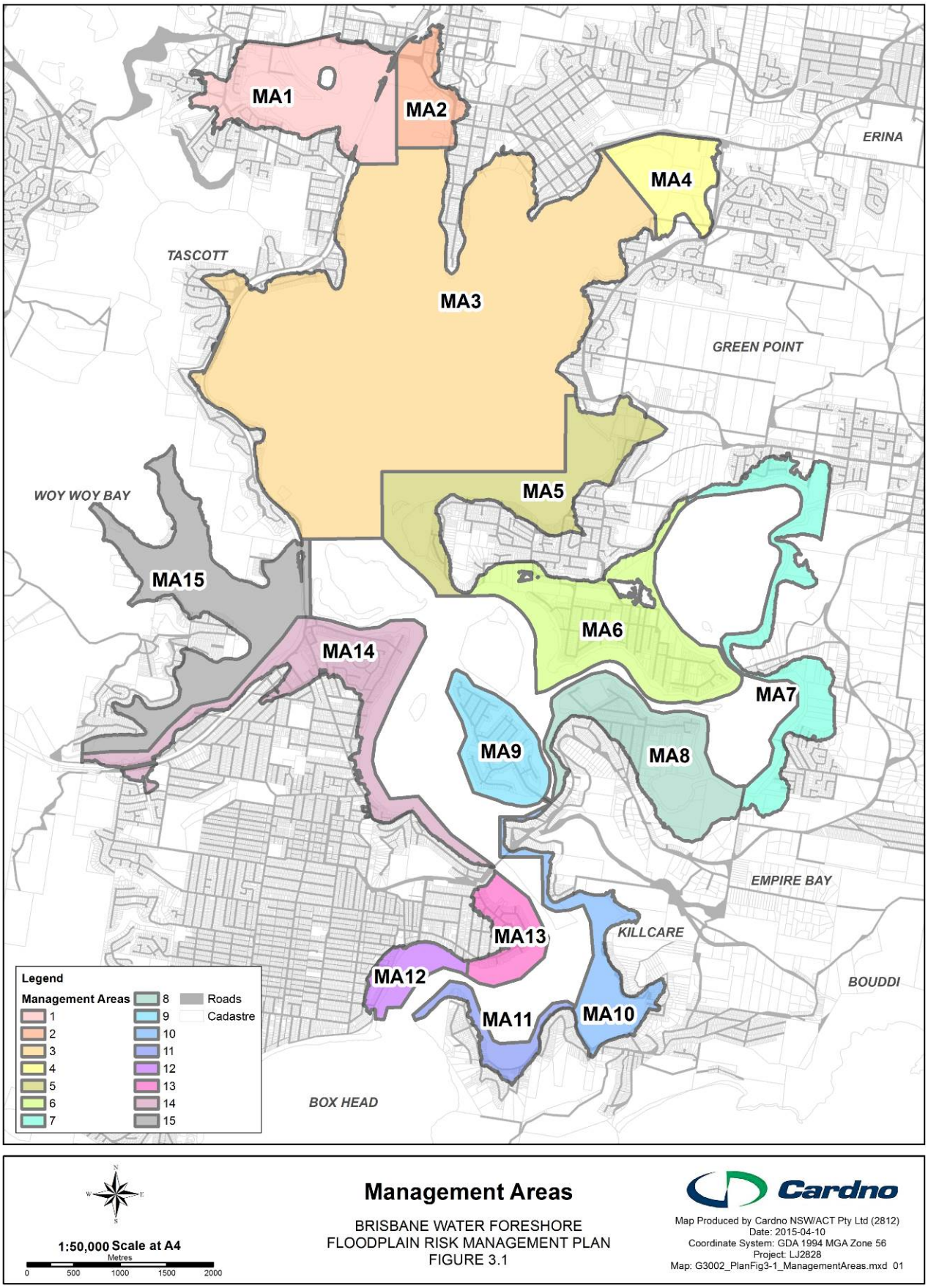


Figure 3.1: Management Areas

Table 3.1: Existing Flood Behaviour, Issues and Properties Affected by Flooding (i.e. any part of the ground of the property is affected) for each Management Area

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)[#]
MA1 West Gosford and Point Clare	➢ Fagans Bay is dominated by catchment flooding in events greater than the 100 year ARI event. This is due to large catchment flows from Narara Creek and the local hydraulic control (the northern railway bridge). The bridge reduces the rate of discharge of catchment flows into the estuary. ➢ The *Review of the Narara Creek Flood Study* (Golder Associates, 2012) provides more detailed analysis of catchment flooding in this location. ➢ Storm surge from coastal events for events less than the 100 year ARI event results in relatively shallow flooding of foreshore properties within Fagans Bay. ➢ The retirement village on Yallambee Avenue represents a potential flood island issue.	➢ Catchment flows in lower probability events. ➢ Coastal flooding in higher probability events.	➢ Open Space ➢ Residential ➢ Special Uses / Infrastructure	162
MA2 Gosford	➢ The foreshore of this location is likely to experience some flooding in less frequent events. ➢ Coastal flooding would affect mainly commercial properties, but only in less frequent events such as the 100 year ARI, 200 year ARI and PMF. ➢ Wave overtopping over the sea wall has occurred in past storm events. ➢ Existing high tides in the Gosford area may result in foreshore inundation, especially with joint occurrence of storm conditions.	➢ Coastal flooding in all events.	➢ Commercial ➢ Special Uses / Infrastructure ➢ Open Space	47

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)[#]
MA3 Point Frederick, East Gosford, Green Point, Koolewong and Tascott	➢ Some localised areas of flooding in more frequent flood events likely to occur, mainly overground flooding for residential properties. ➢ Some areas of Tascott are also affected by catchment flows from the creek at Tascott. These issues are assessed in a separate study; *Tascott Basin Floodplain Management Study* (WMA, 1992) ➢ Existing high tides in this area can cause foreshore inundation, especially high tides with joint occurrence of storm conditions.	➢ Coastal flooding in all events.	➢ Residential ➢ Open Space	540
MA4 Erina	➢ High tides and higher probability events may cause foreshore inundation in this area. ➢ Some areas are affected by catchment flows from Erina Creek. ➢ Emergency services (SES) affected by flood island issue.	➢ Coastal flooding in all events.	➢ Open Space. ➢ Special Uses / Infrastructure. ➢ Industrial	13
MA5 Yattalunga and Saratoga	➢ Residential properties affected by coastal flooding. ➢ Existing high tides in these areas can cause foreshore inundation, especially with joint occurrence of storm conditions.	➢ Coastal flooding in all events.	➢ Residential ➢ Open Space	253

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)[#]
MA6 Davistown	➢ A large number of residential properties are affected, even in more frequent flood events. ➢ Inland penetration of flood waters is larger due to very flat terrain. ➢ Existing high tides in this area can cause foreshore inundation, especially with joint occurrence of storm conditions. ➢ Longer term asset deterioration may occur.	➢ Coastal flooding in all events.	➢ Residential ➢ Open Space	1099
MA7 Kincumber, Kincumber South and Bensville	➢ Relatively small areas of residential properties in these suburbs are affected, and mostly in less frequent events. ➢ Existing high tides in this area can cause foreshore inundation, especially high tides with joint occurrence of storm conditions.	➢ Coastal flooding in all events.	➢ Open Space. ➢ Residential ➢ Special Uses / Infrastructure	116
MA8 Empire Bay	➢ Residential properties are affected even in higher probability events. ➢ Existing high tides in this area can cause foreshore inundation, especially with joint occurrence of storm conditions.	➢ Coastal flooding in all events.	➢ Residential ➢ Open Space	435

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)[#]
MA9 St Huberts Island	➢ Flooding is generally limited by ground levels on the island having been historically filled to above the 100 year ARI event, and only a very small portion of waterfront properties are generally affected. ➢ High tide events in conjunction with storms can cause surcharge of the stormwater system which affects local roads. ➢ Over-floor flooding is unlikely to occur for most residential properties, however, over-ground flooding may be experienced. ➢ Storm surge events greater than 100 year ARI have the potential to inundate this area.	➢ Coastal flooding in all events.	➢ Residential	432*
MA10 Daleys Point, Killcare and Hardys Bay	➢ Flooding is limited by fairly steep terrain at Killcare and Hardys Bay and very steep terrain at Daleys Point. ➢ Over-floor flooding is unlikely to occur for most residential properties, however, over-ground flooding may be experienced. ➢ Flooding may effect evacuation.	➢ Coastal flooding in all events.	➢ Open Space ➢ Residential	79
MA11 Pretty Beach and Wagstaffe	➢ Existing high tides in this area can cause foreshore inundation, especially high tides with joint occurrence of storm conditions. ➢ Storm surge affects local drainage and flood islands may be present.	➢ Coastal flooding in all events.	➢ Residential	105

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)[#]
MA12 Ettalong	➢ Residential properties are generally not affected by flooding in more frequent events. ➢ In the existing 100 year ARI event, the foredune protects properties from direct inundation, however, properties are inundated instead due to surcharge of the stormwater system whereby elevated waters in Brisbane Water "back up" the stormwater system. ➢ High tides do not generally result in foreshore inundation within Ettalong.	➢ Coastal flooding in all events.	➢ Open Space ➢ Residential	10^
MA13 Booker Bay	➢ Some water-front residential properties in this location are likely to be subject to over-ground flooding in more frequent events such as the 5 and 20 year ARI. ➢ Existing high tides in this area can cause foreshore inundation, especially high tides with joint occurrence of storm conditions. In these instances, roads and some residential properties are affected.	➢ Coastal flooding in all events.	➢ Residential	207
MA14 Woy Woy and Blackwall	➢ Residential and commercial properties are affected by flooding even in more frequent flood events such as the 5 year ARI and 20 year ARI. ➢ Existing high tides in this area can cause inundation, especially with joint occurrence of storm conditions. ➢ Flooding likely to affect evacuation. ➢ Flood island issues. ➢ Longer term asset deterioration may occur.	➢ Coastal flooding in all events.	➢ Residential ➢ Commercial ➢ Special Uses / Infrastructure ➢ Open Space	704

Management Area	Description of Flooding Issues	Dominated By	Predominantly Affected Land Uses	Number of Properties Affected in 100yr ARI (Existing)#
MA15 Horsfield Bay, Phegans Bay and Woy Woy Bay	➢ Coastal flooding is confined to small areas within these three bays and is limited in its extent by steep terrain. ➢ Some overground flooding may be experienced but over-floor flooding is unlikely due to floor levels. ➢ Flooding affects arterial and local roads which affect evacuation. The underpass of the railway line is a key example of this.	➢ Coastal flooding in all events.	➢ Open Space ➢ Residential	102

These numbers indicate all properties that intersect with the flood extent for each respective event, even when flooding occurs only on a very small portion of the foreshore land of the property, with no over-floor flooding. Numbers include all properties (residential, commercial, industrial, open space etc.).

* St Huberts Island is not substantially affected by flooding in the existing 100 year ARI event (see # note above).However, a large number of properties has been picked up because most properties have a very small waterfront potion that is affected by flooding. A more realistic number of affected properties for the existing 100 year ARI event (i.e. where a substantial portion of the property is affected) is 10.

^ An increase in affected properties occurs if indirect flooding (via surcharge of the stormwater system) is considered (86 properties instead of 10).

3.1.2 Future Flood Behaviour

The focus of this Floodplain Risk Management Plan is to identify and address the existing flood risk. However, due to the nature of flooding and the urbanised nature of the foreshore of Brisbane Water, it is important to also consider the impacts of sea level rise on flooding. As such, in addition to existing flood risks, projected future flood risks were also assessed in the FRMS, including the consideration of sea level rise of 0.4 and 0.9 metres. The sea level rise benchmarks of 0.4 and 0.9 metres were selected for inclusion in the assessment undertaken in the FRMS (Cardno, 2015) in response to the *NSW Sea Level Rise Policy Statement* (DECCW, 2009). This policy statement was later repealed in 2012 but the benchmarks still provided a sound basis for understanding the likely impacts of sea level rise. When these benchmarks are compared against Gosford Council's existing sea level rise policy (**Appendix B**) they correspond to planning horizons of approximately 55 years and 90 years respectively.

To provide an indication of future flood behaviour, the 0.9m scenario was assessed (in preference to the 0.4m scenario) as this is the maximum sea level rise scenario within current predictions. As such, the results of future flood behaviour give an indication of the potential long term sea level rise impacts with respect to current predictions.

In general, most foreshore areas would be impacted by flooding more regularly, with more properties affected and greater flooding depths experienced in those locations already impacted by flooding under existing conditions. A summary of the number of properties affected by flooding is provided in **Table 3.2**. The numbers in **Table 3.2**:

- Include all residential and commercial properties affected by flooding, even when flooding of the structure or building contained on that property is not affected;
- Include all residential and commercial properties affected by flooding, even when the land of the property is only marginally affected;
- Are not representative of whether the structure or building contained on that property is flood affected; and
- Were calculated based on the property ground and floor levels obtained by a surveyor as part of the FRMS (Cardno, 2015) and were used for the purposes of the flood damages calculations. It is noted that industrial properties were not included in the survey. This data is included in Appendix E (Confidential).

Table 3.2: Properties Affected by Flooding

Flood Event	Properties affected	
	Existing	0.9m Sea Level Rise
5 Year ARI	3,182	5,777
20 Year ARI	3,828	5,963
100 Year ARI	4,304	6,111
200 Year ARI	4,512	6,187
PMF	5,213	6,554

The number of properties affected by over-floor flooding only is provided in **Table 3.3**. The numbers in **Table 3.3** include all residential and commercial properties as per the aforementioned floor level survey data. It can be seen that over-floor flooding affects far fewer properties, particularly in the existing case, and this is due to minimum floor level requirements for properties in the floodplain.

Table 3.3: Properties Affected by Over-floor Flooding

Flood Event	Properties affected by flooding above floor level only	
	Existing	0.9m Sea Level Rise
5 Year ARI	77	1,972
20 Year ARI	202	2,409
100 Year ARI	473	3,003
200 Year ARI	616	3,236
PMF	1,198	3,945

A discussion paper was also included in the FRMS (Cardno, 2015) that outlined the anticipated tidal inundation as a result of sea level rise (i.e. the day to day effects, rather than the effects occurring concurrently with a coastal flood event). A summary of the potential impacts of tidal inundation as a result of 0.9m of sea level rise has been summarised for each Management Area in **Table 3.4**.

Table 3.4: Future Tidal Behaviour with 0.9m of Projected Sea Level Rise

Management Area	Description of Future Tidal Inundation Issues
MA1 West Gosford and Point Clare	➢ High tides are likely to affect lower-lying and foreshore roads in the area and some open space and foreshore areas. Private properties are unlikely to be inundated in regular tidal events.
MA2 Gosford	➢ High tides may affect foreshore roads and open space but private properties are unlikely to be significantly affected. ➢ Some further inundation will occur in high water level events, but would generally be restricted to areas in close proximity to the foreshore due to the topography of the area.
MA3 Point Frederick, East Gosford, Green Point, Koolewong and Tascott	➢ High tides in this area are likely to cause inundation of some foreshore properties, sections of some lower-lying roads, and foreshore open space areas.
MA4 Erina	➢ High tides are likely to cause inundation predominately in open space and wetland areas only.
MA5 Yattalunga and Saratoga	➢ High tides are likely to impact some foreshore properties and local roads.
MA6 Davistown	➢ A large number of residential properties are likely to be affected by high tides. ➢ Key access roads may also be impacted by high tides, with some long term asset deterioration. ➢ Inundation by tides is more extensive due to very flat terrain.
MA7 Kincumber, Kincumber South and Bensville	➢ High tides are likely to cause inundation predominately in open space and wetland areas. Some small areas of private properties may be affected.
MA8 Empire Bay	➢ A moderate number of residential properties are likely to be affected by high tides. ➢ Local roads are likely to be affected, and longer term asset deterioration likely.
MA9 St Huberts Island	➢ A small number of properties and roads likely to be affected by high tides.

Management Area	Description of Future Tidal Inundation Issues
MA10 Daleys Point, Killcare and Hardys Bay	➢ Foreshore inundation from high tides is likely to only affect small areas in these locations. ➢ Inundation by tides is limited by moderately steep terrain at Killcare and Hardys Bay and very steep terrain at Daleys Point.
MA11 Pretty Beach and Wagstaffe	➢ High tides in this area are likely to affect some foreshore roads and properties.
MA12 Ettalong	➢ High tides are unlikely to affect properties or roads.
MA13 Booker Bay	➢ High tides in this area are likely to cause inundation of properties and roads, and longer term asset deterioration.
MA14 Woy Woy and Blackwall	➢ Roads and a large number of residential and commercial properties are likely to be affected by high tides. ➢ Longer term asset deterioration likely. ➢ Inundation by tides is more extensive due to very flat terrain.
MA15 West Gosford and Point Clare	➢ Some foreshore properties are likely to be impacted by high tides. ➢ Inundation is limited by steep terrain.

Whilst the management actions recommended in the Plan (**Section 6**) primarily relate to management of the existing flood risk, it can be seen that the flood risk and tidal inundation may be significantly exacerbated over the coming decades as a result of sea level rise. Management of this risk has been considered in the FRMS (Cardno, 2015) and this FRMP through the following:

- The analysis of likely flood impacts under sea level rise scenarios of 0.4m and 0.9m.
- The analysis of likely impacts on tidal inundation as result of sea level rise scenarios of 0.4m and 0.9m.
- The development of an interim development control matrix that can be adapted to include consideration of the best available science on sea level rise available over time (**Appendix A**).

A key recommendation of this FRMP is that Climate Change Adaptation Plans should be prepared for the Brisbane Water area. This forms Action PM9, which will need to consider the floodplain risk management process and other planning mechanisms so that potential sea level rise can be adequately planned for. It is recommended that the CCAPs review the best available climate change science available and develop strategic policies, frameworks and management strategies for the LGA as a whole and for key areas affected by climate change. The information contained within the Floodplain Risk Management Study will be used to inform these strategies. Further details regarding the proposed Climate Change Adaptation Plans are provided in **Section 6.5** of this FRMP.

3.2 Flood Extents

Flood extents for the Brisbane Water Foreshore were prepared as part of the FRMS (Cardno, 2015). Flood extents for the existing 100 year ARI event and PMF event are provided as **Figure 3.2**. Projected flood extents for the 0.4m SLR and 0.9m SLR scenarios are provided in **Figures 3.3 and 3.4** respectively.

More detailed figures showing flood extents for these and other ARIs can be found in Appendix C (existing scenario) and Appendix F (sea level rise scenarios) of the FRMS (Cardno, 2015).

It is noted that the mapping prepared for the FRMS was undertaken prior to the Council resolution on sea level rise (GCC, 2015), provided in **Appendix B**. The mapping therefore provides an indication of sea level rise values that are based on previous bench marks. However, it is noted that these values are relevant within the next 100 years with regards to the sea level rise predictions adopted by Council.

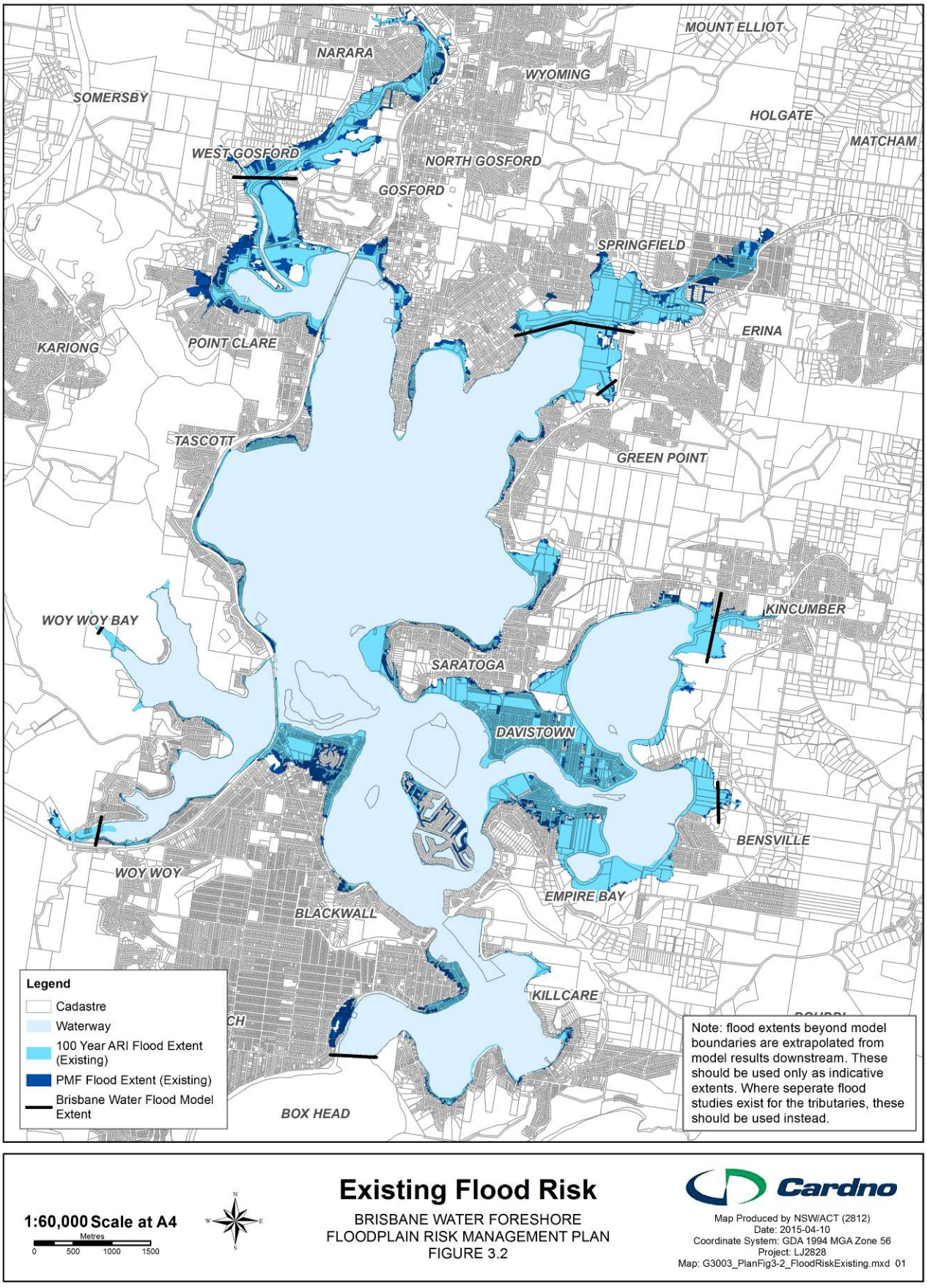


Figure 3.2: Existing Flood Extents

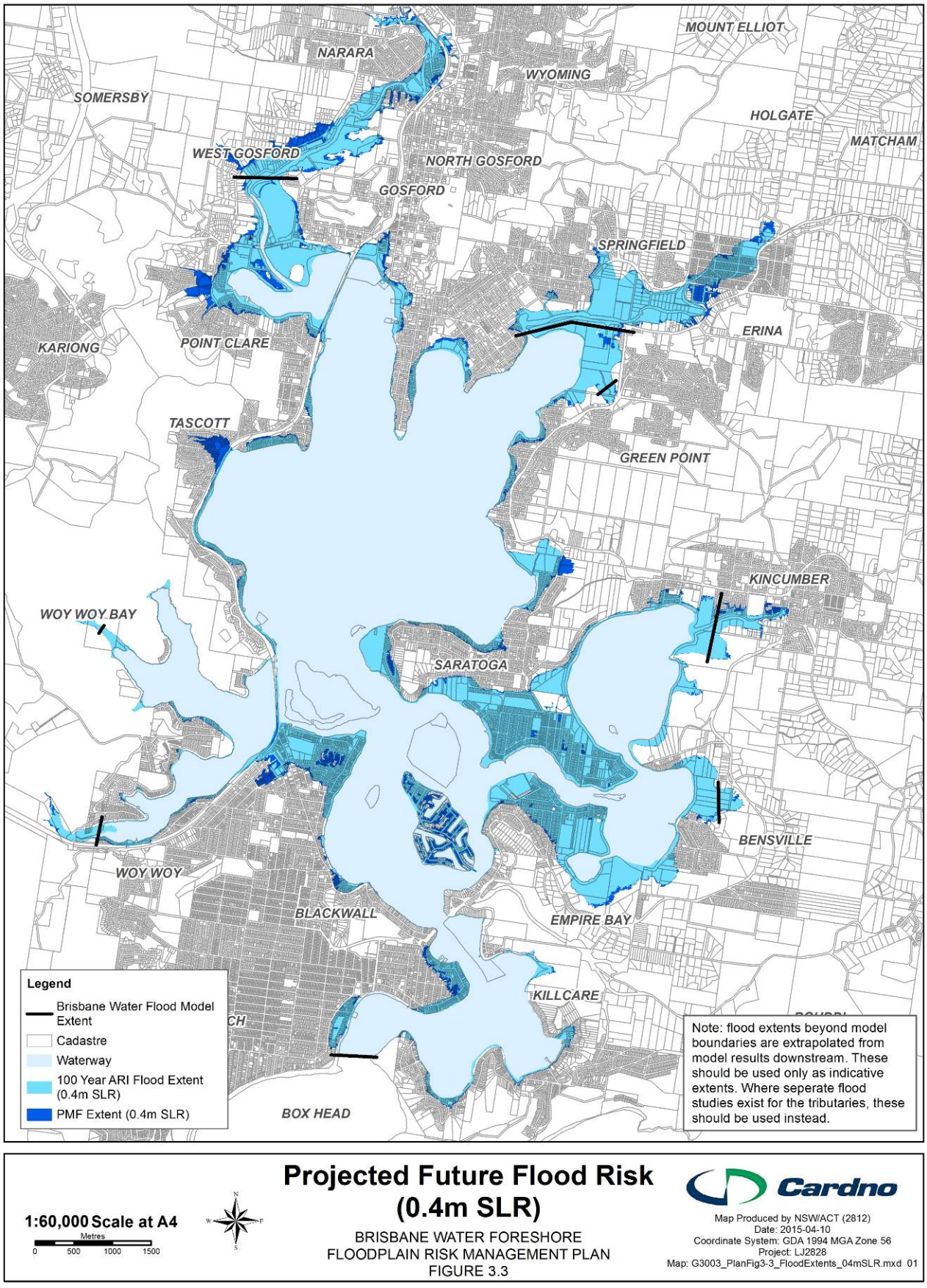


Figure 3.3: Flood Extents with 0.4m Sea Level Rise

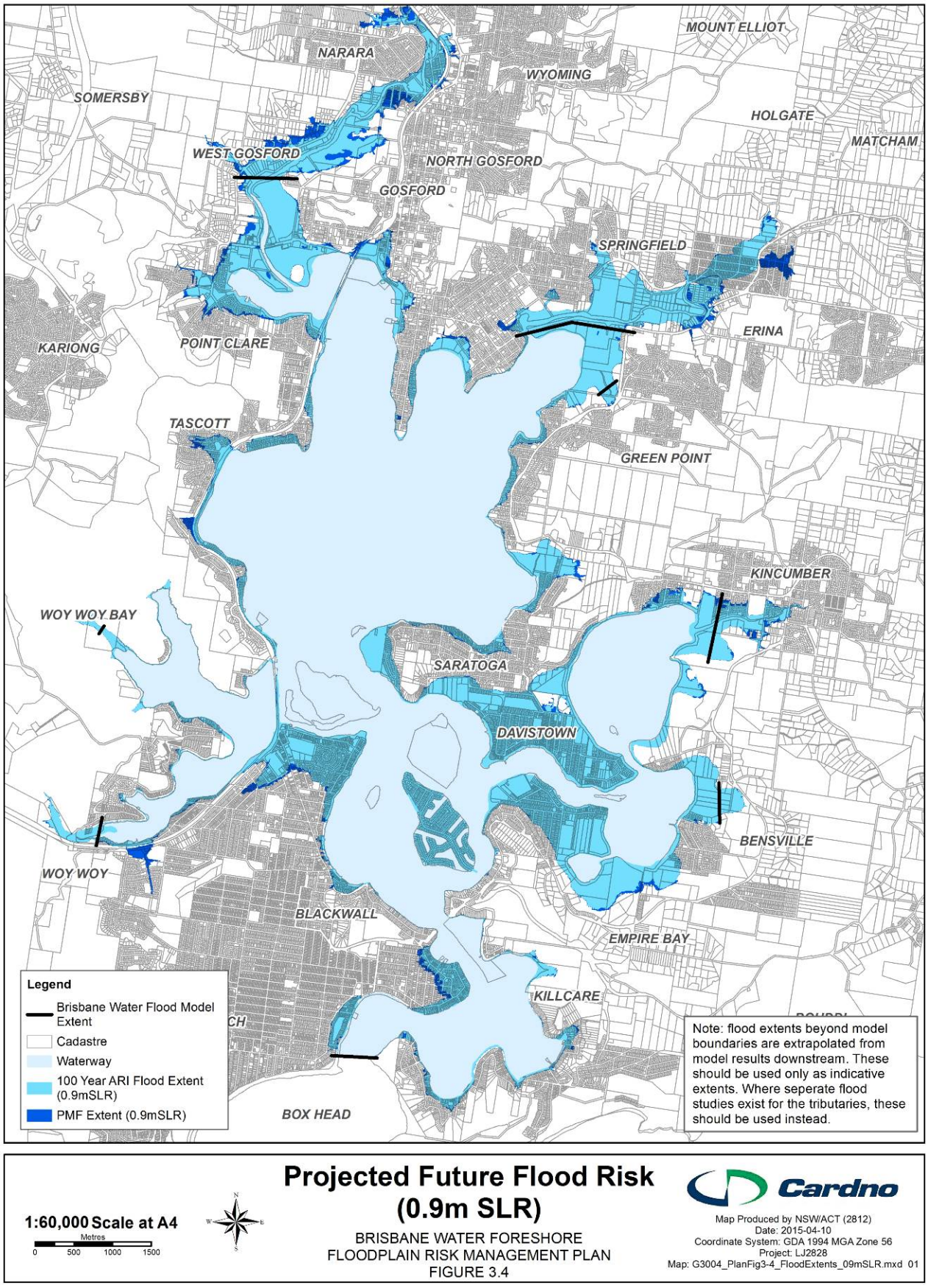


Figure 3.4: Flood Extents with 0.9m Sea Level Rise

3.3 Floodplain Issues

Flooding issues relevant to the Brisbane Water Floodplain as a whole include:

- Flooding of existing developed areas (residential and commercial) and the economic and social effects (e.g. damage to property, social disruption);
- The dominance of coastal flooding in the floodplain (as distinct from catchment flooding);
- The impacts of waves in addition to the flood level itself;
- Evacuation during this type of flood event (i.e. generated by sea storm surge, often with a high tide and generally at night). This can make evacuation more difficult than during a catchment flood event even though there is a longer warning period than other catchments in the Gosford local government area;
- Projected sea level rise impacts likely to exacerbate flooding;
- Development pressures likely to exacerbate flooding;
- Damage to public assets;
- More frequent flood events and tidal inundation; and
- The transition of low flood hazard areas to areas of high hazard as a result of increased flood depths due to sea level rise.

More specific issues were identified through a review of estuary flood behaviour, and raised by the Catchment and Coast Committee and the community. These issues form the basis of the options assessment presented in the FRMS (Cardno, 2015), and this FRMP seeks to address these issues through the implementation of identified actions (**Section 6**).

3.4 Floodplain Risk Management Objectives

The objectives of floodplain management for the Brisbane Water foreshore are in accordance with the overarching NSW *Flood Prone Land Policy.* The primary objective of the Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible and within the constraints of available funding.

The floodplain management objectives for the Brisbane Water floodplain are:

- Reduce the flood damage (and associated losses) to property, and danger to personal safety in the existing community;
- Minimise the disruption that results from flooding;
- Ensure future development is controlled in a manner consistent with the flood risk and associated danger to personal safety;
- Protect and where possible enhance the estuary and floodplain environment;
- Ensure compatibility with the objectives of relevant State government policies include the Flood Prone Land Policy and the ecological objectives identified through the *Brisbane Water Coastal Zone Management Plan*;
- Satisfy the objectives and requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act);
- Ensure the management plan is fully integrated with the local flood and catchment plans, Council's existing corporate, business and strategic plans and proposed environmental

planning instruments, and Council's obligations under the Local Government Act 1993 (LG Act);
- Ensure that the management plan has the support of the local community;
- Ensure actions arising out of the management plan are sustainable in social, environmental, ecological and economic terms and maximise positive and minimise negative impacts; and
- Establish a program for implementation of the management plan including a mechanism for funding that should include priorities, staging, funding and responsibilities.

The focus of these objectives for the Brisbane Water floodplain has been on the current flood risk. However, the FRMS (Cardno, 2015) identified the potential increase in flood risk as a result of sea level rise within the Brisbane Water floodplain to be a significant issue for consideration. As a result the objectives above have also been considered, where possible, within the context of this future flood risk.

Council has undertaken the floodplain risk management process in accordance with the *Floodplain Development Manual* (NSW Government, 2005) to ensure that these objectives are achieved. This will occur through implementation of the proposed floodplain risk management actions that are set out in Section 6 of this FRMP. The implementation program set out in **Section 6.2** provides the framework for implementing the proposed management actions.

4 Flood Planning

Flood planning relates to the application of planning rules to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods. At the same time appropriate planning provisions also recognise the benefits from the use, occupation and development of flood prone land. The planning issues assessed as part of the *Brisbane Water FRMS* (Cardno, 2015) were undertaken in order to achieve these objectives and the objectives of Gosford Council DCP (2013), including:

- To reduce private and public losses resulting from floods.
- To enable safe access or evacuation of people to the existing public road network during flooding.
- To maintain the existing flood regime.
- To limit land uses to those compatible with flood hazard.

The following sections within this chapter provide planning considerations and recommendations with regards to flood hazard, emergency response and development controls. Consideration is also given to future development within the floodplain and the likely impacts of sea level rise.

4.1 Floodplain Hazard

Flood hazard can be defined as a threat to life and potential damage associated with a flood event. The hazard caused by a flood varies both in time and place across the floodplain. The 100 Year ARI high hazard extent forms the basis within Council's planning framework for the land identified as having the highest risk to life and property and has relevant development controls applied (see **Section 4.3** for further details).

4.1.1 Provisional Flood Hazard

Provisional flood hazard is defined by the *Floodplain Development Manual* (NSW Government, 2005) using a relationship between the depth and velocity of floodwaters (Figure L2 in the Manual). Based on this relationship, there are two categories for provisional hazard – high and low.

The provisional flood hazard for the Brisbane Water floodplain was defined as part of the Flood Study (Cardno, 2013b) and mapped as part of the FRMS (Cardno, 2015). Mapping has been based on the design still water level and wave setup (but not wave run-up). Flood hazard mapping for the 100 Year ARI is provided in **Figure 4.1**.

It is noted that with projected sea level rise, areas currently mapped as low hazard are likely to transition over time to high hazard, which has implications for planning and development. This may have planning implications where the high hazard extent is used for defining appropriate development controls.

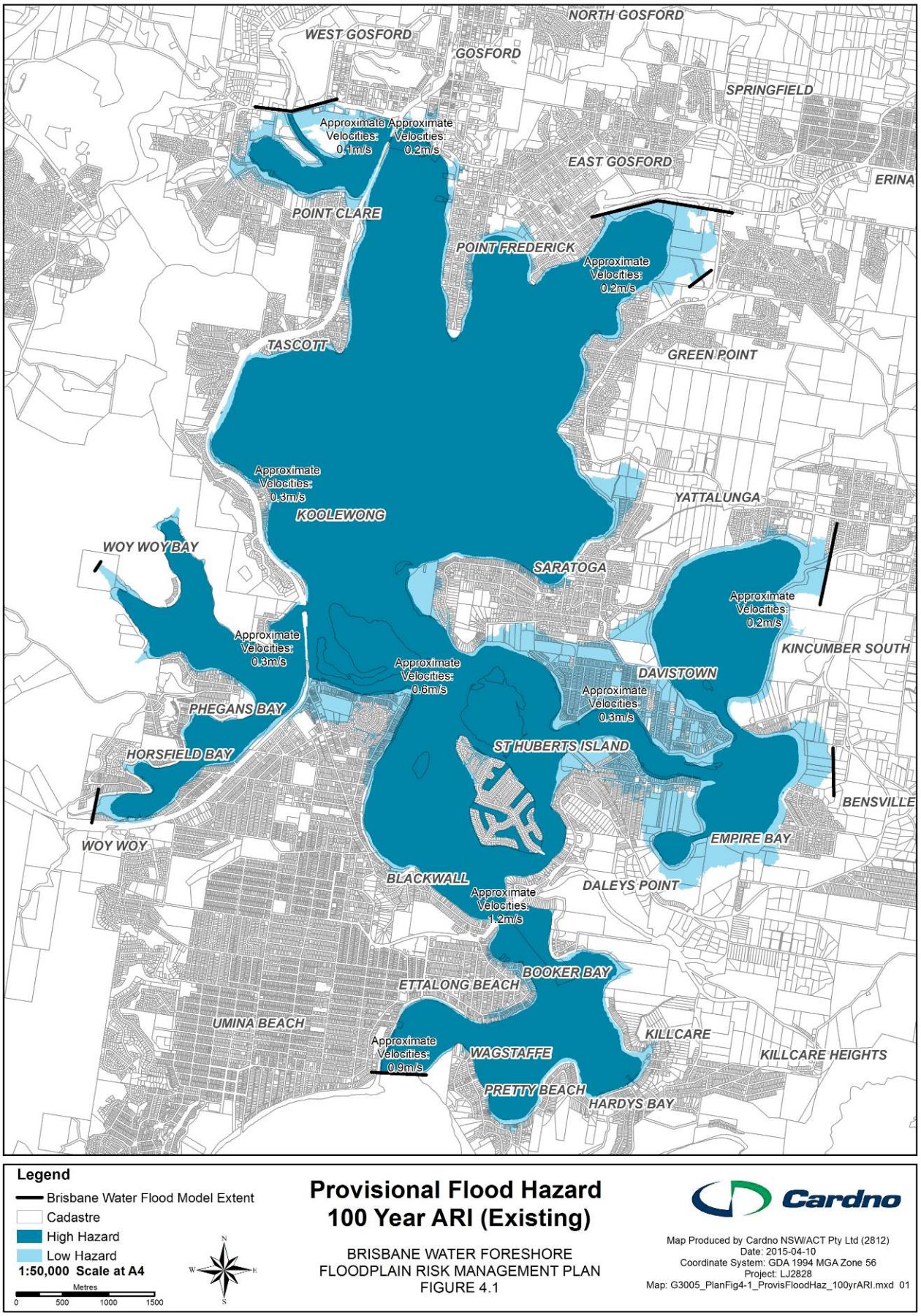


Figure 4.1: Provisional Flood Hazard – 100 Year ARI

4.1.2 True Hazard

The definition of provisional flood hazard is based purely on hydraulic mechanisms and does not consider the range of additional factors that influence flood hazard. Provisional hazard was therefore assessed as part of the FRMS (Cardno, 2015) in the context of a range of other factors so as to provide an indication of the "true hazard" associated with the floodplain. These factors and a brief summary of the assessment results are provided below:

- **Size of flood** – The 100 year ARI hazard mapping forms the basis of the development controls for the floodplain. The hazard extents for the other events provide a useful indication of areas where larger water level depths are experienced, and this may be useful information for the NSW SES in emergency response;
- **Effective warning time** – This can be defined as the time it takes for people to undertake appropriate actions prior to a flood occurring (such as transporting belongings and/or evacuating). Effective warning time for the floodplain is not considered of such a significant duration that it would enable areas of high hazard to be reduced to low hazard. However, it has been considered when developing appropriate development controls related to emergency management;
- **Flood readiness** – This is generally influenced by the time elapsed since the last severe flood event and the regularly and effectiveness of flood education campaigns. The outcome of the community consultation combined with the substantial amount of time elapsed since the 1974 flood event (and the limited nature of more recent events), suggests that it is not appropriate to alter the flood hazard definition to reflect a high level of flood readiness;
- **Rate of rise of floodwaters** – Based on the results of the Flood Study (Cardno 2013b), the rate of rise for the floodplain is relatively low and so no areas have been identified as being at high risk of fast rising floodwaters. Conversely, the rate of rise is not considered sufficiently low such that high hazard areas could be reduced to low hazard;
- **Depth and velocity of floodwaters** – Based on the results of the Flood Study (Cardno 2013b), flood velocities are relatively small and high hazard areas for the majority of the Brisbane Water floodplain are largely dependent on depth;
- **Duration of flooding** – In a 100 year ARI event, the majority of the floodplain is likely to be inundated for approximately 5 hours, with a likely maximum duration of flooding of 9 hours. Because provisional hazard definition within the Brisbane Water estuary is primarily depth-driven, areas that are flooded for longer durations are already defined as high hazard;
- **Evacuation problems** – Evacuation problems are an important factor in floodplain management and future planning controls, however as a true hazard factor it does not affect the hazard categorisation of the Brisbane Water floodplain;
- **Effective flood access** – Rather than modifying the provisional hazard mapping, the NSW SES need to be informed that some areas along the Brisbane Water foreshore would require prioritisation during evacuation from a flood event, e.g. some areas in Woy Woy and the lower portion in the north of St Huberts Island (see **Section 4.1.3**); and
- **Type of development** – Existing development in the floodplain is largely residential, with some areas of open space, commercial, industrial and special land uses. Much of the development has been present for some time; however, Council's existing and future planning controls seek to restrict new development types to be more flood-compatible.

