

Sea Level Rise: The New Atlantis

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Bachelor of Town Planning Thesis Project



Abstract

The earth is changing, the oceans are changing, the weather is changing, and environments are changing, so we must change. The human race is facing an uncertain future due mainly to its own wasteful and destructive past. Climate change and sea level rise are changing our coastline and impacting on coastal ecosystems and the built environment. Globally, hundreds of millions of people will be displaced as a result of the phenomenon and Australia is not immune. Traditional methods of coastal planning will need to evolve. The biggest question facing us is what is the most appropriate and ecologically sustainable response? This thesis examines current policy in New South Wales and compares the sea level rise responses of Byron Shire Council and Port Stephens Council. Through site visits and lengthy discussions with the relevant state and local authorities this thesis reports on the current and potential impacts and adaptation methods used to secure the future of the NSW coastline. Sea level rise response in NSW is relatively weak and fragmented at this stage and there is room within the existing framework to strengthen planning strategies to give much clearer direction for local agencies to use in future adaptation.

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Chapter 1

Introduction

Problem statement

Research objectives



1. Planning for Sea Level Rise

1.1 Introduction

The earth is changing, the oceans are changing, the weather is changing, and environments are changing, so we must change.

“The world as we have created it is a process of our thinking. It cannot be changed without changing our thinking.” - Albert Einstein.

Climate change is a natural cycle that involves the gradual cooling and warming of the earth over time. There are a number of factors that impact on the rates at which the earth will warm or cool. Some of these factors can be heavily manipulated by human use or abuse of the environment. Climate change and sea level rise are currently changing our coastline and impacting on coastal ecosystems and the inter related built environment. Along more vulnerable coastlines it is predicted that for every one metre of sea level rise there will be approximately fifty – one hundred metres of landward horizontal erosion (Pyper 2007 pp 16). Globally, hundreds of millions of people will potentially be displaced as a result of this phenomenon and Australia, with its population concentration along its extensive coastline is not immune.

The human race is facing an uncertain future due mainly to its own wasteful and destructive practices. This thesis will examine the impacts of one of the aspects of climate change – sea level rise, and the strategies that are currently proposed to deal with some aspects of this problem across a variety of jurisdictions. As the growing body of evidence heightens the awareness of sea level rise and its consequences, it is quickly becoming the most important global environmental issue and it has implications for major impacts on communities across the globe.

In Australia the impacts of increased coastal erosion, stronger storm events and coastal inundation are already putting homes at a high risk of being washed into the sea. There are proposed responses to the threats to coastal communities and infrastructure but controversy surrounds these solutions as the competing views of various stakeholders are varied and the level of the threat itself is debated.

Traditional methods of coastal planning are challenged by the threats presented by sea level rise and will need to evolve in the light of the scientific evidence that indicates that coastal communities will be impacted. The biggest question facing authorities is what is the most appropriate and ecologically sustainable response? This thesis examines current policy in New South Wales and compares the sea level rise responses of Byron Shire Council and Port Stephens Council. Through site visits and lengthy discussions with the relevant state and local authorities this thesis reports on the current and potential impacts and adaptation methods used to secure the future of the NSW coastline. At this stage sea level rise response in NSW is relatively weak and fragmented and there is room within the existing framework to strengthen planning strategies to give much clearer direction for local agencies to use in future adaptations.

Globally there are a number of methods being employed and discussed to combat rising sea levels, increases in coastal erosion and coastal inundation. Adaptation measures can be either policy based or hard engineering solutions. Some governments are concentrating on just a single form of adaptation while others are using a combination of strategies. As the sea level rises and coastlines erode, the maintenance costs for hard engineering structures are predicted to soar.

California, the first state in the United States of America to do so, has released climate change policy. California is very comparable to NSW because of similar populations and geography. California is experiencing strong coastal development pressures and equally strong coastal erosion and sea level rise impacts. California is currently investigating a number of adaptation methods and policy responses in relation to the coastline which could be used as a model for NSW adaptation.

The most common solutions emerging in the adaptation for sea level rise and increased coastal erosion are planned retreat and beach nourishment. Sea walls, groynes, dykes, levees and the reclaiming of land are other methods currently being employed around the world. Another approach is more philosophical and involves changing attitudes so that communities can adapt to live on the water rather than fight against it. Land rezoning and land acquisition, either voluntary or mandatory, are strategic methods that are not being considered as long term solutions due mostly to the high financial cost and the unwillingness of the broader community to compensate individual property owners.

The coastal communities throughout NSW are experiencing higher than average population growth (Australian Bureau of Statistics (ABS) 2009). Over 20% (ABS 2009) of the state's population lives in coastal Local Government Areas (LGA's) outside Sydney. The far north coast

is experiencing annual population increases of up to 2.6% (ABS 2009). This population growth is placing increase pressures on coastal development with the 'sea change' lifestyle phenomenon. Local Governments have to ensure that there is land available for development and population growth without compromising the evolving nature of the coastline and the potential impacts of sea level rise, coastal erosion and inundation and the associated liability.

This thesis identifies two case studies. The first of these is the Byron Shire, which is within the Tweed to Richmond Statistical ABS Division and has experienced the largest growth in NSW outside of Sydney. Byron Shire has had coastal erosion and sea level rise policy in place since 1988 and has been in constant conflict with residents as to its appropriateness as a solution and adaptation method. With the Shire's population growing rapidly and the demand for coastal land at an all time high, the Council is faced with a very difficult issue. Not only does the Council have to ensure that zoning allows for increased development pressure demand but the Council also must manage the severe erosion that is occurring on many of its beaches. This erosion is currently directly impacting on multimillion dollar private beachfront estates.

The second case study examines the responses in the area administered by Port Stephens Council, which is a low lying area north of Newcastle. It has a growth rate that mirrors the state average of 2.1% (ABS 2009). Port Stephens Council does not yet have sea level rise planning in place but is in the process of completing a major flood study which will be used to advise the future coastal planning framework. Climate change and sea level rise are issues that have been outlined in the Local Community Issues Paper released in 2008. It is well understood by Council that rising sea level is going to significantly impact on developments within the Council boundaries. The Council also notes in the paper that there will be significant increases in development pressures within the council area due to the continuing Pacific Highway Upgrades and reduced commuting times from the major population centres of Greater Newcastle and Sydney.

Local Councils, to this date, have had to develop and manage their own adaptation policy with very little State Government input. This appears to be about to change as coastal erosion protection and planning in NSW has recently been given direction through coastal erosion policy reform. Sea level rise and increased coastal erosion is threatening homes and infrastructure. There is a clear opportunity for the State Government of NSW to take control and lead Local Governments to an efficient and effective solution. On the 18th of October 2009 the NSW Premier Nathan Rees promised a detailed package including legislation that will allow private land owners to fund their own erosion protection works if they are environmentally feasible (Wilkinson 2009). The Premier stated that "these issues should be dealt with locally but recent disputes have shown that

intervention was required to achieve a practical result” (Walters et al 2009). Under the new plans the cost of protecting the coastline and assets would be shared between affected residents and state and local authorities.

One of the biggest issues with sea level rise and coastal erosion is the potential for people to lose property, often property that they have spent their entire lives working to keep and maintain as a home or a special holiday destination. The potential loss of this asset will mean a substantial financial cost and potentially a significant emotional cost to the individuals involved. People will go to great lengths to protect their properties and policy will need to reflect this issue very carefully while still addressing coastal erosion and the environmental and broader community costs.

The State Government now recognises that sea level rise and coastal erosion is an environmental threat that is predicted to escalate in the coming decades. It is important that the protection methods that are employed are well designed and every impact considered. In NSW, planning policy is likely to include hard engineering methods such as sea walls. Sea walls need to be built and designed so as to not transfer erosion from one spot to another and a budget needs to be allocated for long term maintenance. The State government has indicated that its new policy will provide for the property owner to build protection structures only after carrying out environmental assessment studies and the onus will be on the individual owner to fund the project. The planned retreat policy employed in Byron Shire may be superseded by any new State Government policy but there is an appropriate place in State and local policy for planned retreat strategies to be considered (Wilkinson 2008).

The reality of sea level rise has placed new demands on planning policy in coastal areas. The nature of the issue indicates that coastal areas are no longer stable and any development plans need to be considered in the light of environmental transformations and levels of uncertainty.

1.2 Problem statement

Sea level rise and coastal erosion is a recognised issue for coastal communities globally. Communities along the NSW coastline are losing land to the sea every day yet planning and legislative framework is yet to reflect this trend. Local Governments play an instrumental role in assisting the delivery of sustainable outcomes at the local level, however without significant State Government direction a patchwork of coastal management tools are appearing along the NSW coast.

The success of coastal planning in NSW hinges on the ability of the NSW State Governments to provide clear direction and structure to coastal zone management in NSW.

The research topic concentrates on the strategic response to sea level rise, coastal erosion and coastal inundation. The aim of the paper is to examine the current policy and legislation that is relevant to sea level rise in NSW and particularly on the north coast of NSW where coastal development pressures are expanding with a growing population. The paper intends on identifying the abilities of the government to further improve and evolve the current strategic tools to have a more direct and stable influence on coastal development and policy outcomes in NSW.

1.3 Research objectives

A number of research objectives were developed to guide the development of the thesis. These are as follows:

- Determine that coastal erosion is an issue for the NSW coastline.
- Identify planning policy in NSW that is directed towards management of sea level rise and coastal erosion.
- Identify opportunities within the existing planning systems to include provisions for sea level rise and coastal erosion issues.
- Identify the roles of the different levels of government in NSW to direct planning and coastal management around sea level rise and coastal erosion.

Chapter 2

Methodologies

Issues with the research

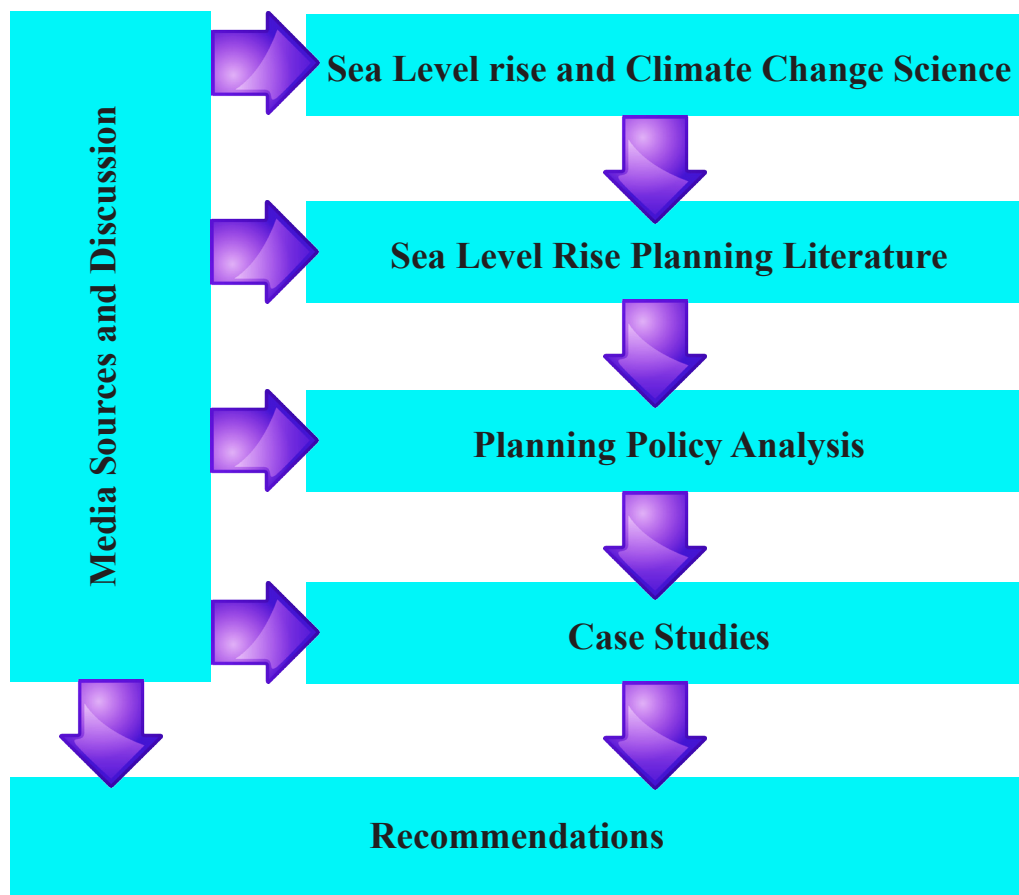
Ethical considerations



2. Research

2.1 Methodologies

A variety of methods were applied in this study including both primary and secondary research. Informal interviews and formal interviews were also planned in the development of the research. This study was primarily designed as a policy analysis and issue identification research paper aimed at providing a comprehensive view of the NSW planning system. A hybrid research design (Hall 2003) was selected for use in this study which is displayed in figure 1 below:



*Figure 1: Thesis research design.
(Source: Author 2009)*

2.1.1 Literature review

An initial review of the existing academic discourse relating to the subject was undertaken to identify the key issues and discussion topics. The review of existing literature was conducted to provide the foundations for the proposed research and identify the issue as an international problem and not one unique to Australia.

The review was intended to identify not only the scientific basis behind the topic but also the planning discussion on adaptation methods in relation to both theoretical and global applications. Through the literature review a number of techniques and tools were identified for possible implementation locally.

2.1.2 Policy review and analysis

A major component of this study is a detailed overview of the way in which sea level rise and coastal erosion has been addressed and the actions currently implemented at a State and regional level have been provided. Relevant contemporary planning documents including plans, policies and legislation have been examined providing a detailed analysis of the legislative framework in NSW.

2.1.3 Case studies

Case studies were undertaken to identify the struggle and difficulties that Local Governments are encountering.

There was a complete policy analysis completed for both the Byron Shire Council case study as well as the Port Stephens Council case study. The policy analysis concentrated on the issues of coastal erosion and sea level rise and identified areas where these policies were lacking.

Site visits were incorporated into the research at this point to gain an understanding of the issues from a practical perspective.

2.1.4 Interviews

In depth interviews were intended to be apart of the research. Informal interviews were conducted with a number of council employees and state government officers but due to the sensitivity of the sea level rise issue in-depth interviews were abandoned.

Informal interviews were undertaken with Sally Whitelaw from Port Stephens Council and the Byron United (Byron Chamber of Commerce) Vice President James Loncaster.

2.2 Issues with the research

2.2.1 In depth interviews

I encountered a number of issues with my research, the main being the high profile of the sea level rise issue, the sensitive political nature of the topic and the potential legal implications of anything being taken out of context.

2.2.2 State Government

A number of discussions were had with officers in NSW State Government Departments including the Department of Planning and the Department of Environment, Climate Change and Water. Through these discussions it was clear that other than the information that was released as part of draft policies or media releases, that officers could not elaborate further in any way on the issues of the report. The relevent state government officials are vital information sources but in depth interviews were deemed to be of no benefit due to their restrictions on their ability to provide perspectives or additional details.

2.2.3 Local Government

Attempts were made to discuss the planned retreat policy with Byron Shire Council Officers with no success. There are many concerns among the community that the council was either not willing or was too under resourced to be able to talk to the community about the issue and this same issue was encountered in undertaking this research.