Similar to provisional hazard, the true hazard associated with the floodplain may change over time as sea levels rise. For example isolation issues may change in location and risk.

4.1.3 Emergency Response Planning

When considering flood resilience, a community at risk needs to understand their role in minimising the impacts of disasters, and have the relevant knowledge, skills and abilities to take appropriate action (Council of Australian Governments, 2011).

A preliminary assessment was undertaken to identify locations within the floodplain (PMF extent) that are likely to be particularly sensitive to flooding. In general, substantial areas of the floodplain have relatively good rising access. Good rising access is generally located in areas where the topography rises continuously with increasing distance from the estuary and roads are located appropriately such that access to higher ground can be achieved as floodwaters rise. For example, although some properties along the Point Frederick peninsular are at risk of inundation, the topography rises towards the middle of the peninsular. Albert Road would not be cut off by floodwaters and would provide rising access such that residents would have sufficient access to evacuate if needed, even in the PMF event. Areas where rising access is likely to be limited include very flat areas (such as Davistown, Woy Woy and Empire Bay) and areas where topography may rise and then decline again with increasing distance from the estuary. This issue is illustrated diagrammatically in Appendix B of the FRMS (Cardno, 2015) as several example cross sections of selected locations around the floodplain.

Locations where critical infrastructure, access routes or properties may become isolated as a result of rising floodwaters have been considered and are presented in **Table 4.1**, along with recommended emergency response arrangements. These locations are mapped in **Figure 4.2**.

Where relevant, it is recommended that Council liaise with the SES to ensure that relevant organisations (such as the retirement village on Yallambee Avenue, West Gosford) have appropriate emergency response plans and that these are updated in accordance with the findings of this FRMP.

In addition, Council should coordinate with the SES to ensure all of the relevant flood information from the Flood Study (Cardno, 2013b), FRMS (Cardno, 2015) and this FRMP are incorporated into Flood Plans and response arrangements. This would include not only flood extents, but duration of inundation, road flooding and any known locations of people with special needs that might hinder evacuation or appropriate response to flooding conditions. This information can also be utilized to ensure that SES and emergency services are located out of the floodplain for current and future sea level rise scenarios.

Table 4.1: Potentially Isolated Locations

Location	Description	Recommended Emergency Response
Several residential properties in the vicinity of Camellia Circle, Woy Woy	As floodwaters rise, access to and from these properties is likely to be cut off prior to the properties being inundated.	Vehicle evacuation must be completed before access routes become inundated. After this time access will then be limited to air or boat. It should be noted that evacuation during a storm event can be inhibited by many factors, included time of day, power and phone outages and general confusion. However, it is also noted that due to the nature of flooding around the Brisbane Water Foreshore there are likely to be several hours prior to significant flooding occurs within which warnings could be distributed. This available time is primarily due to the long term forecasting for coastal storms.

Location	Description	Recommended Emergency Response
Properties along Yallambee Avenue, West Gosford	Road access is likely to be limited due to flooding of roads to this area (including the nursing home/retirement village, which is above the floodplain but is likely to be surrounded by floodwaters).	Vehicle evacuation must be completed before access routes become flooded. After flooding of roads occurs, resupply may not be required, but should be assessed depending on the severity of the flood.
Some areas in Davistown and Empire Bay	Filling in Davistown and Empire Bay means that some properties are located on higher ground. During flood events, this leads to a series of "islands" – areas surrounded by floodwaters and isolated. The inhabitants of these properties may decide to shelter-in-place but will then have limited emergency access once flooding of the surrounding area occurs.	
Properties along Boyd Close and Beachfront Parade, St Huberts Island	These properties are located on higher ground but would be surrounded by floodwaters and isolated during flood events. Road access is also likely to be cut off. The inhabitants of these properties may decide to shelter-in-place but will then have limited emergency access once flooding of the surrounding area occurs.	
Properties along Lara Street and Marloo Road, Koolewong (to the west of the Spike Milligan Bridge)	These properties have the potential to become isolated during flood events when access under the railway bridge is cut off by floodwaters.	
NSW SES Headquarters (Gosford), Erina	This property is located on higher ground but would be surrounded by floodwaters and isolated during flood events. Road access is also likely to be cut off. However, it should be noted that the existing PMF event does not inundate whole area.	Emergency response from this location is unlikely to be efficient in a severe flood event, and alternative arrangements should be made.

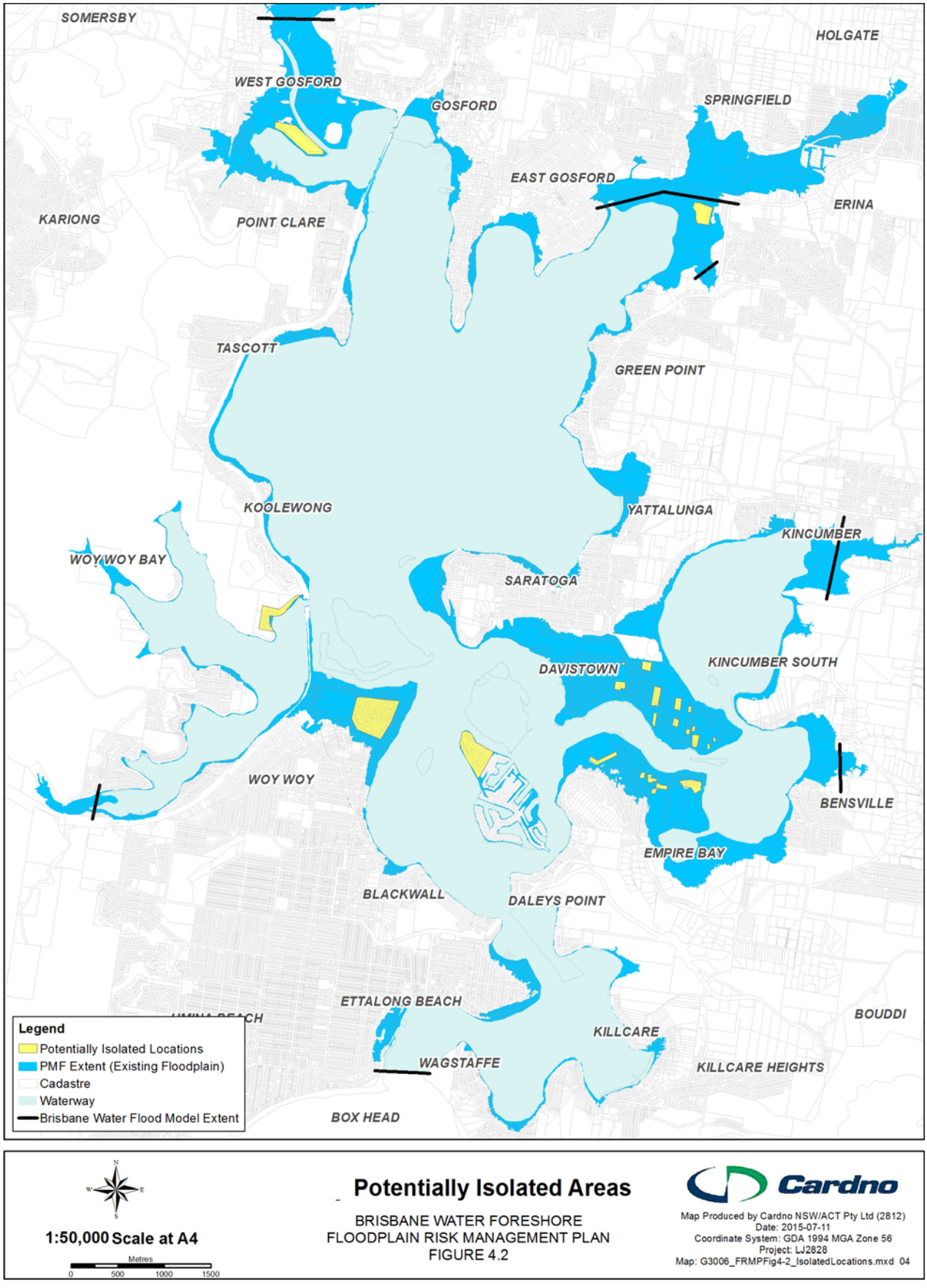


Figure 4.2: Potentially Isolated Locations

4.2 Flood Planning Levels

The Flood Planning Level (FPL) for the majority of flood prone areas across New South Wales has been traditionally based on the 100 year ARI flood level plus a freeboard. The *Guideline on Development Controls on Low Risk Areas – Floodplain Development Manual* (DoP, 2007) states that unless there are 'exceptional circumstances', councils should adopt the 100 year ARI (plus an appropriate freeboard) for residential development. A variety of factors are worthy of consideration in determining an appropriate FPL and whether 'exceptional circumstances' exist for the selection of a FPL other than the 100 year ARI. Most importantly, the flood behaviour and the risk posed by the flood behaviour to life and property in different areas of the floodplain and different types of land use need to be accounted for in the setting of a FPL.

As part of the review of the FPL undertaken in the FRMS (Cardno, 2015), the following elements were considered:

- The current FPL applied to the Brisbane Water foreshore;
- Factors influencing FPLs;
- The potential consequences of adopting the Probable Maximum Flood (PMF) as the FPL (the upper bound of flood risk);
- The effect of climate change projections on FPLs; and
- Potential options for freeboard selection.

Gosford City Council currently uses the existing 100 year ARI flood level associated with observations from an historical event in the absence of detailed flood modelling as the basis for determining the FPL for the Brisbane Water foreshore. The flood event used to determine the existing FPL for the Brisbane Water foreshore floodplain was the May 1974 severe ocean storm which resulted in a range of flood levels being recorded across the floodplain. A single recorded flood level from one of these locations of 1.92m AHD (taken as 1.95 mAHD for planning purposes) was used to develop flood planning levels. The current flood planning level is set at 2.45m AHD. This planning level incorporates the 1.95m AHD observed 1974 level, with the addition of 0.5m freeboard to account for uncertainty (e.g. additional flood impacts resulting from wave and wind set-up, wave run-up and potential climate change).

4.2.1 Recommendations of the Floodplain Risk Management Study

The FRMS was completed in March 2015. Due to the uncertainties associated with applying the risk of sea level rise into planning considerations, it was recommended that a short term approach to considering sea level rise be adopted as part of an interim FPL until the outcomes of the CCAPs (PM9) are known.

It was identified that the adoption of a 2050 sea level rise prediction would account for the predicted increases in flood levels over the next 35 years. Whilst this does not fully account for the typical lifespan of a residential building (approximately 50 years), it does afford some protection against sea level rise until the outcomes of the CCAPs (PM9) are known. The FRMS recommended that the FPL should be reviewed at that stage, or before if relevant information becomes available.

Therefore the interim FPL for the Brisbane Water foreshore floodplain was recommended in the FRMS to be:

FPL = 100 year ARI DSWL + 2050 Projection of SLR + 0.5m Freeboard.

In addition, it was also recommended in the FRMS that vulnerable or longer term development types such as critical infrastructure and assets consider the application of the 2100 projected sea level rise as part of the FPL.

The CCC (25 February 2015) supported the adoption of a flood planning level based on these components (CCC Minutes were received and noted at Council meeting 28 April 2015 - Appendix B).

4.2.2 Changes in Sea Level Rise Policy

The FRMS assessed the potential impacts of sea level rise based on 0.4m and 0.9m of sea level rise. These increases in sea level were applied to the flood study results and in effect represented an increase in sea level from the present day levels. However, it is noted that the (now repealed) state policy from which these values were derived, considered the increase of 0.4m by 2050 and 0.9m by 2100 to be based on 1990 mean sea level.

Since the completion of the FRMS (Cardno, 2015), Gosford Council has revised its sea level rise policy with regards to planning levels. In March 2015 Council resolved to adopt sea level rise planning levels based on projections for the *Representative Concentration Pathway Scenario* RCP 8.5 (**Appendix B**), utilising the medium sea level rise projection. This projection has been provided from 2015 mean sea level. It should be noted that this projection represents a projection of sea level rise based on carbon emissions where little effort has been made to reduce emissions and emissions are not curbed by 2100. The selection of the 'medium line' for this projection results in a projection which has a 50 percent chance of being exceeded.

As a result of this policy review, a further report was prepared for Council's consideration (28 April 2015) of FPLs within Brisbane Water. The report recommended:

- The Flood Planning Level (FPL) for Brisbane Water floodplain should be based on a derived flood level applicable to the development as determined by the Brisbane Water Flood Study (2013b) or any subsequent updated study adopted by Council.
- The FPL will also include a freeboard of 0.5 Metres
- The FPL will include an allowance for projected sea level rise based upon the Representative Concentration Pathway Scenario RCP 8.5 as adopted by Council (Minute 2015/86) commensurate to the asset life and planning horizons or the type of development or land use.
- Within every Council term or within two years of a new IPCC report, Council review the Sea level Rise Planning level.

Figure 1 in April Council Agenda in Appendix B was included in the recommendations provided to Council. This shows diagrammatically the RCP8.5 sea level rise predictions within the context of the current year (2015) and various asset life spans and planning horizons.

The planning horizon adopted for the purposes of sea level rise considerations should be relative to the development type or asset proposed. For example a bus shelter or playground would have a relatively shorter planning period (possibly close to 20 years) than a sewerage system (possibly up to 100 years).

4.2.3 Flood Planning Level Recommendations

The recommendations of the FRMS (Cardno, 2015), the resolution made by Council with regards to sea level rise (March 2015) and the recommendations made by the Catchments & Coast Committee to Council (February 2015) and considered by Council (April 2015) have been incorporated into the recommendations provided below.

The recommended FPL for the Brisbane Water foreshore floodplain is:

FPL = 100 Year ARI DSWL + SLR + 0.5m Freeboard

- SLR should be incorporated in accordance with Council's Resolution (March 2015 or any subsequent amendment). SLR should be commensurate to asset life and planning horizons. A minimum planning horizon of 35 years should apply to all development types. The graph provided in **Appendix B** gives an indication of various design life estimates and the associated sea level rise planning level. It would be appropriate to consider a longer planning horizon when applying SLR for vulnerable or longer term development types, such as:
    - Critical infrastructure, vulnerable development types (e.g. aged care, seniors living, child care) and emergency services;
    - Road raising for critical infrastructure; and
    - Construction of levees.
- At locations where the adopted FPL is higher than the existing PMF, the adopted FPL should still be used.
- Within the floodplain, where the PMF is higher than the FPL, it is not unreasonable for the PMF level to be used as a planning level when considering:
    - Critical infrastructure, vulnerable development types (e.g. aged care, seniors living, child care) and emergency services;
    - Road raising for critical infrastructure; and
    - Construction of levees.

Specific recommendations for design levels for all development types are provided in the Draft Development Control Matrix provided in **Appendix A**.

4.2.4 Applying Flood Planning Levels

To determine the FPL for a particular development, the following would be applied:

- Identification of 100 Year ARI level for 2015 from the Brisbane Water Flood Study (Cardno, 2013b) plus any SLR that may have occurred since 2015 to the date of the development application.
- Addition of an allowance for SLR relevant to the development type (i.e. planning horizon) and the year of the application (it should be noted that an average value of each 5 year period would be applied for all years within that period).
- Addition of 0.5m freeboard.

Two examples are provided below for the same type of development at the same location where the development application was submitted in 2015 and 2020 respectively.

Example 1 – Residential Development Application in Davistown in 2015

- 100 Year ARI Level (in 2015) = 1.45 mAHD
- SLR for 35 year planning horizon from 2015 = 0.2m (see Figure 1 in April Council Agenda in Appendix B)
- Freeboard = 0.5m

FPL = 2.15 mAHD

Example 2 – Residential Development Application in Davistown in 2020

- 100 Year ARI Level = 1.47 mAHD
  - In 2015 = 1.45 mAHD (from Flood Study, Cardno 2013b)
  - Plus SLR occurred since Flood Study = 0.02m (see Figure 1 in April Council Agenda in Appendix B)
- SLR for 35 year planning horizon from 2020 = 0.22m (see Figure 1 in April Council Agenda in Appendix B)
- Freeboard = 0.5m

FPL = 2.19 mAHD

A conceptual diagram showing the application of the FPL to a proposed dwelling is shown in **Figure 4.3**.

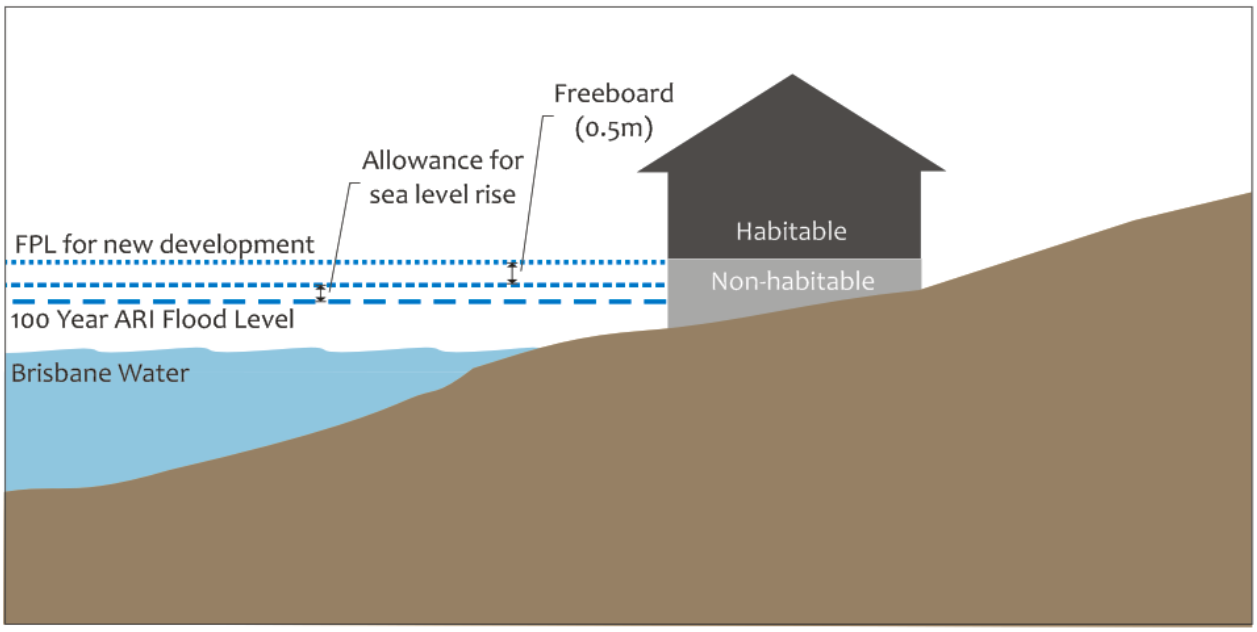


Figure 4.3: Flood Planning Level Conceptual Diagram

4.3 Development Controls

In February 2014, *Gosford City Council's Development Control Plan* (DCP) came into effect. *Section 6.7.7.6* of the DCP outlines development controls relating to floodplain management. Development in the Brisbane Water floodplain is assessed in a manner consistent with the DCPs. Whilst the DCPs have common elements for the management of flooding with respect to development across the entire LGA, this Plan has provided recommendations for development controls which are specific to the flood behaviour in Brisbane Water. These recommendations can be found in Action PM7 (**Appendix C**) and the DCP Matrix provided in **Appendix A**.

It should be noted that these recommendations are for use in developing appropriate flood related controls for the Brisbane Water floodplain within Council's DCP and are likely to require review and modification to ensure consistency with Council's planning approaches and other relevant legislation and plans. For example it should be recognised that the any suggested development controls are guidelines only and where controls are inconsistent or incompatible with the provision of an environment planning instrument the DCP has no effect.

It is the objective of the suggested development controls to:

- Encourage adaption to address future effects of SLR without maladaptation;
- Ensure that occupant's risk is minimised during a storm event is considered carefully while still considering the development on a merit basis;
- Ensure that damage to property is minimised during a storm event; and
- Be consistent with environment planning instruments.

The development control matrix contains development controls specific to various development types within the following flood risk areas:

- 100 Year ARI High Hazard Extent. This extent is defined in **Section 4.1.1** and is considered to contain the highest flood risk. It is predominantly contained to the immediate foreshore areas.
- Flood Planning Area (FPA). This extent is defined as the land below or equal to the Flood Planning Level which is defined in **Section 4.2**. This area forms the majority of the land affected by flood related development controls. For the purposes of this study, the FPA has been defined at the area below 100 Year ARI + SLR + 0.5m Freeboard.
- Probable Maximum Flood (PMF) Extent. This extent is defined as the areas at or below the PMF level. This area is generally considered to contain the lowest flood risk. It should be noted that the PMF extent used in the DCP Matrix does not have any allowance for sea level rise at this time. As such, the proposed FPL (**Section 4.2**) is higher than the PMF at all locations within the floodplain. Therefore, the PMF development controls do not apply to any development type within the floodplain at this point in time. If the FPL or inclusion of climate change in the PMF extent is revised, this position may change.

The planning areas are shown in **Figure 4.4**.

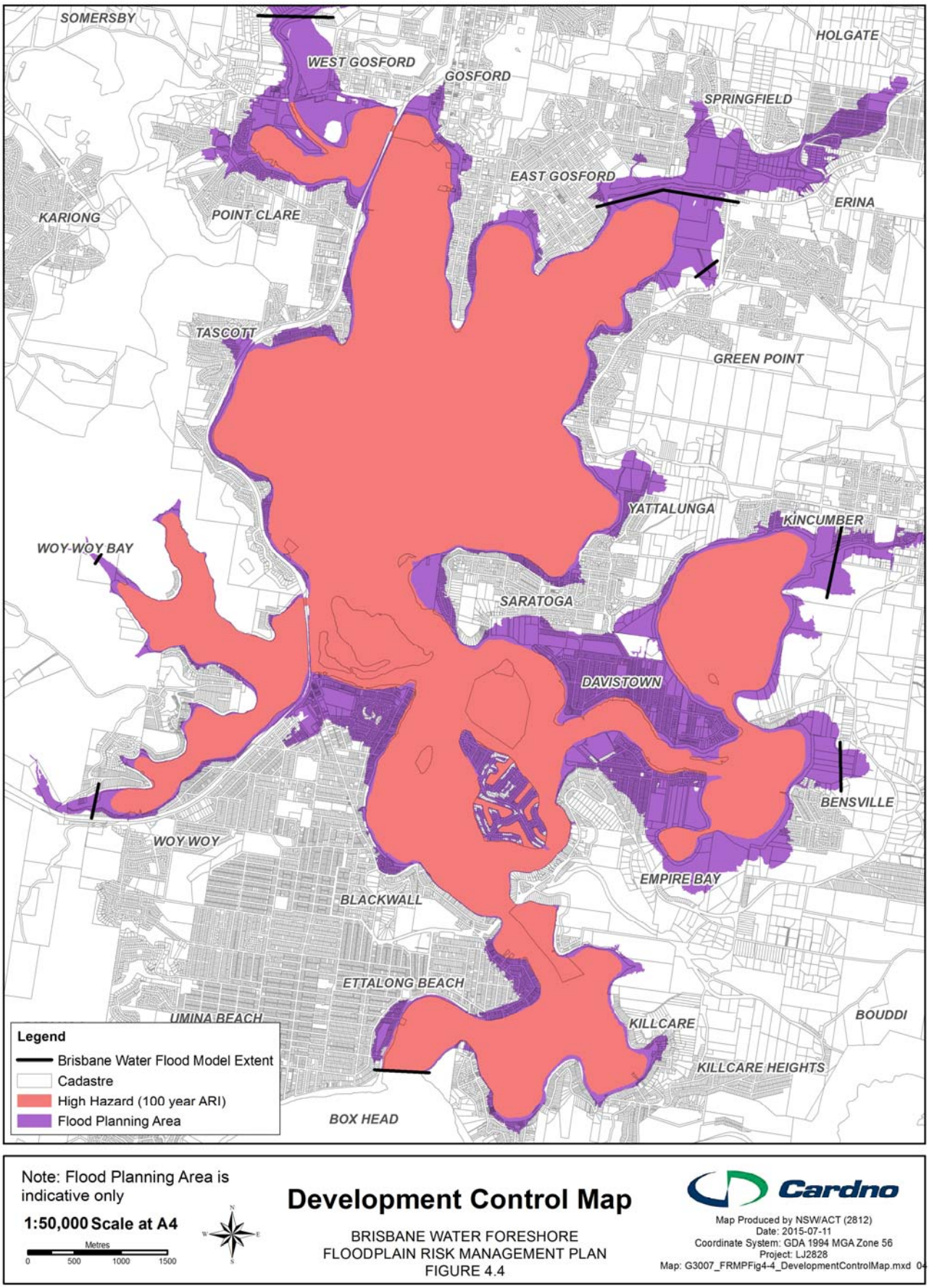


Figure 4.4: Development Control Map

4.3.1 Hazard Notations on Section 149 Planning Certificates

Under Section 149 of the Environmental Planning & Assessment Act 1979 (EPA Act) application can be made for a planning certificate in respect of land. Certain prescribed information must be included on a planning certificate under s149(2), and a council can include advice on other relevant matters regarding the land under s149(5).

The Department of Planning released a draft Planning Circular (PS 14-003 November 2014) regarding notations on s149 certificates in respect of coastal hazards. Specifically, the circular stated that:

- A planning certificate under s149(2) will disclose matters relating to the land, including whether or not the land is affected by a policy that restricts the development of land. These policies can be based on identified risks (Environmental Planning and Assessment Regulation 2000, schedule 4, clause 7), and whether development on land is subject to flood related development controls (EP&A Regulation, schedule 4, clause 7A). Inclusion of this information under s149(2) is a mandatory part of the conveyancing process.
- A planning certificate may also include information under s149(5). This allows a council to provide advice on other relevant matters affecting the land. This can include past, current and future coastal risks. The conveyancing process does not mandate the inclusion of information under section 149(5).
- Where a relevant policy or development control does relate to the land and the policy or development control arises due to a coastal hazard, then notations should:
    - Clearly identify the type of hazard(s); and
    - For each hazard identified, classify whether that hazard is a current or future hazard.

All properties that lie within the Brisbane Water Foreshore Flood Planning Area (FPA) will be notified on the S149 certificate. The FPA is defined as the area below the Flood Planning Level (FPL). As an outcome of the recommendations in this Plan, the FPL includes an allowance for sea level rise. As such, the FPA will include properties affected by both current and future flood risk.

4.4 Future Development – Sea Level Rise

As discussed in the previous sections of this report the proposed development controls have been primarily based on the existing flood risk. The exception to this is the inclusion of SLR in the Flood Planning Level and associated Flood Planning Area (the land below the FPL). This inclusion aims to ensure that development can with stand the predicted short term effects of sea level rise on storm events (i.e. flood proofing below the FPL and appropriate floor levels).

In March 2015 Council resolved to adopt an FPL that will include a projected sea level rise based upon the Representative Concentration Pathway Scenario RCP 8.5. The amount of sea level rise would be commensurate to the asset life and planning horizons for the type of development or land use, Figure 1 in April Council Agenda in Appendix B was included in the recommendations provided to Council (April 2015). This shows diagrammatically the RCP8.5 sea level rise predictions within the context of the current year (2015) and various asset life spans and planning horizons.

In March 2015 Council also resolved to review the sea level rise planning level within every Council term or within two years of a new IPCC report.

It is expected that Council will further address issues associated with the impacts of sea level rise as a part of the Climate Change Adaptation Plans. These plans will report directly back into the Floodplain

Risk Management process with some of the likely outcomes related to the planning recommendations in this FRMP to include:

- The revision of the high hazard extent (which determines appropriate development controls for affected properties) to incorporate sea level rise. This will result in greater depths of flooding and hence a greater area affected by high hazard.
- The revision of the sea level rise component of FPL and hence FPA (which determines appropriate development controls for affected properties).
- The revision of the PMF extent (which determines appropriate development controls for affected properties) to incorporate sea level rise. This will result in greater depths of flooding and hence a greater area affected by PMF.
- The determination of appropriate 'trigger' controls related to the planning horizon of a development.
- The revision of development controls to put more emphasis on adaptable design and resilient construction.

5 Consultation

Consultation is an important element in the Floodplain Risk Management process. The program of consultation undertaken as part of the FRMS (Cardno, 2015) and this FRMP not only canvassed the community and stakeholders for information and opinions, it also sought to improve awareness and understanding of flooding risks within the local community, and to initiate commitments from the relevant stakeholders with respect to the subsequent stages of the process, being the implementation of the FRMP.

Council adopted a Community Engagement Strategic Framework in May 2014. The goals of this framework were to inform, consult, involve, collaborate and empower the community. Consultation with the community included the following components:

- Consultation with the Catchments and Coast Committee (CCC);
- Public exhibition of the Draft FRMS and associated community engagement activities; and
- Public exhibition of the Draft FRMP.

The program of consultation described below primarily consisted of actions throughout the duration of the preparation of the FRMS (Cardno, 2015). A variety of consultation methods were used in order to maximise the potential for consultation and engagement.

5.1 Catchments and Coast Committee

Regular consultation with the Catchment and Coast Committee (which includes community representatives) was undertaken throughout the flood risk management process.

The Catchments and Coast Committee (CCC) was established by Gosford City Council to oversee the FRMS. The CCC includes community members, NSW State Emergency Service (NSW SES) representatives and OEH representatives. The CCC has direct involvement and assisted in guiding the direction of the FRMS.

Cardno attended the following meetings of the CCC in the preparation of the FRMS and this draft FRMP:

- **17 December 2009: Information Session** – Cardno presented a summary of the previous Foreshore Flood Study (Cardno, 2013b) results, and a forward direction for the FRMS.
- **26 August 2010: Management Options Workshop** – Cardno presented the preliminary list of management options to the Committee and requested feedback on these options.
- **7 September 2011: Management Options Workshop 2** – Cardno presented a refined list of management options in response to Council and Committee comments and requested feedback on these options.
- **14 August 2013: Presentation at Committee Meeting** – Cardno presented the Management Study to the Committee with emphasis on the existing flooding scenario, updated options and development control matrix. The Committee were able to express their views and ask questions of Cardno and Council.
- **1 October 2014: Public Exhibition Period – Sub-committee Planning Workshop:** Cardno presented additional information to the Committee regarding the planning recommendations in the FRMS. Committee members provided input regarding planning matters to be used in the development of the FRMP.

- **3 February 2015: Sub-committee Workshop –** Cardno presented a status update on the FRMS, with an emphasis on planning controls and the proposed flood planning level options for discussion and comment.
- **29 April 2015: Sub-committee Workshop** – Cardno presented a summary of the outcomes of the Draft FRMP and any significant changes from the Final FRMS. The committee made recommendations for amendments prior to the document being recommended to the CCC for adoption for public exhibition.
- **21 October 2015: Sub-committee Workshop** – Cardno presented the outcomes of the public exhibition of the FRMP.

5.2 Public Exhibition and Community Engagement Strategy

5.2.1 Floodplain Risk Management Study

The draft version of the Floodplain Risk Management Study was made available for comment via a period of public exhibition. Due to the nature and significance of the study, the exhibition period allowed for a longer than usual period of time and was on public exhibition from 27 August to 12 November 2014. Responses received from the community during the public exhibition period were considered and addressed in the final FRMS (Cardno, 2015). To enable and encourage greater participation from the community, a variety of community engagement methods were used throughout the exhibition period. This included most utilised and successful methods were the Information Sessions with the Community Forum and the online web presence. A summary of engagement tools is presented in **Table 5.1**, with reference to the engagement types fulfilled as per the Council adopted Community Engagement Strategic Framework.

Table 5.1: Engagement Tools – Floodplain Risk Management Study

Engagement Tool	Date	Inform	Consult	Involve	Collaborate	Empower
Media Release	18 August 2014	■	■			
GCC Website 'On Exhibition ' launch	18 August 2014	■	■			
Gosford Have Your Say website launch	18 August 2014	■	■	■		
Public Notice Gosford Connect	20 August 2014	■				
Media Release NBN News	20 August 2014	■				
Scheduled Facebook/Twitter post	22 August 2014	■	■			
Scheduled Facebook/Twitter post	25 August 2014	■	■			
Media Release Gosford Connect	27 August 2014	■	■			
Information Session 1 – Erina Centre (afternoon) Feedback loops, Interactive Mapping, Information Packs, Presentation	27 August 2014	■	■	■		
Scheduled Facebook/Twitter post	29 August 2014	■	■			
Drop-in Session – Davistown (afternoon) One on One Session, Information Packs	3 September 2014	■	■	■		
Radio interview and project overview (ABC radio)	3 September 2014	■				
Information Session 2 – Erina Centre (evening) Feedback loops, interactive mapping, information packs, presentation	4 September 2014	■	■	■		
Progress Association's newsletter update	9 September 2014	■	■			
Information Session 3 – Erina Centre (midday) feedback loops, interactive mapping, information packs, presentation	10 September 2014	■	■	■		

Engagement Tool	Date	Inform	Consult	Involve	Collaborate	Empower
Community Forum invite letterbox drop	17-24 September 2014	■				
Catchments & Coast Committee	7 May 2014 17 September 2014	■	■	■		
Information Session 4 – Woy Woy (afternoon) feedback loops, interactive mapping, information packs, presentation	18 September 2014	■	■	■		
Letter to utilities	25 September 2014	■				
Catchments & Coast Technical Subcommittee Workshop	18 December 2013 27 November 2013 13 February 2014 17 July 2014 1 October 2014	■	■	■	■	
Community Forum – Erina (evening)	8 October 2014	■	■	■	■	
Progress Association meetings	24 September 2014 7 October 2014 23 October 2014	■	■	■		
Report to Council Strategy & Policy	20 May 2014	■	■	■		
Report to Council for Adoption	28 April 2015	■	■	■	■	■
Newsletters (6) sent to all participants who registered interest as the exhibition progressed	27 August - 12 November 2014	■				
Technical Committee Meeting	3 February 2015	■	■			
Catchments & Coast Committee Meeting	10 February 2015	■	■	■	■	
Catchments & Coast Committee Meeting	**25 February 2015**	■	■	■	■	
Catchments & Coast Technical Subcommittee Workshop	**29 April 2015** **10 June 2015**	■	■	■	■	
Report to Council Strategy & Policy	**21 July 2015**	■	■	■		
Report to Council for Adoption for Public Exhibition	**28 July 2015**	■	■	■	■	■

5.2.2 Floodplain Risk Management Plan

A draft version of this Floodplain Risk Management Plan (FRMP) was made available for comment via a period of public exhibition (from August to October 2015). Details of the engagement strategy employed for the public exhibition period is provided in **Table 5.2**. Some examples of consultation materials are provided in **Appendix D**.

Responses received as part of the public exhibition period have been considered and addressed in this final version of the FRMP. The submissions in reply document in **Appendix D** provides a summary of the submissions and the responses provided.