2.2.4 Site visits

Torrential rain was encountered during site visits to both Byron Shire and Port Stephens Shire. For this reason photos of both areas have been sourced externally.

2.3 Ethical considerations

All research and reporting involved in this study, was carried out in a professional and ethical manner. Permission to conduct this research was ascertained from the UNSW Faculty of the Built Environment's Human Research Ethics Advisory Panel in the form of written consent prior to the commencement of this study

Chapter 3

Introduction

The science

Impacts

Planning theories and adaptation measures

Summary



3. Literature Review

3.1 Introduction

Global warming and climate change is a natural process.

It is demonstrated in the literature that the earth periodically cools and warms in a balanced cycle. In the current cycle, there has been a measurable natural warming. Current research indicates carbon concentrations in the earth's atmosphere at a higher level than previously recorded (Chandler 2007) and significantly higher than measured in 650 million year old ice samples (Guggenheim 2007).

The warming rate is faster than at any time in measurable assessment. As far as indicated in the literature and available research the planet has never previously been subjected to this rate of warming. The general consensus is that human activity has directly caused these adverse climatic changes (Kostigen 2008).

The warming of the atmosphere due to significantly increasing levels of greenhouse gasses also warms the oceans, melting the ice caps, fuelling extreme weather events and changing the nature and composition of ecosystems. Global warming is in no small part put down to anthropocentric activity (Kostigen 2008).

As there are many synics on the climate change issue the debate is hostile and usally contested. Figure 2 displays the rising temperatures as recorded in the The Intergovernmental Panel on Climate Change (IPCC) fourth assessment report. There is no debating the rising surface temperatures.

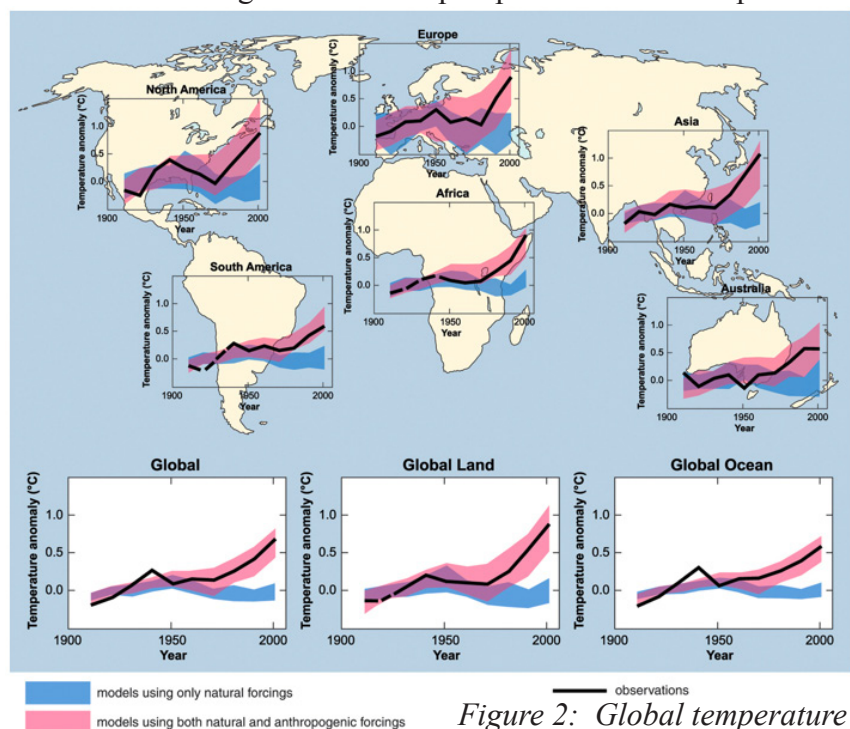


Figure 2: Global temperature change. (Source: IPCC 2007)

Stevens 2009

Sea level rise has been relatively stable at about 1.8mm per year over the last century (Wilkinson 2008). More recent records are showing much higher levels of sea level change. In the period between 1993 and 2003 the sea levels rose at an average of 3.1 mm per year (Wilkinson 2008). The IPCC is a widely recognised and trusted recourse of climate change data and predictions. One of the leading oceanographers on the panel, Dr John Church predicts there will be between 15cm and 70cm of sea level rise by 2050 (Figure 3) and up to an increase in 1.3m by 2100 (Church 2008 pp 16). It will take many more hundreds of years for the ocean to stabilise even if human induced greenhouse gas concentrations were immediately brought back to natural levels (Church 2008).

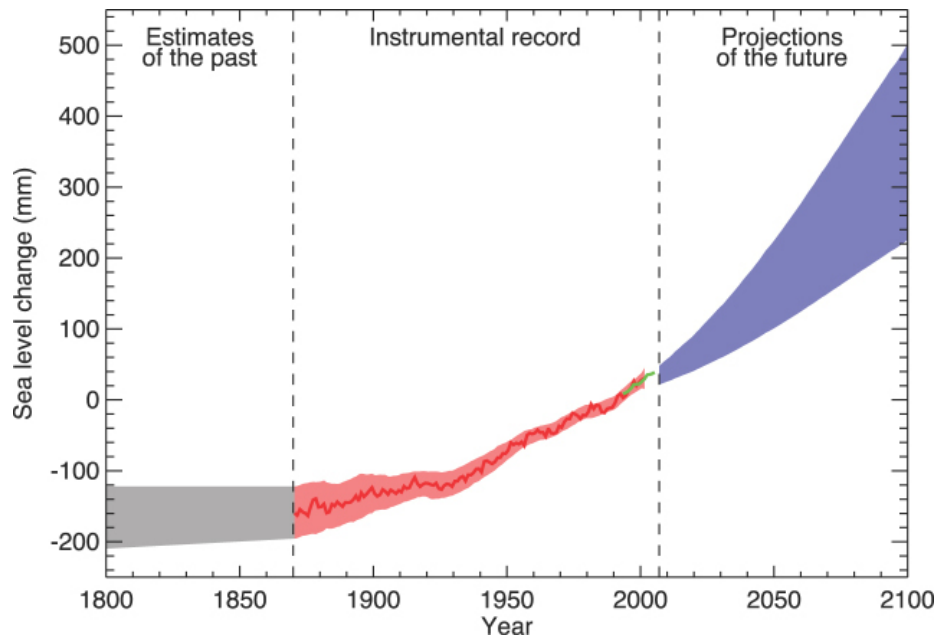


Figure 3: Sea level rise predictions. (Source: IPCC 2007)

The impacts of rising sea level will have global and regional implications, with ecosystems threatened by accelerated coastal erosion, land values and property lost to coastal inundation and flooding, and impacts on drinking water resources.

3.2 The science

By its very nature, sea level rise is a long term concern. The effects of global warming are slow and may take decades to become fully apparent (Walsh et al 2004). Oceans play three major roles in the planet's climatic system:

- Oceans provide a heat bank, collecting, storing and mobilising energy.
- Oceans are a central part of the carbon cycle
- Oceans change in volume to accommodate changes in temperature (Church 2008 pp 15)

All three of these roles are vital in balancing global climate (Church 2008 pp 15). Oceans absorb heat and carbon dioxide. Changes in carbon dioxide concentration and temperatures alter the oceans circulation systems which in turn affect regional climate (Walker 2000).

A number of measures are used to predict sea level rise. They include:

3.2.1 Thermal expansion

The warming of the ocean results in expansion (thermal expansion) which is the main contributor to sea level rise since 1961 (Church 2008 pp 17). Thermal expansion will continue for centuries after greenhouse emissions have stabilised in the atmosphere (Church 2008 pp 17). While measurements are difficult and complicated, a comparison of regional and global observations suggest that thermal expansion has been advancing at a rate of about 1mm per year for the past several decades (Church 2008).

3.2.2 Glaciers and small ice caps

The natural melt of small ice caps and glaciers affects sea level. Over the past century there has been a noticeable retreat in the world's glaciers and ice caps (Walsh et al 2004 pp 588). There are roughly 100 000 glaciers worldwide (Walsh et al 2004 pp 588) with different sizes, rates of movement and melting speeds. Precise measurements of the mass balance of these have only been made for a few of the larger glaciers thus predicting their precise contribution to sea level rise is very difficult. Estimates have been made by breaking the world into regions and making assumptions based on each region having the same mass balance for the glaciers in that region (Walsh et al 2004 pp 588). It is assumed that glacial melt has contributed to sea level rise of 2-4 cm over the period of 1910-1990 (Walsh et al 2004 pp 588).

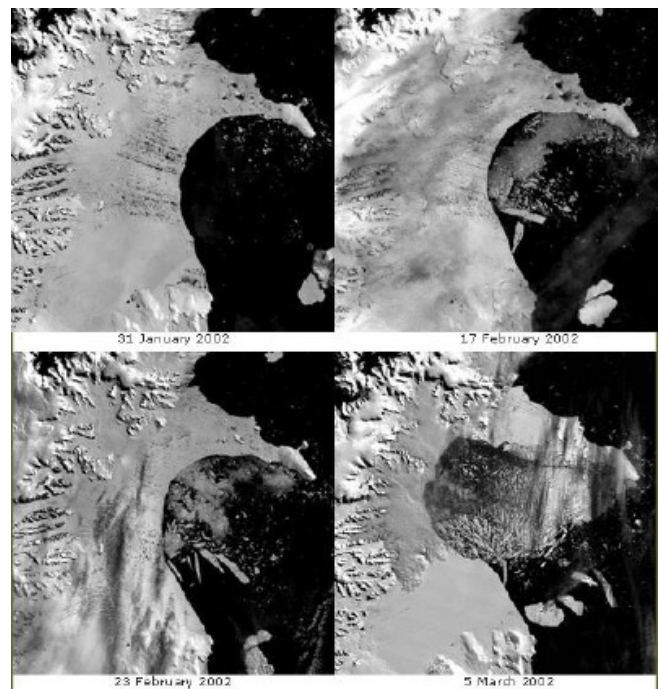
3.2.3 Greenland and Antarctica ice sheets

Potentially the greatest contribution to sea level rise is the melting of the Greenland and West Antarctic Ice Sheets. Together they have the potential to increase the mean sea level by 13m (Church 2008 pp 17).

Large ice sheets such as those in West Antarctica and Greenland gain mass by precipitation and lose it through melting and ice flow into nearby oceans. Models indicate that there will be an increase of approximately 3 degrees Celsius (Pillock 2007 pp 17) to average global temperatures by 2100 which means melting will exceed precipitation in Greenland and Antarctica and therefore these Ice Sheets will continue to contribute to sea level rise (Church 2008 pp 17). These two ice shelves are considered to be the ‘two canaries in a coal mine’ (Guggenheim, 2007). It is clear from literature sourced that global warming will be well advanced and perhaps irretrievable when these canaries begin to melt.

The rate of melt in some areas is already alarming, for example, Larsen B Ice Shelf in Antarctica disintegrated (figure 4) in just 32 days during February 2002 (Guggenheim 2007).

Figure 4: Larsen B Ice shelf melting and breaking up in 2002. (Source: Verne 2009)



3.2.4 Terrestrial storage

Terrestrial liquid is the water stored in the land mass. The volume of terrestrial liquid changes over time due to evaporation, runoff, extraction, reservoirs, storage and irrigation. Current predictions and models suggest that the contribution of terrestrial liquid to sea level rise is not significant in its own right (Walsh et al 2004 pp 588). It is estimated however that permafrost and tundra regions hold significant quantities of terrestrial liquid and the melting of these regions could potentially lead to increased amounts of terrestrial contribution to sea level rise (Walsh et al 2004 pp 588). Rough estimates have terrestrial contributions of sea level rise at 0-0.1mm per year (Church 2008 pp 17).

3.3 Impacts

In 2005 the chief scientific adviser (Sir David King) to the British Prime Minister (Tony Blair) said that ‘the map of the world was going to need to be redrawn as a result of the increased levels of sea level rise being recorded and predicted’ (Wong 2008).

Leading climate change experts are predicting catastrophic consequences including the displacement of up to fifty million people worldwide as a result of global warming (West 2009). If half of Greenland and half of the West Antarctic Ice Sheets melted, the world would see nearly seven metres of sea level rise (Pockley 2007 pp 30). Seven metres of sea level results in forty million people displaced from their homes in Shanghai, thirty million people in Beijing would be forced inland and lose their homes and in Calcutta, India and Bangladesh to the east, sixty million people would see the land they have lived on for centuries swallowed by the sea (Guggenheim 2007). Urban jungles as big as New York City would see a dramatic loss of real-estate to the ocean and nearly half of Florida would be underwater as a result of significant sea level rise, the Netherlands would no longer exist, while many South Pacific and Caribbean islands would disappear completely beneath the rolling swells of the open ocean (Yohe 1991).

In Egypt, half of all irrigated croplands suffer from salinisation, while in Turkey 160 000 square kilometres of farmland is affected by soil erosion. In the United States Louisiana now loses approximately sixty five square kilometres per year due to coastal inundation and erosion by the seas (figure 5), while in Alaska 213 communities are threatened by tides that creep roughly 3 metres further inland every year (West 2009).

Figure 5: Storm surge on a Louisiana highway shows the affects of rising sea levels. (Source: United States Department of Commerce 2009).



Tuvalu, a low lying Pacific island that is already experiencing increased coastal inundation as pictured in Figure 6, had made a deal with the New Zealand Government to accept its entire population of 11 600 in the event of sea level rise (West 2009). It is estimated that over 100 million people globally live in areas that are either below sea level or are subject to storm surge (West 2009).

Figure 6: Tuvaluan kids hang out as extra high tide floods the neighborhood. (Source: Braasch 2005).



The Maldives President Mohamed Nasheed held a cabinet meeting on October 17 2009, underwater, to draw attention to the world's leaders ahead of the UN Climate Change Conference in Copenhagen in December (Ramesh 2009). The ministers will communicate with hand gestures and notes in water proof plates as can be seen in figure 7. The Maldives lies only 2m above sea level and the risk of sea level rise is real and immediate (Ramesh 2009).

Figure 7: Maldivian President Mohammed Nasheed does scuba gear as he signs a document in Girifushi, Maldives, on Saturday that calls on all countries to cut down their carbon dioxide emissions ahead of a U.N. climate change conference. (Source: Starr 2009).



While it is a natural part of a recorded cycle for land to be consumed by the ocean the rate of change is of most concern (Kerr 2007). Natural processes allow ecosystems to adjust and flora and fauna to migrate to more suitable environments as the earth's ecosystems gradually change (Kerr 2007). With the current rapid rates of change it is likely that over a million species could become extinct by 2050 (Hileman 1999).

The 'land mass is not the only place that is impacted by sea level rise, oceans are also impacted. The warming of the earth's atmosphere and thus sea surface temperatures can result in the alteration of the Ocean Conveyor (Copley 2000). The ocean Conveyor refers to the large scale ocean circulation driven by density gradients created by surface heat and freshwater fluxes (Copley 2000). Changes to the ocean's interconnected currents results in changing regional climates, both aquatic and terrestrial (Day et al. 2008). A rise in sea level will mean that the ocean will reach much further inland and mix with sediments that have not encountered sea water in thousands of years. This will change the oceans mineral composition which will significantly affect aquatic environments that rely on extremely delicate chemical balances, such as coral reefs (Day et al. 2008).

It is important to recognise at this stage that literature written by experts and professionals on global warming and sea level rise is in no way contradictory (Guggenheim 2007). It is a widely understood fact that the earth is warming up at a greater rate than naturally acceptable and the link between greenhouse gas concentrations in the atmosphere and global temperatures is clear. Humans are inducing a higher rate of global warming than nature can achieve by itself (Kerr 2007).

Global warming and sea level rise is being compared to issues such as 'does cell phone use result in cancer development?' and the 'Surgeon Generals Report on the implication of smoking cigarettes' (Guggenheim 2007). While it is not yet proven that cell phone use does lead to cancer there are strong correlations between the people that regularly use cell phones and instances of cancerous cells (Mercer 1998). In the same way there is a strong and proven correlation between cigarette use and lung cancer (Peters 2004). The global warming debate is not dissimilar. There are relatively small groups of critics in the world that are trying to turn the global warming issue into theory rather than fact (Guggenheim 2007). The science has a strong argument for proving global warming and sea level rise and continue to build its body of evidence.

3.4 Planning theories and adaptation measures

Sea level rise will severely impact on the entire economy, water resources, wetland habitats, fisheries, endangered species, coastal bluffs, beach and dune systems and coastal property (Fisher 1998). While the knowledge of a rising sea level has been apparent for some time it is not until relatively recently that serious consideration has been put in reducing its impact on the environment that human civilisation has created. There are a number of different ways in which planning can reduce the vulnerability of coastal ecosystems to rising sea levels. One approach, while probably not the most responsible approach is the no-action approach.

The no-action approach is noted in many planning and coastal management discussion articles as the least desirable plan of action (Fisher 1998). A no-action approach will not only result in severe and possibly catastrophic loss of property and infrastructure but very probably also have a severe impact on human life. With a changing climate, and subsequent rising sea levels, coastal erosion, flooding and higher storm surges the risk to unprepared communities is phenomenal (Fisher 1998). This approach to rising sea levels is unsustainable for any community that has been artificially manipulated.

One of the biggest issues coming from current literature is the difficulty in dealing with coastal zone issues separately to non coastal zones issues (Fisher 1998). The sheer magnitude of coastal zones and the associated issues requires special use reviews which are often not possible in under resourced and understaffed municipal planning departments (Fisher 1998). For this reason the response to this date has been either non existent or the employment of a relatively short term engineering response to particularly vulnerable areas (Dossou et al 2007).

3.4.1 Structural planning responses

3.4.1.1 Sea walls

The construction of sea walls to protect both public and private property from the sea has been the traditional response method of choice. However, thanks to science, we now understand more about the magnitude of the issues associated with climate change and sea level rise. It is understood that measures such as sea walls are a temporary solution and do not contribute to beach and coastline amenity (Lipman 2003). Dune systems are very sensitive to change (Lipman 2003) and are particularly vulnerable to artificial interference. Under natural coastal processes dune systems evolve with the winds, the tides and the current sea levels which allow existing ecosystems to thrive in a changing environment (Buynevich 2005). Artificial sea walls deflect coastal erosion and cause greater erosion not only further along the coastline but also in the immediate vicinity (Figures 8 and 9).



Figure 8: A section of Byron Bay sea wall made of rocks and rubble. (Source: Author 2009).

Figure 9: Cronulla sea wall. A prime example of erosive forces being transferred along the beach. (Sutherland Shire Council 2007).



3.4.1.2 Dykes and levees

Dykes and levees are heavily used in the Netherlands and in New Orleans (figure 10) to ensure that private and public property as well as infrastructure that lie in highly vulnerable areas near coastal water bodies is protected from the oceans (Viva 2009). Sea level rise is not going to cease at the end of the century with just 90cm. It will continue to rise and thus cities such as New Orleans will get further and further below sea level. This will inevitably be a stand off that the oceans will win.

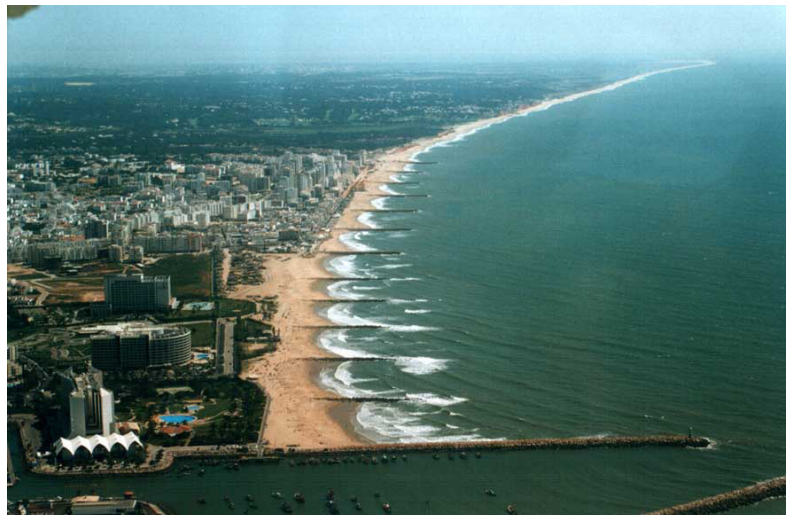
Figure 10: Levees in New Orleans collapsed during Hurricane Katrina. (Source: Michaels 2009)



3.4.1.3 Groynes

Groynes are a hard engineering solution that is becoming increasingly common in coastal communities experiencing high levels of beach erosion placing major stresses on the viability of development (Jackson et al 2002). The process of longshore drift has a significant impact on coastal communities. As a result the government, local authorities or in some cases residents are responding with groynes to protect the cities from the increases in sea level rise and coastal erosion (Jackson et al 2002). In Portugal long shore drift has been a major issue and groynes like the ones in figure 11 have been used to retain the prized sandy beaches.

Figure 11: Groynes on a stretch of beach near Vilamoura, Portugal. (Source: travel-in-portugal.com)



3.4.1.4 Land reclamation

The reclaiming of land, beach renourishment and land fill are increasingly common in coastal environments. In the state of Florida in the United States of America the Government is spending \$30 million per year in beach replenishment to ensure that the ocean does not reach the existing infrastructure and public and private assets (United States of America Environmental Protection Agency 2002). This approach can only be short term as sea levels rise further, greater volumes of sand will be needed but eventually development will be below the mean sea level mark and inundation is inevitable. There is also no guarantee once beach nourishment is completed, the next severe storm will not simply wash the sand away (Campbell 2009). This is what happened on Jimmy Beach on the mid north coast of NSW (figure 12). Beach renourishment is common in Australia as well in Cronulla and Noosa constantly undergoing sand dredging and pumping (Koperberg 2007).

Figure 12: One day of massive seas has undone \$307,000 of sand replenishment at Jimmy's Beach on the mid north coast of NSW. (Source: Campbell 2009).



3.4.2 Strategic policy responses

3.4.2.1 Planned retreat

Planned retreat is a policy adaption that ensures that development within a coastal hazard zone is responsive to a changing coastal environment. This form of legal development regulation involves restricting development or prohibiting redevelopment within a hazard-prone area. For example, adopting erosion-based setback regulations and restricting post-storm reconstruction (El Raey et. al. 1999). Byron Shire Council have had a planned retreat strategy in place since 1988 but so far it has not been totally utilised and there is a large amount of community disagreement over the strategy, especially for those property owners being affected by coastal erosion (Johnston 2009).

A property developer in Old Bar in the Greater Taree Council has proposed a 201 lot development within close proximity to a high coastal erosion zone. The development is proposed adjacent to where three houses have been previously lost to the sea. The developer has included a legal requirement within the application that states that if the water gets to within 50m of homes, the structures must be dismantled and removed. The entire estate is to be built entirely out of kit homes for this reason (Moore 2009).

3.4.2.2 Rezoning

Changing the zone of the land use in vulnerable areas is an opportunity to better utilise land that is not suitable for development. The objective is to change to a less vulnerable land use or to another land use that may be more suited to a marginal increase in sea level such as aquaculture. A slight or moderate SLR may be quite beneficial for development of aquaculture in the coastal areas (El Raey et. al. 1999).

3.4.2.3 Land acquisition

Some governments, both locally and internationally have introduced voluntary buy back and acquisition plans into their coastal management and climate change policies to potentially purchase private land in threatened locations in coastal environments (Lipman 2003). This is an extremely expensive proposition that is very unlikely to be implemented due to the high financial costs and the limited budgets of governmental organisations (Johnson 2000). The NSW State Government Department of Planning has been using land acquisition methods to retain 15,427 hectares of coastal land at a total cost of \$70.8 million since 1973 (NSW DoP 2009). At this stage only land

that has importance to for beach access, visual amenity of important ecological significance is considered for acquisition and not residential or commercial property.

3.4.2.4 Living on water

The Netherlands is one of the most densely populated countries in the world and half of the land is below sea level. For decades the Dutch have been building dams, dykes, water pumps and windmills to manage the issue of inundation but with rising sea levels they have had to look at a new approach (Euronews 2009). The Netherlands are investigating living on the water and developing amphibious dwellings (Figure 13) as a strategy to provide housing for the community (Euronews 2009). So far 46 houses have been built in one village alone. The ideas in the Netherlands are being driven by the philosophy that there are new ways for “multifunctional uses of water where you don’t have to choose between space for people and space for water (river), but rather space for water and people” (Euronews 2009). Amphibious Islands are also being investigated in response to the climate change and sea level rise phenomenon in the Netherlands.

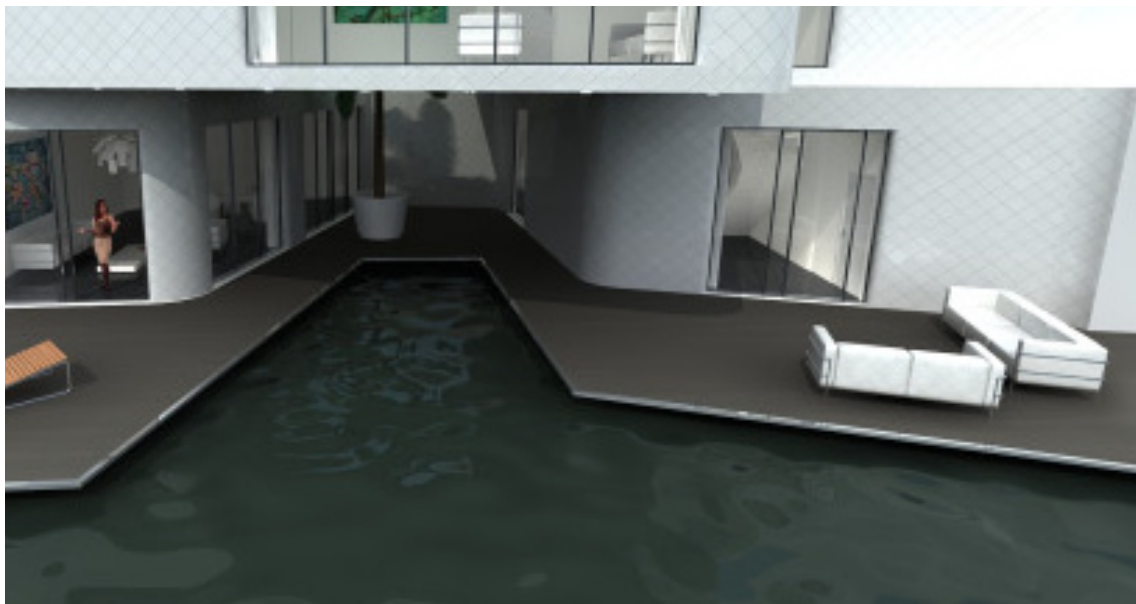


Figure 13: A floating apartment designed by Koen Olthuis of Waterstudio out of the Netherlands.

(Source: Generation eXe 2009)

The concept of living on water is not as feasible on coasts where wave action is common. In protected bays and estuaries floating developments could be used as one part of the answer to the sea level rise (Euronews 2009). Using this solution on the immediate exposed coastline is not possible as there is a high risk of strong wave action doing damage to the developments or even dragging them inland out to sea.

3.5 Summary

There are a large number of adaptation methods available for use by urban planners to ensure that natural and built environments alike are able to cope with the changing coastline. A combination of both strategic and engineering responses is the most likely outcome in most cases however engineering responses are usually considered for shorter term solutions. Ultimately the ability of human civilisation to deal with sea level rise and climate change lies within the willingness of humans to change their lifestyles to become ecologically sustainable.

Chapter 4

Introduction

Relevant NSW legislation

Regional strategies

NSW policy review

Coastal Erosion Management Reforms

Summary



4. Policy Review

4.1 Introduction

People living on the Australian coastline are confronted with a significant problem. How can we protect such an extensive coastline with all its infrastructure and natural coastal ecosystem values from an encroaching sea?

This chapter will evaluate and analyse State Government policies and actions to mitigate for coastal hazards and in particular sea level rise. The actions of NSW planning authorities are compared to actions of California's State Government agencies.

Although the NSW Department of Planning has had global warming and sea level rise on the radar for some time it has only been in recent times that investment in policy research has begun in NSW in earnest. The newly amalgamated NSW Department of Environment, Climate Change and Water released the first of its draft and discussion papers after conducting a series of regional forums in mid 2009.

4.2 Relevant NSW legislation

Legislation in NSW can be split into two categories when analysing the planning response to sea level rise and coastal erosion. Firstly there is legislation that is relevant to planning and development assessment and secondly there is legislation that is of a more operational nature. These two aspects have been separated because operational legislation has very little relevance to planning.

4.2.1 Planning legislation

4.2.1.1 Environmental Planning and Assessment Act 1979 (EP&A Act 1979)

The EP&A Act 1979 governs the powers of consent authorities, being the State Government and local councils, to make plans and approve developments in areas under their jurisdiction. All councils are under an obligation to prepare a Local Environment Plan (LEP) though Section 117 Direction of the EP&A Act 1979. The LEP's must include provisions that give effect and are consistent with the NSW Coastal Policy 1997 as well as a number of other acts and regulations.

The EP&A Act 1979 gives consent authorities the powers of development control in relation to development applications as outlined in Part 4 (Development Assessment) of the Act. The determination of such applications must take into consideration those matters listed in Section 79C of the Act. These include the suitability of the site for development, the likely impacts of that development, the likely impact on natural and built environments, social and economic considerations and the community. Other considerations include the provisions of any current or proposed planning instrument. Development applications made under Part 4 of the Act must consider public consultation, planning agreements and other relevant legislation including Development Control Plans (DCP). Certificates issued under section 149 of the EP&A Act 1979 can be used by Local Councils to alert a potential purchasers to areas subject to flooding, tidal inundation, coastal erosion or any other coastal hazard. Council may also provide advice on potential risks, ecosystems and the prevailing environmental conditions.

4.2.1.2 SEPP 71 (Coastal Protection)

State Environmental Planning Policy (SEPP) No. 71 - Coastal Protection commenced on November 1 2002. The Policy was made under the Environmental Planning and Assessment Act 1979 to ensure:

- development in the NSW coastal zone is appropriate and suitably located;
- there is a consistent and strategic approach to coastal planning and management; and
- there is a clear development assessment framework for the Coastal Zone.