Table 5.2: Engagement Tools – Floodplain Risk Management Plan

Engagement Tool	Date	Inform	Consult	Involve	Collaborate	Empower
Media item directly following the council meeting sent out to all media outlets (over 200 on the list)	August 2015	■	■			
Media release sent out to all media outlets	August 2015	■	■			
Article in the Express Advocate (quarter page)	14 August 2015	■	■			

Engagement Tool	Date	Inform	Consult	Involve	Collaborate	Empower
Front page of Gosford Connect in the Express Advocate	August 2015	■	■			
Article in the online Gosford Connect newsletter (sent out to approx. 1700 inboxes)	August 2015	■	■	■		
CEO message in Gosford Connect AND the Gosford Connect eNewsletter	August 2015	■	■			
CEO blog post on the website	August 2015	■	■			
Facebook event	August 2015	■	■	■		
Website event page	August 2015	■	■			
Latest news item on the front page of the website	August 2015	■	■			
Catchments & Coast Committee Workshop	25 August 2015	■	■	■	■	
Public Exhibition period	22 August to 2 October 2015	■	■			
Information Session 1	9 September 2015	■	■	■		
Information Session 2	15 September 2015	■	■	■		
Information Session 3	23 September 2015	■	■	■		
Catchments & Coast Committee Workshop	21 October 2015	■	■	■	■	
Catchments & Coast Committee Meeting	5 November 2015	■	■			
Report to Council Strategy & Policy	17 November 2015	■	■	■		
Report to Council for Adoption	TBA December 2015	■	■	■	■	■

6 Floodplain Risk Management Actions

6.1 Overview

To manage existing flood risks and issues and achieve the objectives outlined in **Section 3.4**, a range of flood risk management options were considered as part of the FRMS (Cardno, 2015). These options were broadly defined within the following categories:

- **Flood Modification (FM) measures** – Flood modification measures are options aimed at preventing / avoiding or reducing the likelihood of flood risks. These options reduce the risk through modification of the flood behaviour in the catchment.
- **Property Modification (PM) measures** – Property modification measures are focused on preventing / avoiding and reducing consequences of flood risks. Rather than necessarily modify the flood behaviour, these options aim to modify properties (both existing and future) so that there is a reduction in flood risk.
- **Emergency Response Modification (EM) measures** – Emergency response modification measures aim to reduce the consequences of flood risks. These measures generally aim to modify the behaviour of people during a flood event.

These options were subject to a multi-criteria analysis as part of the FRMS and those identified to be the most effective in reducing the incidence of property flooding with specific regard to over-floor flooding, whilst providing social and environment benefits (or at least minimal impacts) have been selected for inclusion as management actions in this FRMP. The key focus of recommended management actions is to address existing risks that currently affect the floodplain. However, the longer term risks associated with the expansion of the floodplain and the transition of low hazard areas to high hazard with projected sea level rise has also been acknowledged as an important consideration in asset planning which needs to start taking place now.

The full list of management options identified for assessment comprises Appendix J of the FRMS (Cardno, 2015). The in-depth process that was undertaken to investigate management options and assess them is described in Section 10 and Section 11 of the FRMS (Cardno, 2015). This included an assessment of the ecological and social impacts / benefits as well as the flooding benefits and costs of implementation. It is noted that several options have been modified since the FRMS was adopted. These modifications have occurred in response to submissions received during the public exhibition period and liaison with relevant agencies and the Catchment and Coast Committee.

It should be noted that whilst many of the options assessed as part of the FRMS (Cardno, 2015) showed flood benefits, they did not rank highly enough against the options recommended in the plan to allow them to be included for implementation. However, the flood benefits associated with these options could be reviewed within the context of other funding or works. For example foreshore sea walls or levees may be incorporated into cycleway or foreshore improvement works being funded separately to the Floodplain Risk Management Program. In addition, many options which only have minimal flood benefits under existing sea levels, may have increased benefits as a result of sea level rise. These options will be reconsidered as part of the CCAPs (PM9).

Those management options that have been recommended to be implemented as part of this FRMP are henceforth referred to as “management actions”. Recommended management actions are listed in **Table 6.1**. Detailed descriptions of management actions are provided in **Appendix C**. Where management actions are proposed for particular management areas, these are shown in **Figures 6.1 to 6.3**.

Table 6.1: Management Actions Recommended

Option ID	Management Strategy	Action Timeline	Capital Cost	Annual Cost	Tidal/Flood Event Addressed										Properties Protected (Existing)	Properties Protected (0.9m SLR)	GCC Responsibility	Private Responsibility	State Responsibility	Feasibility / Integrated Planning R'qd	To be Included in CCAP?
					Tidal			Flood													
					MHWS	+SLR (0.4m)	+SLR (0.9m)	5 yr ARI (20%)	100 yr ARI (1%)	PMF	100 yr ARI (0.4m SLR)	5 yr ARI (0.9m SLR)	100 yr ARI (0.9m SLR)	PMF (0.9m SLR)							
Floodplain-Wide																					
FM3	Develop guidelines for wave run-up management.	Immediate	$30,000	$500	Likely to assist in reducing wave run-up only.										Unkn.	Unkn.	Y	N	N	N	N
FM4	Install flood gates on stormwater pipe outlets as required.	Staged	$100,000	$35,000	Depends on location										Unkn.	Unkn.	Y	N	Y	N	N
FM5	Develop guidelines for sea wall design and maintenance.	Immediate	$30,000	$500	✓	✓	✓	✓	✓						Unkn.	Unkn.	Y	N	N	N	N
PM2a	Develop a voluntary house raising policy	Immediate	$10,000	$500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Unkn.	Unkn.	Y	Y	Y	Y	Y
PM2b	Ongoing monitoring of most at risk houses with regards to Voluntary House Raising	Staged	$0	$2,000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Unkn.	Unkn.	Y	Y	Y	Y	Y
PM2c	Voluntary House Raising (38 Properties Over 16 Years)	Staged	$80,000	$80,000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	38	38	Y	Y	Y	Y	N
PM4	Conduct a program of strategic, balanced and socially sensitive education to advise the local community and prospective property purchasers about the risk and effects of coastal flooding.	Staged	$20,000	$4,000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	N
PM5	Periodic analyses of sea level data to ascertain the rate of sea level rise relevant to Brisbane Water. Periodically communicate results to the community.	Immediate	$0	$5,000		✓	✓				✓	✓	✓	✓	0	0	Y	N	N	N	Y
4_PM6	Review Functionality of NSW SES (Gosford) headquarters during a flood event.	Immediate	$20,000	$0					✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	Y
14_PM6	Review Functionality of Woy Woy Police Station during a flood event.	Immediate	$20,000	$0				✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	Y
PM7	Review and amend planning instruments and development controls across the floodplain to ensure consistency with coastal flooding. Review every five years.	Immediate	$50,000	$10,000	✓	✓	✓	✓	✓		✓	✓	✓		All	Unkn.	Y	N	N	N	Y
PM9	Develop management strategies (as part of Climate Change Adaptation Plans for each management area) to adapt to the impacts of projected sea level rise on tidal inundation.	Staged	$480,000	$72,000		✓	✓				✓	✓	✓	✓	Unkn.	Unkn.	Y	N	N	N	Y
PM10	Evaluate utilities infrastructure relative to flood risk and projected sea level rise benchmarks. Partner with private utilities managers to better understand the risks to assets and formulate a plan of management over the long term for integration into Council's planning objectives.	Staged	$100,000	$7,500		✓	✓	✓	✓		✓	✓	✓		0	0	Y	N	N	Y	Y
PM11	Undertake overland flow investigations for key areas around the foreshore to better understand the combined impacts of coastal and catchment flooding and to provide inputs to masterplanning of floodplain areas.	Staged	$100,000	$100,000											0	0	Y	N	Y	N	Y
EM1	Conduct targeted flood education programs for flood-affected residents.	Staged	$250,000	$25,000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Unkn.	Unkn.	Y	N	Y	Y	N
EM2	Purchase of 8 Portable Variable Message Signage units to be deployed to flooded roads during a flood event.	Immediate	$80,000	$4,000					✓	✓	✓	✓	✓	✓	0	0	Y	N	N	N	N
1_EM2	Install and maintain "Road Floods" signs at the Central Coast Highway, and Yallambee Avenue, West Gosford. Signs could display “Salt water flooding over road.”	Immediate	$2,400	$400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	N
14_EM2	Install and maintain "Road Floods" signs at Blackwall Road, Brick Wharf Road and North Burge Road, Woy Woy. Signs could display “Salt water flooding over road.”	Immediate	$3,600	$600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	N	N
EM3	Review the Gosford Local Flood Emergency Sub-Plan (Gosford LEMC, 2013) with regards to the updated Brisbane Water Floodplain Risk Management Study results.	Immediate	$20,000	$0				✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	N
EM4	Review flood warning systems on a periodic basis and update as necessary.	Immediate	$35,000	$7,000				✓	✓	✓	✓	✓	✓	✓	Unkn.	Unkn.	Y	N	N	N	N
EM7	Review evacuation centre locations with a view to upgrading key evacuation centres that lie outside the floodplain.	Immediate	$50,000	$2,500				✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	Y	Y
EM8	Enhance road evacuation through the development of an alternative route plan for implementation during flood events.	Immediate	$40,000	$2,000				✓	✓	✓	✓	✓	✓	✓	0	0	Y	N	Y	N	N

Notes:

Action Timeline: Immediate – Short term, minimal further investigations required Staged – Short/medium term, further investigations required

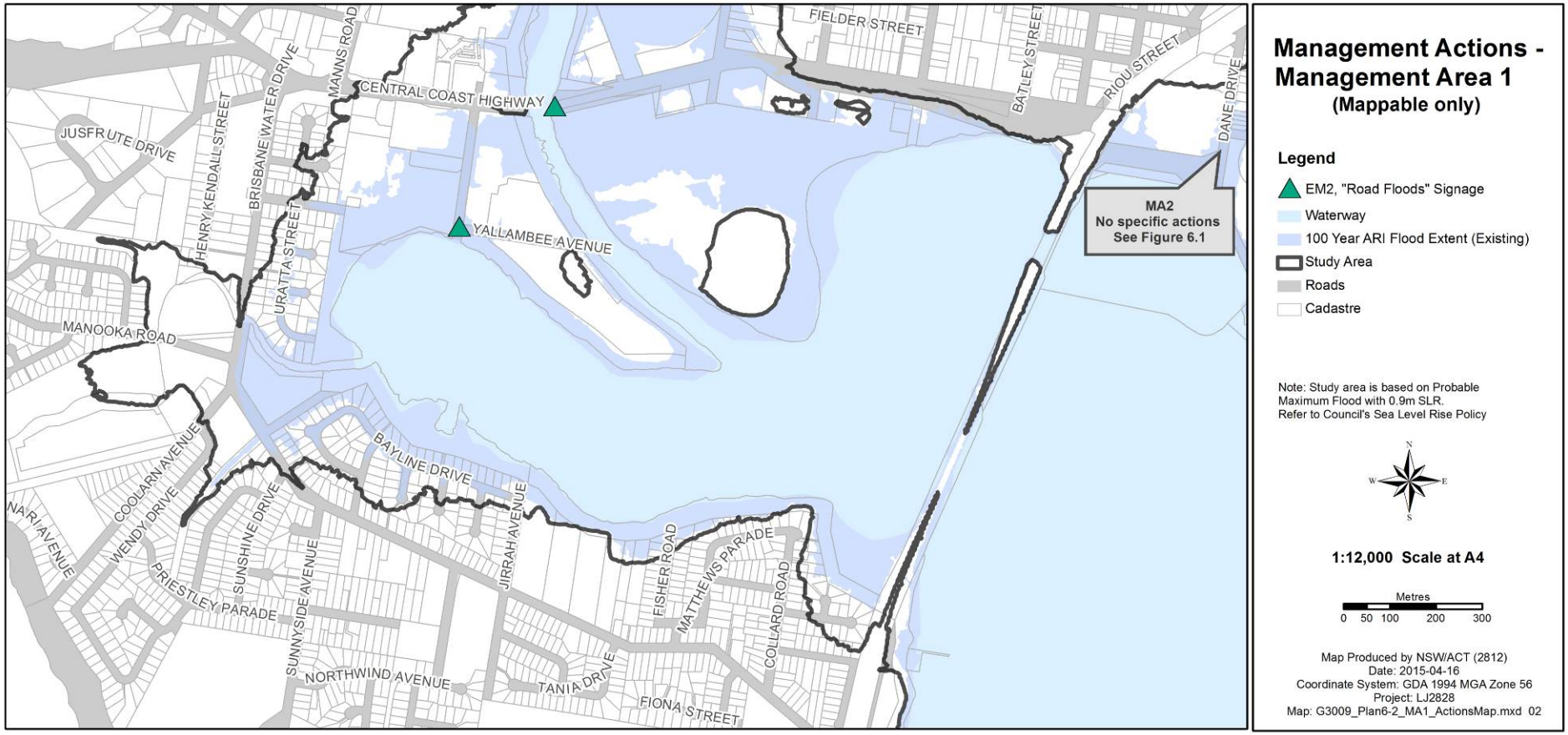
Legend

✓ Water level addressed by option

✓ Stage / trigger level response

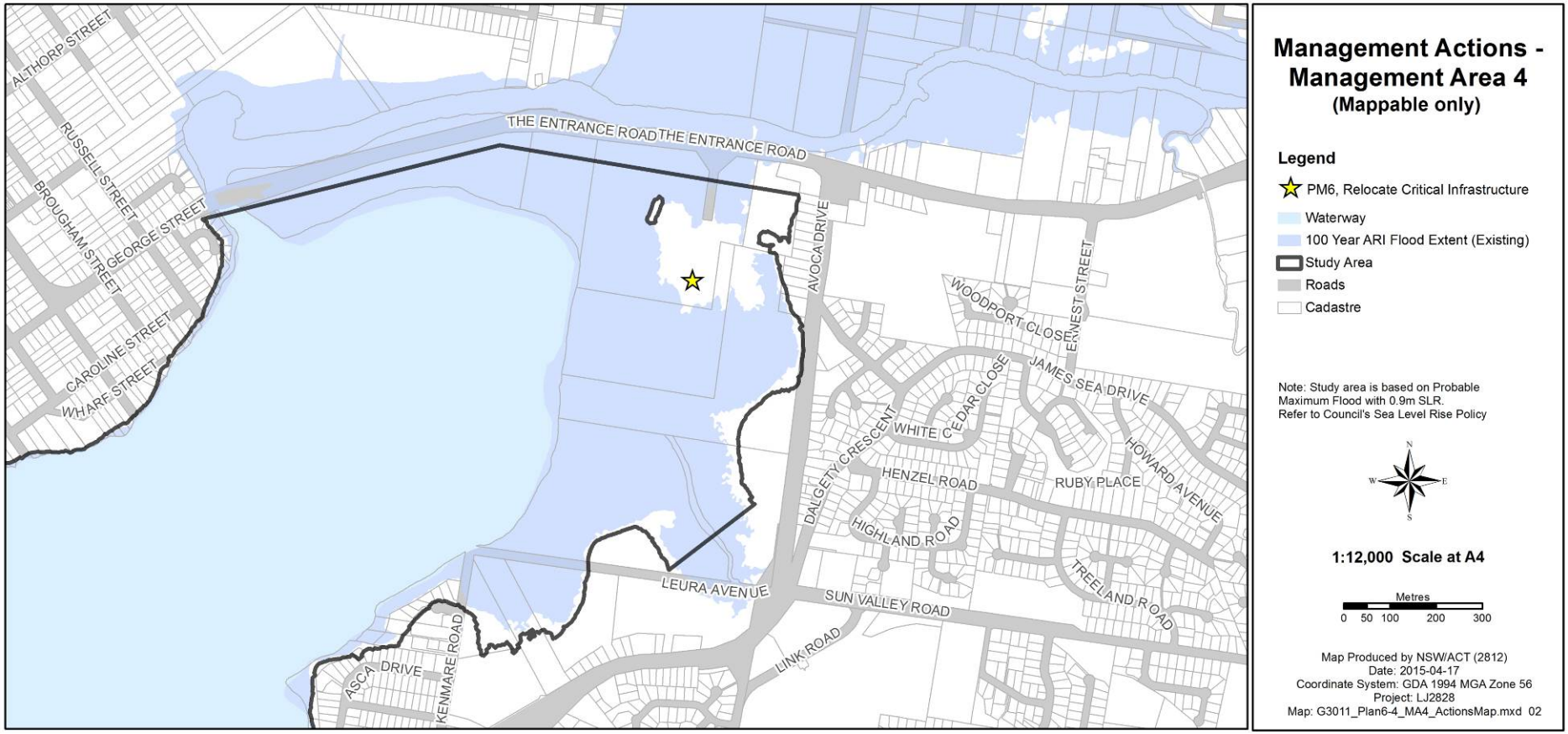
Y - Yes N - No

Unkn. Unknown



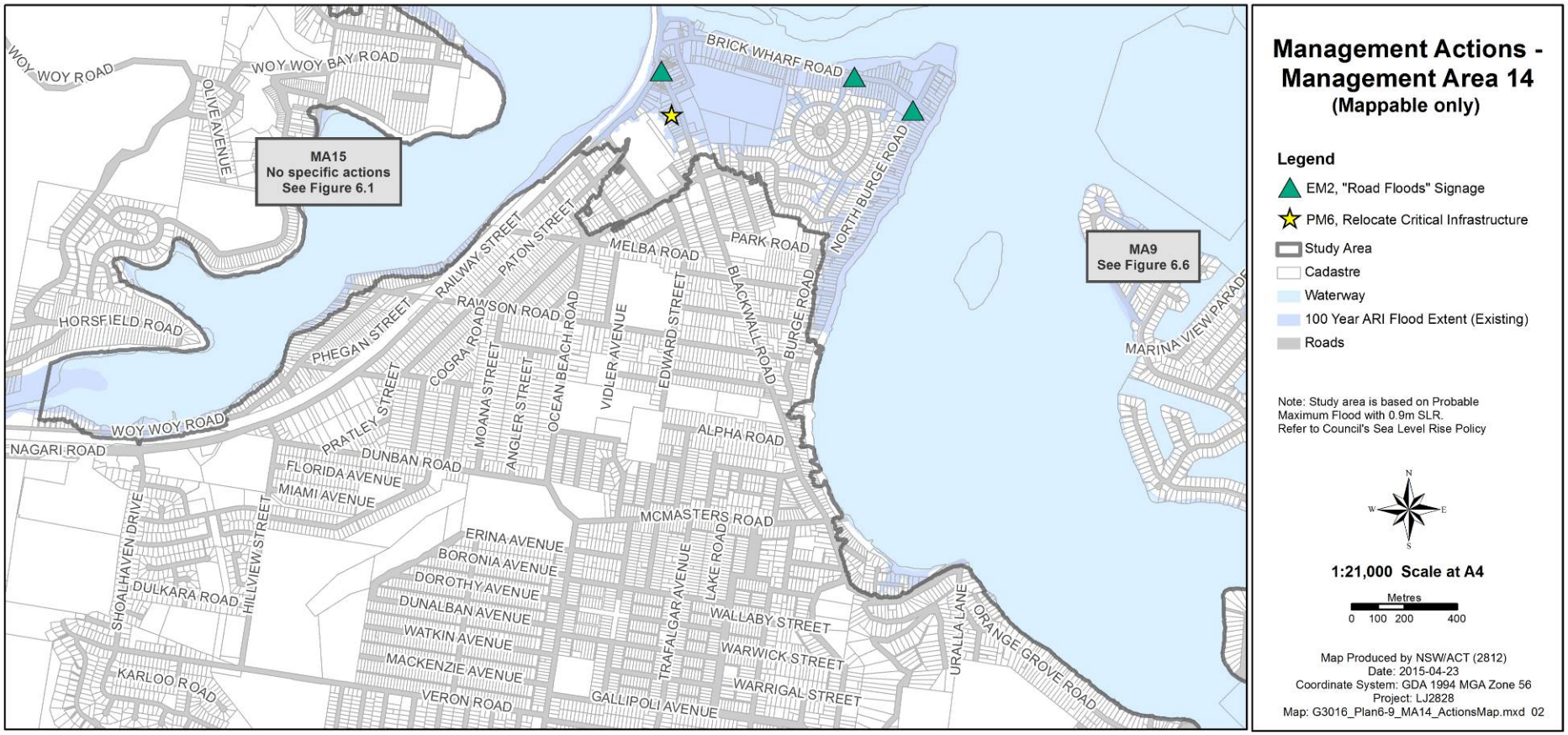
Recommended Actions – Management Area-Specific	Implementation
1_EM2: Install and maintain flood related signage at the Central Coast Highway, and Yallambee Avenue, West Gosford . Flood signage along roads that are liable to flood allow residents to be aware of whether it is dangerous to traverse a particular section of road during a flood event. Signs could display "Salt water flooding over road."	**Immediate**

Figure 6.1: Management Actions – MA1 Fagans Bay



Recommended Actions – Management Area-Specific	Implementation
4_PM6: Review Functionality of NSW SES (Gosford) headquarters during a flood event. This critical infrastructure is currently located in an area that is cut-off by floodwaters during the PMF event. Relocating this infrastructure or developing an alternative operational centre at a location outside the floodplain would provide access to and from the station so that more reliable assistance could be provided to those in need of SES assistance during a flood event. This options proposes for Council to provide advice and assistance to NSW SES in this matter.	**Staged**

Figure 6.2: Management Actions – MA4 Erina



Recommended Actions – Management Area-Specific	Implementation
14_EM2: Install and maintain flood related signage signs at Blackwall Road, Brick Wharf Road and North Burge Road, Woy Woy. Flood signage along roads that are liable to flood allow residents to be aware of whether it is dangerous to traverse a particular section of road during a flood event. Signs should be permanent in these locations since this is a regular occurrence. Signs could display "Salt water flooding over road."	**Immediate**
14_PM6: Review Functionality of Woy Woy Police Station during a flood event. This facility is likely to be subject to coastal flooding in events greater than the 20 year ARI (existing case). Relocating this infrastructure or developing an alternative operational centre at a location outside the floodplain would provide access to and from the station so that more reliable assistance could be provided to those in need of police assistance during a flood event. This options proposes for Council to provide advice to NSW Police in regards to this matter.	**Staged**

Figure 6.3: Management Actions – MA14 Woy Woy and Blackwall

6.2 Implementation Program

The actions listed in **Table 6.1** are recommended for implementation as an outcome of the Floodplain Risk Management process. In order to achieve the implementation of relevant management actions, a program of implementation has been developed. The steps in progressing the floodplain risk management process from this point onwards are:

- Council will adopt the final Plan and submit applications for funding assistance to relevant State and Commonwealth agencies, as appropriate;
- As funds become available from OEH, the Commonwealth, other state government agencies and/or from Council's own resources, recommended management actions will be implemented in accordance with the established priorities.
- Implementation will be require in some cases more detailed cost benefit analysis, assessment and mitigation of environmental impacts and / or detailed design. A number of proposed flood mitigation options involve foreshore modification or alteration to local hydrology. Such management actions may have a detrimental impact on ecological values of Brisbane Water estuary. To minimise impact the design phase should consider environmentally friendly options and ensure environmental impacts (and opportunities) are fully assessed prior to implementation.

Table 6.2 provides the following information relevant to the implementation of the management actions:

- An estimate of capital and recurrent costs for each action (this may, in some cases, include existing staff and funding);
- The agency or organisation likely to be responsible for the action;
- The timeline for implementation (immediate or staged) and priority for implementation (high, medium or low).

Several options also identify potential works that could be undertaken by private land owners (e.g. upgrades to private seawalls). The costs associated with these options have not been included in **Tables 6.1 and 6.2**, but are referenced in Appendix C.

The following provides further detail on the implementation timelines:

- **Immediate** – this indicates actions that could be implemented in the short term if funding and resourcing permits. Feasibility of the action is generally high and additional investigations or further development of the management strategy would be minimal;
- **Staged** – this indicates actions that could be undertaken in the short to medium term. However, additional investigations, feasibility studies or further development of the management strategy are likely to be required. Where appropriate, interim policy and planning measures could be employed in the intervening time.

The following provides further detail on the priorities:

- **High –** A total score in the multi-criteria matrix assessment of greater than 8;
- **Medium –** A total score in the multi-criteria matrix assessment of between 3 and 8; and
- **Low –** A total score in the multi-criteria matrix assessment less than 3.

Table 6.2: Implementation Action List

Option ID	Action	Indicative Costs		Potential Funding Sources/ Responsibility	Implementation Timeframe[1]	Priority	Performance Measures
		Capital	Recurrent				
Emergency Management							
EM1	Conduct targeted flood education programs for flood-affected residents.	$250,000	$25,000	GCC / NSW SES	Staged	Medium	Flood education program is undertaken and documented.
EM2	Purchase 8 Portable Variable Message Signage units to be deployed to flooded roads during a flood event.	$80,000	$4,000	GCC / State	Immediate	High	8 portable variable message signage units are purchased
1_EM2	Install and maintain "Road Floods" signs at the Central Coast Highway, and Yallambee Avenue, West Gosford	$2,400	$360	GCC / State	Immediate	High	Signs are installed and maintained.
14_EM2	Install and maintain "Road Floods" signs at Blackwall Road, Brick Wharf Road and North Burge Road, Woy Woy.	$3,600	$540	GCC / State	Immediate	High	Signs are installed and maintained.
EM3	Review the Gosford Local Flood Emergency Sub-Plan (Gosford LEMC, 2013) with regards to the updated Brisbane Water Floodplain Risk Management Study results.	$20,000	$0	GCC / NSW SES	Immediate	High	The Gosford Local Flood Emergency Sub-Plan is updated.
EM4	Review flood warning systems on a periodic basis and update as necessary.	$35,000	$7,000	BoM / NSW SES	Immediate	High	Documented review of flood warning systems is completed.

Option ID	Action	Indicative Costs		Potential Funding Sources/ Responsibility	Implementation Timeframe[1]	Priority	Performance Measures
		Capital	Recurrent				
EM7	Review evacuation centre locations with a view to upgrading key evacuation centres that lie outside the floodplain.	$50,000	$2,500	GCC/ State / NSW SES	Immediate	High	List of evacuation centres suitable for flood emergency evacuation is prepared and added to SES protocols. Any evacuation centres in need of upgrade are recommended to Council.
EM8	Enhance road evacuation through the development of an alternative route plan for implementation during flood events.	$40,000	$2,000	GCC / NSW SES	Immediate	High	Alternative route plans for evacuation are completed.
4_PM6	Review Functionality of NSW SES (Gosford) headquarters during a flood event. Council to provide advice to NSW SES to assist in this process.	$20,000	$0	GCC / NSW SES / State	Immediate	Medium	Council has advised SES of the flood risk to the existing location and provide assistance with any action taken by SES to improve functionality during a flood event.
14_PM6	Review Functionality of Woy Woy Police Station during a flood event. Council to provide advice to NSW Police Force to assist in this process.	$20,000	$0	GCC / State	Immediate	Medium	Council has advised Police of the flood risk to the existing location and provide assistance with any action taken by Police to improve functionality during a flood event.
Planning and Development Controls							
PM4	Conduct a program of strategic, balanced and socially sensitive education to advise the local community and prospective property purchasers about the risk and effects of coastal flooding.	$20,000	$4,000	GCC / NSW SES	Staged	High	Education program is undertaken and documented.

Option ID	Action	Indicative Costs		Potential Funding Sources/ Responsibility	Implementation Timeframe[1]	Priority	Performance Measures
		Capital	Recurrent				
PM5	Perform periodic analyses to ascertain the rate of sea level rise relevant to Brisbane Water. Council to periodically communicate results to the community.	$0	$5,000	Council	Staged	Medium	Data analysis and a program of community education undertaken and documented.
PM7	Review and amend planning instruments and development controls across the floodplain to ensure consistency with coastal flooding. Review every five years.	$50,000	$10,000	GCC / State	Immediate	High	Changes to planning instruments and development controls made.
PM9	Develop Climate Change Adaptation Plans to adapt to the impacts of projected sea level rise on tidal inundation.	$480,000	$72,000	GCC / State	Immediate	Medium	Climate Change Adaptation Plans are prepared for the LGA and key areas.
PM10	Evaluate utilities infrastructure relative to flood risk and projected sea level rise benchmarks. Partner with private utilities managers to better understand the risks to assets and formulate a plan of management over the long term for integration into Council's planning objectives.	$100,000	$7,500	GCC / State (utilities) / Private (utilities)	Immediate *The assessment of sea level rise impacts on assets may be staged in accordance with PM9.*	High	A plan of management is prepared in collaboration with utilities providers. Total audit of Council assets completed with sea level rise sensitivity.
PM11	Undertake overland flow studies for key areas impacted by both overland flows and storm surge.	$100,000	$100,000	GCC / State	Immediate	High	Overland flows have been undertaken.

Option ID	Action	Indicative Costs		Potential Funding Sources/ Responsibility	Implementation Timeframe[1]	Priority	Performance Measures
		Capital	Recurrent				
Property and Asset Modifications							
PM2a	Develop a voluntary house raising policy.	$10,000	$500	GCC	Immediate	High	Policy has been prepared.
PM2b	Ongoing monitoring of most at risk houses with regards to Voluntary House Raising.	-	$2,000	GCC	Staged	Medium	Periodic evaluation of at risk houses completed in conjunction with sea level rise review.
PM2c	Voluntary House Raising	$80,000	$80,000	GCC / State	Immediate	Medium	House raising of most at risk houses undertaken (approximately 38 properties).
FM3	Develop guidelines for wave run-up management.	$30,000	$500	GCC	Immediate	Low	Guidelines have been prepared.
FM4	Install flood gates on stormwater pipe outlets as required.	$100,000	$35,000	GCC	Staged *The construction of flood gates is staged due to the need for investigation and prioritisation.*	Medium	Investigation is undertaken to identify and prioritise propose flood gate locations. Flood gates are installed.
FM5	Develop guidelines for sea wall design and maintenance.	$30,000	$500	GCC	Immediate	Low	Guidelines have been prepared.

[1] 'Immediate' timeframes identify options that could be implemented in the short term if funding and resources permit.

The anticipated timeline and costs for implementation over the first five stages of the strategy are shown in **Table 6.3**. However, all management actions will need to be programed by the relevant agencies and this will affect the timing of implementation (i.e. not all 'stage 1' actions will be completed in immediately after adoption of the Plan). In some cases, further feasibility, design or impact assessment may be required prior to work commencing (e.g. foreshore works). It is recommended that Council undertake a risk assessment against its own policies and guidelines to more appropriately develop a timeframe for execution of the individual aspects of this plan.

It is noted that the majority of the actions presented are funded at least in part by the State Government. Where Council funding is noted against ground works (i.e. as opposed to education, policies and plans), it should be noted that this only relates to works on Council land.

Significant cost saving could be made by combining relevant studies or works within this Plan and across other Council programs. For example combining EM7 (review of evacuation centres) with EM3 (review of Local Flood Plan) could reduce the overall costs and allow for a better outcome.

Table 6.3: Timeline and Public (GCC and State) Costs for Implementation for First Five Years of Strategy

ID	Action	Indicative Costs		Stage				
		Capital	Recurrent	1	2	3	4	5
	Emergency Management							
EM1	Conduct targeted flood education programs for flood-affected residents.	$250,000	$25,000	$100,000	$100,000	$50,000	$25,000	$25,000
EM2	Purchase of 8 Portable Variable Message Signage units to be deployed to flood roads during a flood event.	$80,000	$4,000	$80,000	$4,000	$4,000	$4,000	$4,000
1_EM2	Install and maintain "Road Floods" signs at the Central Coast Highway, and Yallambee Avenue, West Gosford	$2,400	$360	$2,400	$400	$400	$400	$400
14_EM2	Install and maintain "Road Floods" signs at Blackwall Road, Brick Wharf Road and North Burge Road, Woy Woy.	$3,600	$540	$3,600	$600	$600	$600	$600
EM3	Review the Gosford Local Flood Emergency Sub-Plan (Gosford LEMC, 2013) with regards to the updated Brisbane Water Floodplain Risk Management Study results.	$20,000	$0	$20,000	-	-	-	-
EM4	Review flood warning systems on a periodic basis and update as necessary.	$35,000	$7,000	$35,000	$7,000	$7,000	$7,000	$7,000
EM7	Review evacuation centre locations with a view to upgrading key evacuation centres that lie outside the floodplain.	$50,000	$2,500	$50,000	$2,500	$2,500	$2,500	$2,500
EM8	Enhance road evacuation through the development of an alternative route plan for implementation during flood events.	$40,000	$2,000	$40,000	$2,000	$2,000	$2,000	$2,000
4_PM6	Review Functionality of NSW SES (Gosford) headquarters during a flood event. Council to provide advice to NSW SES to assist in this process.	$20,000	$0	$20,000	-	-	-	-

ID	Action	Indicative Costs		Stage				
		Capital	Recurrent	1	2	3	4	5
14_PM6	Review Functionality of Woy Woy Police Station during a flood event. Council to provide advice to NSW Police Force to assist in this process.	$20,000	$0	$20,000	-	-	-	-
	Planning and Development Controls							
PM4	Conduct a program of strategic, balanced and socially sensitive education to advise the local community and prospective property purchasers about the risk and effects of coastal flooding.	$20,000	$4,000	$20,000	$4,000	$4,000	$4,000	$4,000
PM5	Continue to monitor sea levels and perform periodic analyses to ascertain the rate of sea level rise relevant to Brisbane Water. Periodically communicate results to the community.	$0	$5,000	-	-	$5,000	-	-
PM7	Review and amend planning instruments and development controls across the floodplain to ensure consistency with ocean flooding. Review every five years.	$50,000	$10,000	$50,000	-	-	-	-
PM9	Develop management strategies (as part of Climate Change Adaptation Plans) to adapt to the impacts of projected sea level rise on tidal inundation.	$480,000	$72,000	$300,000	$300,000	$90,000	$90,000	$72,000
PM10	Evaluate utilities infrastructure relative to flood risk and projected sea level rise benchmarks. Partner with private utilities managers to better understand the risks to assets and formulate a plan of management over the long term for integration into Council's planning objectives.	$100,000	$7,500	$40,000	$40,000	$20,000	$7,500	$7,500

ID	Action	Indicative Costs		Stage				
		Capital	Recurrent	1	2	3	4	5
PM11	Undertake overland flow studies for key areas impacted by both overland flows and storm surge.	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
	Property and Asset Modifications							
PM2a	Develop a voluntary house raising policy.	$10,000	$500	$10,000	$500	$500	$500	$500
PM2b	Ongoing monitoring of most at risk houses with regards to Voluntary House Raising.	-	$2,000	-	-	$2,000	-	-
PM2c	Voluntary House Raising	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000
FM3	Develop guidelines for wave run-up management.	$30,000	$500	$30,000	$500	$500	$500	$500
FM4	Install flood gates on stormwater pipe outlets as required.	$100,000	$35,000	$20,000	$26,000	$32,000	$38,000	$44,000
FM5	Develop guidelines for sea wall design and maintenance with consideration of design criteria specified in Action FM3.	$30,000	$500	$30,000	$500	$500	$500	$500
TOTAL[1]		**$1,521,000**	**$358,400**	**$1,051,000**	**$668,000**	**$401,000**	**$362,500**	**$350,500**

[1] Total annual cost would be dependent on the programing of the works, i.e. not all 'Stage 1' project would be initiated immediately after adoption of this Plan.

6.3 Strategic Context

This Plan should be regarded as a dynamic instrument requiring review and modification over time. The catalysts for change could include new flood events and experiences, legislative change, alterations in the availability of funding, reviews of Council's planning strategies and importantly, the outcome of new studies, particularly the Climate Change Adaptation Plans which have been recommended as an outcome of the floodplain risk management process.

It is recommended that the outcomes of this FRMS are incorporated into the Integrated Planning and Reporting Framework which includes Council's Delivery Program Incorporating the Operational Plan, and the Resourcing Strategy. These plans, along with the reports on the progress of each plan, outline the work Council is currently doing within the community, as well as priorities for future services and how we are working to achieve the plans. This FRMP assists in achieving the objectives of Gosford 2025 Community Strategic Plan, and is particularly relevant to Governance and Leadership objectives under the Delivery Program, which includes social planning, coastal and estuary planning, flooding and drainage planning, land use planning and climate change adaptation. Future flood risk management plans and climate change adaptation planning will need to run parallel for some aspects of the decision-making process, given the linkages between these two processes and associated linkages with infrastructure planning and asset life.

6.4 Communication of Flood Risk

A community at risk needs to understand their role in minimising the impacts of disasters, and have the relevant knowledge, skills and abilities to take appropriate action (Council of Australian Governments, 2011). Therefore, a crucial component of the floodplain risk management process is ensuring that the outcomes of the Flood Study (Cardno, 2013b), FRMS (Cardno, 2015) and FRMP are communicated to the community. This has been/will be achieved through the following:

- Public exhibition of the FRMS and FRMP draft documents and the associated community engagement programs;
- S149 Certificates will be updated in accordance with the outcomes of the FRMS and FRMP;
- Council's website provides flood information and will be updated as required based on the outcomes of the FRMS and FRMP;
- Council can provide property specific flood information upon request; and
- Flood education programs will be implemented as per relevant management actions (EM1 and PM4).

6.5 Climate Change Adaptation Plans

This Floodplain Risk Management Plan recommends that a series of *Climate Change Adaptation Plans* (CCAPs) are prepared. These CCAPs would seek to establish a framework for the management of projected climate change, subject to funding resources available to Council. Tidal inundation, in addition to storm events, would be considered as a component of the CCAPs. Recommendations set out in the CCAPs would then flow into the periodic review of the Brisbane Water FRMS and FRMP documents, Gosford City Council policy, Local Environmental Plans and Development Control Plan documents.

The Climate Change Adaptation Plans form Action PM9 of this FRMP. The 'implementation timeframe' and 'priority' for this action is outlined in **Table 6.2**. Under the floodplain risk management

process, this action resulted in a medium priority. This is a reflection of the fact that there are existing flood risks that must be managed and actions to address these existing risks were given a higher priority under this process. However, the importance of Action PM9 under other planning mechanisms in conjunction with the floodplain risk management process is acknowledged given Council's Sea Level Rise Policy. There is a need to start planning immediately for the potential impacts of sea level rise, given new developments may have an asset life of 50+ years. This is reflected in the action being assigned an "Immediate" implementation timeframe.

It is envisaged that a LGA-wide Climate Change Adaptation Plan would be prepared in the first instance as an overarching document to provide guidance for subsequent localised or issue specific plans. As an example projected sea level rise priority areas would then be identified as part of the LGA wide CCAP (based on both flood affectation and the relevance of strategies and plans) and more location-specific plans would be formulated.

The projected impacts of sea level rise on built assets, natural resources, and heritage items and places could be incorporated into the CCAPs. Council's climate change policy and predictions of sea level rise should be reviewed periodically to ensure that the most relevant and recent data is utilised in sea level rise adaptation planning.

7 Conclusions

This FRMP provides a practical framework and implementation plan for managing existing, future and continuing flood risk within the study area.

Overall it is considered that existing risks to the Brisbane Water foreshore floodplain can be managed appropriately through the implementation of development controls, emergency response measures and minor works. The effective implementation of development controls will be of key importance in reducing the damages and risk to life associated with flooding into the future through the construction of flood compatible buildings and assets.

In order to achieve the implementation of relevant management actions, a program of implementation has been developed. The actions listed in **Section 6** are recommended for implementation.

The steps in progressing the floodplain risk management process from this point onwards are:

- Council will adopt the final Plan and submit applications for funding assistance to relevant State and Commonwealth agencies, as appropriate;
- The flood management actions will be prioritised for funding through the Integrated Planning and Reporting Process; and
- As funds become available from OEH, the Commonwealth, other state government agencies and/or from Council's own resources, recommended management actions will be implemented in accordance with the established priorities.