SEPP 71 is a broad document that covers the majority of the NSW coastline and as such it lacks specificity. Each coastal community must work within the plan's framework to ensure development occurs within the context of environmental limitations.

This plan has been developed to:

- ensure that the economic, cultural, recreational and natural attributes of the NSW coast are protected and managed effectively.
- protect public beach access, preserve rock platforms, native coastal flora and fauna, beach environments and visual amenity.
- provide for the implementation of the NSW Coastal Policy 1997 with a coordinated strategic approach to coastal management.

The plan encourages a strategic approach to coastal management including considerations such as site suitability for development. The policy concentrates on the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards. This plan does not mention climate change or the risk of sea level rise in specific terms.

There is scope to simplify and to integrate climate considerations into SEPP 71. In particular, there is the opportunity to identify the risks involved and the range of actions and adaptations available.

4.2.1.3 Local Environment Plan Standard Template

The standard template is a guiding document to be used by local Councils to develop Local Environment Plans that will be consistent throughout the state. The standard template will ensure consistent zone provisions throughout all Local Council's.

The template does not provide for an environmental hazards zone. The template does not provide for a zone where natural hazards can be managed and development can be directed accordingly.

A Natural Hazards Zone should be included in the standard template to provide an opportunity for councils to manage a number of issues including coastal erosion, sea level rise and acid sulphate soils. This zone would restrict development and highlight the danger and power of natural hazards. There should be a number of objectives included in the standard template including:

- to recognise the impacts of natural hazards on development.
- to restrict the construction of hard standing structures.
- encourage natural processes and ecosystem migration.

4.2.2 Operational legislation

4.2.2.1 Crown Lands Act 1989 (CL Act)

The Crown Lands Act 1989 guides the management of Crown Lands. It includes general provisions addressing environmental protection, natural resource conservation, public use and enjoyment and for those areas to be sustained for future generations.

It is assumed by many that the majority of beaches of the State are Crown owned (Thom 2003). In some cases another owner, lessee or other tenure is authorised under the CL Act. Section 10 of the Act makes it very clear that the land is to be managed for the benefit of the people of NSW.

This Act also does not mention climate change issues or sea level rise or the need for any action in response to the predicted impacts of such matters.

There is the opportunity for amendment to the CL Act to assist in planning for sustainable outcomes and to include sea level rise considerations within its framework.

2.2.2 Local Government Act 1993 (LG Act)

The LG Act defines the boundary of the coastal LGA as the low water mark. This boundary may be amended in some cases under the LG Act. With a dynamic and evolving coastline it is important to know where Local Government jurisdiction and responsibilities extend.

A second provision outlines Local Governments power to establish committees with responsibility to advise on any matter relevant to development in the LGA (Thom 2003). Many Local Councils have Coastal Committees which advise on coastal developments. These committees are very important in establishing a lead role in the protection and management of coastal areas including lagoons, beaches and large ecosystems.

The third important provision outlined in this Act protects Local Councils from liability when actions and decisions are made ‘in good faith’.

As this provision does not extend to negligence there is growing concern for a potential flood of compensation claims against Local and State Governments as a result of the impacts of climate change and sea level rise.

Whilst the risk of litigation is a critical consideration, it is not the primary subject of this paper. The report looks at what may be advanced with a more integrated policy approach to avoid the significant impost of litigation on all concerned.

4.2.2.3 Coastal Protection Act 1979 No 13 (CP Act)

There are 5 sections to the Act:

Part 1: Definitions.

Part 2: Composition and functions and of the NSW Coastal Council and its responsibility to the NSW Minister for Planning.

Part 3: Use of the Coastal Zone with a main focus on waters of the State which is westward of the coastal waters boundary and is not within an LGA, not subject to an Environmental Planning Instrument (EPI) other than a State Environmental Planning Policy (SEPP).

Part 4: Works in the Coastal Zone by the Minister to protect, preserve maintain or restore features within the zone.

Part 5: Offences and penalties for breaches of the Act.

The CP Act aims to protect and preserve the coastal zone and ensure that all development within the coastal zone occurs using the principles of Ecologically Sustainable Development (ESD). The Act outlines the Minister's ability to direct Local Authorities to develop a Coastal Zone Management Plan which must deal with the protection and preservation of beach environments and beach amenity.

There is an opportunity for local councils to put in place measures to help communities adapt to climate change and sea level rise through a proactive Coastal Zone Management Plan.

The Act does not specifically mention climate change or sea level rise.

4.2.2.4 NSW Coastline Hazards Policy 1988 (CH Policy)

The policy outlines the provision of financial and technical assistance that would be given to councils to reduce their susceptibility to liability in respect to management of land and development on the coastline zone. The CH Policy provides for the development of the NSW Coastline Management Manual 1990 and amendments to the Local Government Act 1993.

The main goals of the CH Policy are to

- reduce the coastal hazard impacts on public and private assets.
- ensure that losses due to natural coastal forces were minimised.

The policy sets out a number of actions that can be employed to address climate change:

- The impacts of coastal forces on existing developed sites shall be reduced by works or by the purchase of a property on a voluntary basis and where appropriate.
- The implementation of effective planning and development controls by local councils should be carried out to reduce the potential for coastal damage in respect to coastline development.
- All development assessments need to be dealt with using a merit based approach that takes into account social, economic and ecological as well as oceanic concerns.

4.2.2.5 NSW Coastline Management Manual 1990 (CMM)

The NSW Coastline Management Manual is the implementation plan for the NSW Coastline Hazards Policy 1988. The Manual was reviewed and became part of the NSW Coastal Protection Package announced in 2001.

The manual was created to facilitate Councils understanding and management of coastal processes and hazards. The manual identifies all currently available management options and assesses them against environmental, social and economic criteria. The manual provides guidelines for councils to follow and address coastal erosion issues including:

- The preparation of a Coastline Management Plan
- Coastline hazard mitigation works and investigation
- The promotion of hazard awareness to the community
- Beach Management

Part of the manual is set out describing a series of steps that need to be taken in preparing a Coastline Management Plan. Councils need to follow these steps as well as other adaptive actions to address coastal hazards.

4.2.2.6 NSW Coastal Policy 1997

The NSW Coastal Policy set direction for future growth in coastal environments, providing opportunities for economic development and population growth while still protecting the natural, cultural, spiritual and heritage values of the coastal environment (NSW Government 1997). The policy has an outstanding focus on ESD and addresses a number of key themes. The policy focuses on the following themes:

- population growth in terms of location and absolute limits
- coastal water quality issues
- disturbance of acid sulphate soils
- establishing an adequate, comprehensive and representative system of reserves
- better integration of the range of government agencies and community organisations involved in coastal planning and management
- Indigenous and European cultural heritage, and
- Integration of the principles of ESD into coastal zone management and decision making (NSW Government 1997).

Goal 2 of the policy states the intention ‘to recognise and accommodate natural processes and climate change.’ Objective 2.2 of the policy then states the intention ‘to recognise and consider the potential effects of climate change in the planning and management of coastal environments.’

Three strategic actions are provided for in the Policy that follow this objective:

2.2.1 Studies on the influence of climate change for coastal areas will continue to be undertaken in association with the CSIRO Division of Atmospheric Research

2.2.2 Appropriate planning mechanisms will be considered for incorporating sea level change scenarios set by the IPCC.

2.2.3 The sea level monitoring station installed at Port Kembla will be used to monitor changes in sea level as a result of changes in climate as part of the national sea monitoring program.

The NSW Coastal Policy also outlines the need for public setback lines for every new development adjoining beaches with the amount of setback to be determined by local consent authorities taking into account coastal hazards including climate change and sea level rise. The Policy also articulates how ESD principles should be integrated in to coastal management practices including:

- natural processes can be affected by coastal development
- natural processes are affected by global climate change
- natural hazard issues require the use of the precautionary principal, including climate change and sea level rise, and
- coastal processes are complex and natural forces can pose hazards to people and property (Thom 2003).

At the time that this policy was released there had already been two IPCC reports published. Each of these reports contained a clear message that both the climate and sea levels were changing.. It is noted that the policy recognises that climate change and sea level rise could potentially pose a threat to coastal communities, infrastructure and development. There is further opportunity in this policy to provide direction to local councils on potential actions to prevent some of the impacts of a rising sea level on individual municipalities across the state

4.2.2.7 Comprehensive Coastal Assessment (CCA)

Released as part of the NSW Government's Coastal Protection Package, the CCA is an available strategy to help local councils, government agencies and others undertake important strategic land use planning. The CCA toolkit identifies, analyses and assesses data and information on the physical, biological, social and economic values of the State's coastline.

The toolkit is very useful for coastal planning with a large amount of existing and new data being made available including:

- Aquatic habitat mapping for non metropolitan estuaries showing the location and extent of mangroves, salt marsh and seagrasses.
- Flora and fauna audits consolidated.
- Soil and land feasibility maps developed from new GIS based systems.
- Detailed statistics on economic status and incomes, agricultural value, housing and tourism.
- Demographic data displaying coastal population trends and predictions.
- Report on the wild resources important to the indigenous peoples including historical records of interaction between early settlers and indigenous peoples.
- Aboriginal cultural landscape maps.

As part of the toolkit there are a number of indicators that have been developed to aid councils and local authorities in the monitoring of natural coastal environments, local economies and community wellbeing.

While this tool does not specifically detail the potential impacts of sea level rise it does provide very important information that can play an important role in the management of a changing coastal environment. Natural ecosystem location information will allow councils to make decisions on how and where these ecosystems can migrate and ensure that development of the coastline does not impede on their future needs as important coastal habitats.

Other aspects of the impact of sea level rise can also be addressed through the use of this tool such as using coastal population data to manage the population in a logical and sustainable manner without impacting on the coastline or on significant indigenous sites. Soil feasibility mapping is also very important and would be useful when considering the possible need to relocate agricultural activities that may be impacted near the coast.

4.2.2.8 Coastal Lands Protection Scheme (CLPS)

With an annual budget of \$3 million, this scheme is used to acquire significant coastal lands into public ownership for their long term management under local and state authorities. Since the scheme was commissioned in 1973 there have been 3 main criteria for acquisition:

- Public access to the coastal foreshore
- Maintaining the scenic quality of the NSW coastline
- Protect ecological sites with regional, state or local significance

The lands that have been acquired as at June 2009 under the scheme amount to 15,427 hectares at a total cost of \$70.8 million. the areas aquired include coastal features such as headlands, dunes and dune systems, hinterlands, coastal lagoons and lakes, mostly where the original vegetation is still dominant and supporting endemic flora and fauna.

The scheme is a very opportunistic approach to the protection of the coastal environment and by identifying, acquiring and reserving land the Department of Planning have been able to create new coastal national parks and reserves for public enjoyment.

Land managers within the Department of Planning work with private land owners to negotiate purchases and then transfer the ownership to other state and local authorities for future management. The Department of Environment, Climate Change and Water is the main recipient of land acquired under this scheme where it is turned into national parks.

4.2.2.9 Draft Sea Level Rise Policy 2009 (DSLRP)

This draft policy provides projections as a guide for coastal planning in NSW. Based upon national and international techniques, these projections are subject to constant modelling, study and review by the Department of Planning and the Department of Environment, Climate Change and Water in collaboration.

Five principles are built into the policy with the objective to minimise the social disruption, economic costs and environmental impacts resulting from long term impacts of sea level rise. These principles include:

1. promoting an adaptive risk based approach to managing sea level rise impacts by using the adopted projections in the assessment of new and existing developments within the coastal zone.
2. supporting local councils that the NSW State Government will provide both in preparing coastal hazard and floodplain studies and with financial assistance.
3. supporting appropriate coastal development under the EP&A Act 1979 and outlining the projections for sea level rise should not preclude development of land projected to be affected by sea level rise. The goal of this principal is to ensure that developments within the coastal zone recognise and appropriately accommodate the impacts of sea level rise.
4. supporting the community during emergencies such as major storm events and coastal inundation and flooding.
5. ensuring that the NSW State Government provides the community with freely available information on sea level rise and the appropriate actions within coastal zones.

4.3 Regional strategies

The following strategies have been outlined in this section of the report to build a lead into the case studies of Byron Shire and Port Stephens Council where the local issues and policy will be examined to best identify possible sea level rise responses throughout the NSW coastline. The regional strategies as follows are the overarching guidelines to local councils in the respective areas for future direction and planning.

4.3.1 Far North Coast Regional Strategy 2006 (FNCRS)

This strategy is driven by the NSW State Plan 2008 and it applies to six northern coastal local government areas in NSW including Ballina, Byron, Kyogle, Lismore, Richmond Valley and Tweed. The FNCRS strategy consolidates and builds upon a number of previous strategies including the Northern Rivers Regional Strategy and local council settlement strategies.

The main focus of the Far North Coast Regional Strategy is to control and manage the high expected population growth rate in the most sustainable manner. The strategy will protect the unique environments, both natural and built, as well as aim to preserve existing cultural values and natural resources while allowing the population to steadily grow in the region. There is a heightened concern for the pressures of development on coastal ecosystems expressed in the strategy. The strategy outlines that 60% of new dwellings in the region will be within mapped coastal Town and Village Boundaries (NSW Government 2006).

By focusing on limiting the pressures of growth on coastal areas and encouraging growth in non-coastal towns and villages, this strategy aims at identifying potential sites for new housing and industry. In turn this will boost local economies without compromising environmental values or quality of life.

The strategy recognises the contentious issue of climate change and the impacts of sea level rise on the highly developed coastlines of northern NSW. The importance of council acknowledgement of the issue is well highlighted by this strategy. It encourages councils to incorporate planning provisions accordingly into their LEP's and DCP's and no development can be approved within an identified potential coastal hazard area. Under the strategy councils are required to undertake investigations of lands with the potential to be affected by coastal inundation and sea level rise to ensure the of risks to both public and private assets are reduced to a minimum.

The release of new land or the redevelopment of existing properties for the purpose of rural residential housing within the coastal zone, no matter what the existing zoning, is prohibited under the strategy. The sustainability criterion in the strategy also prohibits residential development within the 1:100 floodplain.

4.3.2 Lower Hunter Regional Strategy 2006 (HSRS)

The Hunter Regional Strategy and the Far North Coast Regional Strategy ensure that future urban development will not be located in areas of high risk from natural hazards, including sea level rise, coastal recession, rising water table and flooding.

The strategies are set out in order to manage issues associated with climate change. The strategies direct council's to undertake studies on lands potentially under threat from coastal inundation and sea level rise to minimise risk to public and private assets.

The strategy also direct councils to not approve development or rezone land for development in potential hazard areas. Councils are directed under the strategy to make provisions in LEP's for adequate setbacks from areas at risk of coastal erosion, inundation and sea level rise and to prepare a Coastal Zone Management Plan.

4.4 NSW policy review

In NSW the strategic planning response to global warming and the impacts of sea level rise and climate change is fragmented. There is a multitude of emerging policies and plans seeking to provide for the wise use of land and assets, and to protect public and private assets from the impacts of coastal erosion, inundation and sea level rise. There is little clear direction for councils in the use of these tools at present. The NSW State Government has an obligation to outline a number of key strategies and practical actions to assist LGA and communities mitigate and adapt to imminent changes in the coastal zone.