Based on the implementation program provided in **Section 6**, this FRMP fulfils its objectives accordance with the New South Wales (NSW) Flood Prone Land Policy (NSW Government, 2001) and the principles of the Floodplain Development Manual (NSW Government, 2005).

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Appendix A

Development Control Matrix

Probable Maximum Flood (PMF) Extent (Excluding the Flood Planning Area)

Planning Consideration	Sensitive Uses and Emergency Facilities	High Intensity Uses	Critical Utilities	Land Subdivision	High Density Residential	Low Density Residential (Urban)	Low Density Residential (Rural)	High Density Commercial & Industrial	Low Density Commercial & Industrial	Non Habitable Recreational Facilities	Concessional Development
New Development/Redevelopment	1, 3	1, 3	1, 3	2	2	2	2	2	2	2	
Floor Level	2	2	2								
Building Components	2	2	2								
Structural Soundness	2	2	2								
Flood Affectation	2,3	2,3	2,3	3,4	3	3	3	3	3	3	3
Emergency Management	1,3,4, 5	1,3,4, 5	1,3	3,6	4,5			4,5			
Car Parking	2,3	2,3	2,3		2,3	2,3	2,3	2,3	2,3	2,3	2,3
Management & Design	4,5,7, 9, 10	4,5,7, 9, 10	4,5,7, 9, 10	1,2				5, 10	5, 10	5, 10	
Wave Impacts	1	1	1		1	1	1	1	1	1	1

Flood Planning Area (Excluding the 100 Year ARI High Hazard Extent)

Planning Consideration	Sensitive Uses and Emergency Facilities	High Intensity Uses	Critical Utilities	Land Subdivision	High Density Residential	Low Density Residential (Urban)	Low Density Residential (Rural)	High Density Commercial & Industrial	Low Density Commercial & Industrial	Non Habitable Recreational Facilities	Concessional Development
New Development/Redevelopment					2	2	2	2	2	2	
Floor Level					1	1	1	1	1	5,6,7	3
Building Components					1	1	1	1	1	1	1
Structural Soundness					1,3	1,3	1,3	1,3	1,3	1	1
Flood Affectation					1,3	2,3	2,3	1,3	2,3	2,3	2,3
Emergency Management					1,4,5	1	1	1,4,5	1	1	
Car Parking					1,2,3	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3
Management & Design					5,6,8, 10	5,6,8	5,6,8	3,5,6, 8,10	3,5,6, 8,10	5,6,8, 10	5,6
Wave Impacts					1	1	1	1	1	1	1

100 Year ARI High Hazard Extent

Planning Consideration	Sensitive Uses and Emergency Facilities	High Intensity Uses	Critical Utilities	Land Subdivision	High Density Residential	Low Density Residential (Urban)	Low Density Residential (Rural)	High Density Commercial & Industrial	Low Density Commercial & Industrial	Non Habitable Recreational Facilities	Concessional Development
New Development/Redevelopment					1,3	4	4	1,3	1,3	2	
Floor Level					1,4	1,4	1,4	1,4	1,4	5,6,7	1
Building Components					1,3	1,3	1,3	1,3	1,3	1	1,3
Structural Soundness					1,3	1,3	1,3	1,3	1,3	1	1
Flood Affectation					1,3	1,3	1,3	1,3	1,3	1,3	2,3
Emergency Management					1,4,5	1	1	1,4,5	1	1	1
Car Parking					1,2,3	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3
Management & Design					5,6,8, 10	5,6,8	5,6,8	3,5,6, 8,10	3,5,6, 8,10	5,6,8, 10	5,6
Wave Impacts					1	1	1	1	1	1	1

(grey)	Not Relevant	(pink)	Unsuitable Land Use

New Development/Redevelopment	
1	New developments not suitable. Controls in this matrix apply to redevelopment and replacement only.
2	New developments suitable.
3	Where redevelopment may extend the design life of the structure / facility, this may be considered on a merits basis. However, relocation to an area outside of the floodplain should be considered as a priority.
4	Where the flood hazard can be reasonably mitigated, new developments may be approved by Council on merits based approach. Any proposed mitigation measures would need to be supported by a hydraulic engineers report and emergency response arrangements should be considered in accordance with this DCP.
Floor Level	
1	Habitable floor levels to be equal to or greater than the FPL.
2	Habitable floor levels to be equal to or greater than the PMF or FPL (whichever is higher).
3	Habitable floor levels to be as close to FPL as practical & no lower than existing floor level.
4	All habitable floor levels (proposed and existing) to be raised above the FPL.
5	Floor levels to be 300mm above the ground level or equal to or greater than the 20 Year ARI flood level (whichever is higher)
6	Floor level of boatsheds are recommended to be equal to or greater than the FPL. Unless it can be demonstrated through a Flood Management Report that the boat shed is structurally designed to withstand inundation up to the FPL and wave impacts.
7	No planning levels apply to jetties, bridging ramps or pontoons located on the seaward side of the foreshore edge.

Building Components & Method	
1	All structures to have flood compatible building components below or at the FPL.
2	All structures to have flood compatible building components below or at the PMF or FPL (whichever is higher).
3	Where possible, flood compatible building components are to be incorporated into the existing structure below or at the FPL.
4	Where possible, flood compatible building components are to be incorporated into the existing structure below or at the PMF or FPL (whichever is higher).
Structural Soundness	
1	All structures must be designed and constructed to ensure structural integrity for immersion and impact of velocity and debris up to the level of the 100 Year ARI flood (including wave run up and over topping).
2	All structures must be designed and constructed to ensure structural integrity for immersion and impact of velocity and debris up to the level of the PMF (including wave run up and over topping).
3	If the structure is to be relied upon for 'shelter-in-place' evacuation then structural integrity must be ensured up to the level of the Probable Maximum Flood (including wave run up and overtopping) or the FPL (whichever is higher).
Flood Affectation	
1	Hydraulic Engineers report required to certify that the development will not increase flood affectation elsewhere.
2	The impact of the development on flooding elsewhere to be considered.
3	Filling that impacts on active flow areas in the stream networks feeding Brisbane Water is not permitted. Filling operations must include adequate provision for drainage of surface water erosion and siltation control and be so placed and graded as to prevent the shedding of surface water direct to adjoining properties.
4	Hydraulic engineers report is required to certify that the subdivision will not exacerbate flood levels, velocities or flow distributions at any other location, including cumulative impacts of incremental development, should all the proposed lots be fully developed in the future.
Emergency Management	
1	Pedestrian access is required at or above the FPL from habitable floors to a suitable area of refuge above the PMF level or FPL (whichever is higher), either on site (e.g. second storey) or off site.
2	Pedestrian access is required at or above the PMF or FPL (whichever is higher) from habitable floors to a suitable area of refuge above the PMF level or FPL (whichever is higher), either on site (e.g. second storey) or off site.
3	Reliable vehicle access is required during a PMF event.
4	A site emergency response plan (approved by Council) is required.
5	The development is to be consistent with the site emergency response plan.
6	Applicant to demonstrate that evacuation of potential development as a consequence of the subdivision proposal can be undertaken.
Car Parking	
1	Enclosed garage and enclosed car park: floor levels are recommended to be at or above 'FPL minus 150mm'. Where this is not feasible, floor levels will be considered at or above the 100 Year ARI level or 300mm above the ground level, whichever is higher.
2	Covered basement car parking: all possible water entry points (e.g. access and ventilation) shall be above the FPL or PMF (whichever is higher). Pedestrian access (separate to vehicle access) shall be provided via a low flood hazard area to a 'safe haven' above the FPL.
3	Open car park areas (including covered car park areas) and carports: floor levels to be at the 100 Year ARI level or 300mm above the ground level, whichever is higher.
Management and Design	
1	Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with DCP.
2	The subdivision of land requires the building platforms for each additional allotment created to be at or above the FPL or PMF (whichever is higher).
3	Applicant to demonstrate that area is available to store goods above the FPL.
4	Applicant to demonstrate that area is available to store goods above the FPL or PMF level (whichever is higher).
5	No external storage of materials below the design floor level which may cause pollution or be hazardous during any flood.
6	All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the FPL
7	All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the FPL or PMF (whichever is higher)
8	Sewer and water services within the site should be designed to have continued function up to the FPL. If the development is being used as flood refuge, design should function up to the FPL or PMF (whichever is higher).
9	Sewer and water services within the site should be designed to have continued function up to the FPL or PMF (whichever is higher).
10	Internal storage of materials that may cause pollution or be hazardous during any flood to be waterproofed to the FPL or PMF or located above the FPL or PMF (whichever is the higher).
Wave Impacts	
1	Wave run-up (as calculated in the Flood Study, Cardno 2013) should be managed in development is within 20m of the foreshore for most locations and within 40m of the forshore for some locations near the entrance to Brisbane Water. This may be done through foreshore management (i.e. wave dissipation devices) or construction management (i.e. floor levels, structural soundness). All designs should be prepared in accordance with Council's relevant guidelines.

DEFINITIONS

Term	Definition
Sensitive Uses and Emergency Facilities	Emergency service facilities, group homes, hospitals, disabled housing/seniors living, residential care facilities, schools, preschools. Identified in Council's LEP as "Essential Community Facilities".
High Intensity Uses	Uses that can have a high density of people present (often tourists or visitors): e.g. caravan parks, correctional facilities, tourist and visitor accommodation, community facilities (i.e. churches, public halls and other places of congregation). May be identified in Council's LEP as "Tourist Related Development" or "Recreation or Non-Urban Uses".
Critical Utilities	Assets that are essential for the functioning of a society and economy such as electricity, gas, oil, telecommunications, water and sewerage. Identified in Council's LEP as "Critical Utilities and Uses".
Land Subdivision	Subdivision of existing parcels of land excluding strata and community subdivision. Identified in Council's LEP as "Subdivision".
High Density Residential	Multi-unit dwellings. Identified in Council's LEP as "Residential".
Low Density Residential (Urban)	Single or dual occupancy dwellings on urban zoned land. Identified in Council's LEP as "Residential".
Low Density Residential (Rural)	Single or dual occupancy dwellings on rural zoned land. Identified in Council's LEP as "Residential".
High Density Commercial & Industrial	Multi-unit commercial and industrial development. Identified in Council's LEP as "Commercial or Industrial".
Low Density Commercial & Industrial	Single-unit commercial and industrial development. Identified in Council's LEP as "Commercial or Industrial".
Non Habitable Recreational Facilities	Non habitable recreational structural facilities such as ablutions blocks, kiosk, sports storage facilities. Identified in Council's LEP as "Recreational or Non-Urban Uses".
Concessional Development	Concessional development intends to identify relatively minor building additions that will have minimal impact on the floodplain and will not present an unmanageable risk to life. The development controls applied to concessional development aim to minimise the impact of flood related development controls on the proposed development while still providing adequate protection of property and life.
	The minimum existing Floor level of the dwelling for which Council would consider concessional development is the 5 year ARI (AHD) Flood Event. The following concessional development may be permissible: 1. A maximum extension of 20m2 is allowable where the proposed level is at or above the 5 year ARI (AHD) Flood Event plus the applicable allowance for SLR. OR 2. A maximum extension of 40m2 is allowable where the proposed level is ato or above the 100 year ARI (AHD) Flood Event plus the applicable allowance for SLR. OR 3. 10% increase in floor area for commercial or industrial additions. It should be noted that, if possible, the floor level should be at or above the applicable FPL ie 100 year ARI (AHD) Flood Event plus the applicable allowance for SLR plus 0.5M Freeboard
Flood Planning Level (FPL)	As defined in the Brisbane Water Floodplain Risk Management Plan.
Flood Planning Area (FPA)	The area below the flood planning level. Shown on attached map.
Probable Maximum Flood (PMF)	The flood calculated to be the maximum that is likely to occur. Also referred to as the extent of the floodplain. This area is not relevant to planning controls under the existing FPL (100 Year ARI + 2050 SLR + 0.5m Freeboard). The proposed FPL is higher than the PMF at all locations within the floodplain and as such the FPA is greater than the PMF extent. Therefore the PMF extent is not shown on the attached map.
100 Year ARI High Hazard	Defined as part of the Flood Study (2013). Shown on the attached map.
Reliable vehicle access	Reliable safe flood access is considered satisfactory when the depth of floodwater over vehicular access routes (roads and legal right of ways) allows the safe and stable movement of vehicles. The access route is to be legal and permanent, fail safe and maintenance free.
Habitable floor levels	• In a residential situation: a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom; but excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes-drying room, vehicle parking area, storage area and other spaces of a specialised nature occupied neither frequently nor for extended periods (ABCB, 2013). • In an industrial or commercial situation: an area used for offices or to store equipment, materials or valuable possessions susceptible to flood damage in the event of a flood.
Suitable area of refuge	The suitability of the refuge area will be confirmed by Council dependent on the number of people seeking refuge and the type of development. The refuge area should have access to clean water, toilets, heat and food.
Wave Run-Up	The increase in water level within the foreshore zone above the Design Still Water Level (see Flood Study (Cardno, 2013)) from waves across a natural foreshore or structure (e.g. sea wall). Wave run-up heights calculated in the Flood Study also include provision for Wave Set-Up (see below).
Wave Set-Up	The increase in water level within the foreshore zone above the Design Still Water Level (see Flood Study (Cardno, 2013)) caused by the breaking action of waves.

NOTES

There are several locations which are considered flood islands in the 100yr event (Woy Woy, Davistown). However, they still have significant evacuation and access issues during a flood event. Intensification of development at these locations would therefore not be appropriate. It is recommended that provision for flood islands be included in Management Area-Specific DCP provisions (to be developed) to include appropriate development controls for these locations.
It is important to note that whilst the DCP matrix is in preparation, a DCP is only a guide to the controls that can be imposed on a development (EP&A Act, Section 74BA and Section 74C). Unless an LEP specifically makes reference to controls on a specific location then even site-specific controls in a DCP are a guide only.
Controls have been established based on existing flood risks, with consideration of the effects of projected sea level rise incorporated in the allowance incorporated in the flood planning level, as established in the Floodplain Risk Management Plan. Supplementary controls specifically relating to the effects of sea level rise alone would be addressed as an outcome of the Climate Change Adaptation Plan.

Appendix B

Council and Committee Minutes and Resolutions Relating to Sea Level Rise Planning Levels

Council Meeting Agenda March 2015

Discussion Paper on Sea Level Rise

GOV.15 DISCUSSION PAPER ON SEA LEVEL RISE (IR 20310475)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

BACKGROUND

In 2009, Gosford City Council adopted sea level rise projections of 0.4m by 2050 and 0.9m by 2100 (from 1990 levels). These climate change scenarios were re-considered and re-endorsed by Council in August 2013. In addition to resolving to endorse the climate change scenarios, Council resolved to review the scenarios within 12 months of the release of the Intergovernmental Panel on Climate Change (IPCC) report. The last instalment of the IPCC Report, the *Synthesis Report*, was released in Denmark on 31 October 2014.

Currently, Council is undertaking significant planning studies along our Coast and around Brisbane Waters. Council staff are working with the community through committees, workshops and stakeholder presentations on the development of Coastal Zone Management Plans and Floodplain Risk Management Plans in the Local Government Area.

Some sections of the Community have expressed their appreciation that Council is reviewing and continually improving the planning it undertakes in these at-risk areas, while some sections of the community are concerned with Council's use of climate change data as part of the strategic thinking and plan-making process. In this respect, the focus of most of the concern from the Community has been related to the matter of planning for future sea level rise, including the amount of projected sea level rise and how it is applied to the planning and development processes. A key aspect of the debate is Council's current adopted sea level rise scenario (from 1990 levels) of 40cm increase in sea level rise by 2050 and 90cm by 2100, and whether these figures align with current thinking / best practice and the recommendations of the IPCC Report.

Council is also aware of recent policy decisions of Eurobodalla and Shoalhaven councils, which have adopted sea level rise scenarios different to Gosford City Council's, as well as Wyong Council, which has adopted a zero sea level rise scenario for future planning.

Council has commenced a review of its current sea level rise scenario and has engaged an independent expert to undertake a review. Council needs to move forward with strategic planning projects which are underpinned by Council's sea level rise policy. The advice will be prepared directly by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates, who jointly undertook a review of the appropriate sea level rise allowances suitable for coastal planning for Shoalhaven City Council and Eurobodalla Council late last year. The purpose of discussion paper will be:

- To review the development and adoption of the existing Gosford City Council sea level rise benchmarks.
- To comment on the most recent information relating to the future sea level rise projections including the most recent IPCC reports, the Whitehead and Associates report on the NSW South Coast sea level rise framework, recent publications by the Climate Change Council and the Academy of Sciences, and local press articles relating to the suitability of the current sea level rise allowances.
- To advise Gosford City Council of the suitability or otherwise of its current sea level rise allowances.
- To advise an appropriate framework for ongoing review of the adopted benchmarks.

REPORT

Independent Report

Please refer to the report prepared by Douglas Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates, as Tabled.

Current Practice - Sea Level Rise Scenarios in the Planning Process

Council has a strong tradition in planning for hazards such as coastal erosion and flooding through the preparation of floodplain risk management and coastal and estuary management plans, which in turn have informed the preparation of Local Environmental Plans and associated Development Control Plans. As part of Council's ongoing responsibility for planning and development in the coastal zone and in response to flood risk, Council considers changes in sea levels as part of its long-term strategic policy objectives and as part of the planning tools used to guide development.

Council currently uses up to the year 2100 level with an assumed linear increase as the basis for planning with risk assessment, policy development and strategic planning decisions. Currently, the sea level rise scenario is being incorporated into relevant strategic plans to enable management options for preparation of development controls. In addition, Council will use the sea level rise scenario as part of the strategic planning and management for assets and infrastructure.

Future Planning

Council should use a sea level rise horizon that reflects the asset lifecycle and establish a base upon which settlement patterns (future growth) and related infrastructure (such as roads, water, sewerage, etc. which can span periods of decades to centuries) are appropriately planned for. In this respect, Council can adopt different scenario levels to provide flexibility and to enable location-specific matters are reflected in the outcomes. This could include reduced sea level rise scenarios to reflect short, medium and long term or temporary assets, (e.g. short term - playground equipment, medium term – house, long term – major road, temporary – pop up waterfront development). Council should also factor flexibility into the planning process. An example could be the use of time limited consents for certain types of development including temporary.

Council should ensure that the implementation of sea level rise within its development and planning controls does not prohibit development. Rather it should use a risk-based approach allowing proponents to demonstrate whether they can manage the risk. This would allow for different levels of risk for different types of development, so minor development or renovations would be treated differently from subdivision or land intensification developments which increase the risk. Council, in administering its sea level rise scenario, should ensure that current decision making doesn't create future costs and risks to the community, nor expose Council to legal or insurance risks.

Consideration of uncertainty in projections

Since State Government removed the NSW sea level rise planning levels, they have encouraged Council's to adopt a local sea level rise planning level that should be in accordance with widely accepted competent scientific opinion.

In determining a localised Sea Level Rise Planning Level, Council within the current legislative environment, can as part of their decision making can determine their own scenario based on a plausible future recognising that Global Climate Models include uncertainty given a global response to emissions management.

The **Low Emissions Scenario (RCP 2.6)** includes the active removal of greenhouse gases from the atmosphere.

The **Medium Emissions Scenarios (RCP 4.5 & RCP 6.0)** are mid-range emission scenarios that include gradual reduction of emissions towards the next century.

The **High Emissions Scenario (RCP 8.5)** represents continuation with present patterns of energy use and energy sources.

Council held a Strategy Policy workshop on this matter on 3 March. At this workshop Councillors were also provided legal advice in relation to the implementation of the findings of the Independent Report or an alternative scenario and the applicability of the protections under s733 of the Local Government Act.

Council needs to choose an emissions scenario which, in its opinion, represents a long-term approach to emissions in the future. Council, in making a recommendation, should consider the existing scientific, legal, planning and risk management environment as well as the community interest in climate change and sea level rise. The first key decision to be made is for Council to choose a plausible emissions scenario for the future. Whilst there will always be uncertainty, scientific data provides sufficient confidence to suggest that Council should endorse the upper emissions scenario (RCP 8.5) as it reflects the most likely scenario based on current data.

Council, in making the decision, should be aware of the following advice from an independent expert:

- *That RCP2.6 is not as plausible as the other projections and should not be used for coastal management and planning at this time;*
- *That planning guidelines, legislation and legal advice encourage a cautious approach that promotes the selection of a higher sea level rise projection; and*
- *That, following AR4, there was a tendency both in Australia and globally, to adopt projection based on the fossil fuel intensive scenario (A1FI) for planning purposes. That scenario is most similar to RCP8.5 in the most recent IPCC assessment and there are apparently no widely supported arguments for a change from this approach.*

The independent report also recommends RCP8.5 as a suitable and defensible basis for sea level rise projection at the present time. The report also indicates that recent research on global emissions from recent years indicates that we are tracking on top of the RCP8.5 projection.

Within the high emissions scenario (RCP 8.5), there are three possible trajectories (low, medium, high) which encapsulate the range of the modelling, as shown in the table overleaf:

Source: Whitehead & Associates and Coastal Environment, 2014. Table 1
Comparison of Recommended Projection against Previous Policy Values

Time	Local Sea-level Rise Projection Based on RCP 8.5 (in (metres)			Previous State Policy (approx.)[3]
	Low[2]	Medium[2]	High[2]	
2015	0.00	0.00	0.00	0.0[1]
2030	0.06	0.07	0.10	
2050	0.16	0.20	0.26	0.35[1]
2070	0.29	0.39	0.50	
2100	0.53	0.74	0.98	0.85[1]

[1] Values adjusted by subtracting 50mm to account for apparent rise at Fort Denison between 1990 and the beginning of 2014.

[2] In the absence of detailed, rigorous and justifiable site specific risk assessment which uses all three sets of values, the "High" projection values (with ~ 15% probability of exceedence) are recommended for coastal management and planning, providing that ongoing review of available science and water level data is undertaken to enable adaptation of the approach in future.

[3] To obtain the absolute projected mean sea level elevation relative to AHD, a further 0.08 metres would need to be added to these values.

Each of the projections as shown above are based on the emissions projection of RCP8.5, Adoption of any of these projections, represents a range of low, medium and high differentials at the year 2050.

Given the safety factors inherent in the modelling, and the application of sea level rise benchmarks in flooding and coastal hazard planning, adopting a medium projection based on the RCP 8.5 is considered a reasonable position for Council to take given the information available. This recommendation is proposed on the basis that inherent in councils existing information in relation to flooding and coastal hazard includes an allowance for SLR, for example within Councils freeboard allowance. These existing factors are equivalent to the difference between the medium and high projections at 2100. However, these factors are not as clearly in place in our Coastal Hazard Planning. In addition the recommendation includes a periodic review of the data to ensure that council reviews its decision on a regular basis to confirm the adopted SLR benchmark responds to changing scientific information.

Community Interest

Since adoption of the original sea level rise planning levels in 2009, Council has been engaging with the community through various committees and public exhibition on planning for our coastal zone. There is wide ranging opinion on how best local council should plan for local risks and private property whilst considering climate change and sea level rise as valid factors that must be considered in planning for the future.

Council, in making decisions, must consider and represent the wider community interest in planning for the future. In this respect Council may reasonably adopt a way forward which in their opinion satisfies the statutory environment under which it functions, as well as representing an acceptable strategic basis that the community accepts as how Council should plan for the future.

Such a strategic basis could consider at the highest level Council's economic development, environmental values and social responsibilities. At the micro level, Council should also have regard to the impacts on private property interests and community assets.

Council's consideration of these broad community interest factors, in conjunction with the SLR information provided by the report from Coastal Environment Pty Ltd, may result in a view that a adopting a low projection based on the RCP 8.5 is considered a reasonable position for Council.

Attachments: Nil

Tabled Items: Report prepared by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates (ECM IR 20310475)

FINANCIAL IMPACT STATEMENT

The recommendation does not impact on Council's financial position.

CONCLUSION

As detailed in the tabled Independent Report, the scientific evidence indicates that global emissions are currently tracking on the projection pathway RCP 8.5 (reference pg. 15 Figure 3.4), therefore Council should adopt this scenario for global emissions.

Within this scenario there are three possible trajectories for Sea Level Rise Benchmarks (low, medium, high), which encapsulate the range of the modelling 5 (reference pg. 26 Table 1). Following consideration of these three scenarios it is recommended that, on the balance of both community and environmental factors, Council adopt a medium projection. This recommendation considers both long term strategic planning and the community interest.

The low medium and high projections for RCP 8.5 is 0.16,0.20 and 0.26 respectively at 2050. Reflecting a total variation of 10cm across these projections, the greater variation post 2050 where the variation of low medium and high is between 0.53 and 0.98 with the medium and 0.74, a total variation of 45cm.

The adoption of RCP 8.5, and the medium projection will give Council a sufficient timeframe to review these benchmarks as new scientific information becomes available without significant change to our Coastal and Estuary planning.

RECOMMENDATION

A Council note the Independent Report prepared by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates.

B Council adopt a Sea Level Rise Planning Level based on RCP8.5 and the medium sea level rise projection as defined in the Independent Report, as a strategic position to inform Council's planning and plan making processes. The rates are detailed in Table 1 in the above report, as follows:

Local sea level rise projection

Year	Medium local sea level rise projection based on RCP8.5 Measured in metres (m)
2015	0.00
2030	0.07
2050	0.20
2070	0.39
2100	0.74

Note: To obtain the absolute projected sea level elevation relative to AHD, a further 0.08m would need to be added to these values

C Council next review the Sea Level Rise Planning every five years with the next review being in the financial year 2020/2021 or within one year of a new IPCC report.

Council Meeting Minutes March 2015

Council Resolution on Sea Level Rise

J 3.7 REMAINING CLIMATE CHANGE FUNDS

The CCROC request the Minister for the Environment, Heritage and Central Coast, Rob Stokes, remove the barriers to utilizing the remaining Central Coast Climate Change Funds for necessary works for the Central Coast Water Supply.

TR/15/01 REPORT OF THE LOCAL TRAFFIC COMMITTEE HELD ON 2 FEBRUARY 2015 (IR 20172271)

Department: Construction & Operations
Service Unit: Construction Planning & Management

2015/85 RESOLVED (Ward/Burke) that the Minutes of the Local Traffic Committee be received and noted.

ITEM STARRED FOR DISCUSSION

The following item has been starred by Councillors or the Public for discussion or public participation.

MATTER SUBMITTED BY THE DIRECTOR - GOVERNANCE AND PLANNING

GOV.25 DISCUSSION PAPER ON SEA LEVEL RISE (IR 20310475)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

MOVED (Bowles/Macfadyen) that the recommendation of the Director - Governance and Planning be adopted subject to the amendment of Part B as follows:

B Council adopt a Sea Level Rise Planning Level based on RCP8.5 and the ~~medium~~ ***low*** sea level rise projection as defined in the Independent Report, as a strategic position to inform Council's planning and plan making processes. The rates are detailed in Table 1 in the above report, as follows:

Local sea level rise projection

Year	~~Medium~~ ***Low*** local sea level rise projection based on RCP8.5 Measured in metres (m)
2015	0.00
2030	~~0.07~~ ***0.06***
2050	~~0.20~~ ***0.16***
2070	~~0.39~~ ***0.29***
2100	~~0.74~~ ***0.53***

Note: To obtain the absolute projected sea level elevation relative to AHD, a further 0.08m would need to be added to these values

MOVED AS AN AMENDMENT (Morris/Scott) that the recommendation of the Director - Governance and Planning be adopted subject to the amendment of Part B as follows:

B Council adopt a Sea Level Rise Planning Level based on RCP8.5 and the ~~medium~~ ***high*** sea level rise projection as defined in the Independent Report, as a strategic position to inform Council's planning and plan making processes. The rates are detailed in Table 1 in the above report, as follows:

Local sea level rise projection

Year	~~Medium~~ ***High*** local sea level rise projection based on RCP8.5 Measured in metres (m)
2015	0.00
2030	~~0.07~~ ***0.10***
2050	~~0.20~~ ***0.26***
2070	~~0.39~~ ***0.50***
2100	~~0.74~~ ***0.98***

Note: To obtain the absolute projected sea level elevation relative to AHD, a further 0.08m would need to be added to these values

On being put to the meeting the AMENDMENT WAS LOST.

On being put to the meeting the MOTION WAS LOST.

The matter was then AT LARGE.

MOVED as a FURTHER MOTION (Doyle/Strickson) that the recommendation of the Director - Governance and Planning be adopted.

On being put to the meeting the FURTHER MOTION WAS LOST on the casting vote of the Mayor.

The matter was then AT LARGE.

MOVED as a FURTHER MOTION (Doyle/Burke) that the recommendation of the Director - Governance and Planning be adopted subject to the amendment of Part C and the addition of Part D as follows:

C ***Within every Council term*** or within ***two years*** of a new IPCC report, ***Council*** review the Sea Level Rise Planning ***level.***

D Council write to both State and Federal Governments calling on them to take an intergovernmental approach to sea level rise.

On being put to the meeting the FURTHER MOTION WAS CARRIED with the following votes being recorded:

For the Motion: Councillors McKinna, Macfadyen, Ward, Bocking, Bowles, Burke, Doyle and Strickson.

Against the Motion: Councillors Morris and Scott

2015/86 RESOLVED (Doyle/Burke) that:

A Council note the Independent Report prepared by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates

B Council adopt a Sea Level Rise Planning Level based on RCP8.5 and the medium sea level rise projection as defined in the Independent Report, as a strategic position to inform Council's planning and plan making processes. The rates are detailed in Table 1 in the above report, as follows:

Local sea level rise projection

Year	Medium local sea level rise projection based on RCP8.5 Measured in metres (m)
2015	0.00
2030	0.07
2050	0.20
2070	0.39
2100	0.74

Note: To obtain the absolute projected sea level elevation relative to AHD, a further 0.08m would need to be added to these values

C ***Within every Council term*** or within ***two years*** of a new IPCC report, ***Council*** review the Sea Level Rise Planning ***level.***

D Council write to both State and Federal Governments calling on them to take an intergovernmental approach to sea level rise.

LATE ITEMS

Nil.

NEXT MEETING

An Ordinary Meeting of Council (2014/4) will be held on Tuesday, 24 March 2015.

CLOSE OF BUSINESS

The meeting closed at 7.35 pm.

This is page 57 of the Minutes of the Ordinary Meeting (2014/3) of the Council of the City of Gosford held on Tuesday, 10 March 2015.

Council Meeting Agenda April 2015

Brisbane Water Foreshore Floodplain Risk Management Study – For Adoption

GOV.47 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT STUDY - FOR ADOPTION (IR 10630517)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

EXECUTIVE SUMMARY

The minutes of the Catchments & Coast Committee of 25 February 2015, which are the subject of a separate agenda item at the Council meeting of the 28 April 2015, include a recommendation from the Catchments & Coast Committee that the Draft Brisbane Water Foreshore Floodplain Risk Management Study be adopted by Council to enable the preparation of a Draft Brisbane Water Foreshore Floodplain Risk Management Study and Plan, subject to:

1 *A Flood Planning Level based on the derived 100 year flood level (Brisbane Water Foreshore, 2013) plus a freeboard and projected sea level rise component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development.*

2 *The recommended freeboard = 0.5 metres.*

3 *Minor amendments that do not change the intent of the document.*

While this recommendation enables the preparation of the next phase (the Plan) to commence, part one (1) of the recommendation to nominate a residential planning horizon is restrictive in comparison to the Strategic Policy decision of Council made on 10 March 2015, in respect of Sea Level Rise (SLR). It is recommended that Council, when endorsing the minutes of the Catchments & Coast Committee, not adopt the 2050 residential planning horizon as proposed in part one (1).

BACKGROUND

Council, at its 10 March 2015 ordinary meeting adopted (Minute 2015/86) a SLR Planning Level. This decision followed consideration of an independent report prepared by Doug Lord of Coastal Environment Pty Ltd and Dr David Wainwright from Whitehead and Associates as well as the community interest in climate change, legal, planning and risk management issues.

In considering the recommendation of the report, Council resolved (Minute 2015/86) to adopt a series of SLR projections based upon the *Representative Concentration Pathway Scenario RCP 8.5* (medium prediction) relative to the beginning of 2015. This data series has been synthesised graphically (see attachment) to inform Council's strategic management plans that are impacted by climate change.

These projections now replace Council's existing benchmarks (NSW Government Sea Level Policy Statement, 2009) relative to mean sea level (MSL) in 1990 of 40cm by 2050 and 90cm by 2100 when considering coastal hazard and flood risk for land use planning and development.

This report supplements Catchments & Coast Committee report item CC.003 Brisbane Water Foreshore Floodplain Risk Management Study & Plan (BWFFRMS&P) and seeks to clarify the application of an allowance for SLR when determining the Flood Planning Level (FPL) for development.

REPORT

The Brisbane Water Foreshore Floodplain Risk Management Study (the Study) is now complete and has been recommended for adoption. The Study advocates a risk based approach when considering urban areas that are categorised currently as low hazard transitioning to high hazard due to the affects of SLR.

To address SLR, an allowance has been included in the FPL. This allowance should address this transition in the short to medium term. However, the effects of latent conditions such as rising ground water tables (*due to more frequent tidal inundation)* on the serviceability of assets such as residential properties, roads, sewer and water supply in low lying areas require further investigation. It also recommended in the Study that Climate Change Adaptation Plans (CCAPs) be prepared to address the medium to longer term planning horizons. Until the CCAPs are completed the Study recommends an Interim Flood Planning Level (FPL) that includes an allowance for SLR commensurate with the development.

The decision by the Catchments & Coast Committee to nominate a residential planning horizon (2050) provides a fixed benchmark for future planning. A fixed horizon does not enable flexibility in planning for short, medium & long term horizons reflecting development of differing asset life, risk or strategic benefit.

Since the 25 February 2015 meeting, Council resolved at its 10 March 2015 ordinary meeting to adopt a series of SLR projections based upon the *Representative Concentration Pathway Scenario RCP 8.5* (see attachment). These projections now replace Council's existing linear benchmarks (NSW Government Sea Level Policy Statement, 2009) relative to mean sea level (MSL) in 1990 of 40cm by 2050 and 90cm by 2100

To ensure consistency of message within the draft Brisbane Water Foreshore Floodplain Risk Management Plan (the Plan) currently being prepared for public exhibition this year, it is proposed that the above Committee recommendation (CC.003) be considered in light of Council Minute 2015/86 adopted 10 March 2015. This will provide additional guidance for determining future FPLs for a range of developments potentially affected by SLR.

In reviewing the Catchments and Coast Committee's report CC.003 (Part B.1) and Council's recent resolution with respect to SLR, Council staff considers that the following alternate recommendation reflects those decisions.

> *A Flood Planning Level (FPL) based on the derived flood level applicable to the development as determined by the Brisbane Water Flood Study, 2013 or any subsequent updated study adopted by Council.*
>
> *The FPL will also include a freeboard and a projected sea level rise based upon the Representative Concentration Pathway Scenario RCP 8.5 as adopted by Council (Minute 2015/86) commensurate to the asset life and planning horizons for the type of development or land use.*

Attachments: Graph SLR Projection RCP 8.5 (50% Exceedence) (ECM Doc # 20557650)

Tabled Items: Brisbane Water Foreshore Floodplain Risk Management Study (ECM Doc # 20547973)

FINANCIAL IMPACT STATEMENT

The recommendation does not impact on Council's financial position.

RECOMMENDATION

A Council adopt the exhibited Brisbane Water Foreshore Floodplain Risk Management Study and prepare a Draft Brisbane Water Foreshore Floodplain Risk Management Plan for public exhibition subject to the following:

- The Flood Planning Level (FPL) will be based on a derived flood level applicable to the development as determined by the Brisbane Water Flood Study (2013) or any subsequent updated study adopted by Council.
- The FPL will also include a freeboard of 0.5 Metres
- The FPL will include an allowance for projected sea level rise based upon the Representative Concentration Pathway Scenario RCP 8.5 as adopted by Council (Minute 2015/86) commensurate to the asset life and planning horizons or the type of development or land use.

B Council note this report.

ATTACHMENT

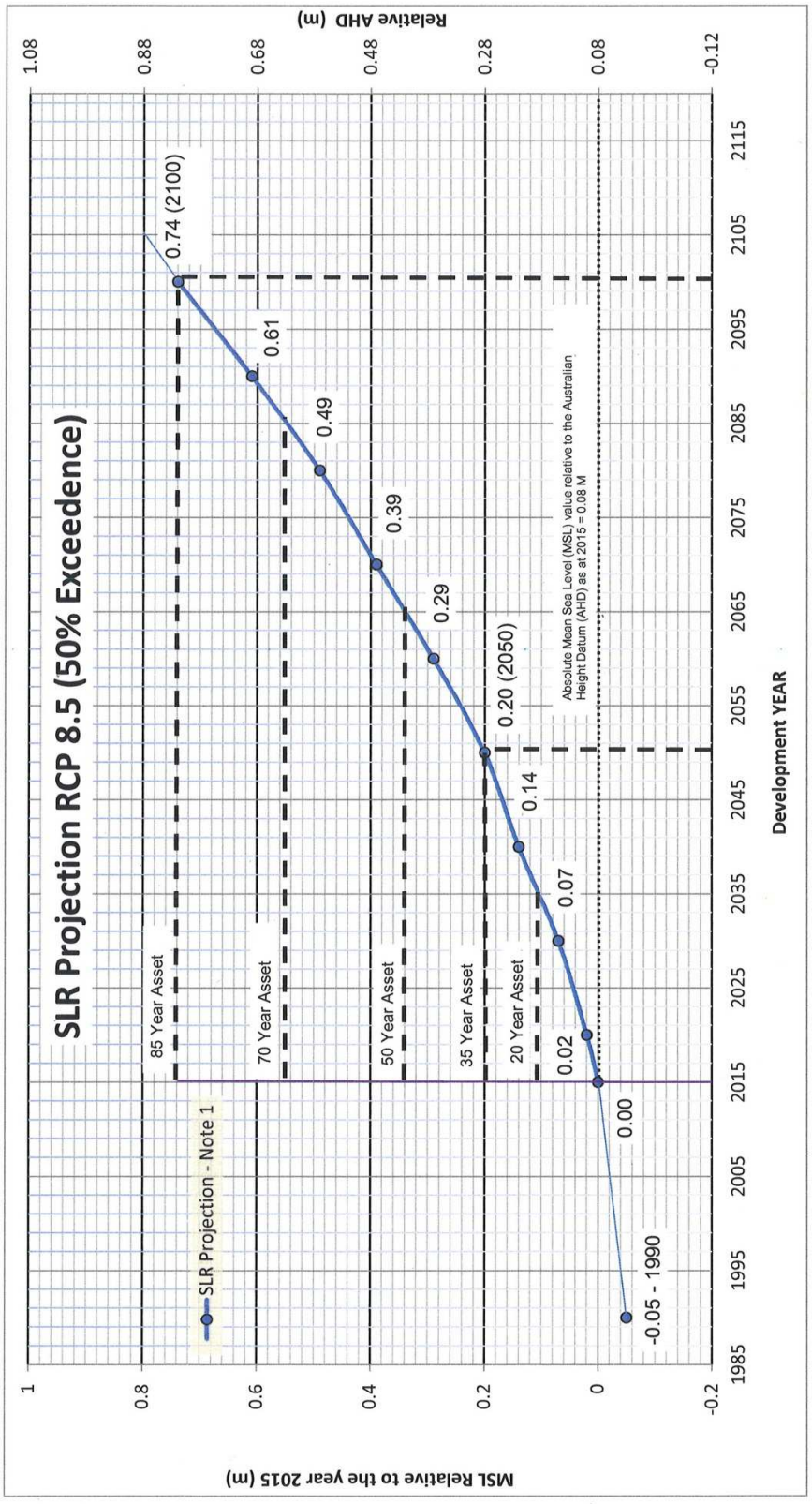

Figure 1- Sea Level Rise Projection RCP 8.5

[1] Extracted from Table 1 p26 Gosford City Council Sea Level Rise Benchmarks Discussion Paper Whitehead & Associates Environmental/Coastal Environment (Feb, 2015)
Intermediate values obtain Table 10 South Coast Regional Sea Level Rise Policy and Planning Framework – Whitehead & Associates Environmental/Coastal Environment (2014)

Council Meeting Agenda April 2015

Report of the Catchments and Coast Committee Meeting

MATTERS SUBMITTED TO COUNCIL BY INTER-DEPARTMENTAL AND ADVISORY COMMITTEES OF COUNCIL

CCC/15/01 REPORT OF THE CATCHMENTS & COAST COMMITTEE MEETING 25 FEBRUARY 2015 (IR 20131366)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

MEETING NUMBER

Meeting No CCC/15/01 commenced at 2:36 pm.