There is an opportunity for all three levels of government to work together and to take a strong leadership role on this issue. There is a universal need for setting parameters and establishing the most appropriate planning responses including voluntary acquisition, retreat policies and engineering considerations.

At this stage there are eleven policies, acts and toolkits and guidelines that play a role in the management and planning of the NSW coastline and there does not seem to be a single clear direction coming from the NSW State Government as to the future of coastal development in light of an evolving environment. The current strategic response is clear in that there is a strong need to protect the coastline from over development and assist in the protection of natural environments and habitats but there is no clear policy on how exactly local authorities can go about enacting these ideals. There is a clear opportunity for the NSW State Government to step up and give Local Councils a tool such as planned retreat, land rezoning guidelines or other method of coastal land use management to cope with coastal erosion and inundation threats.

4.5 Coastal Erosion Management Reforms

(announced 18 October 2009)

A coastal erosion reform package has just been released by the NSW Government. This package aims at moving forward policy to better equip the State and local councils with the tools needed to deal with the challenges of coastal erosion. The reforms include amendments to legislation, new guidelines, and additional support for councils to re-energise their planning processes and in particular, concentrate on coastal processes and risks. The NSW Government has identified 19 'hot spot' beaches along the NSW coast where the coastline is erosion the risks to property and assets is severe

4.5.1 Legislative amendments

The Coastal Protection Act, the Local Government Act and various regulations are being upgraded as part of the reform to:

- Include adaptation to sea level rise as a management objective (DECCW 2009).
- Require benefiting owners of coastal erosion protection measures to make pro rata contributions. These costs will cover the private benefits share of design, construction and operational costs (DECCW 2009).
- Support landowner funded coastal protection works to slow erosion of their properties where the works are environmentally feasible. These will only be approved if they comply with stringent environmental and engineering requirements, including managing potential off-site impacts during construction and thereafter (DECCW 2009).
- Provide new powers to enable a council or the Minister to issue an order to stop an unapproved action likely to result in significant beach erosion, backed by increased penalties for unlawful works or activities. These orders may be appealed in the Land and Environment Court (DECCW 2009).
- Various operational and procedural matters not yet defined in detail.

4.4.2 Coastal zone management plans

Those councils that contain one or more of the identified 'hot spot' beaches will be directed by the minister to complete an overall coastal zone management plan if one is not yet completed. This plan will be required to be completed within 12 months (DECCW 2009).

4.5.3 New coastal zone management planning guidelines

The draft Coastal Zone Management Manual 2002 will be replaced with new Coastal Zone Management Guidelines. Draft guidelines will be released for consultation at the NSW Coastal Conference in November (DECC 2009).

4.5.4 Indemnity provisions

Amendments will be made to the Local Government Act to clarify indemnity provisions. The limits of Council liability for property damage due to coastal erosion caused by natural processes will be clarified.

4.6 California Climate Adaption Strategy 2009

(Draft Discussion)

Having a comparable distance from the equator and a parallel geographic profile, California is a very comparable study area to NSW. California is very similar to NSW in terms of the development pressures that are being placed on its expansive coastline. There are many examples of severe coastal erosion occurring in California and the government is beginning to take strong action.

California is the first state in the United States of America to release a State Agency level plan for adapting to climate change. The draft plan developed by California's Natural Resource Agency was released on August 3 2009. It directs government agencies to prepare for rising sea levels, increased wildfires and a number of other expected changes. The report is in response to Governor Arnold Schwarzenegger's Executive Order (EO) S-13-08 which was signed on November 14, 2008. The order called on State agencies to develop California's first strategy to identify and prepare for these expected climate impacts.

There key recommendations of the report include:

- directions to State agencies to not plan or develop significant new structures in a place that will or may require protection from rising sea levels, storm surges or coastal erosion.
- all proposed structures must consider climate change, sea level rise, coastal inundation and coastal erosion impacts in the development process.
- consider project alternatives to avoid significant new development in areas that cannot be adequately protected (planning, permitting, development, and building) from flooding due to climate change.
- the most risk-averse approach for minimizing the adverse effects of sea level rise and storm activities is to carefully consider new development within areas vulnerable to inundation.
- State agencies should generally not plan, develop, or build any new significant structure in a place where that structure will require significant protection from sea level rise, storm surges, or coastal erosion during the expected life of the structure.
- vulnerable shoreline areas containing existing and proposed development that have regionally significant economic, cultural, or social value may have to be protected, and in-fill development in these areas should be accommodated.

- State agencies should incorporate this policy into their decisions, and other levels of government are also encouraged to do so (California natural resources Agency 2009).

The California State's Coastal Adaptation Working Group which was set up to inform this strategy has identified a number of strategy actions to deal with sea level rise and coastal inundation. Both long term and short term responses have been identified for each strategy action. The short term actions are those that can be commenced or completed by 2010. Longer term actions require multiple state agency co-ordination or require significant legal or regulatory changes.

4.6.1 Strategy summaries

Strategy 1: Establish state policy to avoid future hazards and protect critical habitat

- a. Near term actions
 - i. Hazard avoidance by not developing hazard prone land.
 - ii. Innovative design of necessary development on hazard prone land.
 - iii. Habitat protection through the use of buffer zones and allowing for ecosystem and species migration.
- b. Long term actions
 - i. Co-ordinated policy implementation promoting hazard avoidance.

Strategy 2: Provide state-wide guidance for protecting existing critical ecosystems, existing coastal development, and future investments

- a. Near term actions
 - i. Establish decision guidance through coordination with state resource to develop a state wide framework that can be used by state and local agencies as guidance in preparation of adaptation plans.
- b. Long term actions
 - i. Pilot studies to examine the efficiency of the near term action.

Strategy 3: State agencies should prepare sea-level rise and climate adaptation plans

- a. Near term actions
 - i. Adaptation planning where all state agencies are required to prepare agency specific adaptation strategies, plans, guidance and criteria for the management and regulation of resources and infrastructure in light of sea level rise.
- b. Long term actions
 - i. Adaptation plan updates

Strategy 4: Support local planning for addressing sea-level rise impacts

- a. Near term actions
 - i. Public outreach and involvement through community meetings.
 - ii. Funding mechanisms for local governments and agencies to revise local plans.
 - iii. Local Government guidance with local planning strategies including:
 - a. Setbacks
 - b. Additional buffer areas
 - c. Clustered coastal development
 - d. Rebuilding restrictions
 - e. New development techniques
 - f. Relocation incentives
 - g. Rolling easements
 - h. Engineering solutions
 - iv. Amend Local Coastal and General Plans to address climate change adaptation.

Strategy 5: Complete a state-wide sea-level rise vulnerability assessment every five years

- a. Long term actions
 - i. Vulnerability assessments to be co-ordinated with all state agencies available.

Strategy 6: Support essential data collection and information sharing

- a. Near term actions
 - i. High resolution mapping to provide elevation data.
 - ii. Tidal datum
 - iii. Ecosystem research to monitor changes to coastal ecosystems.
 - iv. Coastal wetland process studies to determine the prospects of maintenance, restoration and nourishment projects.
- b. Long term actions
 - i. Decision support to state and local agencies.

The CCAS is intended to be a living document that will evolve with the availability of information and research data. The strategy will be used as a tool to deliver direction and information to smaller coastal agencies and municipalities for more specific action.

4.7 Summary

Compared to the planning framework in NSW for climate change and sea level rise this California strategy, even while still in draft form, is far superior in providing a comprehensive analysis and assessment of the sea level rise issue and the adaptation process. The strategy outlines a number of actions for local and state agencies in the management of coastal development and areas at high risk from sea level rise and coastal inundation. The NSW planning system and response to climate issues, especially sea level rise, is alarmingly fragmented and the large number of policies, acts and strategies that cover small sections of the issue is not efficient. A unambiguous and precise piece of planning framework with clear, justified direction for local Councils is what is needed to make a significant impact on coastal development policy to allow for the evolution of the NSW coastline without serious risk to public, private and natural assets.

Chapter 5

Introduction

History of coastal planning in Byron Shire Council

Current policy

Success of planned retreat in Byron Shire

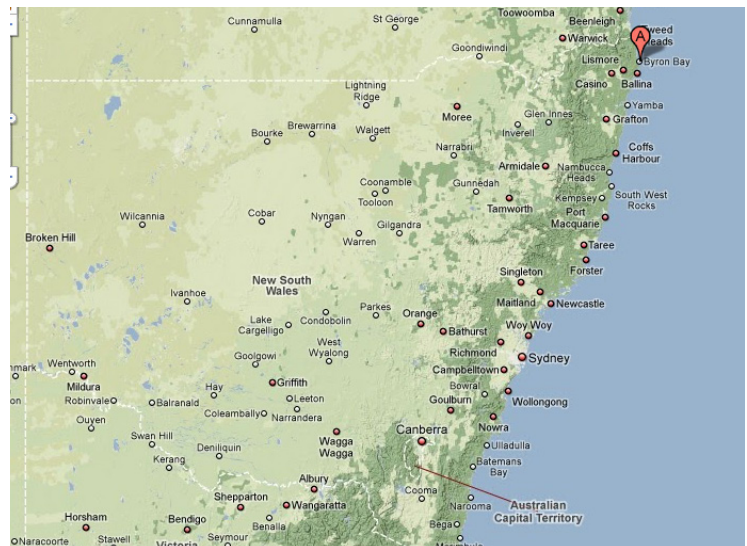


5. Case Study: Byron Shire Council

5.1 Introduction

The Byron Shire is located on the most easterly point of mainland Australia as shown in figure 14. Defined by its iconic white lighthouse, the town of Byron Bay has a population of just 5,600 people and the hinterland and immediate surrounds houses a further 28,766 (ABS 2006). Known as Cavvanbah by indigenous peoples of the area, Byron Shire is rich in cultural and natural history and has traditionally been a favourite holiday location for Australian and international tourists who crave the beautiful beaches and stunning scenery.

Figure 14: Marked A on the map, Byron bay is on the located on the far north coast of NSW. (Source: Google maps 2009)



The location of Byron Shire ensures that the coastline is periodically subject to cyclones and damaging storms causing, at times, portions of land to be engulfed by oceanic forces, including associated storm surge. As these forces combine with rising sea levels over time, the impacts are becoming more immediate and apparent. Many residents are now becoming increasingly concerned, especially those that are beginning to see their properties disappear and decline in value. As a result the Local Council and the State Government have introduced planning strategies to allow natural processes to continue while protecting public and private assets in the region.

The concept of restrictions on coastal development is not new in Byron Shire. Byron Shire Mayor stated in a Byron Shire Council media release on June 22 2009 that “Coastal Councils around Australia are facing increasing pressures in tackling coastal erosion from storm events and as far back as the 1960s the NSW Public Works Department (PWD) identified the need for development restrictions in coastal areas at risk from storm events and erosion” (Johnston 2009 C).

5.2 History of coastal planning in Byron Shire Council

Following a series of major damaging storm events, the PWD completed a study named the Byron Bay to Hastings Point Erosion Study in 1978. This study was commissioned to develop specific management options for the coastline from Byron Bay to Hastings Point. Hastings Point is located forty kilometres to the north of Byron Bay. The study aimed to develop a complete understanding of the coastal processes that impact on the area. The study also included an investigation into five identified categories of management options. Additionally the study included a number of techniques that could be implemented to appropriately manage this particular coastal zone. The five categories identified in this study are:

1. A co-ordinated management plan
2. Rezoning affected lands
3. A policy of relocation
4. Insurance policy
5. Engineering works

Each of these management options are discussed in detail in the 1978 report but the report did not identify a 'preferred' solution due to the perceived negative and positive debates over potential impacts on the economy, environment, and social and cultural values of this part of the coastline.

Between 1968 and 1988 the development along the Byron Shire coastline was determined under the Interim Development Order No 1 – Shire of Byron. It was not until after the release of the Byron Bay to Hastings Point Erosion Study in 1978 that amendments were made to include specific coastal zone requirements for new development.

A Draft DCP on coastal erosion was developed in the mid 1980's which was soon superseded by the Byron Local Environment Plan 1988 and Development Control Plan No 1 1988 (DCP 1999). Part J of the DCP 1988 related to development on coastal lands and importantly, was developed under recognition of the long term erosion trends of the coastal embayment as identified in the Byron Bay to Hastings Point Erosion Study 1978. Council adopted a policy of relocation or planned retreat under this DCP which marked the beginning of the first coastal adaptation policy in the area.

The basis of planned retreat lies within the Byron DCP 1988 and the more recent Byron Shire DCP 2002. These plans ensure that development built on coastal lands is sympathetic to the risk associated from coastal hazards.

Coastline Management Study (CMS) was completed in 2003, following both the Byron Coastline Values Study 2000 and the Byron Shire Coastline Hazard Definition Study 2000. The CMS recommends future long term coastline management techniques which are intended to be used for the basis of the Byron Shire Coastal Zone Management Plan. A draft Coastal Zone Management Plan due to be on public exhibition by early 2010. All the recommendations in the study are consistent with the NSW Coastal Policy 1997.

The study examines a number of alternatives for combating the issues of sea level rise and coastal erosion. Some of the options are not financially viable, some are opposed to the principals of the NSW Coastal Policy 1997, some are prone to a high risk of failure and others provide very limited public beach access. There are 3 generalised options:

1. Structural
 - a. Seawall construction
 - b. Groyne construction
2. Beach Nourishment
 - a. Beach nourishment alone
 - b. Beach scraping
 - c. Beach nourishment with end control
 - d. Beach nourishment with end control and seawall
 - e. Beach nourishment with groynes
 - f. Beach nourishment with offshore breakwaters
3. Planned retreat
 - a. Retreat under public ownership
 - b. Retreat under private ownership
 - c. Retreat under both public and private ownership

This thesis will not go into detail about the results of the study but all options were considered by Council. Sand nourishment was the main recommendation made by the study.

The Cape Byron Sand Lobe Study 2006 was commissioned as a result of the finding of the CMS which detailed the complexity of accessing sand deposits for beach nourishment to support the

option of engineering works.

The main purpose of the study was to examine the potential of extracting sand deposits sitting more than twenty metres below the ocean's surface off Cape Byron. This option would require a sand dredge that would need to be brought in from Denmark as there is no other machinery capable of the task existing within the southern hemisphere. There was no guarantee that after the huge expenditure, the months of moving sand and the impact of complete beach disruption that the sand would not simply wash back into the sea with the next storm event.

Beach nourishment would not be a stand alone solution to the particular sections of the Byron Shire coastline. There would also need to be a number of structural engineering solutions installed which would require constant and potentially expensive maintenance. The beach nourishment option itself also has problems as the extraction of large quantities of sand from the Marine Park off Cape Byron would have significant environmental costs and furthermore, there would be a high risk that the plan would not get approval from the State Government. As a result of these concerns the Council, in 2006, unanimously decided to accept the Cape Byron Sand Lobe scoping study and abandon any further investigation into sand nourishment and thereby reconfirmed its commitment to planned retreat for parts of the Byron Shire coastline (Byron Shire Council 2009).

Council now ensures that new land owners are aware of the risks that are associated with owning and occupying property on or near the coastline by providing information in Section 149 certificates on coastal hazards that may apply to the property. Land owners are made aware that there are restrictions on the use of the land and that they are purchasing at their own risk. Byron Shire places conditions and restrictions both on new developments as well as on additions to existing developments. These conditions identify the need for structures to be demountable and the trigger for removal or demolishing them is identified in the process (Byron Shire Council 2009).

5.3 Current policy

5.3.1 Byron Local Environment Plan 1988

There is no mention of sea level rise or coastal erosion planning provisions in the Byron LEP 1988. The LEP provides framework for the detailed planning responses of the Byron Shire DCP 2002. There is an opportunity in the LEP to provide for over riding management of sea level rise within the locality. Sea level rise and coastal erosion should be mentioned in some form in the LEP of every coastal Council in NSW.

5.3.2 Byron Shire Council Development Control Plan 2002

The Byron Shire DCP 2002 outlines that new buildings or works are to be temporary and able to be readily removed in the event of coastal erosion. This document identifies specific erosion zones and defines the limits for development in response to the coastal erosion threat.

This strategy was inherited by the Council from the state government administration era and has been consistently reviewed with current data, reports and studies. The policy is considered to be the most appropriate and effective response to sea level rise, coastal inundation and coastal erosion issues (Johnston 2009 C).

The Byron Shire DCP 2002 outlines and maps three precincts immediately adjacent to the beach escarpment. Precinct 1 is the area from the beach escarpment to the immediate impact line, Precinct 2 occupies the land between the immediate impact line and the fifty year erosion line and Precinct 3 is the area of land between the fifty year and the one hundred year erosion lines as defined by lines on the accompanying maps and adopted from the Byron Bay to Hastings Point Erosion Study 1978.

5.3.1.1 Precinct 1

The objective of Precinct 1 is to ensure the impact of coastal processes on potential development is minimised by limiting development in this area and ensuring any development is of a temporary nature (Byron Shire Council 2009).

The performance criteria and prescriptive measures outline the development conditions that apply to the land within this precinct. Summarised these are:

- No building is to be located with twenty metres of the erosion escarpment.
- New buildings or works are to be temporary, single storey, modular and able to be readily removed in the event of coastal erosion. Development proposals must include complete details of the removal procedure to ensure relocation can be practically achieved in twelve hours. Removal must be possible with the use of only one 4WD vehicle. Relocation equipment must not rely on mainspower supply and must be maintained to always be in sound working order and stored on site.
- Development that is of a community nature, which relates to the use of the beach front may be considered provided that any building is easily removable and does not require a major extension to a service main.
- Where vacant urban-sized lots exist wholly within this precinct, the location of unregistered mobile homes as defined by the Moveable Homes and Caravan Parks Regulation and as further described in this DCP, may be considered. These may comprise more than one unit, but all units must be capable of separation and relocation by four wheel drive car (rather than truck) prior to damage by the sea.
- Erection of sacrificial structures, such as decks, may be possible where these do not prejudice relocation of other building sections. All elements, including decks, foundations and supports must be removed from the site prior to damage by the sea.
- Extensions or alterations to existing buildings in Precinct 1 must be limited to minor works only, and must be capable of swift removal or demolition if coastal processes threaten the development.

5.3.1.2 Precinct 2

This objective is set out to ensure the impact of coastal processes on potential development is minimised by ensuring any development is readily relocated as the erosion escarpment nears the development (Byron Shire Council 2009).

The performance criteria and prescriptive measures outline the development conditions that apply to the land within this precinct. Summarised these are:

- Development in Precinct 2 must be designed to be relocated or demolished, or to cease operation, should the erosion escarpment come within fifty metres. This includes Class 1 residential buildings. Prior to lodging an application with Council, the developer of the land must determine whether buildings are to be relocatable to outside the fifty metre zone or demolished should the consent cease.
- The dwelling-house must be designed and constructed so that it can be easily removed from the site by road vehicle. The plans of the building must include an adequate description of the removal procedures.
- The dwelling must be located so as to maximise as far as practicable the distance from the nearest point of the building to the seaward boundary of the site.
- Development consent will cease if at any time the erosion escarpment, as defined by the Works and Services Director of the Council of the Shire of Byron, comes to within fifty metres of any building associated with this development. The owner of the land must then remove that building.
- Subsequent to any approval being given for a relocatable dwelling, no works must be carried out on the property which might hinder the ready relocation of the building.

5.3.1.3 Precinct 3

The objective of Precinct 3 is to ensure that the impact of coastal processes on potential development is minimised by ensuring any development ceases as the erosion escarpment nears the development (Byron Shire Council 2009).

The performance criteria and prescriptive measures outline the development conditions that apply to the land within this precinct. Summarised these are:

- Development in Precinct 3 must be designed to be relocate or demolished, or to cease operation, should the erosion escarpment come within fifty metres. If the development consent does cease then the owner of the land will be responsible for the removal of all buildings including Class 1 residential buildings.

5.3.1.4 Servicing

The objective of this section of the DCP 2002 is to define the circumstances in which public utility services may be provided to development which is potentially threatened by coastal processes (Byron Shire Council 2009).

The performance criteria and prescriptive measures outline the development conditions that apply to the land within any of the 3 precincts. These are:

- Vehicular access, water, sewerage, electricity, telephone and other services must be located so as to minimise the impact from the sea.
- All services must be provided from the landward side of the development such that the building is between the services and the erosion escarpment.

5.3.1.5 Beach Protection

The objective of beach protection in the DCP 2002 is to ensure that works proposed by property owners to protect land from coastal processes will not have adverse effects on other land or on coastal processes (Byron Shire Council 2009).

The performance criteria and prescriptive measures outline the development conditions that apply to the land within any of the 3 precincts. These are:

- Any work proposed by individual property owners to protect land from erosion must be designed to ensure that the work will not cause adverse impacts on other lands or on coastal processes.
- Any work carried out by individual property owners to protect land from erosion will require the consent of Council.
- Council will consider consent for such works only where such works will have no adverse effect on any adjoining properties or on any coastal processes.
- Rock, concrete and like hard materials must not be used for the construction of beach protection works.

Byron Shire Council has been very firm in its policy making and direction as to not allow structures to be built or dumped on public or private land to protect against coastal erosion, a stance that has often been ignored by residents as noted in figure 15. Residents, especially along the prestigious Belongil Beach, are infuriated by Council's position on the matter (O'Neill 2009). Byron Shire Council has traditionally been dominated by an environmentally sustainable ideology. Council's attitude towards rising sea levels and eroding coastlines is to allow the processes to happen naturally and unimpeded to ensure the environment and coastal ecosystems can adjust accordingly (Byron Shire Council 2009).

Figure 15: Residents along Belongil Beach, Byron bay, have dumped sandbags on the seaward side of their properties to stop them being washed into the sea. (Source: Tondorf 2009)



The Byron Shire DCP 2002 is very clear in its aims and objectives to ensure that property and assets within the one hundred year erosion zone are properly identified and managed accordingly. Erosion along the coast is well reported and remains a constant struggle for coastal residents who, at this stage, are refusing to honour the DCP. There are still no examples of the planned retreat policy having taken effect despite large amounts of erosion and a number of properties being within Precinct 1.

5.3.3 Draft Coastal Zone Management Plan

The DCZMP is currently on public exhibition with the the 22 of December 2009 as the closing date for comments.

The DRZMP aims to further improve the implementation process for Byron Shire Council's planned retreat policy and to further articulate the Shire wise coastal management plan. While planned retreat has been a policy of the Byron Shire Council for over twenty years, the implementation so far has only been through planning and managing development around the areas affected by coastal hazards.

Currently, planned retreat policy relies on a twenty metre buffer zone within Precinct 1 and a fifty metres buffer zone within Precincts 2 and 3. The new approach, according to the DCZMP, will simplify the process with a uniform buffer across all precincts of just twenty metres. This will establish and maintain an appropriate buffer from the erosion escarpment to soak up immediate and long term natural coastal processes allowing residential property owners to use their properties for the maximum time before necessary relocation (Byron Shire Council 2009).

The DCZMP will also reduce the number of Coastal Planning Precincts from 3 to 2 with an immediate (CPP1) and one hundred year (CPP2) planning horizon and will include clear building requirements for each. The precincts proposed in the CZMP are displayed in appendix 1. Appendix 1 displays a snapshot of the implimentation of precincts 1 and 2 around the Byron Bay town centre, Belongil Beach, Main Beach, Clarks Beach and Tallows Beach.

Any new development approved under this plan must abide by the conditions of the new precincts. CCP1 will remain free of any development within 20m of the erosion escarpment. CCP2 will allow both relocatable development and non relocatable development. Relocatable development can occur further than twenty metres from the erosion escarpment but non relocatable development must not be constructed within fifty metres of the erosion escarpment. If the erosion

escarpment comes to within twenty metres of relocatable development then the development must be demolished or removed. If the erosion escarpment comes to within fifty metres of non relocatable development then the development will require demolition.

The DCZMP identifies management actions for implementation including completion timeframes and costs. The DCZMP also identifies priority management actions which take into consideration their urgency with respect to implementation of the planned retreat policy (Byron Shire Council 2009).

Planned retreat of existing development located in the coastal planning areas with planned retreat conditions of development is implemented by the DCZMP through:

- voluntary relocation or removal by property owners
- enforcement by Byron Shire Council of development consent conditions, once the specified trigger distances have been realised and
- enforcement by Byron Shire Council under recognition of risk to people and the environment resulting from possible dwelling collapse.

In all cases relocation or removal of a dwelling will occur at the property owner's expense, in accordance with the Environmental Planning and Assessment Act 1979. (Byron Shire Council 2009)

There is no provision for the development of hard engineering solutions in the DCZMP but there are provisions for their removal where the structures are existing coastal fixtures. Byron Shire Council received advice from DECCW on the 18th of September 2009 which outlined the need to manage any 'ad hoc rock seawalls placed by or on behalf of land owners which have been in place for many years.' The advice from DECCW continues to state that 'a reasonable approach may involve permitting these seawalls to remain in place after any safety issues are addressed, with benefitting land owners contributing to maintenance costs.' This is yet to be addressed in the DCZPM.

5.4 Success of planned retreat in Byron Shire

At present approximately twenty five homes have been identified as being within twenty metres of the erosion escarpment, thirteen of which have conditions attached to development consent which would require demolition or relocation in the at risk zone (Burmester 2009 B). There are deep concerns within the entire Byron community about the planned retreat policy and its effectiveness and appropriateness as an adaptation method. The president of Byron United, the Byron Chamber of Commerce, Ed Ahern, was reported saying in the print media in September 2009 that ‘it is unacceptable management to let people’s homes wash away, the beach to wash away and the sand dunes to wash away’ (Burmester 2009 A). On further discussions with the Vice president of Byron United, James Lancaster, it is clear that there are grave concerns about the planned retreat policy and there being very little confidence in the ability of the Council to deliver a successful and appropriate coastal management policy. In the view of Byron United, the legislative and policy drives should be coming from the State and Federal Governments (Lancaster 2009 pers. com.).

The planned retreat policy has been in effect since 1988 yet there is no evidence of the strategy having taken effect within the community. In fact residents of Belongil Beach have tried to defy the policy by dumping rocks and sandbags seaward of their properties in an attempt to stop the erosion (figure 16). Soft engineering solutions are not permitted under the policy (Byron Shire Council 2009). Belongil resident, Laurie Lynch was interviewed by Byron Shire News, and expressed a concern that the retreat policy “has never been allowed to be discussed with the community” (Burmester 2009 A). Mr Lancaster stated in the same article that “Belongil Residents are being treated like guinea pigs” (Burmester 2009 A).

Figure 16: Illegal sandbagging along Belongil Beach, Byron Bay. (Source: Byron Shire News 2009)



The President of the Belongil Progress Association, Geoff Taubre, was also interviewed for the Byron Shire News for the article published September 24 2009 and believes that if the Council does go ahead and order the demolition of homes on the dunes, compensation would be a major issue and Council's policy would change property laws in Australia (Burmester 2009 A).

Ms Barham continues to push the point that "Byron Shire has been innovative in addressing coastal erosion and climate change adaptation with its planned retreat model" (Johnston 2009 C). A spokesman for Byron Shire Council told the Northern Star that Council stands firm with its planned retreat policy and has said that any protection works at "Belongil posed a potential public safety risk and could harm the environment" (O'Neill 2009 B). The Council sought an injunction against property owners with the Land and Environment Court seeking a permanent stop work order in June 2009. This occurred after John and Anne Vaughan begun to dump rocks in front of their Belongil property to protect it from the erosive nature of the ocean. The Land and Environment Court granted Council the injunction. There are many benefits with the planned retreat policy including low maintenance costs and the protection of the environment and natural amenity of beaches (O'Neill 2009 D). This does not involve the consideration of the community who live and operate their lives in the immediate risk zone.

Land owners are feeling very vulnerable (Figure 17) according to Ed Ahern, the President of Byron United. Mr Ahern informed the Northern Star that "ignoring and refusing to help residents threatened by natural disasters is unacceptable" (O'Neill 2009 C). Mr Ahern went on to say "our community deserves to have our natural environment protected from this vandalism" (O'Neill 2009 C). With regard to a potential breach of Belongil Spit, Mr Ahern said that it "would cost the Council and community millions of dollars, threaten hundreds of homes and have the immediate impact of losing at least 40 jobs" (O'Neill 2009 C). Despite this Ms Barham pointed out that "people who buy into planned retreat areas are informed of the restrictions for development. They purchase with the knowledge of the risk" (O'Neill 2009 C). Byron Resident Christopher Dean feels as though the policy has "bitterly divided the community" (O'Neill 2009 D) as reported in the Northern Star on July 4 2009. Mr Dean feels as though Council has "an attitude of 'they're just rich bastards and they can all go to hell'" (O'Neill 2009 D).

Figure 17: Ian Astley, manager of the Bluewater by the Sea holiday accommodation, shows how serious the erosion is. (Source: O'Neill 2009 B)



The planned retreat response to coastal erosion and sea level rise is highly contentious. It is clear that residents and business who are at risk of losing property and assets worth millions of dollars are not interested or willing to comply with the policy and are willing to go to great lengths to ensure the protection of their properties. Residents have a valid concern that if they are prevented from taking action to protect their homes from the sea, there would be no compulsory acquisition or compensation. A media release by the Belongil Progress Association summed up the issue, “if the government approved the coastal management plan and houses were destroyed, people would be left standing in the street with no assets and a mortgage to pay, their lives ruined, savings destroyed, jobs lost, community housing assets destroyed and the Council’s rate base eroded” (Byron Shire News 2009).