ACKNOWLEDGEMENT TO COUNTRY

The Chairperson gave an acknowledgement to Country to the original inhabitants of this land.

OH&S INDUCTION

ATTENDANCE

Present: Councillor Hillary Morris (Gosford City Council - Chairperson)
Councillor Deanna Bocking (Gosford City Council – arrived 2:48 pm)
Alister Trendell (Senior Development Assessment Engineer Gosford City Council – left 4:00 pm)
Craig Hillman (Community Representative)
David Medcalf (Coordinator Transport Project Development Gosford City Council)
Gary Slack (Community Representative)
Jane Smith (Community Representative – arrived 3:38 pm)
Matthew Prendergast (Manager Sustainable Corporate & City Planning Gosford City Council)
Michael Alsop (Community Representative – left 3:59 pm)
Michael Kilp (Community Representative)
Neil Kelleher (Office of Environment & Heritage)
Pat Aiken (Community Representative – arrived 2:41 pm)
Phil Cantillon (Manager Culture Gosford City Council)
Robert Baker (Flooding and Drainage Engineer Gosford City Council)
Tim Macdonald (Environmental Planning Officer Gosford City Council)
Tony Sweeney (Community Representative)
Vic Tysoe (Flooding & Drainage Management Engineer Gosford City Council)
Warren Brown (Coastal & Estuary Officer Gosford City Council)
Werner Klumpp (State Emergency Services Gosford Region)

Apologies: Councillor Chris Burke (Gosford City Council)
Adrian Williams (Community Representative)
Bruce Macnee (Manager Development & Compliance Gosford City Council)
Danielle Dickson (Director Governance & Planning Gosford City Council)
Garry Hemsworth (Manager Asset Operations Gosford City Council)
Lara Davis (Office of Environment & Heritage)
Lionel Huang (Drainage Assets Engineer Investigations Gosford City Council)

COMMITTEE CHANGES

Nil.

DECLARATION OF PECUNIARY INTEREST

The Chairperson invited Committee members to declare any pecuniary interest they might have, in accordance with Section 451 of the Local Government Act 1993, in respect to the agenda for this meeting.

No declarations were received.

DECLARATION OF NON-PECUNIARY INTEREST

The Chairperson invited Committee members to declare any non-pecuniary interest they might have, in accordance with Section 440 of the Local Government Act 1993 and Council's Code of Conduct, in respect to the business of this meeting.

Clr Hillary Morris declared her non-pecuniary interest in relation to Item CCC.003, under Chapter 14 of the Local Government Act 1993 as she owns an investment property in Point Clare.

Craig Hillman declared his non-pecuniary interest in relation to Item CCC.003, under Chapter 14 of the Local Government Act 1993 as he owns properties potentially affected by this Study.

Gary Slack declared his non-pecuniary interest in relation to Item CCC.003, under Chapter 14 of the Local Government Act 1993 as he owns a waterfront property in Koolewong in the Brisbane Water floodplain area.

Vic Tysoe declared his non-pecuniary interest in relation to Items CCC.003, under Chapter 14 of the Local Government Act 1993 as he has several relatives who own properties in the Davistown area.

CONFIRMATION OF PREVIOUS MINUTES

THE COMMITTEE confirms (Sweeney/Prendergast) the minutes of the meeting held on 25 November 2014, which were received by Council on 10 February 2015.

AGENDA ITEMS

CCC.001 ADMINISTRATION/PROCEDURAL MATTERS

Information about Administration/Procedural Matters, including the Discussion of Agenda Items and Councillor Membership, was provided to Committee members in the meeting notes distributed prior to the meeting.

THE COMMITTEE noted the information.

CCC.002 SEA LEVEL RISE BENCHMARKS

Manager Sustainable Corporate & City Planning reported that an independent consultant has been engaged to look at Council's current sea level rise scenario and relevant documentation, including IPCC reports and the report recently commissioned by Shoalhaven City Council and Eurobodalla Shire Council. It is anticipated that a report on this matter will go to Council on 10 March 2015.

THE COMMITTEE noted the information.

CCC.003 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Gary Slack declared his non-pecuniary interest in relation to this item, under Chapter 14 of the Local Government Act 1993 as he owns a waterfront property in Koolewong in the Brisbane Water floodplain area, however considered he was capable of making an impartial decision in respect to this matter.

Craig Hillman declared his non-pecuniary interest in relation to this item, under Chapter 14 of the Local Government Act 1993 as he owns properties potentially affected by this Study, however considered he was capable of making an impartial decision in respect to this matter.

Vic Tysoe declared his non-pecuniary interest in relation to this item, under Chapter 14 of the Local Government Act 1993 as he has several relatives who own properties in the Davistown area.

Clr Hillary Morris declared her non-pecuniary interest in relation to this item, under Chapter 14 of the Local Government Act 1993 as she owns an investment property in Point Clare, however considered she was capable of making an impartial decision in respect to this matter.

Flooding & Drainage Engineer explained that, following the twelve-week exhibition period for the Draft Brisbane Water Foreshore Floodplain Risk Management Study, all submissions have been collated, reviewed by Council's consultant and summarised for inclusion in the final document. Once the Draft Brisbane Water Foreshore Floodplain Risk Management Study has been adopted by Council, Council can move forward in the preparation of a Floodplain Risk Management Plan.

Copies of letters from the Office of Environment and Heritage and from Mr Adrian Williams, Community Representative, (Attachments A and B) were made available to all Committee members present.

Discussion followed regarding flood planning levels, particularly the freeboard and sea level rise component, and the implementation of planning levels through the DCP. After some debate, the majority of voting committee members agreed to the following recommendation.

THE COMMITTEE RECOMMENDS (Morris/Prendergast) that the exhibited Draft Brisbane Water Foreshore Floodplain Risk Management Study be adopted by Council to enable the preparation of a Draft Brisbane Water Foreshore Floodplain Risk Management Study and Plan, subject to:

1 A Flood Planning Level based on the derived 100-year flood level (Brisbane Water Foreshore Flood Study Cardno, 2013) plus a freeboard and projected sea level rise component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development.

2 The recommended freeboard = 0.5 metres.

3 Minor amendments that do not change the intent of the document.

Mr Craig Hillman and Mr Pat Aiken requested a division.

On division, the following votes were recorded:

For the motion: Councillor Morris, Councillor Bocking, Mr Alsop, Mr Kilp, Mr Sweeney, Mr Prendergast

Against the motion: Mr Hillman, Mr Aiken and Mr Slack

Mr Craig Hillman, Mr Pat Aiken and Mr Gary Slack requested that it be noted that they were voting against the motion as they believe the proposal is not in the best interests of the communities they represent.

CCC.004 PLANNED RETREAT

Environmental Planning Officer referred to information provided to Committee members in the meeting notes distributed prior to the meeting, in response to queries introduced by Mr Pat Aiken at the meeting of 25 November 2014.

Discussion on this matter followed, with Environmental Planning Officer explaining that, if the Coastal Zone Management Plan for Gosford's Beaches is adopted, Council would not be looking at Planned Retreat as an option. It was clarified that there would be greater opportunity to discuss this in the Coastal Subcommittee meeting scheduled for 27 February 2015.

THE COMMITTEE noted the information.

CCC.005 FLOODPLAIN RISK MANAGEMENT PLAN UPDATE

A Floodplain Risk Management Plan Update was provided to Committee members in the meeting notes distributed prior to the meeting. The meeting notes provided information about the Erina Creek Floodplain Risk Management Study and Plan, Flood Information Certificate, Flood Mapping and Grant Offers for 2014/2015.

Flooding & Drainage Management Engineer reported that the consultants have now made amendments to the Erina Creek Floodplain Risk Management Study and Plan, and that a Subcommittee meeting will soon be scheduled to assess the document.

Mr Hillman reported that he has had recent conversations with staff regarding concerns with flood insurance premiums, Council's flood information certificate and flood mapping. He thanked staff for their assistance in these matters. He suggested that if the flood information certificate, which is available for purchase from Council for each individual property, contained more detailed information, this would make it more useful to residents or homeowners in insurance negotiations. He was advised that Council is investigating various improvements to studies, mapping and certificates that should address most of his concerns.

Mr Klumpp reported that the Gosford SES Unit is looking to increase its knowledge of flood behaviour at various local flood hotspots, and the potential to effect rescues at these locations, with grant money provided by the NRMA and assistance from Council staff with flood mapping regarding depths and velocities.

THE COMMITTEE noted the information.

CCC.006 FLOOD MITIGATION IMPLEMENTATION UPDATE

A Flood Mitigation Implementation Update was provided to Committee members in the meeting notes distributed prior to the meeting.

THE COMMITTEE noted the information.

CCC.007 NARARA CREEK FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Information concerning the Narara Creek Floodplain Risk Management Study and Plan and a proposed Community Engagement Strategic Framework was provided to Committee members in the meeting notes distributed prior to the meeting.

THE COMMITTEE RECOMMENDS (Morris/Prendergast) that the Community Engagement Strategic Framework for the Narara Creek Floodplain Risk Management Study and Plan (Attachment C) be adopted by Council as a guiding principle when engaging affected residents and the wider community.

CCC.008 COASTAL MANAGEMENT PLAN UPDATE

A Coastal Management Plan Update was provided to Committee members in the meeting notes distributed prior to the meeting.

THE COMMITTEE noted the information.

CCC.009 COASTAL ZONE MANAGEMENT IMPLEMENTATION UPDATE

Coastal & Estuary Officer provided information concerning the following projects:

1 Elfin Hill Road Reserve foreshore stabilisation design
2 Correa Bay dredging strategy
3 Ettalong Beach
4 Environmental Trust Dune Restoration at Wamberal, Umina and Putty Beaches

THE COMMITTEE noted the information.

GENERAL BUSINESS

CCC.010 SECTION 149 PLANNING CERTIFICATES

Manager Sustainable Corporate & City Planning reported that Council has asked a solicitor to review Council's provision of Section 149(2) and 149(5) Planning Certificates, and a report on this matter will be prepared for Council's consideration. Further information will be reported back to the Committee at a future meeting.

THE COMMITTEE noted the information.

Action for the Committee

CCC.002 SEA LEVEL RISE BENCHMARKS
CCC.010 SECTION 149 PLANNING CERTIFICATES

Attachments:
- A Office of Environment & Heritage Letter Providing Advice on Freeboard and Flood Planning Levels (ECM Doc # 20336279)
- B Letter from Mr Adrian Williams (Community Representative) Regarding Freeboard and Flood Planning Levels (ECM Doc # 20364513)
- C Community Engagement Strategic Framework for the Narara Creek Floodplain Risk Management Study and Plan (ECM Doc # 20371565)

Tabled Items: Nil

NEXT MEETING

Date: 5 May 2015
Time: 2:30 pm
Venue: 1st Floor Committee Room

CLOSE OF BUSINESS

The meeting closed at 4:07 pm.

RECOMMENDATION

A The Minutes of the Catchments & Coast Committee be received and noted.

B CCC.003 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

The exhibited Draft Brisbane Water Foreshore Floodplain Risk Management Study be adopted by Council to enable the preparation of a Draft Brisbane Water Foreshore Floodplain Risk Management Study and Plan, subject to:

1 A Flood Planning Level based on the derived 100-year flood level (Brisbane Water Foreshore Flood Study Cardno, 2013) plus a freeboard and projected sea level rise component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development.

2 The recommended freeboard = 0.5 metres.

3 Minor amendments that do not change the intent of the document.

C CCC.007 NARARA CREEK FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

The Community Engagement Strategic Framework for the Narara Creek Floodplain Risk Management Study and Plan (as attached) be adopted by Council as a guiding principle when engaging affected residents and the wider community.

ATTACHMENT A

NSW GOVERNMENT | Office of Environment & Heritage

Our reference:
Contact: Peter Evans
4904 2594

General Manager
Gosford City Council
PO Box 21
GOSFORD NSW 2250

Attn.: Matthew Prendergast
Manager Sustainable Corporate & City Planning

Dear Mr Prendergast,

Freeboard and Flood Planning Levels

I understand that Council's Catchments and Coasts Committee has been considering a reduced freeboard component in the Flood Planning Level (FPL) for Brisbane Water, and the retention of a single design flood level based on the 1974 flood in lieu of the variable 1% Annual Exceedance Probability (AEP) level determined in the Brisbane Water Flood Study (2013).

The following comments are offered to assist in those deliberations.

Freeboard is included in FPLs as a factor of safety to provide reasonable certainty that the adopted risk exposure is not exceeded. The typical 0.5m freeboard recommended in the NSW Governments *Floodplain Development Manual* (2005) is designed to allow for:

- Uncertainties in the hydrological and hydraulic modelling used to estimate flood levels;
- Minor difference is water levels across a floodplain, such as those caused by wind set-up;
- Blockages in waterways;
- Local wave action; and
- Changes in catchment and floodplain conditions over time, including incremental and cumulative impacts of development.

As stated in the *2010 Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments*, the freeboard also provides a relatively small allowance to accommodate some of the projected increases in rainfall intensity associated with climate change. Accordingly, the 0.5m freeboard figures should be considered to address only some of the uncertainty associated with estimating climate change impacts. Freeboard should not be used to allow for sea level rise impacts; instead these should be quantified and applied separately.

Reducing freeboard effectively reduces the factor of safety that is applied to the flood planning level, and therefore has the potential to increase losses in future flooding events

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Level 4, 26 Honeysuckle Drive
Newcastle NSW 2300
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ABN 30 841 387 271
www.environment.nsw.gov.au

and so should not be undertaken without careful deliberation. It is open to councils to adopt a freeboard figure that is appropriate for their local circumstances. However, any departure from the figure suggested in the *Floodplain Development Manual* would need to be supported by detailed investigation of its various components.

In relation to flooding around the Brisbane Water system, the following is noted:

- Brisbane Water is a large, exposed water body and as such, flood levels are subject to significant wave and wind effects including set up and seiching.

- The current FPL is based on a single, mean 1974 flood level. This level has been used by Council for planning purposes for approximately the past 30 years. The Public Works report of the 1974 flood levels in Brisbane Water included theoretical estimates of the spatial variability of flood levels that ranged from 0.2m below the mean level to 0.5m above it. The observed variations were greater.

- In 2013, Cardno completed the Brisbane Water Foreshore Flood Study. This study was based on detailed hydrological and hydraulic models prepared specifically for the area, and determined the 20% AEP; 10% AEP; 5% AEP; 2% AEP; 1% AEP; 0.5% AEP and PMF design flood levels..

  The Cardno study considered the effects of elevated ocean water levels, wave set up and wind set up at both the local and ocean boundaries. It also considered inundation due to wave run-up and wave overtopping of the shoreline, which is dependent on the edge treatment of each specific location.

  The Cardno study therefore presents an accurate representation of the variable flood risk exposure around Brisbane Water.

- Whilst the study estimates the effect of waves on mean water levels, the design levels do not include the waves themselves. On Brisbane Water waves frequently exceed 0.5m. Vessel and vehicular wakes are also known to have caused problems in past flooding events around Brisbane Water. Freeboard is required to account for the risk posed by wave action.
- In 2009, Gosford City Council adopted sea level rise projections of 0.4m by 2050 and 0.9m by 2100. These climate change scenarios were re-considered and re-endorsed by Council in August 2013

The *Guideline on development controls on low risk areas – Floodplain Development Manual* was issued in January 2007 by the NSW Department of Planning, to provide additional guidance on matters dealt with in the *Floodplain Development Manual (2005)*. The Guideline confirms that, unless there are exceptional circumstances, councils should adopt the 1% AEP flood as the FPL for residential development. In proposing a case for exceptional circumstances, a council would need to demonstrate that a different FPL was required for the management of residential development due to local flood behaviour, flood history, associated flood hazards or a particular historic flood. The Guideline also notes that, unless there are exceptional circumstances, councils should not impose flood related development controls on residential development on land above the residential FPL (low flood risk areas).

Appendix K of the *Floodplain Development Manual* states that "As with other planning decisions, councils have a duty of care in advising property owners, occupiers and developers on the extent and level of flooding and in making decisions with regard to the appropriate FPL. Because of the importance of such decisions, councils should document and carefully explain the basis of selecting the FPL."

In conclusion, any departure from the guidance provided in the Floodplain Development Manual and subsequent guide notes would need to be carefully considered, justified and documented. Continuing use of a uniform FPL across Brisbane Water would require the approval of both the NSW Department of Planning and Environment and the Office of Environment & Heritage.

Please contact me on 4904 2595 if you should need any clarification of this advice.

Yours sincerely

23/2/15

PETER EVANS
Senior Team Leader
Regional Operations

ATTACHMENT B

Hardys Bay Residents Group Inc.

"Working for a positive lifestyle and healthy environment from Killcare to Wagstaffe"

P.O. Box 4057
Wagstaffe NSW 2257
Phone 0418 250 237
Web site: http://hardysbay.com/

24 February 2015

Chairman Catchment & Coast Committee
Councillor Bourke
Gosford City Council.

Dear Mr Chairman,

Unfortunately I am unable to attend the full committee meeting scheduled for February 25th, and I have previously extended my apologise.

I would respectfully request that this letter is tabled and noted in the minutes.

My understanding was initially the committee was led to believe that the 2.45 FPL was the favoured option, and this was the case for a substantial period of time, however this was subsequently abandoned.

At a recent technical sub-committee meeting when an around the table question of our views, I supported the FPL 1% and 30cm Freeboard. Again my understanding is the Sea Level rise component was to be 40cm through to 2050, again which I support.

I would again ask that my views are recorded and minuted.

Yours sincerely

A H. Williams
President
Hardys Bay Residents Group Inc.
Web site: hardysbay.com

Council Meeting Minutes April 2015

Brisbane Water Foreshore Floodplain Risk Management Study – For Adoption

The Deputy Mayor advised the meeting that due to a lack of a quorum the meeting was adjourned and the matter was AT LARGE. Item GOV.46 is deferred to be considered at the Ordinary Council Meeting to be held on 12 May 2015.

The following Councillors were present:

The Deputy Mayor, Councillor J M Macfadyen and Councillors D M Bocking, H A Morris V L Scott and R V Ward.

Mr Paul Anderson returned to the meeting at 6.55 pm.

Councillors McKinna and Bowles returned to the meeting at 6.55 pm. The quorum was resumed and the meeting resumed at 6.55 pm.

The Mayor resumed the Chair.

The following Councillors were present:

The Mayor Councillor L McKinna, (Chairman) and Councillors J M Macfadyen, D M Bocking, G L Bowles, H A Morris, V L Scott, and R V Ward.

GOV.47 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT STUDY - FOR ADOPTION (IR 10630517)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

MOVED (Bowles/Morris) that the recommendation of the Director - Governance and Planning be adopted.

On being put to the meeting the MOTION WAS CARRIED.

2015/166 RESOLVED that

A Council adopt the exhibited Brisbane Water Foreshore Floodplain Risk Management Study and prepare a Draft Brisbane Water Foreshore Floodplain Risk Management Plan for public exhibition subject to the following:

- The Flood Planning Level (FPL) will be based on a derived flood level applicable to the development as determined by the Brisbane Water Flood Study (2013) or any subsequent updated study adopted by Council.
- The FPL will also include a freeboard of 0.5 Metres
- The FPL will include an allowance for projected sea level rise based upon the Representative Concentration Pathway Scenario RCP 8.5 as adopted by Council (Minute 2015/86) commensurate to the asset life and planning horizons or the type of development or land use.

B Council note this report.

Council Meeting Minutes April 2015

Report of the Catchments & Coast Committee Meeting

C Council notify all grant applicants accordingly.

D Council note a reduction of $4,086.00 in the recurrent budget for 2015/16 for this program.

MATTERS SUBMITTED TO COUNCIL BY INTER-DEPARTMENTAL AND ADVISORY COMMITTEES OF COUNCIL

CCC/15/01 REPORT OF THE CATCHMENTS & COAST COMMITTEE MEETING 25 FEBRUARY 2015 (IR 20131366)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

MOVED (Macfadyen/Ward) that:

A The Minutes of the Catchments & Coast Committee be received and noted.

~~B CCC.003 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN~~

~~The exhibited Draft Brisbane Water Foreshore Floodplain Risk Management Study be adopted by Council to enable the preparation of a Draft Brisbane Water Foreshore Floodplain Risk Management Study and Plan, subject to:~~

~~1 A Flood Planning Level based on the derived 100-year flood level (Brisbane Water Foreshore Flood Study Cardno, 2013) plus a freeboard and projected sea level rise component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development.~~

~~2 The recommended freeboard = 0.5 metres.~~

~~3 Minor amendments that do not change the intent of the document.~~

C CCC.007 NARARA CREEK FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

The Community Engagement Strategic Framework for the Narara Creek Floodplain Risk Management Study and Plan (as attached) be adopted by Council as a guiding principle when engaging affected residents and the wider community.

On being put to the meeting the MOTION WAS CARRIED.

Council Meeting Agenda July 2015

Report of the Strategy/Policy Workshop

REPORTS OF THE STRATEGY/POLICY WORKSHOP HELD ON 21 JULY 2015

SF.11 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT PLAN - FOR EXHIBITION (IR 10630517)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

BACKGROUND

This item was considered at the Strategy/Policy Workshop held on 21 July 2015.

The following Councillors were present for this item:

Councillors McKinna, Ward, Bowles, Morris and Scott.

Following an extensive public consultation period in 2014, the Draft Brisbane Water Foreshore Floodplain Risk Management Study (BWFFRM Study) was completed in February 2015 and adopted (Minute 2015/166) by Council 28 April 2015.

In considering that recommendation, Council also resolved to proceed to the next phase of the Floodplain Risk Management process and prepare a Draft Brisbane Water Foreshore Floodplain Risk Management Plan (BWFFRM Plan) for public exhibition, subject to incorporating a Sea Level Rise Planning Level adopted (Minute 2015/86) by Council 10 March 2015. This resolution adopted a series of SLR projections based upon the *Representative Concentration Pathway Scenario RCP 8.5* (medium prediction) relative to the beginning of 2015.

Subsequent to this resolution, the Catchments & Coast Committee (meeting held 13 May 2015) recommended (IR 20451728) that; subject to a review by Technical Subcommittee, the Draft BWFFRM Plan be exhibited for a period of six weeks in accordance with the Community Engagement Strategic Framework for the Draft Brisbane Water Foreshore Floodplain Risk Management Plan (Attachment A). This strategic framework will be used as a guiding principle when engaging the identified stakeholders.

A Draft BWFFRM Plan (Tabled Item) has now been prepared in accordance with the NSW Flood Prone Land Policy and the NSW Floodplain Development Manual (2005) for Council to consider placing the document on public exhibition to allow opportunity for the wider community to provide feedback to Council with respect to the management strategies identified.

EXECUTIVE SUMMARY

The Draft Brisbane Water Foreshore Floodplain Risk Management Plan (BWFFRM Plan) represents the fifth stage of a six-stage multi-disciplinary process to complete the Plan. The process began in 2006 with a comprehensive technical investigation of flood behaviour in and around the Brisbane Water Foreshore.

Exhibition of the Draft BWFFRM Plan provides an opportunity for the community and other stakeholders to have a final say on recommended management options considered in the previous stage of the process, the Brisbane Water Foreshore Floodplain Risk Management Study (BWFFRM Study).

On completion of the exhibition period, Council will consider written submissions from the community and where appropriate review and amend the Draft BWFFRM Plan.
Following adoption, Council will implement those management options that can be accommodated within the current delivery program or recommend them for consideration in the 2017/18 -2020/21 delivery program.

REPORT

The BWFFRM Study examined and considered a range of risk management strategies to address the impacts of flood behaviour posed by ocean storm surge generated from "East Coast Lows", similar to those storm events experienced in 1974, 2007 and April 2015, including strategies that recognise the potential increase in future flood risk.

The Draft BWFFRM Plan now prioritises these strategies in sufficient detail to facilitate implementation.

Implementation of the Draft BWFFRM Plan is contingent upon available resources and other operational priorities of Council. Management strategies that relate to land-use planning could be achieved in the short to medium term, however any residual flood risk will need to be managed by emergency response.

The Draft BWFFRM Plan recognises *"that it is impractical to eliminate all flood risks from the Brisbane Water floodplain. Instead, the aim is to ensure that existing and future development is exposed to an 'acceptable' level of risk*" (Cardno 2015).

The Draft BWFFRM Plan categorises flood risk according to the way it will be managed. These broad categories are:

Property Modification (PM) Actions - Preventing/Avoiding Risk

- Inform strategic land-use planning on the capability of the land to support short term and long term development, limitations and controls without exacerbating the existing flood risk. A key component is the Flood Planning Level (FPL) and flood resilient construction.
- Inform emergency management planning on the limitations to, and constraints on, emergency response and the implications for the capability of the land to support future development.
- Develop a management strategy that will consider the potential impacts of sea level rise at an early stage so that planning and some degree of readiness can commence prior to any impacts occurring.
- Continue to monitor properties that are affected by more frequent flood event and encourage house raising wherever possible.

Flood Modifications (FM) Actions - Reducing the Likelihood of Risk

- Reducing the impacts of wave run-up associated with ocean storm events around the periphery of the foreshore by maintaining public infrastructure and developing guidelines that will assist private and public landowners in designing and developing sea walls.
- Continue installing, maintaining and assessing floodgates on critical stormwater infrastructure to reduce the impact of localised flooding during ocean storms.

Emergency Response Modification (ERM) Actions - Reducing the Consequence of Risk

- Continue to work closely with SES to ensure that the wider community is informed and educated of the dangers associated with “East Coast Lows”.
- Targeted programs with a particular emphasis on communities or senior living precincts where evacuation routes are inundated.
- Review of response plans
- Strategic land-use planning on the capability of the land to support evacuation
- Flood forecasting

Key Strategies - Property Modification

Following the historical 1 in 100 year flood event of 1974, Council developed a Floodplain Management Policy (1980), which among other recommendations included a Minimum Floor Level (MFL) of 2.45 M relative to the Australian Height Datum (AHD). This level applied to all new developments in and around Brisbane Water and is still the current policy.

The effect of this policy has, over time, significantly reduced the number of properties that would have experienced over floor flooding. While this policy has been very effective it has now been reviewed to reflect best practice and consideration of projected SLR. Setting a minimum floor level is again recommended as a key flood mitigation measure.

Applying Flood Planning Levels

To determine the FPL for a particular development, the following would be applied:

- Identification of 100 Year ARI level for 2015 from the Brisbane Water Flood Study (Cardno, 2013a) plus any SLR that may have occurred since 2015 to the date of the development application.
- Addition of an allowance for SLR relevant to the development type and the year of the application. A minimum of 35 years is considered as an appropriate planning horizon.
- Addition of 0.5m freeboard.

SLR is determined by the projection curve (RCP 8.5) and will be reviewed by Council periodically. Two examples are provided below that depict the variance of the FPL across the study area for a typical residential development application submitted in 2015, more detailed discussion is provided in the Draft BWFFRM Plan.

Example 1 – Davistown Area

- 100 Year ARI Level (in 2015) = 1.48 m AHD (average)
- SLR = 0.20m (Council Resolution Minute 2015/86)
- Freeboard = 0.5m

FPL = 2.18 m AHD

Example 2 – West Gosford Area

- 100 Year ARI Level (in 2015) = 1.77 m AHD (average)
- SLR = 0.20m (Council Resolution Minute 2015/86)
- Freeboard = 0.5m

FPL = 2.47 m AHD

Providing an allowance for SLR in the Flood Planning Level provides a "safety buffer" in the decision making process and complements another key strategy identified in the Draft BWFFRM Plan to develop adaptive responsive pathways that will address low lying properties that transition from a low to high hazard over time.

Review of land use planning development controls that reduce unreasonable risks from identified hazards requires careful consideration particularly where communities will be isolated during a flood event or where flooding will exceed the flood planning level. It is also recommended that key emergency response organisations such as SES relocate operational functions out of the floodplain.

Key Strategies - Flood Modification

The majority of private assets within the study area that are inundated during frequent and infrequent flood events are foreshore residential properties. While the BWFFRM Study recognises this flood behaviour, it could not provide any justification in the short to medium term to implement structural flood mitigation measures such as levees to modify flood behaviour. However, as a consequence of projected SLR, low lying properties will transition from a low to a higher flood risk category. The effect of this scenario will be a significant increase in flood damages on private and public infrastructure.

In the short term the Draft BWFFRM Plan recommends that Climate Change Adaption Plans (CCAP) be prepared to address projected sea level rise. CCAP will provide a decision pathway that will respond commensurate to the hazard and the risk posed, align objectives and prioritise management options.

In the short to medium term, managing flood behaviour will be limited to maintaining and expanding flood control gates and reducing the effect of wave run-up at the foreshore interface.

Key Strategies – Emergency Response Modification

Emergency response seeks to modify the behaviour of people during flood events. A key strategy of the Draft BWFFRM Plan is to continue targeted community education projects on an ad hoc basis in co-operation with the SES. Residents who are isolated during flood events should be well prepared and have clear and effective understanding of what options are available and which option provides the best response as the flood approaches.

Where development exists, signage indicating depth over road would alert the community of local hazards. Alerts via Variable Message Signage (VMS) either by portable or traffic management systems operated by NSW Roads and Maritime Services has been proposed as an effective method of communicating hazards and alternate routes.

The periodical review of the Gosford City Flood Plan is critical to emergency response. The BWFFRM Study provides flood intelligence at locations that are most vulnerable during a flood event. This information will be made available to SES to assist operational decisions during a storm event. The Draft BWFFRM Plan also recommends that this intelligence be used to review of evacuation centres, as some centres are located within the floodplain or are impacted by road closures.

Conclusion

The BWFFRM Study identified, reviewed and assessed the effectiveness of a range of management options that addressed flood risk. These options were ranked according to feasibility, practicality and cost effectiveness to inform the decision making process.

The Draft BWFFRM Plan acknowledges that the current level of flood risk is manageable provided recommended priority actions are implemented as soon as practicable. The key recommended actions in the short to medium term can be achieved by effective development controls and continuing to improve emergency response in cooperation with other agencies such as SES.

The Draft BWFFRM Plan provides a practical framework for implementation. The strategy addresses existing, future and residual risk that should reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and reduce private and public losses resulting from floods. The exhibition of the document will provide an opportunity to inform and consult with the community. Following the exhibition period and review of submissions by the Catchments & Coast Committee a further report will be prepared for Council consideration. This report will outline any amendments made as a result of public exhibition and recommend a final Draft BWFFRM Plan for adoption.

Attachment: Community Engagement Strategic Framework for the Draft Brisbane Water Foreshore Floodplain Risk Management Plan (DN 20978215).

Tabled Item: Draft Brisbane Water Foreshore Floodplain Risk Management Plan (DN 21152638).

FINANCIAL IMPACT STATEMENT

The recommendation does not impact on Council's financial position. All costs associated with exhibition are covered by existing project budgets.

RECOMMENDATION

A Council place the Draft Brisbane Water Foreshore Floodplain Risk Management Plan on public exhibition for a period of 6 weeks.

B Council exhibit the draft document in accordance with the principles and goals as described in the Community Engagement Strategic Framework for the Draft Brisbane Water Foreshore Floodplain Risk Management Plan (Attachment).

Community Engagement Strategic Framework

Project Name	Draft Brisbane Water Foreshore Floodplain Risk Management Plan	Revision Date:	28-April-2015

What Success looks like	The Project Team	The Council	The Community & Other Stakeholders
	The document has delivered an appropriate range of management options for the public to consider.	To provide information to communicate the effects of coastal flooding implications and to present suitable solutions.	Understand the issues relating to flood hazards and the management options and strategies proposed.

INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Public Participation Goal	**Public Participation Goal**	**Public Participation Goal**	**Public Participation Goal**	**Public Participation Goal**
To provide the public with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision, including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise	**Promise**	**Promise**	**Promise**	**Promise**
We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulation solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Stakeholders	**Stakeholders**	**Stakeholders**	**Stakeholders**	**Stakeholders**
Other Utilities	Community Interest Groups Wider Community MP's - Local Members	Brisbane Water Foreshore Floodplain Risk Managment Technical Subcommittee of the Catchments & Coast Committee	Catchments & Coast Committee Gosford Council Business Units	Councillors
Engagement Tools	**Engagement Tools**	**Engagement Tools**	**Engagement Tools**	**Engagement Tools**
Displays & Exhibits Media Releases Printed Information Technical Papers (Study & Plan)	Drop in Sessions (2) Questionnaires and Response Council Website (reports) Letters	Technical Assistance Submissions Workshops (2)	Catchments & Coast Committee Meetings Internal Briefings	Council Meetings Council Stratpol Workshop

Council Meeting Minutes July 2015

Report of the Strategy/Policy Workshop

EC.4.001 DRAFT OPEN BURNING POLICY

Council note the Environment Committee is opposed to any proposed change to Council's current approach to managing opening burning activities within the LGA. The Committee supports Council remaining in Part 1 of Schedule 8 of the *Protection of the Environment Operations (Clean Air) Regulation 2010*.

EC.4.002 STORM IMPACTS AND MANAGEMENT

Council consider the preparation of an urban tree policy that would guide appropriate tree planting in urban streetscapes.

HC/15/03 REPORT OF THE HERITAGE ADVISORY COMMITTEE MEETING 17 JUNE 2015 (IR 20937996)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

2015/338 **RESOLVED** (Strickson/Burke) that the Minutes of the Heritage Advisory Committee Meeting be received and noted.

REPORT OF THE STRATEGY/POLICY WORKSHOP HELD ON 21 JULY 2015

SF.11 BRISBANE WATER FORESHORE FLOODPLAIN RISK MANAGEMENT PLAN - FOR EXHIBITION (IR 10630517)

Department: Governance & Planning
Service Unit: Sustainable Corporate & City Planning

2015/339 **RESOLVED** (Strickson/Burke) that:

A Council place the Draft Brisbane Water Foreshore Floodplain Risk Management Plan on public exhibition for a period of 6 weeks.

B Council exhibit the draft document in accordance with the principles and goals as described in the Community Engagement Strategic Framework for the Draft Brisbane Water Foreshore Floodplain Risk Management Plan (Attachment).

Appendix C

Management Actions – Detailed Descriptions

Detailed Description of Actions

The following descriptions and assessment of the floodplain risk management actions are separated into:

- Flood modification (FM) actions (**Section C.1**);
- Property modification (PM) actions (**Section C.2**); and
- Emergency response modification (EM) actions (**Section C.3**).

Details regarding the relevance of implementing the actions within specific management areas have also been discussed.

C.1 Flood Modification Actions

FM3 – Wave Run-Up Management Guidelines		
Action Type: Flood Risk Modification	**Action Timeline:** Staged	**CCAP:** Not included

Background:

Wave run-up can increase the impacts associated with flooding from ocean storm events. In particular, some properties around the periphery of the floodplain are not identified as flood affected. However, depending on swell and wind conditions, these properties may be impacted by wave run-up.
This action proposes the preparation of wave run-up management guidelines to assist foreshore property owners in understanding the risks to their property from waves and providing guidance on appropriate management strategies to reduce the impacts on their property.

Action Overview:

Modify the existing foreshore in areas most affected by wave run-up to incorporate wave energy dissipating designs.

Flood Mitigation Outcomes:

Individual properties protected from wave run-up to the 100 year ARI (with 0.9m SLR).

Management Areas:

This action may apply to any management areas.

Projected Sea Level Rise:

The wave run-up heights and extent of impact will vary depending on the sea level used to identify the 100 Year ARI flood level.

Additional Information

Wave run-up can be managed through either reducing the ability of the wave to enter the property (through modification of the foreshore) or through appropriate design of any proposed buildings likely to be impacted by wave run-up. This is identified in the proposed development control matrix in Appendix A.

This action proposes the development of guidelines to assist property owners in managing the impacts of wave run-up on their property. The guidelines should provide details of how to identify the likely wave run-up risk (based on the property location) and design guidelines for options available for management of this risk.

It is noted that Action FM5 proposes the development of seawall maintenance and construction guidelines. Seawalls may in some cases provide protection from the impacts of waves. It is important that both sets of guidelines are developed in a collaborative manner.

The likely wave heights around the foreshore areas of Brisbane Water are provided in the Brisbane Water Flood Study. The overall height of impact (i.e. 100 Year ARI level plus wave run-up) and the extent of the impact will be dependent on the sea level used to identify the 100 Year ARI level.

Whilst all flood affected properties may need to consider the impacts of wave run-up in any development application submitted to Council, some properties that are not flood affected, may be impacted by wave run-up. The guidelines will need to identify all locations that should consider the impacts of wave run-up. As part of the development and assessment of this proposed action, locations likely to impacted by wave run-up (but not 100 Year ARI flooding) were identified. These locations are shown on the attached figure. The following criteria were used to identify the locations:

- Within 20 metres of the foreshore (this is the likely extent of wave run-up for most location around the foreshore); AND
- Below 3m AHD (this is the likely maximal wave height); AND
- Above the existing 100 Year ARI flood level.

Aerial photographs and a site inspection conducted on 6 April 2011 revealed that several of the identified locations would not provide benefit or be suitable for the construction of wave energy dissipation devices. The following criteria were used to subjectively assess and remove those locations that were not considered suitable. A location was removed if:

- The area was located in was open space and dwellings were not located in the vicinity; OR
- Continuous foreshore vegetation was present (mangroves provide natural wave-dissipation so there is no need to add further structures).

FM3 – Wave Run-Up Management Guidelines		
Considerations/Impacts		
Economic[1]	**Social**	**Environmental**
Construction of dissipation structures were estimated to be $1200 per linear metre and assume rock fill extends 4m from the shoreline at average 1m depth. This price may vary significantly depending on the nature of the design adopted. All works on private land would be the responsibility of private land owners. The costs shown in **Section 6** of this FRMP relate to the cost of developing appropriate guidelines for wave run-up management. This cost is estimated at $30,000.	This action is not likely to have substantial negative social impacts due to the small and generally localised scale of the action. To limit any visual impacts the design of these structures should be compatible with the landscape at each location.	Site-specific investigations would need to be undertaken to assess environmental impacts, particularly with regard to the cumulative impact of several adjacent structures. In order to minimise the impact on the estuary environment, foreshore structures would need to be designed in accordance with the DECC (2009a) guideline, *Environmentally Friendly Seawalls – A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries*.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

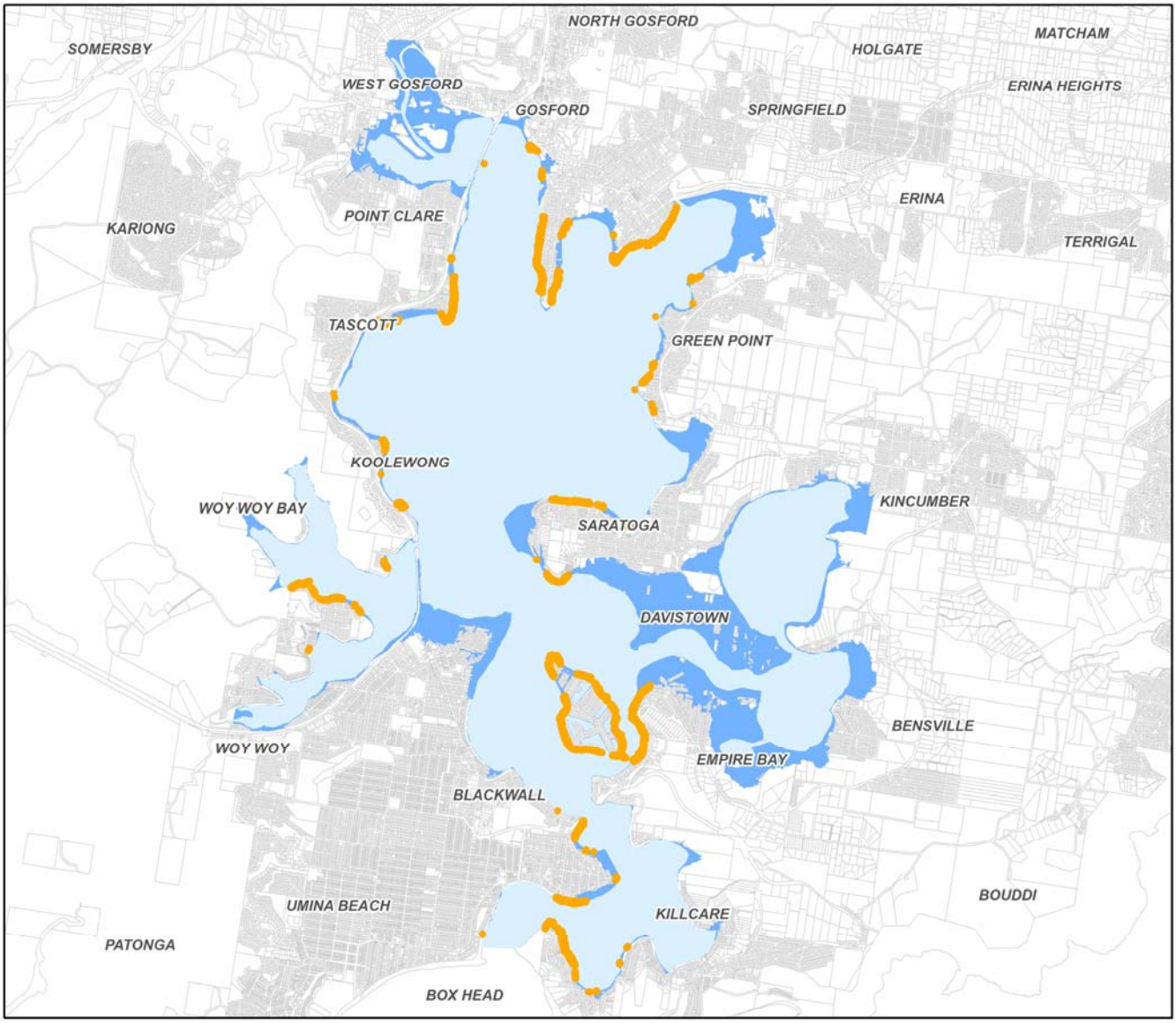


Figure C1: Locations identified during preliminary assessment of wave runup.

FM4 – Stormwater Floodgates/Tidal Valves		
Action Type: Flood Risk Modification	**Action Timeline:** Staged	**CCAP:** Not included
Background: Some low-lying areas are protected from direct coastal flooding due to a naturally higher portion of land that lies along the foreshore (between the location of interest and the estuary, basically functioning like a natural levee). However, many of these locations are connected to Brisbane Water by the stormwater system. As estuary water levels rise, the stormwater system is inundated and effectively 'backs up' into the previously unaffected areas and inundates them. Flap-type valves or small floodgates fitted to the outlets of stormwater pipes can be used in these instances to minimise surcharge of the stormwater system in a flood event.		
Action Overview: Install flood gates/valves on stormwater pipe outlets in locations affected by surcharge of the stormwater system. This action should seek funding to expand Council's current works program.		
Flood Mitigation Outcomes: Protection for locations affected by surcharge of the stormwater system (up to existing 100 year ARI).		
Management Areas: This action is floodplain-wide, as required. One area that may be of particular note is East of Lemon Grove Park, Ettalong. The foredune at Ettalong is likely to provide protection from the direct impacts of coastal flooding in this area. However, stormwater surcharge may be an issue for properties on low-lying land behind the dune.		
Projected Sea Level Rise: This action would provide some protection until the land itself above the stormwater outlet is overtopped. Adjacent areas near flood gates would need careful consideration.		
Considerations/Impacts		
Economic	**Social**	**Environmental**
The installation of stormwater floodgates or valves is likely to be reasonably inexpensive. Maintenance of floodgates may incur some cost over time, particularly since in some areas in NSW, floodgates are known to be somewhat prone to vandalism. Estimated capital (initial) and recurrent (per year) costs are likely to be $5000 and $1500 respectively (per structure) but would vary depending on the type and size of the outlet. Costing of this option has allowed for 20 gates to be installed.	The floodgates would be installed in locations that already have stormwater infrastructure and therefore social impacts are expected to be negligible.	The environmental impacts associated with the installation of floodgates are likely to be minimal as in most cases the flood gates would be implemented on drains which do not provide fish passage. However, if fish passage is identified at any of the proposed locations, the floodgates should be designed in a "fish-friendly" manner. Guidelines on fish-friendly structures are provided in the Queensland Government's *Fisheries Guidelines for Fish-Friendly Structures* (DPIF, 2006).

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

Examples of tidal valves/stormwater floodgates.

Photograph Sources: http://www.dpi.qld.gov.au/documents/Fisheries_Habitats/Water-barriers-Fact_Sheets.pdf and http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/208851/KEY-TIPS-FOR-A-FISH-FRIENDLY-FARM.pdf

FM5 – Seawall Maintenance and Raising Guidelines		
Action Type: Flood Risk Modification	**Action Timeline:** Staged	**CCAP:** Included
Background: Seawalls do not necessarily provide protection in large flood events (due to their generally discontinuous nature) but may assist in reducing the impact of smaller flood events and wave run-up.		
Action Overview: Undertake a program of seawall maintenance and raising for existing seawalls in appropriate locations along the foreshore, ensuring that seawalls are maintained in accordance with *Guidelines for Environmentally Friendly Seawalls* (DECCW, 2009a). Consideration should also be given to the design criteria specified in Action FM3.		
Flood Mitigation Outcomes: Maintains existing flood protection and provides some protection from wave run-up.		
Management Areas: This action has been recommended for MA7, however this management action may be appropriate for other areas as part of climate change adaptation and could be further investigated in the CCAPs.		
Projected Sea Level Rise: Seawalls can provide some protection against the tidal inundation impacts of projected sea level rise.		
Additional Information		
This action does not propose the introduction of additional seawalls around Brisbane Water but rather the maintenance, and in some areas raising, of existing seawalls to improve flood protection. It is noted that an investigation of the existing quality of seawalls (e.g. construction type, evidence of slumping or other failures) was not undertaken and further investigation is necessary prior to implementation. Seawall maintenance and raising could be done in conjunction with or instead of wave run-up protection works outlined in Option FM3. It is recommended that Council develop seawall design and construction guidelines. This is also discussed in Option FM3.		
Considerations/Impacts		
Economic	**Social**	**Environmental**
The cost of seawall maintenance and raising would vary according to the location and condition of existing sea walls. Costs have been estimated at an average of $415 per linear metre, however costs are likely to be highly dependent on the current condition of the wall and the amount of raising implemented. The costs shown in **Section 6** of this FRMP relate to the cost of developing appropriate guidelines for sea wall maintenance and raising. This cost is estimated at $30,000.	Raising of seawalls may impact on visual amenity and connectivity to the foreshore, particularly for recreational purposes. In several locations, the maintenance and raising of seawalls conflicts with the management actions recommended in the *Brisbane Water Estuary Management Plan*	This action is not likely to have substantial negative environmental impacts due to the fact that this action is only proposed where seawalls already exist.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

C.2 Property Modification Actions

PM2 – Voluntary House Raising Program		
Action Type: Property Modification	**Action Timeline:** Staged	**CCAP:** Included
Background: House raising involves elevating an existing house by progressively raising the piers and associated floor area to a level above the flood planning level. The construction sequence to achieve required raising will be dependent on the individual dwelling. This action is not applicable for properties which are "slab on ground" construction or where the dwelling lies within a high hazard flood area.		
Action Overview: Implement a voluntary house raising program for identified dwellings that meet specified criteria and develop a Council policy for voluntary house raising. It is recommended that flood hazards at identified properties are monitored over the course of time prior to any house-raising being implemented (refer to the information provided in the "additional information" section of this table).		
Flood Mitigation Outcomes: Reduces flood risk to residents (selected properties only).		
Management Areas: This action may apply to any management areas.		
Projected Sea Level Rise: Hazards will need to be monitored with projected sea level rise as low hazard areas transition to high hazard. This may result in properties no longer being suitable for house raising (i.e. in high hazard areas) or additional houses being suitable for house raising (i.e. over floor flooding in a 5 year ARI event as a result of SLR).		
Additional Information		
This action identifies the worst affected residential properties on the floodplain and, through state government assistance, these properties can become eligible for voluntary raising so that the flood risk can be reduced. This action can only be applied to houses that are not of slab-on-ground construction and do not lie within a high hazard location. The following criteria have been established to identify properties suitable for ongoing monitoring for possible voluntary house-raising: - Over floor flooding in the existing 5 year ARI event; and - Comprises a residential dwelling/building of construction type suitable for house-raising. It is estimated that there are 38 properties that fulfil this criteria The suitability of house raising would be dependent not only on the building construction type, but also on the levels of the surrounding infrastructure and landform. It is recommended that Council develop a house raising policy to facilitate the process of evaluating the suitability of properties where owners apply for house raising subsidies. Council may look at the potential for house raising subsidies being used as part of a larger redevelopment of the property (which includes the raising of the existing floor levels above the FPL). As low hazard areas of the estuary foreshores transition to high hazard over the course of time (with projected sea level rise) identified properties may become more suitable for land swap or property purchase. House-raising may also become unsuitable for some properties that are highly affected under sea level rise (e.g. if regular tidal inundation becomes dominant at the property and access becomes restricted).		
Considerations/Impacts		
Economic	**Social**	**Environmental**
Funding for VHR is often offered as a ratio of $2 State to $1 Council or local contribution. Councils often structure VHR schemes to require the local contribution to be fully paid by the house owner as the beneficiary of the damage reduction under the project. In these cases councils may assist the owner by waiving their inspection and approval fees. The cost of raising one house can vary significantly but for the purposes of this assessment it has be estimated to be in the order of $40,000. 38 properties have been identified as potentially suitable for house raising. The total cost of raising all of these houses is estimated at $1.52 Million (2:1 State Government and Local Funding). The preparation of a house raising policy would incur a one off cost of $10,000 (FM2a). Monitoring the hazards at the most at risk properties would incur a small recurrent cost of approximately $2,000 (FM2b).	Social impacts would generally only occur on a localised scale. Long-term impacts on visual amenity may result, particularly for adjacent properties. However, it is likely that the floor levels will be raised to similar or slightly higher levels to surrounding properties, and raising must be undertaken within relevant development controls.	Environmental impacts would be minimal if the modifications took place only within the existing building footprint.

PM4 – Property Flood Risk Education Program		
Action Type: Property Modification	**Action Timeline:** Staged	**CCAP:** Not included
Background: As compared to Action EM1 (which provides an opportunity for education mainly relating to emergency response and evacuation), Action PM4 provides an opportunity for education in terms of protection of property. It is considered that there is a need for property owners and potential buyers of properties need access to risk information for them to be able to make informed decisions about how they manage risks. This could include measures such as ensuring that spatial risk information is readily available to members of the public, providing flood risk brochures at real-estate agencies, and brochures titled "What does my S149 Certificate mean?" to be included with all S149 certificates when received by property purchasers.		
Action Overview: Conduct a program of strategic, balanced and socially sensitive education to advise the local community and prospective property purchasers about the risk and effects of coastal flooding.		
Flood Mitigation Outcomes: Educates the wider community on the impacts of flood events.		
Management Areas: This is a floodplain-wide action that applies to all management areas.		
Projected Sea Level Rise: This action could include information relating to sea level rise but it would not result in any direct protection from coastal flooding or tidal inundation associated with sea level rise.		
Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be fairly minor, but would include costs for preparation and distribution of information materials. Actual costs would be dependent upon the program adopted, estimated to be a $20,000 initial cost and $4,000 recurring annual cost. It is noted that these costs would likely be included in Council's existing budget.	This action has the potential to have a social impact, especially for property-owners that hold flood-affected land. However, the benefits of an informed community and future property owners should also be considered. This action has been assigned an action timeline of "staged" since additional consideration may be required prior to undertaking this action given its potential sensitivity in the community, particularly with property owners in the floodplain.	Environmental impacts would be negligible.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM5 – Analyse and Communicate Sea Levels		
Action Type: Property Modification	**Action Timeline:** Immediate	**CCAP:** Included

Background:

This action includes the acquisition of continued monitoring of sea levels and periodic data analyses to ascertain the rate of sea level rise relevant to Brisbane Water. The gauges would need to meet strict standards set by the National Tidal Facility to ensure the data is reliable and fully quality controlled. Responsibility of maintenance and reporting could be transferred to the State Government as part of the NSW *Monitoring, Evaluation and Reporting Strategy*. Water level gauges would need to be maintained accordingly.
It is noted that the primary tidal gauge at Fort Denison in Sydney remains relevant to sea level rise analysis and projections, as per Council's Sea Level Rise Discussion Paper (Whitehead and Associates, 2015). In addition, Council's current sea level rise policy is primarily linked to the IPCC outcomes.

Action Overview:

Continue to monitor sea levels and perform periodic analyses to ascertain the rate of sea level rise relevant to Brisbane Water. Maintain gauges as required. Periodically communicate results to the community in an effective manner.

Flood Mitigation Outcomes:

Monitoring data can be used to establish trigger levels for use in land use planning.

Management Areas:

All Management Areas

Projected Sea Level Rise:

This action relates directly to sea level rise however it would not result in any direct protection from storm surge or tidal inundation associated with sea level rise.

Additional Information

This action aligns with the *Brisbane Water Estuary Management Study* (Cardno, 2011a), which also recommended the continued monitoring of sea levels into the future.
It is proposed that relevant water level data (likely to be sourced from the Fort Denison Gauge) is to be analysed within every Council term or within two years of a new IPCC report. This analysis will provide a key input to Council's review of the sea level rise planning level (which is to be reviewed at the same time in accordance with Council's resolution, see Appendix B for details).
In addition to the Fort Denison Gauge, it is noted that local water level gauges are located at the Punt Bridge (Erina), Wharf Street (Erina) and at Koolewong and Ettalong. However, MHL has advised that the water level gauges within Brisbane Water have an accuracy and tolerance for error of +-2cm. Further, they advised that they are primarily used to record tidal heights. Ocean tide sites are used to monitor sea level rise.

Considerations/Impacts

Economic	**Social**	**Environmental**
The economic impact of this management action would be fairly minimal. It is estimated that the acquisition and analysis of data would cost approximately $5,000. This would be done on a periodic basis as outlined above.	Social impacts may include negative reactions to the release of sea level rise data. Reactions may include rejection of the concept of sea level rise and concern that release of information may devalue private properties.	Sea level rise is predicted to affect the whole of the Brisbane Water foreshore floodplain. As such, action PM5 applies to all management areas in terms of monitoring, analysis and communication of results to the public.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM6 – Review the Functionality of Critical Infrastructure and Facilities During a Flood Event		
Action Type: Property Modification	**Action Timeline:** Staged/Trigger	**CCAP:** Included for some locations

Background:

Critical infrastructure and facilities are often required during flood events to assist injured and displaced people, however some facilities are actually situated on flood-prone land. Relocation of such facilities to a location outside the floodplain is important so that these facilities do not become inundated or isolated during a flood event and can perform their emergency service response services adequately. It has been assumed for this action that relocation takes place to a location outside the PMF flood extent (with 0.9m SLR).
It is noted that relocation of these facilities may be done on a temporary basis during a flood event to a location that has effective access to emergency response and Council staff and adequate facilities to ensure effective operations during a flood event. A full cost benefit analysis would need to be undertaken to identify the preferred location and approach.

Action Overview:

A review both the SES Headquarters (Gosford) and the Woy Woy Policy station would be undertaken by the relevant agency. Council would provide the relevant information to assist with this review and would work collaboratively with the agencies to ensure appropriate operational arrangements can be made for these facilities during a flood event.

Flood Mitigation Outcomes:

Elimination of flood risk for critical infrastructure, and enhancement of emergency services to operate in flood emergencies.

Management Areas:

MA	Location	Notes
4	NSW SES Headquarters (Gosford), Erina	The NSW State Emergency Service provides emergency assistance during floods and storms. Although some of the grounds and buildings are likely to be unaffected, mobilisation via Pateman Road and The Entrance Road would be impeded due to flooding. Relocation of the SES headquarters may also need to consider the relocation of RFS and Council Depot.
14	Woy Woy Police Station, Woy Woy	This facility is likely to be subject to coastal flooding in events greater than the existing 20 year ARI. Relocating this infrastructure to a location outside the floodplain would provide flood-free access to and from the station so that more reliable assistance could be provided to those in need of police assistance during a flood event.

Projected Sea Level Rise:

Under projected sea level rise, this action would remove the flood risk for those selected properties and/or allow flood-free access for emergency services.

Considerations/Impacts		
Economic	**Social**	**Environmental**
The costs of this option have been estimated based on the review of the facilities and the impacts of flooding on the functionality of the facilities during a flood event. Council would be involved in the transfer of relevant flood information relating to these facilities and the associated access routes. It is estimated that the cost of this review would be $20,000 per site.	Social impacts would be relatively minor, and would probably be primarily dependent on how far away the new site was to be from the community accessing it. If a more central location is identified, this may have social benefits.	Environmental impacts would depend on the existing land use of the new site and the future land use of the current site. For example, infrastructure being relocated to an existing building with the land use of the original infrastructure site remaining as was, environmental impacts would be negligible since no actual change has taken place to building structures. However, if the new site had to be cleared, then environmental impacts would obviously be higher. If the original infrastructure site was to be converted to coastal open space after relocation, a positive environmental outcome could apply. The matrix assessment has assumed that the net environmental impact of the infrastructure relocation would be negligible.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM7 – Review and Amend Planning Instruments and Development Controls		
Action Type: Property Modification	**Action Timeline:** Immediate	**CCAP:** Included

Background:

This action involves a review of planning instruments and development controls. Amendments would be made accordingly to ensure consistency with coastal flooding and the impacts of predicted sea level rise on coastal flooding. A draft development control matrix (**Appendix A**) for the Brisbane Water floodplain has been prepared for inclusion in the Gosford Development Control Plan (DCP) 2013. Additional details regarding planning recommendations are provided in **Chapter 4** of this FRMP.

Action Overview:

Review and amend planning instruments and development controls to ensure consistency with coastal flooding and the impacts of predicted sea level rise on coastal flooding and tidal inundation. Enforce amendments and review development controls every five years in accordance with updated sea level rise data and trigger levels.

Flood Mitigation Outcomes:

Properties progressively protected to the Flood Planning Level or PMF (as appropriate).

Management Areas:

This is a floodplain-wide action that applies to all management areas.

Projected Sea Level Rise:

The LEP 2014 and DCP 2013 consider climate change in broad terms. In the future Council may wish to include specific sea level rise predictions in the definition of hazard areas utilised within the planning instruments and development controls. This action proposes to include an allowance for SLR in the Flood Planning Level (in accordance with Council's Climate Change Policy, D2.11, 2013 and subsequent Council resolutions provided in **Appendix B**). This will provide protection for properties from the impacts of storm surge and increased tidal inundation related to sea level rise by changing the way that the floodplain is developed.

Additional Information

The following planning measures are recommended for the Brisbane Water floodplain:

- Allow filling on a lot-by lot basis within the Brisbane Water foreshore floodplain (but not within catchment floodways or catchment flood storage areas);
- Restrict subdivision within the Brisbane Water flood planning area where the proposed subdivision does not have suitable emergency access or the development is likely to have adverse impacts on flood behaviour;
- Make provisions for wave run-up protection designs for dwellings and infrastructure;
- Application of the Flood Planning Level based on 100 Year ARI level contained within the Flood Study (Cardno, 2013b), sea level rise and a freeboard; and
- Consideration of the interim development controls for the Brisbane Water foreshore floodplain prepared as part of the FRMS.
- It is recommended that Flood Certificates issued by Council should identify the type of flooding that impacts the property (i.e. storm surge, riverine and / or overland flow).

Filling

Due to the impracticalities of implementing filling on a regional basis (as described in Action FM9), increasing the capacity of landowners to fill individual lots within the floodplain is likely to be more appropriate, assuming drainage requirements are adequately met and environmental impacts are suitable managed.
Filling of the land within the Flood Planning Area is not permitted under the current DCP unless it is allowable as part of an adopted Floodplain Risk Management Plan. It is the recommendation of this FRMP that appropriate filling is permissible except in those areas defined as flood storage or flood fringe areas for catchment flooding.
This action may assist with planning into the future for the projected impacts of tidal inundation as a result of sea level rise. If over time, most lots have been raised substantially, there may be opportunities for Council to raise the infrastructure supporting the properties (e.g. roads, water and sewer) resulting in the areas remaining viable into the future. As such, Council may seek to encourage filling as part of development applications in suitable locations within the Brisbane Water floodplain.

Subdivisions

The current DCP does not permit subdivision for the purposes of creating additional lots within the flood planning area. It is recommended that this control be reviewed to consider permitting appropriate subdivisions that provide building platforms at or above the Flood Planning Level and that do not exacerbate flood levels, velocities or flow distributions at any other location, including cumulative impacts of incremental development should all the proposed lots become fully developed. Consideration should also be given to emergency access and evacuation.

Wave run-up protection designs for dwellings and infrastructure

This would incorporate a provision in Council's DCP that relates to wave run-up protection designs for new and existing dwellings and infrastructure. This could include recommendations for designs such as enhanced window and door seals or raised floor levels on new dwellings located in wave run-up zones. This may also include the development of sea wall and foreshore structure design guidelines (as discussed in FM3 and FM5).

PM7 – Review and Amend Planning Instruments and Development Controls

Flood Planning Level

The application of a Flood Planning Level to development reduces risk to life and property, thereby reducing the overall damages to the floodplain. The existing FPL for the Brisbane Water floodplain is set at a constant 2.45mAHD. This does not account for changes in flood levels as a result of sea level rise and in addition, the Flood Study (Cardno, 2013b) found that the flood level varies across the floodplain and as such a constant FPL is not suitable.

A revised FPL has been recommended to account for this variability and the future risk associated with sea level rise. However, due to the uncertainties associated with applying the risk of sea level rise into planning considerations, it is recommended that a short term approach to considering sea level rise be adopted as part of an interim FPL until the outcomes of the CCAPs (PM9) are known.

The recommended interim FPL for the Brisbane Water foreshore floodplain is:

FPL = 100 year ARI DSWL + SLR + 0.5m Freeboard

- SLR should be incorporated in accordance with Council's Resolution (March 2015 or any subsequent amendment). SLR should be commensurate to the asset life and planning horizons. A minimum planning horizon of 35 years should apply to all development types. The graph (provided in Appendix B) provides an indication of typical design life estimates and the associated sea level rise planning level.
- At locations where the adopted FPL is higher than the existing PMF, the adopted FPL should still be used.
- The proposed life span for proposed development should be considered when applying SLR to FPLs. The graph (provided in Appendix B) provides an indication of typical design life estimates and the associated sea level rise planning level.

Specific recommendations for design levels for all development types are provided in the Draft Development Control Matrix provided in **Appendix A**. Additional details regarding the application of sea level rise within the FPL are provided in **Chapter 4** of this FRMP.

Adaptive Design

Adaptive design methods should be encouraged in areas likely to be impacted by sea level rise. This may include construction methods that allow for the floor level to be raised over time without significant construction impacts (e.g. allowing additional ceiling height).

Interim Development Control Matrix

An interim development control matrix has been prepared as part of the FRMS and is provided in **Appendix A** of this FRMP. The matrix has been developed to incorporate the issues outlined above and to consider the objectives of DCP 2013 and LEP 2014. Future amendments to DCP documentation utilise this matrix in the development of flood related development controls for the Brisbane Water floodplain.

The development control matrix has identified controls relating to three management areas:

- 100 Year ARI High Hazard
- Flood Planning Area (equal to land below the Flood Planning Level and excluding the High Hazard area)
- PMF Extent (excluding the Flood Planning Area)

The proposed Flood Planning Level (FPL) is equal to the 100 Year ARI Flood level + sea level rise + 0.5m Freeboard. When considering the current IPCC results and a recommended minimum planning horizon of 35 years, this level is above the PMF at all locations in the Brisbane Water foreshore floodplain. As such, there will be no PMF extent with regards to development controls. However, if there are changes to Council's existing sea level rise policy or the proposed FPL, the PMF area controls may be relevant.

Floodplain Development Masterplans

It is recommended that masterplans are developed for Key areas within the Brisbane Water floodplain to assist property owners to understand the most flood compatible way to redevelop their land. This could include guidance on applying floor levels and identification of areas where property filling is recommended and the fill levels for each location that may be appropriate.

Further details regarding proposed planning measures including sea level rise planning levels is provided in Chapter 4 of this FRMP. Any updates to the DCP or associated planning document should consider this FRMP in its entirety. The planning recommendations provided in this FRMP are recommendations only and cannot be inconsistent or incompatible with the provision of an environmental planning instrument.

PM7 – Review and Amend Planning Instruments and Development Controls		
Considerations/Impacts		
Economic	**Social**	**Environmental**
Estimated costs are $50,000 capital cost and $10,000 recurrent cost. Cost includes an initial review and future updates every five years. Studies associated with the further investigation areas would be supplementary to this. Some budget allocation is included in Council's annual budget Economic benefits would be provided in the form of reduced flood damages.	The social impacts of modifying Council's development controls would not be substantial; however impacts from implementing actions under the new development controls (e.g. filling properties) may have social implications.	The environmental impacts of modifying Council's development controls would not be substantial; however impacts from implementing actions under the new development controls (e.g. filling properties) may have environmental implications.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM9 – Develop Climate Change Adaptation Plan		
Action Type: Property Modification	**Action Timeline:** Staged	**CCAP:** Included

Background:

The detailed assessment of the impacts associated with increased tidal inundation as a result of sea level rise was beyond the scope of the FRMS. However, preliminary mapping and assessments have been undertaken and are presented in Appendix G of the FRMS. Action PM9 recommends that the information provided is used to form part *Climate Change Adaptation Plans*. This could include a policy position from Gosford Council and specific development controls (in some cases, location-specific).

Under the floodplain risk management process, this action did not rank particularly high since there are existing flood risks that must be managed and actions to address these existing risks were given a higher priority under this process. However the importance of Action PM9 under other planning mechanisms in conjunction with the floodplain risk management process is acknowledged given Council's Sea Level Rise Policy. There is an important need to start planning for the potential impacts of sea level rise now, given new developments may have an asset life of 50+ years and subdivisions approved now could have potential for long term use of the land and therefore developments should take account of the future risk associated with sea level rise Planning horizons and consideration of sea level rise in planning is discussed further in **Chapter 4**.

Action Overview:

Develop management strategies to adapt to the impacts of sea level rise on tidal inundation. This should include a policy position from Gosford Council and specific development controls (in some cases location specific).

Flood Mitigation Outcomes:

Mitigation of the impacts on properties, infrastructure, fauna, flora and heritage.

Management Areas:

This is a floodplain-wide action that applies to all management areas.

Projected Sea Level Rise:

This action relates directly to sea level rise and, over time, should provide protection for properties from the impacts of storm surge and increased tidal inundation related to projected sea level rise by changing the way that the floodplain is developed.

Additional Information

It is a key recommendation of this FRMP that *Climate Change Adaptation Plans* are prepared to ensure an integrated approach to dealing with the risks associated with climate change. It is envisaged that a LGA-wide CCAP would be prepared in the first instance as an overarching document for subsequent plans. Projected sea level rise priority areas would then be identified (based on both flood affectation and the relevance of strategies and plans) and more location-specific plans would be formulated.

It is anticipated that the Hunter & Central Coast Regional Environmental Management Strategy would be used to facilitate the preparation of the CCAPs. This decision support tool includes a handbook to provide ensure consistency and transparency in decision-making and collaboration, engagement and communication processes so as to manage relevant climate change risks. A report on adaptation to sea level rise by design (Clouston Associates, 2012) may also be of assistance in consideration of management strategies as part of this action.

The projected impacts of sea level rise on the following assets could be incorporated into the investigations:

- Residential areas, both existing and proposed (i.e. identified growth areas) and the long term viability of these areas for development both with and without adaptation strategies.
- Public infrastructure – investigate the long term viability of the infrastructure servicing potentially affected areas. Strategies should be identified for works to protect these assets from the impacts of sea level rise and how this may be incorporated into the existing maintenance regime. Trigger levels should be identified when infrastructure is no longer viable (e.g. tidal levels at which road surfaces need to be upgraded / raised due to increasing frequent inundation).
- Heritage items and places – Investigate the impacts of future flooding and emergency response arrangements on heritage buildings, structures, items and places This should include a field survey of historic infrastructure and archaeological items and review of known heritage database records for both Aboriginal and non-Aboriginal heritage. Recommendations for the mitigation of negative impacts on heritage items should also be formulated.
- Flora, fauna and other natural resources – Investigate the impacts of projected sea level rise on flora and fauna, with particular emphasis on changes in foreshore vegetation. Reference can be made to Appendix D of Cardno (2010b) Sea Level Rise and the Estuarine Intertidal *Zone – Discussion Paper*.

Flood risk mitigation works should be assessed within the context of the findings of these studies. This may include reviewing some of the options presented in the FRMS which resulted in minimal current flood benefits but that may provide flood benefits for flooding conditions as a result of SLR. One particular example is voluntary purchase of high risk properties. Voluntary purchase is a potential option where there are highly hazardous flood conditions and the principal objective is to remove people living in these properties and reduce the risk to life of residents and potential rescuers. Under existing sea level conditions, there are no legal habitable dwellings within the high hazard extent for Brisbane Water. However, due to increased

PM9 – Develop Climate Change Adaptation Plan		
flood depths as a result of sea level rise, over time additional areas are likely to become high hazard. This will occur on the lowest lying properties first. As such, those properties identified as having over ground flooding in a 5 year ARI event should undergo ongoing monitoring and evaluation to assess the ongoing viability of the property for residential purposes. If its viability becomes doubtful, then the possibility of voluntary purchase may be considered. A further outcome of the CCAPs would be the revision of flood related development controls. The current planning recommendations for the Brisbane Water floodplain as a whole are provided in Action PM7. Once the outcomes of the CCAPs are known, these controls should be reviewed. In addition, location specific controls may become necessary due to increased risk, access and ongoing viability of the area. Option PM8 (outlined in the FRMS) provided some details of the likely local issues to be addressed. This option has not been included in the recommendations of this FRMP as it will be primarily dependent on the outcomes of the CCAPs and would be scoped accordingly at that stage.		
Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be in the order of $480,000 capital cost and $72,000 recurrent cost. This assumes the preparation of an initial LGA-wide plan and then the preparation of plans for two subsequent priority areas. Recurrent cost would comprise future amendments to strategies and policies as new climate change and sea level rise data becomes available. Costs would be highly dependent on the level of detail adopted. The economic benefits would be in the reduced damages associated with flooding and tidal inundation as a result of sea level rise.	Negative social impacts would be negligible; some social benefits would be likely.	Environmental impacts of strategy development would be small, however there may be potential environmental implications associated with the implementation of these strategies.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM10 – Evaluate Utilities Infrastructure		
Action Type: Property Modification	**Action Timeline:** Staged	**CCAP:** Included

Background:

The Brisbane water foreshore floodplain comprises a range of above-ground and underground infrastructure assets including electricity, water, sewer, natural gas and telecommunications infrastructure. These assets are predominately managed by private companies, with the exception of water and sewer assets which are managed by Gosford City Council's Water and Sewer department. Many of these assets are designed to withstand intermittent flooding, however the impact of projected sea level rise on utilities and services is potentially a major issue within the floodplain.

In accordance with the Floodplain Development Manual, the FRMS incorporates economic damages for private properties (i.e. residential, commercial, industrial land uses) however economic damages for infrastructure and utilities has not been assessed. This action would aim to ascertain levels of impact on assets, especially in the context of sea level rise.

Planning for sea level rise requires the involvement of private asset holders so that integrated decision-making can be undertaken for affected areas and appropriate management strategies implemented.

Action Overview:

Evaluate utilities infrastructure relative to flood risk and sea level rise benchmarks. Partner with private utilities managers to better understand the risks to assets and formulate a plan of management over the long term for integration into Council's planning objectives.

Flood Mitigation Outcomes:

Evaluation outcomes should progressively minimise the impacts of flooding on utilities infrastructure, particularly with sea level rise.

Management Areas:

This is a floodplain-wide action that applies to all management areas.

Projected Sea Level Rise:

Over time, this action should provide protection for utilities infrastructure and allow the floodplain to continue to have access to utilities and services infrastructure.
This action should be undertaken in conjunction with PM9 (CCAPs) to identify assets at risk due to sea level rise and ensure the long term viability of assets into the future.

Additional Information

Consultation with and collaboration between private utility/service owners, Council asset managers and other infrastructure managers (e.g. RMS) would be necessary as part of this action. Consultation was initiated with the relevant agencies by Council as part of the FRMS (Cardno, 2015), however, responses were limited and engagement would need to be improved through the undertaking of this Management Action. Consideration would need to be given to how partnering and collaboration can be achieved efficiently. Strategies for integrated management of assets should be formulated with recommendations made regarding the implementation of flood modification actions (structural works) in the future.

Considerations/Impacts

Economic	Social	Environmental
Economic impacts would be fairly minimal and would relate to investigations and consultation undertaken. Economic impacts would be in the order of $100,000 capital cost and $7,500 recurrent cost. It would be most efficient if this action is undertaken concurrently with the CCAPs (PM9) or as a component of them. Costs incurred on this action that are additional to undertaking the CCAPs could be incorporated within Council's existing budget and staff.	Social impacts of the review itself would be negligible, however the implications of the findings of the review may have some indirect social impacts, such as disruption to utilities and services.	Environmental impacts of the review would be negligible.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

PM11 – Overland Flows Studies		
Action Type: Property Modification	**Action Timeline:** Immediate	**CCAP:** Included

Background:

The Brisbane Water Flood Study assessed the impacts of ocean storm surge on the foreshore of Brisbane Water. The FRMS assessed options for managing this flood risk. Several recommendations (such as the use of filling of private property) may have impacts on overland flows. As such, this action recommends the undertaking of overland flow studies for the purpose of information planning decisions in areas impacted by both storm surge and overland flows. These overland flow studies could also be used in the analysis of flood management options as part of the CCAPs. This may include options identified as part of the FRMS.

Action Overview:

Develop appropriate hydraulic model to assess overland flows within the context of the Brisbane Water foreshore areas.

Flood Mitigation Outcomes:

No direct flood mitigation actions, however the results of the investigation will allow the evaluation of planning measures for management of storm surge impacts and will also be used in the preparation of CCAPs.

Management Areas:

This is a floodplain-wide action that applies to all management areas. However, several management areas have already been subject to previous overland flow investigations.

MA	**Location**	**Status of Overland Flow Assessments**
MA3	Koolewong and Tascott	None undertaken.
MA3	Point Frederick, East Gosford and Green Point	Existing studies available. Review and / or updating may be required.
MA7	Kincumber, Kincumber South and Bensville	Existing studies available. Review and / or updating may be required.
MA9	St Huberts Island	None undertaken.
MA13	Booker Bay	None undertaken.

Projected Sea Level Rise:

Overland flow studies can be used to evaluate management options identified as part of the CCAPs (PM9). This may include options that were identified as part of the FRMS. Several of these options were not included in this FRMP as they did not have significant benefits for flooding under the existing sea levels. However, with sea level rise these options may become viable.