Chapter 6

Introduction

Sea level rise action in Port Stephens

Looking at the future of Port Stephens



6. Case Study: Port Stephens Council

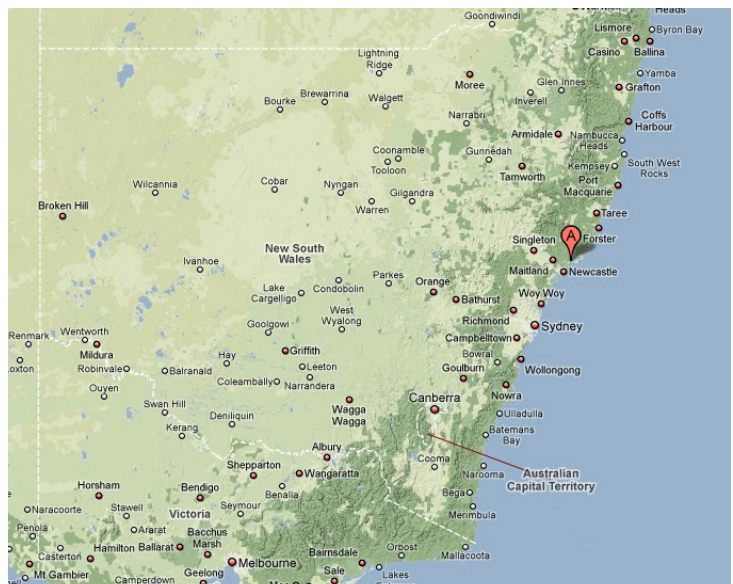
6.1 Introduction

Located approximately 200 kilometres north of Sydney (figure 18), Port Stephens includes a unique section of the NSW coastline. The Council area itself covers 979 square kilometres stretching 57 kilometres inland and 30 kilometres from north to south (Port Stephens Council 2009). Its position on the southern shores of the extensive bay and the inclusion of the extensive beach and dune systems of Stockton Beach have handed Port Stephens Council a strong susceptibility to coastal erosion and inundation as a result of sea level rise.

The Council area contains a significant amount of coastal and estuary based development as well as approximately 26 percent (Wilton 2002 pp 26) of the state's mangrove population, the largest percentage of any NSW waterway. This combined with the low lying nature of the area compounds the concern of the impacts of sea level rise (Port Stephens Council 2008). Inundation around the port is already becoming an issue with some Council roads being regularly submerged on the larger high tides.

Port Stephens has similar population growth to the NSW average. It is envisaged that the population within Port Stephens Council area will begin to boom in the next decade as the Pacific Highway is upgraded and travel times to Newcastle and Sydney are significantly reduced (Port Stephens Council 2009). This will allow for commuters to live further from their place of work and pursue lifestyle orientated living arrangements. Increased development pressures on the coastal environment is inevitable and without proper coastal zone management tools in place these pressures may result in property and assets being put at danger by rising sea levels, coastal inundation and coastal erosion.

Figure 18: Marked by A. Port Stephens Council is located on the mid north coast of NSW. (Source: Google maps 2009)



6.2 Sea level rise action in Port Stephens

Port Stephens Council does not currently have any sea level rise, climate change or coastal erosion policy, guidelines or framework in place. The coastline of Port Stephens is characterised by very low lying geography containing significant estuarine wetlands which could be degraded or destroyed as a result of rising sea levels (Port Stephens Council 2008). At this stage Council is still investigating potential sea level rise adaptation options..

The draft Foreshore Management Plan for Port Stephens 2007 recognises that ‘sea level rise and climate change is likely to increase foreshore inundation and reduce shoreline stability, leading to a need for action on a whole of coastline basis’ (Port Stephens Council 2008).

The Greenhouse Local Action Plan 2007 also recognises the potential for the low lying areas of the Council area, particularly the mangrove and wetland ecosystems, to be inundated by rising sea levels and the increasing large storm events. Again Council has not at this stage expanded its policies beyond the recognition of the issue.

In May 2009 Port Stevens Council adopted sea level rise figures released by DECCW in the Draft Sea Level Rise Strategy. This is the first step for Port Stephens Council in dealing with the issue but it has found that moving forward from this point is very difficult. It is clear from discussions held with Council’s Natural Resources Coordinator, Sally Whitelaw, that there is some progress in the development of sea level rise and coastal erosion adaptation measures. Council is currently in the process of mapping the Council area with funding from the NSW State Government to identify the areas that are at risk (Port Stephens Council 2009).

Once this mapping is completed Council may considering developing a series of risk management contours on existing maps. These risk management contours will reflect the levels of risk posed by coastal inundation, coastal erosion and sea level rise over a number of yet to be determined years. These contours will form the basis of coastal planning and risk management. At this stage this is all theoretical and no action plan has been approved beyond informal discussion between Council officers.

Climate change has been noted as no more than an issue for consideration in asset management plans. Sea level rise has not yet been singled out by Council as a major issue that needs to be dealt with on a larger scale with specific policies or legislative requirements.

Once the contours are established they will be noted on Section 149 certificates to notify potential land owners of the risks on the land they are considering for investment. In this very early development phase of its coastal planning the Council is currently investigating different policy options that they may employ to adapt to the changing coastal environment.

As part of these considerations Council is canvassing a range of options to help in the adaptation process for rising sea levels. Restrictions via the use of planning controls as well as engineering solutions for the protection of public infrastructure are the main focus of the Council. The Council is aware that a large percentage of their infrastructure, such as water lines and sewage pipes, are very old and with rising sea levels, this infrastructure might need to be updated and moved.

One of the strategies that may be considered is a version of planned retreat. Council may adopt a time based approach with development consent only lasting till a designated date when the development will be required to be removed or relocated from the property. This approach may also include a re-evaluation of the risk on the date development consent ceases.

Existing development within the ‘at risk’ zone will be very difficult to manage and is an issue being faced by coastal Councils internationally. Port Stephens is no different and discussions with existing land owners will need to be precise and each party must be prepared to consider all realistic options to discuss the most appropriate result.

Another major issue for Council as outlined by Sally Whitelaw is the need to maintain the large amount of fisheries and mangrove ecosystems that exist in and around the port. Port Stephens attracts recreational fishing and dolphin watching tourism, both of which contribute significantly to the local economy. Mangrove ecosystems are an important factor in maintaining the health of the marine population (Figure 19). Rising sea levels may force the mangrove ecosystems to migrate inland. Careful consideration needs to be put into the development pressures so that areas are reserved to allow the unimpeded upslope migration of the regionally significant mangrove ecosystems.

Figure 19: Boardwalk and mangroves in Lemon tree passage, part of the extensive mangrove community that call Port Stephens home. (Source: Sinclair 2009)



Coastal planning is a regional issue and is not unique for each separate Local Government area. For this reason Port Stephens Council is intending to develop a coastal management plan that is in conjunction with neighbouring coastal Councils bordering to the north and south. This will ensure a regionally consistent approach. Potentially this approach could spread along the entire NSW coastline with each Local Government area sharing and evolving coastal zone management plans with state wide input and information. It would be a practical approach to share and discuss issues between Councils to ensure the best result for the environment and the community.

“Any plans or policies that may be considered with Council will be subject to intensive public consultation” (Whitelaw 2009 pers. comm.) and the public will be continually consulted throughout the policy development process. It is very important to Council that the community remains informed and in general agreement with Council on issues that impact on the greater community.

Community consultation is one of the most important aspects of the planning system. Decisions that will directly impact on the community need to be discussed and debated before a final decision is made. The views of all stakeholders should be considered and addressed. As can be seen in Byron Shire where the Council has taken a hard line on a single adaptation plan, further community discussions and information sessions throughout the course of the plan’s operation may have resulted in a more acceptable outcome with greater community consensus.

It is a legislative requirement for Councils to commit to community consultation as part of the planning and policy development process and Port Stephens should be considering discussion sessions at a very early stage in the policy development process. A number of information sessions and further consultation sessions at reasonable periods during the process would also be beneficial to the Council’s perception to the community at the least.

6.3 Looking at the future of Port Stephens

Port Stephens Council is in a relatively good position to develop a sea level rise and coastal erosion plan. With the announcement of the NSW State Government to allow residents to construct their own erosion protection works under a new state policy and amended legal framework, Port Stephens should work on a Coastal Zone Management Plan that would give certainty to all stakeholders. A new coastal planning framework could have potential to be made into a state model for coastal Councils to deal with management issues arising from increasing sea levels.

In contrast to the approach to this issue in Byron Bay, Port Stephens is in the very early stages of policy development. The mapping project that is currently under way in Port Stephens should provide good baseline data from which Council can form future policy. From this data hard decisions should to be made regarding zones that are labelled at risk over various time frames. Once these areas have been identified, policies should to be implemented that deal with the existing properties that are at risk and the demand for further development in the identified zones. This proactive approach will provide some certainty and is preferable to a reactive approach which is likely to be very expensive in the longer term. As there is very little precedent for this approach, Port Stephens Council has the opportunity to set the standard for other Councils along the coastal strip.

Chapter 7

Summary

Recommendations

Conclusion



7. Recommendations and Conclusions

7.1 Summary

7.1.1 Role of Government

The State Government plays a central role in the planning process of NSW and the lack of direction on the important issue of coastal erosion and sea level rise is alarming. The new NSW coastal erosion reform package has potential to revolutionise coastal planning in NSW.

The State Government recognises the “progress on coastal planning has been slow and needs to be accelerated” (DECCW 2009). DECCW continues by recognising that “to date few coastal management plans have been completed for coastal areas with houses at immediate risk and a number of other plans in various stages of development need to be completed.” The State Government needs to play a much greater role in leadership with coastal planning. The key to successful coastal planning will engage a collaborative effort with coordinated and detailed involvement from all stake holders including the community, the NSW State Government Departments of Planning and Environment, Climate Change and Water and Local Councils. The NSW State Government will need to play a central role in guiding Local Councils in the most appropriate direction in terms of the forms of coastal erosion policy and infrastructure for their specific area.

Significant capital costs will be involved in the protection of coastal environments with new sea walls, groynes and beach nourishment all being considered as potential solutions. It should be understood that local residents will have some financial responsibility for the cost or construction and maintenance of protection measures.

As can be seen from the embryonic reforms tabled by the NSW Department of Environment, Climate Change and Water in October 2009, the role of agencies in supporting adaptation is increasingly visible. It is also clearly evident that communities are looking for guidance from government at all levels, and that the potential for damaging litigation is high. There are few local, regional or even national governments in the world that will be in a position to compensate for perceived responsibilities. Accountabilities are already being tested in courts across the world.

7.1.2 Adaptation measures

7.1.2.1 Planned retreat

The most likely and most suitable outcomes will include variations of a planned retreat policy where land that is in severe immediate danger from coastal erosion or inundation. This will require the demolition of or relocation of dwellings where engineering solutions are unsustainable and inefficient. Planned retreat will be most successful in areas where significant development is not present.

Planned retreat will be suitable for areas of the coastline where it is essential for natural ecosystems to be able to migrate unimpeded inland with the increasing sea level. It will also be an appropriate solution where the cost to protect assets far out weighs the value of the assets themselves.

7.1.2.2 Zoning

Zoning land subject to natural hazards needs careful consideration. The occupation of land within high risk zones may be considered for uses that can easily be removed from the site if threatened. Uses such as caravan and holiday parks, camp grounds and relocatable dwellings could be suitable. These uses would insure that coastal land that is at high risk from coastal erosion or inundation and cannot be developed is utilised. Other uses could include aquaculture, sporting fields and community parks and reserves. An appropriate zone should be developed to accommodate natural hazards.

7.1.2.3 Sea walls

Sea walls should be considered in cases where development is at risk from erosion and rising sea levels. Sea walls need to be deemed environmentally feasible. The feasibility of any sea walls would need to be carefully examined and the adverse affects of transferred wave energy and erosion to other parts of the coastline carefully managed. The capital cost and ongoing costs of maintenance will need to be jointly funded by benefiting parties and the Government for the life of the project.

7.1.2.4 Beach nourishment

Beach nourishment is a method currently used on beaches up and down the NSW coast as well as a prominent beaches internationally. Beach nourishment needs to be used to complement an existing structure and not as a solution on its own. There needs to be some protection of the sand that is being dumped on the beach or otherwise millions of dollars worth of work can be lost overnight such as what has happened at Jimmy's Beach (Campbell 2009). Beach nourishment will also need to be jointly funded.

7.1.2.5 Community involvement

Community involvement in the planning process is the most important component of a successful planning system. The community needs to be educated, aware and feel involved in the decision making process.

The community is directly impacted by planning decisions and when their property and assets are concerned they have a right to their view being heard and addressed. Each and every council is required to consult the community on planning decisions. It is recommended that the community is not only consulted but involved at each step of the planning process and kept up to date with the progress of coastal management plans and policy.

7.2 Recommendations

Recommendations here are drawn from sourced literature, direct research and interviews.

There are clear opportunities for the NSW planning system to accommodate safe and practical ways for communities to adapt to predicted sea level rise and coastal erosion.

The issues facing national, state and local governments in Australia and along the study area are replicated across the globe. The challenges for legislators, policy makers, planners and communities are significant, as evidenced by the daily exposure of coastal erosion in the study area, on talk back radio, and in the public media during the thesis preparation period.

If adopted the recommendations provided here are likely to enhance the planning system in NSW and enable reduced conflict, reduced litigation, increased community safety and amenity, and better use of community resources. The approach would also assist planners and communities protect landscape values and modify the potentially significant threat to economic life.

7.2.1 Recommendation 1

The NSW State Government provide factual advice to communities, and lead in the development of practical coastal erosion and sea level rise policy with communities.

Reasoning:

The State Government has the legislative power to develop and provide for a range of locally adaptable planning and renewal mechanisms for local Councils working with their communities. Community knowledge, skills and resources will be essential for the transition to occur within economic boundaries. The state government can be an effective broker for practical mechanisms with access to national and international networks.

7.2.2 Recommendation 2

The NSW State Government can be a key broker for financial assistance and funding to Local Councils to provide for responsible coastal protection and practical short to medium term engineering activity. This recommendation is coupled with recommendation three, as the two are directly linked

Reasoning:

Local Councils do not have the funding needed to carry out expensive engineering works or to compensate risk takers. The NSW State Government can provide access to other sources of funding as part of an overall strategy that prevents loss of life, development and natural ecosystems. The ability of communities and their local authorities to implement engineering works on any scale will be limited. No amount of engineering will withstand the natural coastal processes predicted during storm events and sea level rise. Wise investment will require sound planning and will need to work with these processes.

7.2.3 Recommendation 3

A natural hazards zone can be included in the Local Environment Plan Standard Template with the following objectives:

- to recognise the impacts of emerging natural hazards on current and potential infrastructure development.
- to restrict the construction of inappropriate and long term infrastructure from these natural hazard zone.
- support natural resilience, natural renewal processes and the migration necessary to sustain the biological diversity required for healthy landscape functioning.

Reasoning:

Emerging natural hazard zones can provide a practical guide for decision making, that reflect the likely short, medium and long term situation on coastal NSW and in the study area. The approach will enable planners and local communities to establish respect for naturally occurring events including flooding and coastal erosion within the new parameters, and to begin to address the processes that bring damaging acid sulphate soils and the resulting loss of biodiversity, ecosystem resilience and productivity. The development of these zones can be used to increase community awareness and understanding and to increase the community effort in areas of priority. The approach can help to reduce pressure on the public purse for compensatory litigation. By establishing these zones, local communities can develop ways to adapt infrastructure to the new limitations and negotiate practical outcomes across tenure. By highlighting the range and extent of emerging natural hazards communities and government can work together to mitigate for potential loss of life and adapt to the economic needs of the region with new and appropriately sustainable developments.