Considerations/Impacts		
Economic	**Social**	**Environmental**
The estimated cost for a full investigation is $100,000 per management area. Costs might be lower for those locations requiring only an updated investigation. It has been assumed that one investigation would be undertaken per year for 5 years.	Social impacts of the review itself would be negligible.	Environmental impacts of the investigations would be negligible.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

C.3 Emergency Response Modification Actions

EM1 – Emergency Response Education Program		
Action Type: Emergency Response Modification	**Action Timeline:** Staged	**CCAP:** Not included
Background: Flood-risk education can serve as a tool for indirectly reducing risk to life during flood events. Preparedness for a flood event is likely to improve as a result of increased community flood-awareness. This action has been assigned an action timeline of "staged" since it is anticipated that implementation would take place progressively over the course of time. An initial education program based on the results of the FRMS can be undertaken immediately, however it is anticipated that additional and modified educational material would be required to be disseminated subsequent to the results of the CCAPs.		
Action Overview: Conduct targeted flood education programs for flood-affected residents.		
Flood Mitigation Outcomes: Educates the wider community about the impacts of flood events on access and evacuation.		
Management Areas: This action applies to all management areas. Flood-affected residents within each management area would form the target audience for the education program.		
Projected Sea Level Rise: This action is relevant in the existing flood scenario and does not provide protection under projected sea level rise.		
Additional Information		
This action involves conducting targeted flood education programs for flood-affected residents through a variety of means, such as the distribution of brochures to households in the area or advertisements in the local newspaper advising residents of flood-related resources (e.g. held at Council or the library). This Management Action would build on the actions already being undertaken by SES and Council including a review of the Draft *Flood Education Strategy – Building Community Capacity on the Central Coast: 2011 – 2015*. Residents could be provided with an informative overview of what to expect during a flood (e.g. flood evacuation procedures, location of evacuation centres, access to evacuation centres etc.). Residents could be referred on to the current Gosford City Flood Plan for further information and details. A multi-lingual education program is desirable, as cultural and language barriers may inhibit emergency response during a flood event. Education for specific groups of residents such as older people in retirement villages/aged care homes (e.g. Leisure Living Retirement Village and Aged Care, West Gosford), or residents with properties that may be cut off from transport routes (e.g. Camellia Circuit, Woy Woy), should also be targeted by the program. Where relevant, it is recommended that Council liaise with the SES to ensure that relevant organisations (such as the retirement village on Yallambee Avenue) have appropriate emergency response plans and that these are updated in accordance with the findings of this FRMP. It is noted that education for residents in areas that are not directly flood-affected is also likely to be relevant. For example, those residents in locations whose residences do not lie on flood prone land, however they are likely to experience the effects of road closure.		
Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be in the order of $250,000 capital cost and $25,000 recurrent cost. Recurrent costs likely to be higher (based on salary for one part-time employee). Costs would be highly dependent on the program adopted. The strategy would need to be reviewed annually and reinforced with community knowledge. Funding would likely be based upon the availability of grants and existing Council and SES budgets.	Negative social impacts are likely to be minimal. Positive social outcomes may result from an increased understanding of flood emergency procedures.	Environmental impacts would be negligible.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

EM2 – Flood Related Signage		
Action Type: Emergency Response Modification	**Action Timeline:** Immediate	**CCAP:** Not included

Background:

Flood signage along flood liable roads allows residents to be aware of whether it is dangerous to traverse a particular section of road during a flood event. Signs could display "Salt water flooding over road."

It is noted that technology currently exists that incorporates real-time water level monitoring data into flood warnings such as Portable Variable Message Signage (VMS) which is used on roads to alert the community of hazards including floods. This could be considered in conjunction with Action PM5 and Action EM4 to combine technologies.

Action Overview:

Survey, install and maintain flood signage at selected locations.

Flood Mitigation Outcomes:

Assists in indicating to residents that roads may not be safe to cross during flood events.

Management Areas:
The locations identified for permanent signage were based on a threshold of >0.3m peak flood depth (vehicle stability depth) for the 20 year ARI event.
VMS could be deployed to any location within the floodplain.

MA	Location (approximate distance to closest residences)
1	Yallambee Avenue, West Gosford (120m) and Central Coast Highway, Gosford (120m)
14	Brick Wharf Road, Woy Woy (10m)
	North Burge Road, Woy Woy (10m)
	Blackwall Road, Woy Woy (200m)

Projected Sea Level Rise:

This action is relevant in the existing flood scenario. Under projected sea level rise, many more roads would be affected.

Additional Information

This Management Action allows for the installation of flood depth markers at the 5 locations listed above. The prioritisation of the installation of flood depth markers can use the flood data (depths and extents) provided by the Flood Study (Cardno, 2012). If additional funding becomes available, flood depth markers may be considered at other locations as summarised in **Table 9.1** of the FRMS (Cardno, 2015).

Whilst there are only limited locations with significant road flooding in more frequent events (20 Year ARI or less), in a 100 Year ARI event, there are 13 locations where roads are flooded to a depth greater than 0.3m (see **Table 9.1** of the FRMS). Electronic signage is generally considered to provide a better response by motorists. However, given the infrequent nature of road flooding in the floodplain permanent electronic signage is not considered cost effective. As such, this Management Action has incorporated the purchase of 8 portable VMS units to be deployed by Council during a flood event. Given the relatively slow rate of rise of flood waters, there should be adequate time to allow for the deployment of portable signage. With the highest risk locations and those locations with fastest inundation identified for permanent flood depth markers as above.

The type and location of signage acquired and deployed would likely be reviewed in further detail before implementing this option. There may be benefits across other floodplains within the LGA to be considered.

Considerations/Impacts

Economic	Social	Environmental
Estimated capital (initial) and recurrent (per year) costs are approximately $1200 and $200 (per permanent depth marker set). Plus estimated capital costs of $10,000 per portable VMS unit with recurrent costs of $500 for maintenance. The cost of the VMS units may be able to be off set against other Council budgets as they could have multiple uses within Council.	This action may not be well-received by residents who live nearby to a location earmarked for flood signage. Residents may feel that their property will be devalued because flood signage may indicate to prospective property purchasers the presence of flood risk. For each location above, the distance to the closest residences has been calculated, giving an indication of how acceptable the flood signage is likely to be among nearby residents.	Environmental impacts would be minimal due to the small scale of the works.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

EM3 – Review NSW SES Flood Plan		
Action Type: Emergency Response Modification	**Action Timeline:** Immediate	**CCAP:** Not included

Background:

The following provides suggestions for matters to be included in a revised *Gosford City Flood Plan*:

- Review the whole document to ensure that flooding occurring due to coastal flood mechanisms is appropriately incorporated;
- If evacuation from residences is required, then evacuees should be directed to those locations which are outside of the floodplain, via non-flood affected roads;
- Remove Central Coast Leagues Club and Gosford RSL Club from the list of flood evacuation centres, since these are within the Brisbane Water foreshore floodplain;
- Incorporation of flood evacuation centres (Section 9.5.3 of the FRMS);
- Note that Surf Life Saving Clubs may not be appropriate evacuation centres during coastal flooding associated with oceanic storm surge, due to the general proximity of these clubs to the ocean;
- Incorporate the details of road flooding (Section 9.5.1 of the FRMS); and

The implications of projected sea level rise and the impact on future flooding should be incorporated into the Plan where possible.

Action Overview:

Undertake a review of the *Gosford City Flood Plan* with regards to the updated *Brisbane Water Foreshore Floodplain Risk Management Study* results.

Flood Mitigation Outcomes:

Community emergency services better prepared to assist the community during flood events.

Management Areas:

This is a floodplain-wide action that does not apply to any specific management area.

Projected Sea Level Rise:

The implications of projected sea level rise are to be incorporated into the *Flood Plan* so that this action is relevant for the future sea level rise scenario.

Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be in the order of $20,000 capital cost with no recurrent cost. Includes one review and one update of the document. These costs would likely be incorporated into Council and SES existing budgets.	Social impacts would be minimal.	Environmental impacts would be minimal.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

EM4 – Review Flood Warning Systems		
Action Type: Emergency Response Modification	**Action Timeline:** Immediate	**CCAP:** Not included

Background:

The NSW Bureau of Meteorology (BoM) is responsible for issuing warnings when potential flood emergencies are imminent. The New South Wales and Australian Capital Territory Flood Warning Centre is the specialised organisation within the BoM which carries out these warnings for NSW.

Dissemination of information received from BoM is integral in allowing flood-affected residences to evacuate appropriately and safely from their properties. The following recommendations apply to a review of flood warning systems for Brisbane Water:

- Ensure that warnings for storm-surge flooding are appropriately distributed (in addition to warnings for catchment flooding) by acknowledging the similarities and differences between the two flooding types;
- Liaise with the NSW RMS (especially the RMS office at Woy Woy) so that light-emitting diode (LED) variable messaging signage (VMS) (both permanent and demountable) can be utilised to provide flood warnings. It is noted that a permanent VMS exists at Kariong and this could be utilised. The location and availability of permanent and demountable VMS's would need to be ascertained through liaison with RMS. This also links action EM2 which allows for the purchase of additional VMS units by Council to alert of road flooding;
- Develop a storm fprecasting decision support tool;
- Integrate the results of the FRMS into NSW SES flood planning (e.g. sharing of GIS data for use by NSW SES);
- Develop/review alternative routes and detours and distribute plans as appropriate; and
- Undertake periodic liaison (between BoM, NSW SES and Council) to ensure consistency.

Action Overview:

Review flood warning systems on a periodic basis and update as necessary. It is anticipated that this action would be undertaken as a first step, followed by EM2 (flood-related signage) and in parallel with PM5 (monitoring sea levels).

Flood Mitigation Outcomes:

Assists in optimising flood warning and evacuation processes.

Management Areas:

This is a floodplain-wide action that does not apply to any specific management area.

Projected Sea Level Rise:

This action is more relevant for the existing flood scenario and for people who are at risk right now.

Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be in the order of $35,000 capital cost with $7,000 recurrent cost. Cost includes initial review, implementation of updates and further reviews as necessary. Costs are difficult to determine and would be dependent upon the nature of any system gaps and the program adopted. At the time of preparing this Plan, Council had recently secured some funding for flood forecasting.	Social impacts would be minimal.	Environmental impacts would be minimal.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

EM7 – Review Evacuation Centres		
Action Type: Emergency Response Modification	**Action Timeline:** Immediate	**CCAP:** Included

Background:

The results of the flood extent mapping (Cardno, 2015) suggest that a number of evacuation centres currently listed as being suitable for evacuation lie within a floodplain (either the Brisbane Water floodplain or a creek floodplain) and are therefore not suitable for use during a flood event since they are actually at risk of inundation. In addition, evacuation locations that are situated in open coast locations (e.g. surf life-saving centres) may not be appropriate during storm surge events, particularly with projected sea level rise. As such, a review of evacuation centres is required.

Existing facilities that may be suitable as evacuation centres for flood emergencies are mapped in Section 9.5.3 of the FRMS. The total number of evacuees that could be housed at these facilities is 3,406. Given the number of properties affected by over-floor flooding in the existing PMF event (1198) and the average household size (2.2 persons), these evacuation facilities are likely to be adequate in housing all evacuees in such an event (Cardno, 2015). In addition, it has been noted that Brisbania School, in Saratoga, may be suitable as an evacuation location.

The evacuation centre review should:

- Investigate the accessibility of the facilities with regards to access road inundation, including the consideration of road upgrade to assist with evacuation of an area (e.g. Woy Woy Road); and
- Investigate the feasibility of upgrading existing facilities in key areas to multi-purpose centres that can be used more readily in non-flood times could be undertaken.

This Management Action could be undertaken in conjunction with the review of NSW SES Flood Plan (EM3) to ensure the incorporation of the outcomes of this action into the Flood Plan.

Action Overview:

Review evacuation centre locations with a view to utilising other suitable locations, and upgrading key evacuation centres that lie outside the floodplain, as required.

Flood Mitigation Outcomes:

Facilitates more effective evacuation from flood-affected areas and provides a hub for emergency services.

Management Areas:

This action applies to all management areas.
Nearest evacuation centres (not in floodplain):
MA1 – Kariong Community Centre
MA2 – Kariong Community Centre
MA3 – Kariong Community Centre or Green Point Community Centre
MA4 – Green Point Community Centre
MA5 – Kincumber and District Neighbourhood Centre
MA6 – Kincumber and District Neighbourhood Centre
MA7 – Kincumber and District Neighbourhood Centre and La Salle Youth Camp
MA8 – La Salle Youth Camp and the Ettalong War Memorial Club
MA9 – Ettalong War Memorial Club
MA10 – Ettalong War Memorial Club
MA11 – Ettalong War Memorial Club
MA12 – Ettalong War Memorial Club and Umina Bowling Club
MA13 – Ettalong War Memorial Club and Umina Bowling Club
MA14 – Woy Woy Peninsula Community Centre
MA15 – Kariong Community Centre

Projected Sea Level Rise:

Existing evacuation centres would also need to be reviewed in the context of sea level rise. Over the long term, some evacuation centres that are currently suitable for evacuation (i.e. out of the floodplain) are projected to become unsuitable due to sea level rise. As such, a regular (e.g. 5 year) review should be undertaken so that evacuation centres can be decommissioned when they are no longer outside the floodplain. Any new evacuation centres identified as a result of this action should consider projected sea level rise predictions.

Considerations/Impacts		
Economic	**Social**	**Environmental**
Economic impacts would be in the order of $50,000 capital cost with $2500 recurrent cost. Costs would relate to investigations and a review of evacuation locations. The results of the review may lead to the upgrade of evacuation centres in key locations to allow increased evacuation space. Evacuation centre upgrades would have much more significant costs mainly relating to construction materials and labour.	Social impacts would be minimal.	Environmental impacts would be minimal as it is envisaged that existing buildings would be utlised.

EM8 – Enhance Road Evacuation		
Action Type: Emergency Response Modification	**Action Timeline:** Immediate	**CCAP:** Not included

Background:
As an alternative to road-raising or upgrades which have high economic costs, this action aims to enhance road evacuation through the forward planning of alternative routes. A corresponding addition to this action could be the integration of flood data into future road designs (however this does not address emergency response).

It is recommended that the following be undertaken as part of this action:
- Develop/review alternative routes and detours in accordance with the results of the FRMS;
- Distribute alternative route plans to relevant organisations and authorities (e.g. Council, NSW SES, Police) as appropriate. Electronic data transfer is desirable (e.g. GIS data);
- Integrate the results of the FRMS into future road planning undertaken by the RMS;
- Engage with the RMS office at Woy Woy to utilise a local knowledge base and achieve relevant results.

Action Overview:

Liaise with the NSW RMS and the NSW SES to develop and review detours and alternative routes to be used during times of coastal flooding.

Flood Mitigation Outcomes:

Assists in optimising road evacuation.

Management Areas:

This is a floodplain-wide action that does not apply to any specific management area.
Key roads subject to flooding include:
MA1 – Central Coast Highway and Brisbane Water Drive.
MA2 – Central Coast Highway.
MA3 – Brisbane Water Drive and Manooka Road.
MA4 – Pateman Road and the Entrance Road.
MA6 – Davistown Road and Malinya Road, Davistown.
MA8 – Greenfield Road and Rickard Road.
MA9 – Helmsman Boulevard.
MA10 – Araluen Drive.
MA11 – Pretty Beach Road.
MA12 – The Esplanade.
MA13 – Booker Bay Road..
MA14 – Woy Woy Road, Blackwall Road, Brick Wharf Road, North Burge Road and Brisbane Water Drive.

Projected Sea Level Rise:

This action is primarily relevant for the existing flood scenario, however forward planning should include sea level rise predictions.

Considerations/Impacts		
Economic	**Social**	**Environmental**
The economic cost of this action would be variable depending on the program adopted, however estimated capital costs are in the order of $40,000 to produce a plan and a $2,000 recurrent cost. Implementation of this option should take place in parallel with other relevant residual risk actions to ensure cost efficiency.	Social impacts would be minimal.	Environmental impacts would be minimal.

[1] It is noted that the economic assessment undertaken had some limitations with regards to the scope of the impacts and benefits that could be assessed.

Appendix D

Example Consultation Materials and Submissions in Reply

Do you live near the Brisbane Water Foreshore?

Floodplain management

On exhibition

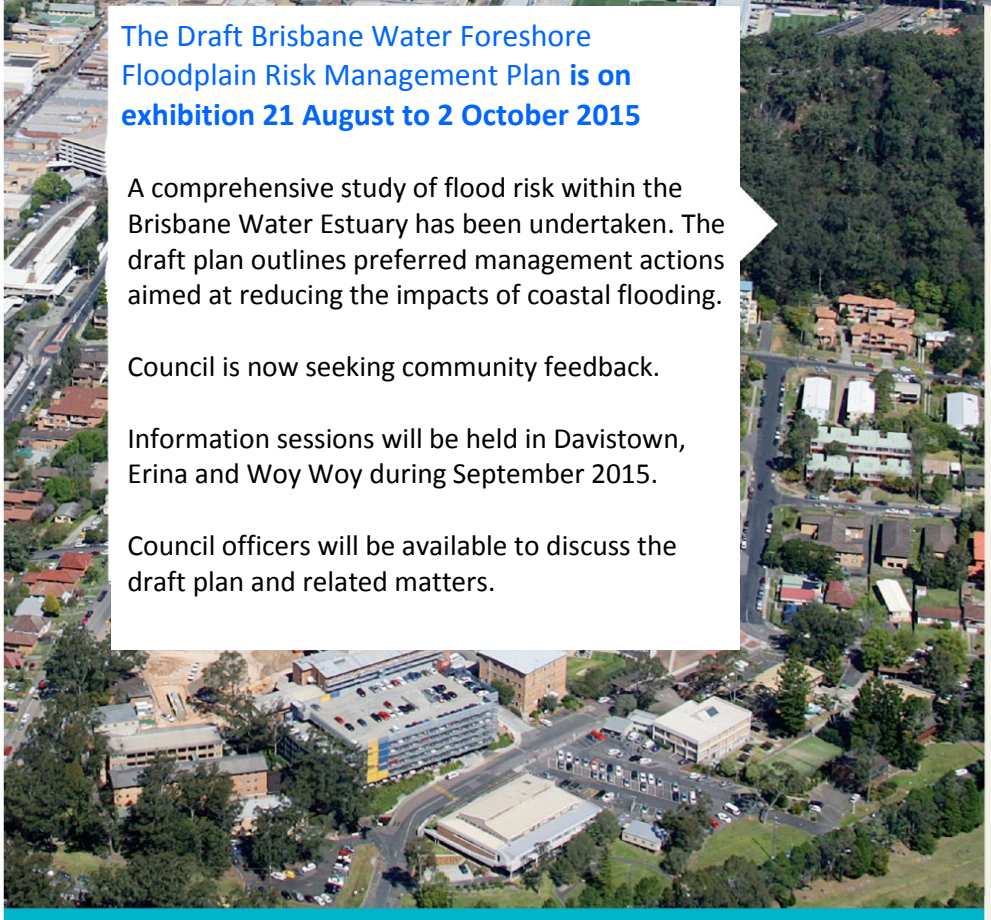
The Draft Brisbane Water Foreshore Floodplain Risk Management Plan **is on exhibition 21 August to 2 October 2015**

A comprehensive study of flood risk within the Brisbane Water Estuary has been undertaken. The draft plan outlines preferred management actions aimed at reducing the impacts of coastal flooding.

Council is now seeking community feedback.

Information sessions will be held in Davistown, Erina and Woy Woy during September 2015.

Council officers will be available to discuss the draft plan and related matters.



GOSFORD CITY COUNCIL

Information Sessions

9 September 2015 4 pm to 8pm
Davistown Progress Hall
5 McCauley St Davistown

15 September 2015 4 pm to 8 pm
The Erina Centre , Erina Fair
Terrigal Drive Erina

23 September 2015 4 pm to 8 pm
Peninsula Community Centre
93 Macmasters Rd, Woy Woy

Visit : www.gosford.nsw.gov.au and click on "items on exhibition"

Call : 02 4304 7087
Email : flooding@gosford.nsw.gov.au

Have your Say .....how to make a submission

Community input into the draft plan is highly valued. Written submissions should be forwarded to Gosford City Council PO Box 21, Gosford 2250 or emailed to goscity@gosford.nsw.gov.au and marked attention to Robert Baker. Please quote 'Draft Brisbane Water Foreshore Floodplain Risk Management Plan' in the subject reference.

Submissions must be received by Friday 2 October 2015. It should be noted that all submissions will be publicly available and may be read and copied. To ensure your submission is duly considered, please include your name and contact details.

Ettalong Beach is prone to erosion. Council wants your ideas to prevent it. Picture: MARK SCOTT

Plan for natural hazards

RESIDENTS will soon be invited to give their views on Gosford Council's plans for the future management and protection of the region's coastline, beaches, estuary foreshores and creeks.

Three draft plans are to go on exhibition from August 21 until October 2 to think about and deal with a range of strategies aimed at minimising the impact of coastal and flood hazards on residents, built assets and coastal ecosystems.

"Gosford City's coastlines, estuaries, beaches and creeks are vulnerable to a number of natural hazards that could potentially impact property development, public infrastructure and recreational activities all along out coastline," council's governance and planning director Danielle Dickson said.

"As part of our coastal management and flood risk management planning we have looked very closely at the processes and hazards that impact on the region."

She said these included beach erosion, shoreline decline, sand drift, flood and floodplain risks, coastal inundation and climate change.

The council will hold a series of community drop-in sessions throughout next month.

Call 43 258 222 or visit the council's website to find out where and when the sessions will be held.

ID	Date	Summary	Response
1	6-Oct-15	The Floor Level Survey included as an appendix to the Plan, is highly flawed and as a consequence will damage the livelihood and wellbeing of affected residents. The Catchments and Coasts Committee has never been afforded an opportunity to actually review the survey prior to exhibition and despite the many concerns raised by community representatives regarding the survey and recording of floor levels for homes affected by flooding, Council has published data that it knew contained errors. This information is now in the public domain with the potential to be misused by home insurers and other parties as was the case when Council previously identified communities such as all of St Huberts Island being affected by a 1:100 Flood Event when in fact it wasn't. Home insurers such as the NRMA and APIA used this flawed information to determine their risk when insuring homes. Residents who participated in the survey were not advised that this information would be placed in the public domain and certainly were not advised that it would be provided to the Insurance Council of Australia. Council has not conducted the most basic process of proofing the data it has now published. It is of great concern that Council will also use this flawed information to inform future S149 Planning Certificates and a revised Development Control Plan for flood liable communities.	- Floor level data is not used to inform S149 Certificates. S149 Certificates are based upon the interest ion of property boundaries with the flood mapping provided in the Floodplain Risk Management Study. - Post exhibition Council was advised of specific properties that were in apparent error. A subsequent investigation revealed an administrative processing error which was confined to addresses that were prefixed with alpha numeric description. The error is also confined to the accuracy of the "indicative ground levels" and not surveyed floor levels. Council will now address the errors found and revise the document accordingly. - Ground level data does not impact on insurance. However, the floor level data can be used by property owners to negotiate appropriate flood coverage (i.e. where the property is impacted by flooding but the floor level is above the flood level, this information may assist in reducing premiums). *Errors in ground level for several properties have been amended. The floor level survey will no longer be included as a publicly available appendix to the FRMP.*
2	6-Oct-15	It is obvious that Council's intention is to later apply a much higher asset life for substantial residential development such as two storey homes built in typical flood liable areas today. It is entirely unreasonable that affected residents have not been given an opportunity to make an informed comment related to this issue. Instead Council will revise this lack of information and indicate the actual asset life for a range of residential development after the exhibition period has ended and after residents have reviewed the proposed plan. This is not consultation and totally unreasonable and unprofessional!	This is not the intention of the FRMP. Following the of the document recommendations on a priority basis. The document refers to the projection of SLR based on Council's resolution and its relationship to asset life. This can be found on page 79. , this graph would form the basis of any future revision to Council's Development Control Plan. It is intended that a matrix would accompany the graph to assist with implementation. The revised DCP would be put on public exhibition for consultation with the community. It is also noted that the Committee proposed that a minimum planning period of 35 years should be included as a recommendation of the FRMP with regards to SLR (April 2014 Sub-Committee Workshop). *No change has been made to the FRMP document.*
3	6-Oct-15	Council's failure to actually develop an adaptation plan as a part of the process of developing the BWFFMP is a failure to follow through on promises it has made over the last 5 years since first advising that 9000 properties would be affected by sea level rise (SLR) projections. According to the NSW State Government, Council has received over $6.5million in grants for coastal management. This equates to a commitment of around $10million when Councils contribution has been included. Council advised owners in 2010 that they would have their say and that the development of strategic plans was commencing. Five years later there are no strategic plans that offer future certainty. Not even the actual risk of current flooding will be addressed by a confirmation of construction of future protective works. All that Council has put in place is an unknown Flood Planning Level, more plans for plans and a mechanism that will ensure that every year the Flood Planning Level will increase without ever explaining or stating what that FPL will be. The revised Council SLR policy has not provided any known advantage for residents affected by current and future coastal flooding This is highly deceptive and to be condemned.	During this Floodplain Risk Management process Climate Adaption was duly considered, options were identified but due to the relative low risk at present day scenario these have deferred on a cost benefit basis. Other coastal councils have similar recommendations in this Plan, detailed investigations into asset classes such as roads and utilities were beyond the scope of this project, however the risk management options were evaluated against the potential reduction in flood damages both in direct and in direct costs as required in the floodplain development manual. Community response to this project has been mixed with regards to project SLR, this plan provides management options that addresses existing risk and future risk. The Study identified that while existing risk can be defined as low, there is a need to consider the transition of this risk form low to high over a period of time, the Plan recommends that implementation of any structural mitigation measures such as levees requires careful consideration to avoid maladaptation. Actions that addressed existing flood risk ranked higher because of cost versus benefits . The Flood Planning Level (FPL) is an affective measure against future storm events such as occurred in 1974. The FPL can be calculated is known and is discussed in detail in Section 4.2. The new FPL will actually reduce the current FPL by up to 300mm in the more protected embayment's such as Davistown, Bensville Empire Bay areas. Future risk has been identified and management options deferred for future investigations. Implementing those options NOW are not warranted (ranked low in Quad BL) and may cause unintended consequences without further due diligence. No change has been made to the FRMP document.

ID	Date	Summary	Response
4	6-Oct-15	The Plan drops any attempt to qualify the type of property that is affected by future and current flooding. Included in the more than 6000 properties affected by flooding are open spaces, commercial and industrial property, public utilities and residential property. Council must include a schedule that accurately identifies all types of properties with a particular focus on residential property to ensure that the possibly exaggerated and unqualified reference to over 6000 properties is not misunderstood to represent residential property only, as was the case in 2010 when Council exaggerated the number of properties that would be affected by future SLR when it stated that 9000 properties would be affected.	The comparison of property flooding between existing and future in Table 3.2 is to show the widespread nature of the issue. This will impact public open space as well as residential and commercial properties and will pose a significant management issue for both the private and public sector. Table 3.3 provides details on over floor flooding to show the likely impacts associated with existing and future flooding on residential and commercial properties only. *Additional text has been included to clarify what type of properties are included in Tables 3.2 and 3.3.*
5	6-Oct-15	Despite advice from Community representatives and the full agreement of all participants in a sub-committee meeting Council decided not to adopt a 35 year asset life for low density residential construction. Knowing what was intended at the time – 35 year asset life for single homes - Council has instead offered an example formula that refers to an asset life for Residential Construction per se.	- As an outcome of the recommendations of community representatives it is recommended in Section 4.2.3 that "a minimum planning horizon of 35 years should apply to all development types". It is also recommended that "it would be appropriate to consider a longer planning horizon when applying sea level rise for vulnerable or longer term development types, such as: o Critical infrastructure, vulnerable development types (e.g. aged care, seniors living, child care) and emergency services; o Road raising for critical infrastructure; and o Construction of levees." - An example of applying FPLs is provided section 4.2.4 to assist the reader in understanding the recommendations. The example uses a 35 year planning period for residential development. - It is not appropriate for a FRMP to provide the exact wording to be included in the DCP. The FRMP has endeavoured to represent the intent clearly. This intent includes the application of a 35 year planning period to residential development. *No change has been made to the FRMP document.*
6	6-Oct-15	Council has rejected advice from the sub-committee to allow garage floor levels to be built to the Flood Design Level instead adopting a height 150mm below the Flood Planning Level. This is completely unworkable and will over time see Council paying costs for ongoing appeals to the Land and Environment Court as a consequence of such an ill-conceived development constraint. The reason given was that it would be unsafe for people who illegally inhabit a garage. This constraint will result in ramps into garages that are up to 1.5 metres above the ground, require a significantly lengthy ramp to achieve transition profiles and that will require side barriers to ensure safety when used.	It is noted in the April 2015 minutes that the sub-committee advice was the enclosed garage floor levels at the 100 Year ARI level or 300mm above the ground level, whichever is higher. This was based on the premise that the constructability of access ramps and linkages to adjoining houses would be not feasible due to the height of the garage floor. A review of the ground levels near residential properties across the floodplain shows that on average the garage level would be around 0.5m above the ground level, when a floor level of 0.15 below the FPL is applied. There are less than 10 properties where this garage floor height is greater than 1.5m. To allow for situations where the design of the garage floor level to the required height is not achievable, the requirement for garage floors included the allowance for floor levels to be considered at the 100 Year ARI level or 300mm above the ground level (which ever is higher). Additional advice was also sought from Council's DA assessors to ensure this recommendation was feasible. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
7	6-Oct-15	The final plan should have gone much further in encouraging residents to raise their land to the existing FPL when undertaking knockdown/rebuild development. This would commence a process of adapting to SLR immediately while also preventing tidal inundation and reducing or removing the impact of current flooding. Flood liable suburbs currently faced with uncertainty would benefit and the economy of the local area would benefit. This was potentially one of the most significant outcomes that could have been achieved with a truly strategic approach that considered the future wellbeing and livelihood of flood liable communities.	The detailed recommendations in PM7 for revisions and amendments to Planning Instruments and Development Controls provides details on how filling may be allowed and encouraged by the DCP. In order to gain a full understanding of the extent and height of filling it may be beneficial to prepare a master plan that would guide development overtime. The Davistown Progress association Committee supported this approach during the engagement process. *This recommendation will be outlined in the executive summary to provide more emphasis on the opportunities for filling outlined in PM7. In addition, a recommendation for a masterplan to guide future development including filling has been included in PM7.*
8	2-Oct-15	We would like to request that council and its experts look at the area of foreshore between Elfin Hill Rd and Lexington pde Green Point. This area lost a further half to one meter of foreshore (and several trees) after the April 2015 storms. This foreshore area is still waiting to be cleared from the April storms(See photos). In previous talks with council staff and engineers we were told that our area of foreshore would be recommended to have seawall maintenance to help prevent further erosion (similar to the area of foreshore completed at Yattalunga). In this final draft plan our area seems to have been omitted. We request that our area be included again to help prevent further damage to our property.	The proposed locations for this option are approximate only and were delineated from aerial photographs (this information is provided in the FRMS - Appendix I pg 11).Where seawalls were not present or difficult to see they may not have been delineated in the mapping. A detailed investigation of the quality of seawalls (e.g. construction type, evidence of slumping or other failures) was not undertaken, and this would form part of a separate investigation. The floodplain risk management process is not intended to directly mitigate erosion impacts. This matter has been forwarded on to Council as a separate matter. However it is worth noting that as part of the FRMP, guidelines are proposed for the development of seawalls in the area to provide for more consistent construction and maintenance. Council has noted the issue associated with debris from the last storm event and referred the submission to the relevant department of Council for action. *No change has been made to the FRMP document.*
9	1-Oct-15	This submission acknowledges the intention to adopt reduced flood levels and floor levels each of which now reflect with more precision what has been well known locally with respect to past flood events.	Noted.
10	1-Oct-15	This submission acknowledges that reduced finished floor level requirements still contain satisfactory and effective freeboard.	Noted.
11	1-Oct-15	This submission provides for maintenance of car parking at the reduced flood level (and takes issue with any requirement to elevate garaging to or within 150mm of finished floor level)	A review of the ground levels near residential properties across the floodplain shows that on average the garage level would be around 0.5m above the ground level, when a floor level of 0.15 below the FPL is applied. There are less than 10 properties where this garage floor level is greater than 1.5m. To allow for these cases, the requirement for garage floors included the allowance for floor levels to be considered at the 100 Year ARI level. Additional advice was also sought from Council's DA assessors to ensure this recommendation was feasible. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
12	1-Oct-15	This submission accepts that there are compelling reasons for the Council to conclude its investigative works at Davistown and Empire Bay and implement low cost long term policies that will protect the estate by integration of:- I. Public works within the recreation reserves fronting Brisbane Water including integration of promenade walkway at 1% AEP; ii. Integrating of road and drainage works programmes to formalise drainage swale profile/incorporate low flow agg line invert; iii. Progressively elevate trafficable surface of public roads; and iv. Accommodate/permit/require land fill to minimum flood level of future wholesale redevelopment sites and adjustment to DCP or other policy as required.	The consideration of public works at the recreation reserves in the form of levees was included in the FRMS (Options FM6a and FM6b) and it was noted that these levees could be incorporated with public infrastructure upgrades such as walkways and cycleways. The outcome of the FRMS assessment was that levee options and road raising options (FM1a and FM1b) were not recommended for inclusion in the FRMP as they did not have an appropriate benefit-cost ratio under existing flood conditions and sea levels. However, given the potential benefits of these types of options with rising sea levels, it is anticipated that these options will be investigated as part of the Climate Change Adaptation Plan that will be prepared for Davistown. Drainage options (e.g. tidal valves on stormwater outlets) were also considered as options in these areas and have been recommended as part of the FRMP. *No change has been made to the FRMP document.*
13	1-Oct-15	Issue is still raised as to the utility of recently compiled survey information regarding existing finished floor levels, notations upon S149 Certificates and the absence of any cross referencing or access to survey data held by Council in relation to any and all development proposals approved since the mid late 1980's i.e. Council holds within its records survey data as to the finished floor levels of all recently approved works in flood affected areas.	The survey data was collected in 2014. Floor levels generally represent the lowest habitable floor levels observed from the street frontage. This survey was undertaken externally to the building and whilst all care has been taken to ensure a high degree of accuracy, Council cannot verify the complete accuracy of the sourced information. The purpose of the data was to inform the economic damages assessment and then the economic comparison of some of the larger structural flood management options identified in the FRMS. This survey data, or any floor level data, is not used to inform S149 certificates. S149 Certificates are based upon the intersection of property boundaries with the flood mapping provided in the Floodplain Risk Management Study. *No change has been made to the FRMP document.*
14	29-Sep-15	Council's decision to offer only "Drop In" sessions rather than Open Forums with Questions & Answers do not encourage clear consistent messaging to the community. This avoidance by council of forum style engagement where the wider community can hear consistent responses to questions should be discouraged in future. This aversion to public scrutiny by Council does not support its "Open & Transparent" consumer facing messaging.	The development of the Draft BWFFRMP followed extensive consultation during the study phase, the study is informs the plan. The Plan should be amended to include all the additionally engagement including workshops, the plan was exhibited in accordance with the recommended community engagement strategy endorsed by the committee, those who attended the session were interested in one on one engagement , the community engagement undertaken reflected that process. *The Final FRMP document has been updated to include the consultation activities undertaken as part of the public exhibition phase.*