7.3 Conclusion

The combination of policy and structural adaptation methods should be considered as the future of coastal planning and management in NSW. Residents living on the coast are aware of the hazards that exist in coastal environments and will need to contribute financially to the protection of their assets. Governments will need to pursue a hard line with coastal planning and management. With community support through education, a sustainable coastal management program can be developed.

Coastal erosion and sea level rise is an issue that is not recent but the lack of action has made it an urgent matter for consideration in NSW. Local and State Government are just beginning to work together for a solution to the adaptation process. If left without action, the issue of sea level rise and coastal erosion will compound exponentially and result in substantial impacts on assets and possibly human lives.

The State Government has for the first time started to become involved in possibly the greatest threat to the NSW coastline. The no action approach of the state Government in the past has led to a patchwork of Coastal Zone Management Plans appearing along the NSW coast. The new reform is a start to a collaborative approach to coastal management and needs to be backed up with community education programs, increased coastal protection funding and strong legislation.

Coastal protection methods need to be examined by each local authority and a combination of strategic and structural responses to adaptation employed urgently. The longer that the coastline is undermanaged the greater the potential loss of assets and ecosystems. Fast action is vital and the following quote from Albert Einstein recognises the need for the evolution of coastal planning.

“The world we have created today, as a result of our thinking thus far, has problems that cannot be solved by thinking the way we thought when we created them.” –Albert Einstein

With coastal planning an increasing concern and legal battles looming in many coastal areas, there is no second chances at getting coastal planning processes right the first time. In many coastal areas coastal management plans and coastal zone management plans have been in the development stages for over a decade (DECCW 2009) and the time has come for these plans to be implemented with the community's best interest in mind. Councils like Port Stephens need desperately to start considering sea level rise and coastal erosion in development assessments to ensure that new buildings are not approved where the land may be at risk within the lifespan of the development. It is very important that councils do not put themselves at risk of expensive legal battles due to a lack of consideration of environmental and climate change issues in development assessment. Coastal Zone Management Plans should be the next step for coastal councils in NSW to start preparing their coastlines for future development and environmental pressures.

Chapter 8



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Title and Chapter Photo’s

- Chapter 6 title: Sinclair 2009
- Appendix: Enterprise Community Development District 2007
- All remaining chapter titles: Author 2009
- Title: Author

Appendix

Byron Bay Coastal Zone Management Precincts





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Design:	MJC	Date: 12 June, 09
Checked:	MCR	Fig. No: A3
Drawn By:	Byron Shire Council and PE	

Planning Precinct and Hazard Lines 3

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 Client: Byron Shire Council
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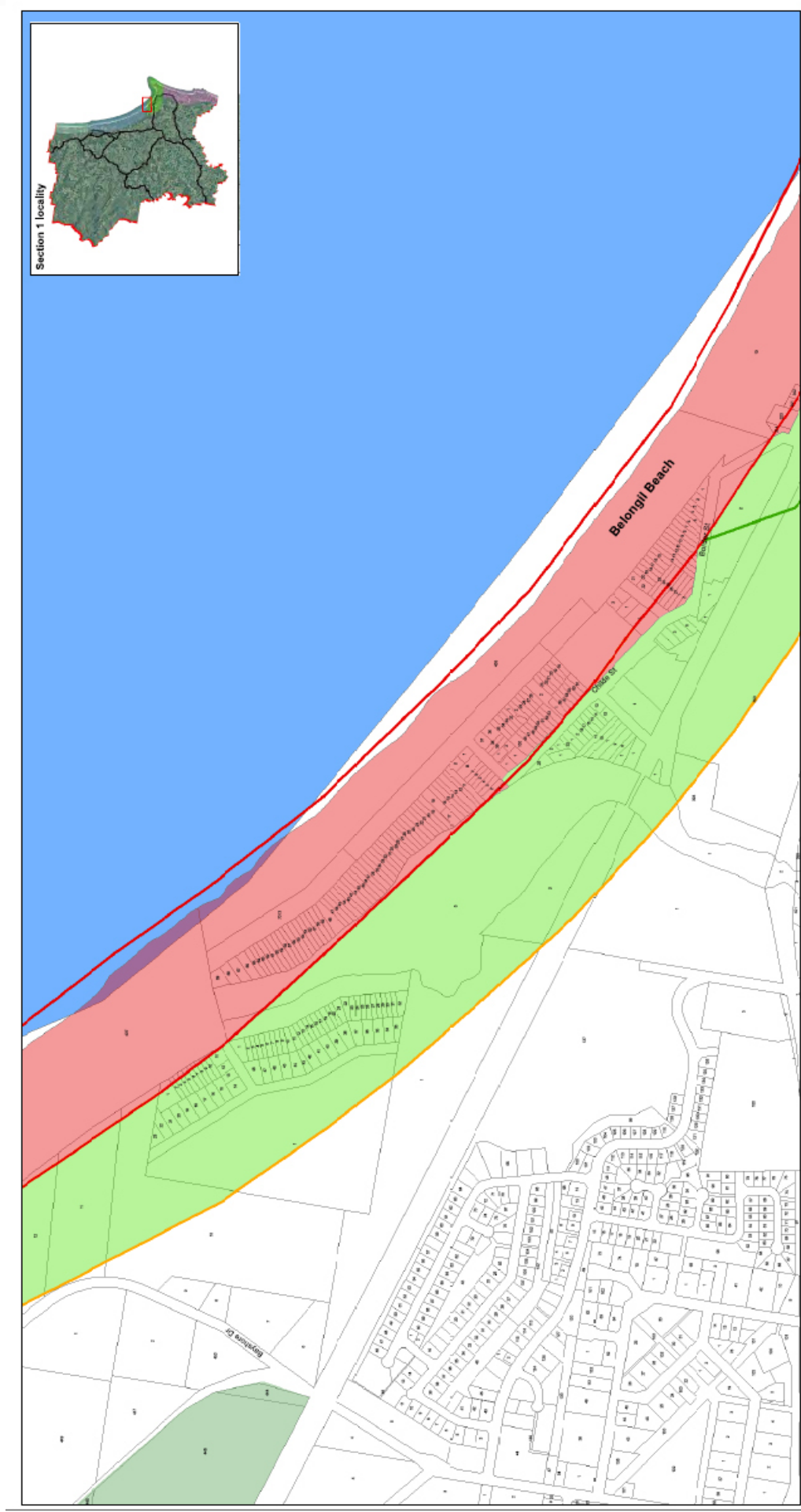
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Legend

- Precinct 1 Byron Immediate
- Precinct 2 Byron WBL 50yr worst
- Byron WBL 100yr worst

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 Note: The information shown on this map is a copyright of the Byron Shire Council and the NSW Department of Lands.

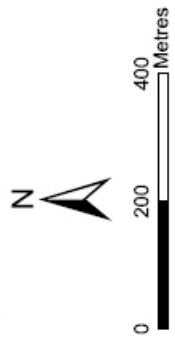


Section 1 locality

Coastal Planning Precincts

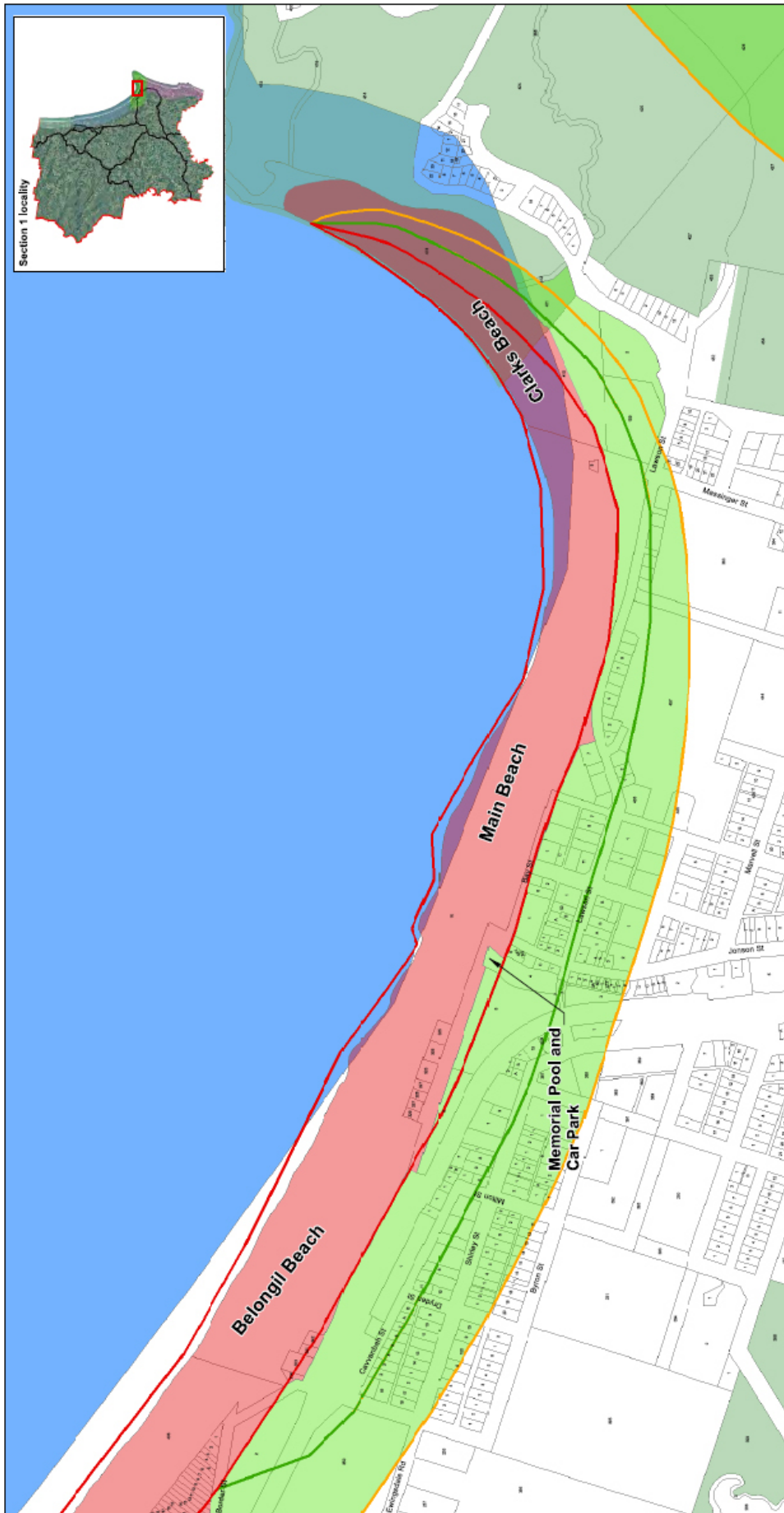
- Precinct 1
- Precinct 2
- Precinct 3

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 NSW Department of Lands



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Coastal Planning Precincts and Hazard Lines



Coastal Planning Precincts

- Precinct 1
- Precinct 2
- Precinct 3

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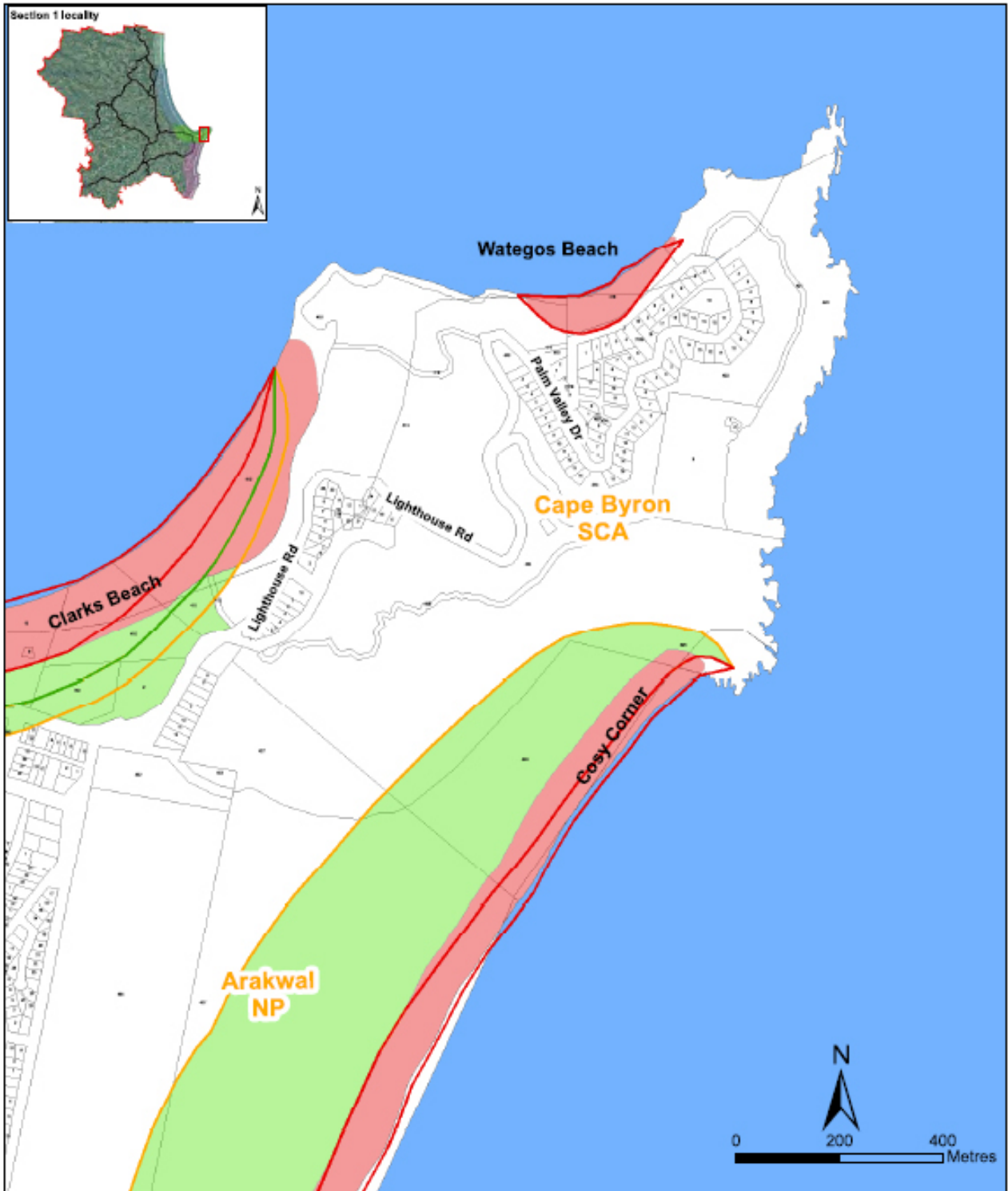
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DCZMP Coastal Planning Precincts and DCP 2002 Part J Precincts Figure A11

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 Client: Byron Shire Council
 Project No: 2122798A
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 Fig. No.: A11

Coastal Planning Precincts and Hazard Lines



Coastal Planning Precincts	
■ Precinct 1	 Part J DCP 2002 Precinct 1
■ Precinct 2	 Part J DCP 2002 Precinct 2
■ Precinct 3	 Part J DCP 2002 Precinct 3

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Title: DCZMP Coastal Planning Precincts and DCP 2002 Part J Precincts
 Figure A12



Project: Byron Shire Coastal Zone Management Plan		Datum: GDA 1994 MGA Zone 56	
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