ID	Date	Summary	Response
15	29-Sep-15	The application of TBL is inconsistent and inadequate, in many cases the economic impacts of proposed actions is ether missing completely or inadequate. In other cases inconsistencies are apparent with Council's costs only considered while neglecting economic impacts on those to whom the proposal impacts, and economic costs to the community in others.	The quadruple bottom line analysis was prepared in accordance with industry practice. Economic assessment could only be quantified for those options that could be hydraulically modelled and where a direct economic benefit could be perceived when the option was implemented in the model (e.g. a direct reduction in economic damages due to a flood mitigation work). In many cases where indirect economic benefit may be achieved by the option, these were not able to be assessed in the same manner. The economic, social and environmental implications of each recommended action is provided in appendix C of the FRMP. This information was also provided for all options considered in the FRMS. It is acknowledged that not all possible impacts and benefits over time may have been considered due to the limitations of the scope of the assessment process. However, it is unlikely that additional inputs would have changed the outcome of the multi-criteria options assessment significantly. This limitation will be noted in the Plan. It is important to note that the final results of the analysis were used only to guide the development of the actions proposed in the Plan and to stimulate discussion of the actions and next steps, rather than directly determining all proposed actions in the Plan. *The final FRMP document has been updated to note the limitations of the TBL assessment.*
16	29-Sep-15	The process leading to the Plan while time consuming and extremely costly to rate payers and government has resulted in a Plan that fails in its duty to mitigate the impacts of the known 1% flood on the most vulnerable estuary communities. Mitigation has been sidelined in favour of an unfunded Climate Change Adaptation Plan (CCAP) to occur at some unknown time in the future. These communities have been left exposed to nuisance and at times more serious flood events for decades and unfortunately the Flood Plan simply perpetuates the ongoing failure of Council to mitigate the issue. Overall the Plan delivers very little benefit to the most at risk communities and does nothing to assure the long-term viability of these communities. The Key Deliverable of this expensive exercise can be summarized as " A Plan for more expensive and time-consuming Plans", while this strategy may do wonders for local government job security it offers no real benefit for those it sets out to assist. By comparison Lake Macquarie Council have now delivered an adaptation strategy for their most vulnerable suburbs in a fraction of the time and at a fraction of the cost of Gosford Council's efforts. This adaptation strategy assures the future well-being of those suburbs in stark contrast to Gosford's effort of projecting future disaster and offering few if any solutions.	The key findings of the FRMS were that the existing flood risk across Brisbane Water floodplain is relatively low and can be managed to an acceptable level primarily through the implementation of development controls, emergency response measures and minor works. Of key importance is the appropriate implementation of warnings and evacuation directions. The recommendations in the FRMP reflect this. The Lake Macquarie Adaptation Plan is an plan for future flood risks not current flood risks. The Brisbane Water FRMP prioritises the management of current flood risks. However, the future flood risks are acknowledged in the FRMS and the assessment of management strategies for the floodplain. These options are similar to those presented in the Lake Macquarie Plan. The proposed climate change adaptation plans (CCAPs) seek to address the issues identified around climate change including the impacts on flooding. These plans will be prepared with a similar intent to the Lake Macquarie Adaptation Plan. *No change has been made to the FRMP document.*
17	29-Sep-15	The Plan offers the 2 suburbs most vulnerable to the current flood and projected future sea level rise, Empire Bay & Davistown no mitigation against either the current or future threat. Why has Gosford Council purposely excluded the suburbs from any true mitigation and thwarted any attempt to begin long-term adaptation? Combined Empire Bay & Davistown represent close to 50% of the defined at risk properties yet have been abandoned by this process.	The outcome of the FRMS assessment was that development controls in these locations are to be amended to facilitate enhanced future flood planning of all of the Brisbane Water floodplain, including these areas. Several of the hard engineering options identified for Davistown and Empire Bay (e.g. road raising FM1a and FM1b; and levees FM6a and FM6b) were not recommended for inclusion in the FRMP as they did not have an appropriate benefit-cost ratio under existing flood conditions and sea levels. However, given the potential benefits of these types of options with rising sea levels, it is anticipated that these options will be further investigated as part of the Climate Change Adaptation Plans that will be prepared. Climate Change Adaptation Plans were an outcome/ recommendation of the Floodplain Risk Management process, but need to be undertaken separately as it is beyond the scope of the Floodplain Risk Management Study/Plan where the focus is managing existing flood risk. An individual Climate Change Adaptation Plan will be prepared for each management area identified in the FRMS, with Davistown, Empire Bay and Woy Woy being of highest priority. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
18	29-Sep-15	Funding - Where funding sources are identified there is no explanation of how the funding would be enforced or sought. An example – where the funding source is identified as the property owner (Refer Beneficiary Pays comment) the Plan offers no strategy on how this would be implemented, is Council going to enforce a levy or perhaps go door to door with cup in hand?	Table 6.3 identified the potential source of funding for each of the options recommended for implementation. Where private land owners are identified as a potential source of funding, this relates to works on private land. See notes within Table 6.3 for options 11_FM3, 7_FM5, 3_FM3, 13_FM3 and 9_FM3. These options relate to works that would protect individual properties (e.g. wave run-up devices and private sea wall raising and maintenance). Funding and undertaking of these works would be on a voluntary basis by each property owner. It is acknowledged that the private landowner may not always be the only beneficiary from works such as sea walls. However, the FRMS identified that the construction of levees for the purposes of flood protection is not a viable option based on the current flood risk (i.e. with no sea level rise) and as such, the raising of sea walls (including those on private property) to provide a regional levee would not be funded by public revenue. If property owners want to improve their property protection from impacts of storm surge (including inundation and erosion) by improving their seawalls, this would be funded privately. However, the increased viability of regional levees may be identified by the CCAPs and as such, alternative sources of funding may become available as a result of the acknowledgement of the wider benefits of improved continuous seawalls across both public and private land. *No change has been made to the FRMP document.*
19	29-Sep-15	Implementation – The Plan provides at best vague time lines for implementation and no priority list by location.	Each management area only has three or less actions specific to the area. As such, there is no need to prioritise the actions by area. The implementation of management actions will be in most cases based on the availability or funding and other required resources. As such, to guide this process each actions has been identified as having 'immediate' or 'staged' implementation. Immediate implementation indicates actions that could be implemented in the short term if funding and resourcing permits. Feasibility of the action is generally high and additional investigations or further development of the management strategy would be minimal. Staged implementation indicates actions that could be undertaken in the short to medium term. However, additional investigations, feasibility studies or further development of the management strategy are likely to be required. Where appropriate, interim policy and planning measures could be employed in the intervening time. To further assist Council with allocating funding and resources as they become available, each action has been identified as having High, Medium or Low priority. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
20	29-Sep-15	The application of a beneficiary pays principle by Council seems arbitrary and random. Council spends many millions in ratepayers funds on a range of services including more recently on coastal protection work at Ettalong. Ratepayers generally contribute to these projects but when it comes to coastal protection for beachfront properties, Council applies the mantra of "beneficiary pays" despite the value of such works for the protection of public assets and private property behind those frontline properties. There seems no clear line on how or when this approach is applied. The Plan offers no specifics on who the "beneficiary" may be, this oversight renders the option ambiguous. Given the nature of Brisbane Water Estuary any benefits of proposed works will extend significantly landwards, this should be clarified in the Plan.	Beneficiary payments are only mentioned with regards to PM2 - Voluntary House Raising (VHR). As this type of option only benefits one property per application, many Councils often structure VHR schemes to require the local contribution to be fully paid by the house owner. The beneficiary is the property owner. The property owner would be provided with the opportunity to take up this option, it would not be mandatory. It is acknowledged that the private landowner may not always be the only beneficiary from works such as sea walls. However, the FRMS identified that the construction of levees for the purposes of flood protection is not a viable option based on the current flood risk (i.e. with no sea level rise) and as such, the raising of sea walls (including those on private property) to provide a regional levee would not be funded by public revenue. If property owners want to improve their property protection from impacts of storm surge (including inundation and erosion) by improving their seawalls, this would be funded privately. However, the increased viability of regional levees may be identified by the CCAPs and as such, alternative sources of funding may become available as a result of the acknowledgement of the wider benefits of improved continuous seawalls across both public and private land. *No change has been made to the FRMP document.*
21	29-Sep-15	While much time was spent discussing the opportunity presented by the current redevelopment cycle these communities are experiencing, no concise actions have been incorporated in the plan. This is despite an undertaking by the consultant (Emma) that a recommended (rather than mandated) fill level could be incorporated in the Plan and promoted by Council as properties are redeveloped. As has been stated numerous times, simply "allowing fill" continues to result in an ad hoc approach to the issue. Refusal to provide reasonable guidance in this regard will result in ongoing ad hoc fill levels and does not assist in addressing the current flood issue nor does it assist in preparing the community for future adaptation. Advice from Council regarding filling of land, when sought by owners is too often inconsistent in this regard.	The detailed recommendations in PM7 for revisions and amendments to Planning Instruments and Development Controls provides details on how filing may be allowed and encouraged by the DCP. *This recommendation will be outlined in the executive summary to provide more emphasis on it.* The exact level and nature of fill permissible for each property may vary depending on a variety of design issues (flooding and drainage may only be one of these). The amendment to the DCP will need to define this information in more detail. This will not be undertaken as part of this FRMP.
22	29-Sep-15	Mandating garage floor levels at the FPL less 15cm will significantly increase development costs and offer little benefit. The inclusion of the disclaimer "where feasible" adds to the burden of assessing officers and will result in ad hoc outcomes. The Plan should be providing concise guidance rather than subjective suggestions that leave residents unclear on requirements. The associated ramps to allow access will impact the streetscape and significantly add to construction costs. This issue highlights the "tick a box" nature of the Council's C&C Committee as it is one of a number of items where 100% opposition of the C&C committee / Sub-Committee was overruled by unidentified parties within Council with no explanation.	It is noted in the April 2015 minutes that the sub-committee advice was the enclosed garage floor levels at the 100 Year ARI level or 300mm above the ground level, whichever is higher. This was based on the premise that the constructability of access ramps and linkages to adjoining houses would be not feasible due to the height of the garage floor. A review of the ground levels near residential properties across the floodplain shows that on average the garage level would be around 0.5m above the ground level, when a floor level of 0.15 below the FPL is applied. There are less than 10 properties where this garage floor height is greater than 1.5m. To allow for situations where the design of the garage floor level to the required height is not achievable, the requirement for garage floors included the allowance for floor levels to be considered at the 100 Year ARI level or 300mm above the ground level (which ever is higher). Additional advice was also sought from Council's DA assessors to ensure this recommendation was feasible. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
23	29-Sep-15	The introduction of a sliding scale methodology that in most suburbs will initially lower the FPL but over time will increase it above the current 2.45MAHD should not be supported. Given the supposed short term nature of the FPL policy, assuming the much anticipated CCAP will likely change the policy, there is a significant question mark over the need to adopt a long term highly complex strategy? Compound this with Council's ambiguous approach to asset life span (low density residential – minimum 35 years) and it seems likely that council seems intent on introducing a myriad of FLP levels dependent upon both location and perhaps Asset lifespan (low density residential) based upon size of home or building material used?? Why is the detail of this proposal being withheld from public scrutiny? Given the lack of concise information regards FLP calculation within the Plan it is not possible to calculate the intended future FPL – Once again, we are left with vague assertions that Council will "fix it up in the DCP" in short - a blank cheque! Surely this is not the "transparency" that Council so often promotes?	Council adopted a SLR planning strategy in March 2015, a subsequent resolution with respect to BW FRMP was adopted in April 2015. The information related to the "sliding scale methodology" has been available since April 2015 and open to scrutiny at a technical committee workshops facilitated by council prior to exhibition. Technical subcommittee members were invited to attend or could discuss any matters one-one in Council chambers, these invitations were also declined. Additionally the document was exhibited for 6 weeks, during this period 3 information sessions were available including another technical committee workshop. With regards to assets life the min 35 years was applied to satisfy the 2050 benchmark endorsed by the Catchments & Coasts committee. *No change has been made to the FRMP document.*
24	29-Sep-15	The decision by council to publish the floor level survey identifying individual addresses could prove very damaging to the community. Council states the floor level survey was primarily conducted to enable the accurate calculation of damages at a suburb level. This objective could have been achieved without the publication of street addresses. Council has acknowledged on a number of occasions that the data will contain errors, this is also acknowledged by the extensive disclaimer on the document, while errors will not fundamentally alter the calculation of flood damages at a suburb level it will fundamentally disadvantage the owner of the property that is the subject of the error. Council has committed significant time and effort in managing recent concern over sky rocketing home insurance, this issue was caused by Council publishing highly inaccurate flood mapping that exaggerated the flood level at nearly all locations. Council itself advises that it did not provide this inaccurate flood mapping to the insurance industry and that the insurance industry "may have lifted the information from the public domain". The current decision by Council to publish floor level data in the public domain that Council admits contains inaccurate information could be construed as "wilfully negligent" given Council's acknowledgement of past experience.	In NSW it is common practice to include floor level information as part of developing a Floodplain Risk Management Studies & Plans. Council also adopted the minutes of the 25 November 2014 meeting Catchments and Coast Committee which discussed the inclusions of the floor level information within the appendices of the study in line with general practice. This will discussed with the Committee and Council in more detail prior to the finalisation of the FRMP. *No changes have been made to the FRMP document.*
25	29-Sep-15	While not mentioned in the Plan, Council's "Flood Certificate" deserves some commentary. As has been raised numerous times the current flood certificate is not fit for purpose as it does not define the nature of the flood that it includes, being either overland or estuary/storm surge – This has been acknowledged by Council yet a seemingly quick fix seems beyond the capacity of Council to implement. This definition is critically important to those the flood certificate is designed to service in that the type of flood in the majority of cases will define the coverage or lack of coverage extended by home insurers. The benefits and potential disadvantages of the flood certificate were extensively discussed within the C&C Committee yet this basic and fundamental flaw remains unaddressed. In the event of a significant flood event the cost to the community from this oversight will be significant as many home owners will likely be denied insurance coverage on the grounds that the event represented "storm surge" as opposed to the insured flood definition.	Existing flood certificates don't identify whether the property is impacted by storm surge, riverine or overland flow flooding, or a combination of these. *The details of PM7 in the FRMP have been updated to provide the recommendation that this information be included.*
26	29-Sep-15	Can Council rule in or rule out Planned Retreat immediately? Surely, after 10 years and the expenditure of in excess of $6.5 Million of State Government funds on Management Planning, the residents of Brisbane Water deserve some surety in this regard? The ongoing uncertainties associated with Council's continued reference to planned retreat cause unnecessary economic and social distress and impacts. IS PLANNED RETREAT THE PLAN FOR EMPIRE BAY & DAVISTOWN?	This option is not a recommended outcome of the floodplain risk management process due in part to the extensive social disruption and financial cost that would be incurred under current sea level rise conditions. However, in the future, this option may become more viable depending on the impacts of sea level rise. It is proposed to further investigate this option in the Climate Change Adaptation Plans that will be prepared for each management area. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
27	29-Sep-15	It is noted that many of the options suggested may conflict with the Estuary Management Plan (itself an environmental centric document with little or no regard for Economic or Social impacts – refer TBL comment). This conflict has been left unresolved and could ultimately render the already ineffectual BWFFRM Plan a completely lame duck.	Options proposed in the FRMS represent all options that may be suitable for the mitigation of flood risk in the floodplain. Several of these options were not found to be consistent with Council's Plans and Policies and as such (in addition to other reasons) they have not been recommended as actions in the FRMP. The actions proposed in the FRMP have been checked for consistency with the Estuary Management Plan. In particular, FM5 has been added to ensure that guidelines on seawalls are prepared to provide for more consistent construction and maintenance of these structures. Wave dissipating structures would only be installed in a manner that is consistent with the objectives of the Estuary Management Study. *No change has been made to the FRMP document.*
28	29-Sep-15	The initial expert recommendation of 30cm freeboard has been overturned in favour of a greater freeboard of 50CM. It is acknowledged that a 50cm freeboard generally includes a safety component for sea level rise (20cm?), this fact was included in previous Draft versions of the document but was removed for unspecified reasons. The FPL now includes both the 50cm freeboard (with SLR component) plus a separate sliding scale sea level component. This double up of risk factors represents a continuation of councils unnecessarily risk averse approach to management at the expense of a balanced risk management strategy.	The freeboard and allowance for sea level rise have been refined and developed over the course of the FRMS and the FRMP based on expert advice, advice from state agencies (OEH), Council, Committee members and the public exhibition periods. As stated in the 2010 Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments, the freeboard provides a relatively small allowance to accommodate some of the projected increases in rainfall intensity and sea level rise associated with climate change. This point was raised in a letter from OEH in 2014 specifically for this project. Whilst the FRMP recommends the incorporation of an allowance for sea level rise into the FPL, separate from the freeboard, the current allowance for sea level rise is based on RCP 8.5 utilising the medium sea level rise projection (which has a 50 percent chance of being exceeded). In addition, the design life for residential development has been recommended at 35 years for the purposes of identifying the sea level rise value to be included in the FPL. This is well below the 50 to 60 year design life identified by the Building Code of Australia. These considerations combined with the complex nature of flooding and localised impacts of flooding across the floodplain (discuss further in the FRMS) have led to the recommendations provided in the FRMP. It is also noted that the Floodplain Development Manual (NSW Government, 2005) recommends that typically a freeboard of 0.5m is adopted. Reducing the freeboard from this value effectively reduces the factor of safety that is applied to the FPL, and therefore has the potential to increase losses in future flooding events and so should not be undertaken without careful deliberation. *No change has been made to the FRMP document.*
29	29-Sep-15	The Plan repeats the historically inaccurate claim that the historical flood level (1974 reference flood) of the estuary was 2.04M Standard Datum or 1.95M AHD. The truth is that this level was observed and validated at one location only within the entire estuary and that Council has known (or should know) that the related 1976 Brisbane Water Flood Levels Report 204 and the 1975 Brisbane Water Waterway/Foreshore Study, both by Department of Public Works, clearly state that the general flood level experienced in the 1974 event was circa 1.6M Standard Datum which is slightly less than 1.6MAHD. Further it is acknowledged that the referenced 1974 flood level of 1.95MAHD is greater than the simulated 1974 flood level for this same location which is given as 1.82MAHD. The simulated 1:200 ARI is given as 1.83MAHD. All of these levels are greater than the modelled 1:100 ARI of 1.75MAHD now identified as the Design Flood Level for this location. (Figure 6.11in the Brisbane Water Foreshore Study 2009, Version 8 July 2013). This continued distortion of know historical fact, which is also reflected in the written advice from OEH (attachment Appendix B) which claims that the current FPL is based on a single mean flood level, must be corrected and one can only wonder what motivation lays behind these inaccurate claims from both Council and OE&H?	This matter is discussed in the FRMS document. The executive summary makes reference to the range of observed 1974 levels which differ depending on location, e.g. 2.01m AHD at Gosford and 1.59m AHD at Davistown. It is also discussed in the FRMS that the 1974 storm was likely to have been close to the 150 - 200 year ARI event. Further historical context is also provided in the FRMS relating to the 1981 definition of the FPL at 2.45m AHD. This information had not been brought over to the FRMP as the document is aimed to be a concise summary of the key outcomes of the FRMS. These details do not impact the recommendations or the context significantly. *To clarify the context of the existing FPL and the recommendations made in the document. The text in Section 4.2 has been amended explain that the FPL was based on a single location recording only.*

ID	Date	Summary	Response
30	2-Oct-14	At our general meeting held on 11th September 2014, a motion was passed with strong support to write a submission to Gosford City Council requesting that the still water level +0.4m sea level rise +0.3m freeboard option specified in the study document be the one adopted by Council in the BWFRMP. We would like to validate the motion by emphasising the following information that is included in the Study document: - Very high accuracy of flood level data - Relatively slow and predictable rate of flood water rise - Relatively low velocity of flood waters from storm surge - Siltation in flood waters is minimal - Relatively shallow height of floodwaters (above 1m in the 100year ARI) Overall the study document clearly specified that the 0.3m freeboard option provides adequate protection, and for these reasons the lower freeboard option is the correct option. Higher freeboard options have a range of adverse effects on property owners,e.g. additional stairs to floor level; steeper or longer access ramps for the disabled; increased insurance premiums; increased building costs; more expensive wave run-up considerations; and less flexibility in building design.	After careful consideration of the submissions received, collaboration with the committee and discussions with OEH, Council is proceeding with the recommendation of an FPL as follows: 1. A Flood Planning Level based on the derived 100-year flood level (Brisbane Water Foreshore Flood Study Cardno, 2013) plus a freeboard and projected sea level rise (SLR) component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development. 2. The recommended freeboard = 0.5 metres. This is reflected in the Council resolution from April 2015. *No change has been made to the FRMP document.*
31	2-Oct-15	The foreshore at Elfin Hill Reserve, Green Point requires protection as there has been significant erosion in this area, particularly after the April storm. We would like to se a continuous protective wall along the length of elfin hill Reserve, e.g. a large sandstone block wall would be quick, effective and aesthetically pleasing, and similar to those we have seen in other parts of the Central Coast.	The floodplain risk management process is not intended to directly mitigate erosion impacts. This matter has been forwarded on to Council as a separate matter. However it is worth noting that as part of the FRMP, guidelines are proposed for the development of seawalls in the area to provide for more consistent construction and maintenance. There are options included in the Brisbane Water Estuary Management Plan that seek to address issues associated with erosion. *No change has been made to the FRMP document.*
32	1-Oct-15	Overall the draft Plan seems well constructed to deal with the present risks of flooding around Brisbane Water, however it is noted that the Plan deal only in a limited way with sea level ris and it is necessary that this gap be addressed promptly through the proposed Climate Adaptation plans. One issues is the consistency between Plans. The draft plan for the Open Beaches and for Brisbane Water should to a very large extent follow consistent frameworks and principles. Additionally, some area-wide actions should be addressed on an integrated LGA basis covering both the beaches and Brisbane Water. It is not evident how strongly the two teams working on these Plans have concerted their focus to deliver a consistent approach, for example the issues of sea level rise and the cost of major protection works has not been dealt with consistently.	Climate adaptation and emergency management planning processes will enhance preparedness and response measures required. Climate change adaptation should be seen as a whole of government approach. Key principles should be agreed in an overarching framework that encompasses Floodplain Risk Management Plans, Estuary Management Plans Coastal Zone Management Plans and Asset Vulnerability. This should ensure that any co-ordinated response through planning, education, research, mitigation and compliance would meet the aims and objectives of common goals. *No change has been made to the FRMP document.*
33	1-Oct-15	The BWFRMP makes the point that future damage costs will be much higher due to sea level rise and emphasises that the proposed actions in the Plan are confined to addressing the current flood risk with the exception of interim flood planning levels. Accordingly, it is important that Council proceed with the development of the Climate Change Adaptation Plans promptly and this step should enable planning approaches for Brisbane Water and the Open Beaches that area suitable consistent in dealing with simultaneous extreme sea events.	Noted. The Climate Change Adaptation Plans are proposed to be undertaken as a priority action /recommendation of the Plan. *No change has been made to the FRMP document.*
34	1-Oct-15	It is essential to have a clear rationale set out in the Plan for allocation of costs between public sources (e.g. Council funding) and private interests (e.g. property owners) in the event of damages occurring and for undertaking preventative measures. This is missing from the draft Plan and should be included and should be consistent with the Open Beaches Plan. It is noted that although several management actions proposed in the Plan have listed the parties that will meet the cost of the proposed actions, there seems to be some contradiction and/or lack of clarity between those measures on the question of allocation of responsibility for meeting the costs. For example, PM3 and PM2 do not provide details on the specifics of the subsidy programs e.g. the logic behind contemplating subsidy programs, what special circumstances might make it appropriate etc. in addition, 11FM3 to 9FM3 on page 52-53 state that the works on private land are the responsibility of the owners however it is not clear what this means exactly.	Table 6.3 identified the potential source of funding for each of the options recommended for implementation. Where private land owners are identified as a potential source of funding, this relates to works on private land. See notes within Table 6.3 for options 11_FM3, 7_FM5, 3_FM3, 13_FM3 and 9_FM3. These options relate to works that would protect individual properties (e.g. wave run-up devices and private sea wall raising and maintenance). Funding and undertaking of these works would be on a voluntary basis by each property owner. Appendix C provides details on PM2 and PM3 with regards to identifying properties to be considered for subsidies, the benefits of providing subsidies and alternatives with regards to redevelopment or lobbying state government to provide discounts on GST and stamp duty when flood compatible redevelopment is undertaken. *Further explanation on this matter has been provided in the executive summary to clarify.*

ID	Date	Summary	Response
35	1-Oct-15	It is important that the community be well informed about the flood risk and that property owners and prospective property owners have ready access to risk information. The measures of informing the community that are set out in Section 6.4 constitute a sound framework for proceeding, however this section would benefit from additional details regarding: - What appears in Section 149 certificates and what the updating will involve - Better specificity surrounding the flood information to which current and prospective land owners may have access - a brochure on the topic of coastal flooding, insurance and properties on the Open Beaches, Broken Bay and Brisbane Water should be included in the information program. Council has issued a brochure regarding riverine flooding and it would be useful to prepare a similar brochure for coastal flooding.	Noted. Report to be updated with additional details on S149 certificates and the information that current and future land owners have access to. This information is prepared in accordance with the State Government Planning Circular PS 14-003. It is anticipated that a storm surge flooding brochure would form part of Action PM4. *Section 6.4 of the document has been updated with details of the information to be included on S149 certificates.*
36	20-Aug-15	In order to be better able to carry out the responsibilities of the SES in storm flood and tsunami management, the NSW SES Gosford Unit would like to obtain from Council some information relating to properties impacted by flooding. What we would like, if possible, is to obtain detailed information for those properties which in any size flood event, either: - have flooding on some part of the property but not over floor level of the residence; - have over floor flooding in the residence; or - are isolated by flooding due to road access being cut by floodwaters. It is requested that this information be in electronic format which can be transferred into SES computers. This information would not be shared with any third parties outside of the NSW SES.	Council to provide this information to the SES. Section 4.1.3 discussed the transfer of data from Council to the SES from the Flood Study, FRMS and FRMP. *No changes have been made to the FRMP document.*
37	5/09/2015	I have the following comments on the Study/Plan: - insurance costs have increased owing to you Plan - when a person extends their original home, why do they have to increase the floor level? This does not assist the elderly.	Concerns regarding insurance have been referred to Council for their consideration when liaising with the Insurance Council of Australia. With respect to floor levels, these are required to be set based on known flood risks. They are set to facilitate a reduction in flood risk and the safety of the community. After careful consideration of the submissions received, collaboration with the committee and discussions with OEH, Council is proceeding with the recommendation of an FPL as follows: 1. A Flood Planning Level based on the derived 100-year flood level (Brisbane Water Foreshore Flood Study Cardno, 2013) plus a freeboard and projected sea level rise (SLR) component as per Council's adopted Sea Level Rise Scenario at 2050 for residential development. 2. The recommended freeboard = 0.5 metres. *No change has been made to the FRMP document.*
38	23-Sep-15	The foreshore at Woy Woy from Bowden Road northwards has had a cycleway built by Council which is a wonderful amenity, however it currently unnecessarily restricts drainage towards Brisbane Water when there has been salt water flood and storm inundation. Instead, the saltwater runs towards the houses, and this has the potential to cause damage to the foundations of houses over time. Unfortunately in parts, the cycleway has been built higher than the reserve, and the reserve has not yet been levelled out properly by Council to drain towards Brisbane Water. We suggest that consideration be given to the reserve being graded appropriately to allow floodwater drainage back to Brisbane Water.	This issue will be considered as a separate matter by Council. *No change has been made to the FRMP document.*
39	6-Oct-15	The DPA notes that a number of issues in the final draft have been answered and resolved at the last exhibition and a subsequent meeting. However, the DPA would like the following points to be noted. - DPA is concerned with the references to the retreat of wetlands in the current Coastal Zone Management Plan for Brisbane Water which is connected to the BWFRMP. DPA would like a clear statement that wetlands will not be allowed to retreat into any existing area of residential development in the event of rising sea levels.	The proposed Climate Change Adaptation Plans will assess the implications of rising sea levels on the foreshore area, including urban and ecological areas. The FRMP can not clarify, as requested, if or where retreat of wetlands would be permitted, if at all. The Estuary Management Plan should be referenced for details on this issue. *No change has been made to the FRMP document.*
40	6-Oct-15	The DPA notes that the previous reference of an adaptation plan for Brisbane water estuary contained in the CZMP. DPA considers that the Climate Change Adaptation Plans for low-lying areas such as Davistown and Empire Bay should be immediately implemented as it is considered to be an urgent and missing item of importance for our community.	Noted. The Climate Change Adaptation Plans are proposed to be undertaken as a priority action /recommendation of the Plan. This action is listed as "Staged" since it will require additional information and continual adaptation as scientific data and information progresses. It is intended that individual Climate Change Adaptation Plans will be prepared for each management area identified in the FRMS, with Davistown, Empire Bay and Woy Woy being of highest priority. Other Council priorities may determine timing. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
41	6-Oct-15	Given that growth centres have been identified in the Gosford LGA including Terrigal, Erina, Kincumber Woy Woy and Gosford CBD, we assume that minimal resources would be available from within council to complete the FRM process for those areas such as Davistown and Empire Bay where flood studies have already been completed but which are not included as one of these growth centres. However it is important for issues in these locations to be addressed sooner rather than later given that areas such as Davistown and Empire bay are affected more than most by flooding and potential future sea level rise.	The recommendations of the FRMP prioritise actions based on existing flood risk and effectiveness of implementing the various actions. The actions in the growth centres have not be placed as a higher priority that other areas. A masterplan for development would be beneficial in areas where flood studies have already been undertaken. *A recommendation has been included in PM7 regarding a masterplan for future development.*
42	1-Oct-15	We are concerned that the open forums which offered more opportunity for discussion, have been replaced by drop-in sessions.	The development of the draft FRMP followed extensive consultation during the preparation of the FRMS. The FRMS informs the draft FRMP. *No change has been made to the FRMP document.*
43	1-Oct-15	We feel Council needs to start mitigation procedures now rather than just talking about it. A decision needs to be made sooner rather than later especially given recently experienced extreme weather which did cause flooding. The Plan does not offer Empire Bay and other vulnerable areas any mitigation against current or future flood threats.	The outcome of the FRMS assessment was that development controls in these locations are to be amended to facilitate enhanced future flood planning of these areas. Emergency response and education measures were also identified as providing reduction in the impacts and risk to life associated with flooding of the Brisbane Water foreshore. Other measures such as house rasing and lot based filling were recommended to manage the impacts of flooding on residential property. Several of the hard engineering options identified for Davistown and Empire Bay (e.g. road raising FM1a and FM1b; and levees FM6a and FM6b) were not recommended for inclusion in the FRMP as they did not have an appropriate benefit-cost ratio under existing flood conditions and sea levels. However, given the potential benefits of these types of options with rising sea levels, it is anticipated that these options will be further investigated as part of the Climate Change Adaptation Plans that will be prepared. Climate Change Adaptation Plans were an outcome/ recommendation of the Floodplain Risk Management process, but need to be undertaken separately as it is beyond the scope of the Floodplain Risk Management Study/Plan. An individual Climate Change Adaptation Plan will be prepared for each management area identified in the FRMS, with Davistown, Empire Bay and Woy Woy being of highest priority. *No change has been made to the FRMP document.*
44	1-Oct-15	We are not pleased that Council is publishing individual addresses from the results of the floor level survey, particularly as Council acknowledged there were errors in the data. Homeowners insurance cover and premiums have been compromised by inconsistent definitions of flooding on Council's flood certificate.	In NSW it is common practice to include floor level information as part of developing a Floodplain Risk Management Studies & Plans. Council also adopted the minutes of the 25 November 2014 meeting Catchments and Coast Committee which discussed the inclusions of the floor level information within the appendices of the study in line with general practice. *No change has been made to the FRMP document.*
45	1-Oct-15	We do not agree with the prospect of planned retreat and hope that it can be ruled out. Continuing uncertainty surrounding this issue is causing distress.	This option is not a recommended outcome of the floodplain risk management process due in part to the extensive social disruption and financial cost that would be incurred under current sea level rise conditions. However, in the future, this option may become more viable depending on the impacts of sea level rise. It is proposed to further investigate this option in the Climate Change Adaptation Plans that will be prepared for each management area. *No change has been made to the FRMP document.*

ID	Date	Summary	Response
46	1-Oct-15	It would appear that there has been misrepresentation of the levels of flooding in different parts of the estuary in the 1974 event and therefore Council shouldn't be basing their strategy on the highest level above high water, instead of the mean.	This matter is discussed in the FRMS document. The executive summary makes reference to the range of observed 1974 levels which differ depending on location, e.g. 2.01m AHD at Gosford and 1.59m AHD at Davistown. It is also discussed in the FRMS that the 1974 storm was likely to have been close to the 150 - 200 year ARI event. Further historical context is also provided in the FRMS relating to the 1981 definition of the FPL at 2.45m AHD. This information had not been brought over to the FRMP as the document is aimed to be a concise summary of the key outcomes of the FRMS. These details do not impact the recommendations or the context significantly. *To clarify the context of the existing FPL and the recommendations made in the document. The text in Section 4.2 has been amended explain that the FPL was based on a single location recording only.*
47	16-Sep-15	This process appears to have been most ineffectual, with recommendations being made but nothing really being done. Expecting property owners to raise floor levels but then Council not raising roads and infrastructure accordingly is not appropriate. If Council has already made the decision to retreat in some of the most affected areas you need to tell the community now.	Floor levels controls have been recommended to ensure that any new developments have floor levels high enough to reduce the risk of most flood events for current sea levels. Increasing road and infrastructure for current sea levels would be done to facilitate better emergency evacuation of some areas. While these options were considered, they were not considered viable due to the generally relatively shallow depths of flooding and duration of flooding likely to occur. Raising of roads and other infrastructure to address the future impacts associated with sea level rise will be investigated more thoroughly as part of the proposed climate change adaptation plans. Planned retreat is not a recommended outcome of the floodplain risk management process due in part to the extensive social disruption and financial cost that would be incurred under current sea level rise conditions. However, in the future, this option may become more viable depending on the impacts of sea level rise. It is proposed to further investigate this option in the Climate Change Adaptation Plans that will be prepared for each management area. *No change has been made to the FRMP document.*
48	?	I would be very interested in PM2 voluntary house raising for our house. Could you please put our house on the list. At present we have people filling their land, some slowly and causing run off and seepage to neighbouring properties. Some have used ag pipe instead of stormwater pipe for stormwater which causes problems for neighbours. Please keep our drain clean and free from silt and trees etc.	House raising was identified for further investigation for properties that filfilled a certain set of criteria. This included: - Over floor flooding in the 5 year ARI event; - Comprises a residential dwelling of construction type suitable for house-raising (i.e. not slab on ground); and - The house does not lie within the high hazard extent. *No change has been made to the FRMP document.*
49	2/10/2015	I think that some other management options to manage flood risk could be: - more retaining walls along waterfront where none have been constructed. - all retaining walls along waterfront to be made higher by about 60cm at least. - stormwater outlets on reserves to be made higher as possible so as to deter tidal water going up the pipes and thus allow stormwater from residents to get away.	As part of the FRMP, guidelines are proposed to be developed with regard to seawalls in the area to provide for more consistent construction and maintenance. It is noted that seawalls and retaining walls need to be designed appropriately so as to prevent adverse environmental impacts on the foreshore. Making stormwater outlets higher could result in a backing up of the stormwater system and may not allow stormwater to escape appropriately. An alternative to this is the use of one-way valves on stormwater outlets. This has been recommended as an action to be implemented in the Plan (FM4). *No change has been made to the FRMP document.*

ID	Date	Summary	Response
50	2/10/2015	A suggested evacuation centre for the Davistown/Saratoga area is Brisbania School.	*The use of Brisbania School has been noted and is to be considered as part of Action EM7.*
51	2/10/2015	Please keep our drains clean and free from silt, some drains even have trees growing in them.	Noted and referred to Council as a separate matter. *No change has been made to the FRMP document.*
52	12/10/2015	1- Table 6.1 and Table 6.2 – management actions recommended for the overall floodplain – it would be helpful if these were numbered from 1 – 30.	*Numbering relating to the Plan will be provided rather than only using the numbering from the Study. Although reference to the study option ID will still be retained to ensure cross referencing with the study is achievable.*
53	12/10/2015	2- Section 4.2 discusses flood planning levels and recommends the use of an interim flood planning level. The discussions and justification for using a shorter term sea level rise component of the flood planning level is that climate change adaptation plans (CCAP)will be carried out for each area, or particular areas, which will re-examine flooding, and sea level rise constraints. However, in table 6.1, these actions are listed as the eleventh (11th) management strategy, and indicated as a Medium priority in Table 6.3 . OEH's understanding was that these climate change adaptation plans are the highest priority with regard to planning controls for the flood prone areas to provide certainty for both existing and future development, and the outcomes of the Brisbane Water foreshore FRMP would enable to the priority areas to be identified for the first CCAP's. with the way the actions are currently listed in Table 6.1 and Table 6.2, it is difficult to ascertain the exact priority of these CCAP's with regard to other management actions, let alone identify what areas are high/medium/low priority for CCAP's. the discussion in section 6.5 just muddies this issue even further, with regard to priority areas for the Brisbane Water Foreshore.	Option PM9 (CCAPs) does not address the existing flood risk and is proposed as an adaptation strategy for infrastructure, residential areas and ongoing functionality of the Gosford LGA as a result of SLR. The priority in the rankings for the BW FRMS&P was based upon existing risk. Hence PM9 which seeks to address future risk does not rank as highly and this is why it receives a "medium" priority with regards to addressing existing flood risk. *No change has been made to the FRMP document.*
54	12/10/2015	3- It would be beneficial if the priority for the actions listed in Table 6.1 and 6.2 included their priority, as shown in table 6.3	*No change has been made to the FRMP document.*
55	12/10/2015	4- It would be beneficial if the total cost of the recommended works were indicated.	*Total cost of implementing the entire plan will be shown.*
56	12/10/2015	5- Table 6.3 - Some of these costs seem high. A large portion of these costs would be covered by work carried out by these agencies as part of "business as usual", for example reviewing SES Local Flood Plan / development of alternate route accesses/reviewing and amending planning controls etc….. They end up indicating the cost of the FMRP as quite high, when really, the costs could and will be managed in-house by each agency, and thus not create extra burden for existing budgets, and therefore the overall cost of implementing the FRMP in the long-term would be financially more manageable, and more amenable to the decision makers on its adoption and implementation.	*The costing of the Plan has been revised.*
57	12/10/2015	6- Table 6.3 - EM&7 discusses evacuation centres – Department of Community Services (formally referred to as DOC's, however not sure if they have a new name are acronym) are actually responsible for evacuation centres during flood events.	Noted.
58	12/10/2015	7- Table 6.3 – many other agencies have been indicated in this table as being responsible for the cost of implementing the specific action. Have these agencies been contacted and their concurrence gained, to be included in the FRMP? i.e. 14_PM6 included a cost of $4.3 million to relocated Woy Woy police station. Have NSW Police been contacted about this? If not, it is questionable whether the costs should be included in the FRMP, as shown in the "TOTAL" of table 6.4, the costs apportioned to this action, as well as relocating the SES HQ, significantly distort the estimated cost of proposed actions for that period.	The appropriate agencies have been contacted. It is noted in the FRMP that relocation of these facilities may be done on a temporary basis during a flood event to a location that has effective access to emergency response and Council staff and adequate facilities to ensure effective operations during a flood event. A full cost benefit analysis would need to be undertaken to identify the preferred location and approach. *The costs for these options have been reviewed as part of the Final FRMP document.*
59	12/10/2015	8- Table 6.3 – PM5 – this is a Council responsibility, not state government	*Responsibility will be changed to Council.*
60	12/10/2015	9- Table 6.3 – There are a number of recommendations regarding detailed investigation on the impacts on structural floodplain risk management options that are identified as high priority for immediate implementation, whereas the CCAPS's come in at a medium priority. Why would these structural floodplain risk management options be considered before the CCAP's are complete for each area, I thought that was the intent of doing the CCAP's first.	*These options have been reviewed and updated to reflect the need for overland flow assessments within the context of assessing floodplain filling and sea level rise management.*
61	12/10/2015	10- Table 6.3 – PM2 discusses voluntary house raising, however it was shown not to be currently viable anywhere. The detailed floor level survey that was carried out for this study should be able to indicate where this option could apply to in future. This information could be used as part of the CCAP's. although specific houses/properties do not need to be identified in this study, the information could be used to identify priority areas, or areas where work on CCAP's should commence immediately.	*The option for VHR has been revised to include three separate components. The development of a VHR policy. Ongoing monitoring or properties not identified for VHR but that may become viable as a result fo SLR. And VHR of appropriate dwellings impacted by 5 Year ARI over floor flooding.*

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62	12/10/2015	11- Table 6.3 - final action 9_FM3 – this is not a flood mitigation option, so why is it included in the floodplain risk management plan? This is included in estuary/coastal management plans, and my understanding is that the Brisbane Water Estuary Management Plan includes actions similar to this.	This action has been recommended to dissipate wave run-up and overtopping and hence reduce flood risk. The Estuary Management Plan addresses foreshore erosion not property inundation. *This options has been revised to allow for the prepration of wave management guidelines to assist property owners in understanding and managing the risks of waves.*
63	12/10/2015	12- Table 6.4 – Can council commit to spending this proposed money and resourcing these commitments? It is questionable whether current council resources would be able to match this plan, with regard to financial and technical assistance.	*The costs of the FRMP has been updated reflect this comment.*
64	12/10/2015	13- Section 6.5 – states that CCAP's should be prepared as separate documents from floodplain risk management planning process. Why is this? They can be carried out through this process if Council wishes to do so, there are a number of Councils carrying out these projects, and supported by OEH's Floodplain Management Program.	The statement to this effect in Section 6.5 was intended to show that the CCAPs would be undertaken following the finalisation of this FRMP (i.e. as an outcome of this FRMP). The CCAPs have not been incorporated into the FRMS or FRMP as it was decided that the FRMP should endeavour to focus on the existing flood risk and the finalisation of the FRMP should not be delayed further by incorporation of extensive analysis on future flooding risk. The FRMS was also being finalised concurrently with Council providing a position on climate change. *The wording in Section 6.5 has been updated to clarify this matter.*