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Greater Taree City Council

GREATER TAREE CITY COUNCIL

A Coastal Zone Management Plan for Greater Taree

301017-00051 – CS-REP-0001

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SYNOPSIS

The area in which this Coastal Zone Management Plan (CZMP) applies to is the Greater Taree Local Government Area (LGA). The LGA includes some 47 kilometres of coastline between Black Head in the south and Diamond Head in the north. During the course of investigations to identify coastal processes and associated hazards affecting Old Bar, Greater Taree City Council (Council) decided to extend the scope of the study to cover the area from Black Head (at the southern boundary of the LGA) to Crowdy Head in the north.

Council has adopted a policy stance of planned retreat for the management of the entire Greater Taree coastline. Council recognised by adopting the planned retreat policy stance that a coastal strategy which favours the retreat of public and private assets from coastal hazards represents the best strategic approach to the management of the uncertainty associated with the impact of coastal hazards. Planned retreat involves the removal or relocation of development or structures when the erosion escarpment reaches a pre-determined (trigger) distance from the seaward edge of the structure, or when road access and/or services (water, sewage and electricity) are no longer available to the property.

Council expects public and private assets along the coastline will continue to be vulnerable to coastal hazards both now and into the future. It is likely that the intensity of coastal hazards along the coastline will increase over time, as will the risks to public and private assets as the effects of climate change are realised. Even with the current best available information, the true impacts/risks resulting from climate change and coastal hazards on the Greater Taree coastline still remains uncertain, although some of these risks have been modelled and used to produce coastal hazard lines. The plan does not advocate the sterilisation of all property seaward of the 2100 hazard line. It seeks to permit the beneficial occupation of land subject to coastal hazards for as long as reasonably possible.

This CZMP contains actions to assist in the implementation of this plan and associated actions in relation to beach access and amenities. The primary purpose of the CZMP is to describe proposed actions to be implemented by Greater Taree City Council, other public authorities and the private sector to address priority management issues in the coastal zone over a defined implementation period. Issues include community uses of the coastal zone, pressures on coastal ecosystems, and managing risks of public safety and built assets. This CZMP refers to the Greater Taree Coast Emergency Action Plan (EAP) in the event that a major storm occurs before development and structures at immediate risk can be removed or relocated. While Council's policy stance is planned retreat, the *State Environmental Planning Policy (Infrastructure) 2007* makes provision for landowners to lodge a development application for the purposes of a sea wall or beach nourishment.

This Coastal Zone Management Plan is prepared in accordance with the document titled *Guidelines for Preparing Coastal Zone Management Plans* prepared by the NSW Department of Environment, Climate Change and Water. The guidelines have been adopted by the Minister for Climate Change and the Environment as guidelines under Section 55D of the *Coastal Protection Act 1979*. The CZMP

is also to be developed in accordance with Part 4A of the *Coastal Protection Act 1979*. The Plan should be read in conjunction with the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a) and the *Greater Taree Coastline Management Study - Black Head to Crowdy Head* (WorleyParsons 2010b).

Council in partnership with WorleyParsons has prepared this document with financial assistance from the NSW Government through the Office of Environment and Heritage (OEH). This document does not necessarily represent the opinions of the NSW Government or the Office of Environment and Heritage.

Disclaimer

PROJECT 301017-00051 - A COASTAL ZONE MANAGEMENT PLAN FOR GREATER TAREE

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Final	C Taylor	P Moses	D Powell	20/3/2013	N/A	

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CONTENTS

Tables

Figures

Appendices

Appendix A - Consultation

Appendix B - Public Consultation Information

Appendix C - Hazard Lines

1 BACKGROUND

Greater Taree City Council (Council) began the process of preparing a Coastal Zone Management Plan (CZMP) in 2008. Originally a CZMP was to be prepared for Old Bar Beach (considered the area most at risk within the Greater Taree Local Government Area (LGA)). During the course of investigations to identify coastal processes and associated hazards affecting Old Bar, Council decided to extend the scope of the study to cover the area from Black Head (at the southern boundary of the LGA) to Crowdy Head in the north (see **Figure 1.1**). Through this process the following supporting documents were produced:

- *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a),
- *Greater Taree Coastline Management Study – Black Head to Crowdy Head* (WorleyParsons 2010b), and
- *Greater Taree Coast Emergency Action Plan (*WorleyParsons 2011).

A number of draft reports were subject to peer review by the then Department of Environment, Climate Change and Water (DECCW) and Council's Estuary, Coastline and Manning Catchment Advisory Committee (ECMCAC), now known as the Manning Estuary, Coastline and Catchment Advisory Committee (MECCAC). Final draft reports were publicly exhibited (for further information refer to **Appendix A**, which outlines the public consultation process).

At its Ordinary Meeting on the 16th February 2011, Council considered management options included in the *Coastline Management Study* (WorleyParsons 2010b) and resolved:

i. That Council adopt a policy stance of Planned Retreat in the Coastline Management Plan for the entire coastline, in the absence of the implementation of a property protection management option for any particular area.
ii. That Council note the community input in regard to management options.
iii. That Council not endorse any particular management option for individual areas of the coastline, but instead include all management options from the Coastline Management Study into the drafting of the Coastline Management Plan.
iv. That Council instructs its consultants, WorleyParsons, to prepare the Coastline Management Plan and Emergency Action Plan in accordance with the above resolutions.
v. That Council place on public exhibition for a period of 21 days the Coastline Management Plan and Emergency Action Plan.
vi. That the ECMCAC be consulted on further actions that facilitate coastline management.

This resolution reflected Council's current and likely future financial position and hence ability to proceed with any future coastal protection works, as well as being the most equitable response to the broader community.

As the *Coastline Management Study* (WorleyParsons 2010b) included different options for implementation of a planned retreat strategy at different locations, Council developed a definition of planned retreat for this Coastal Zone Management Plan (refer to **Section 4.3)**.

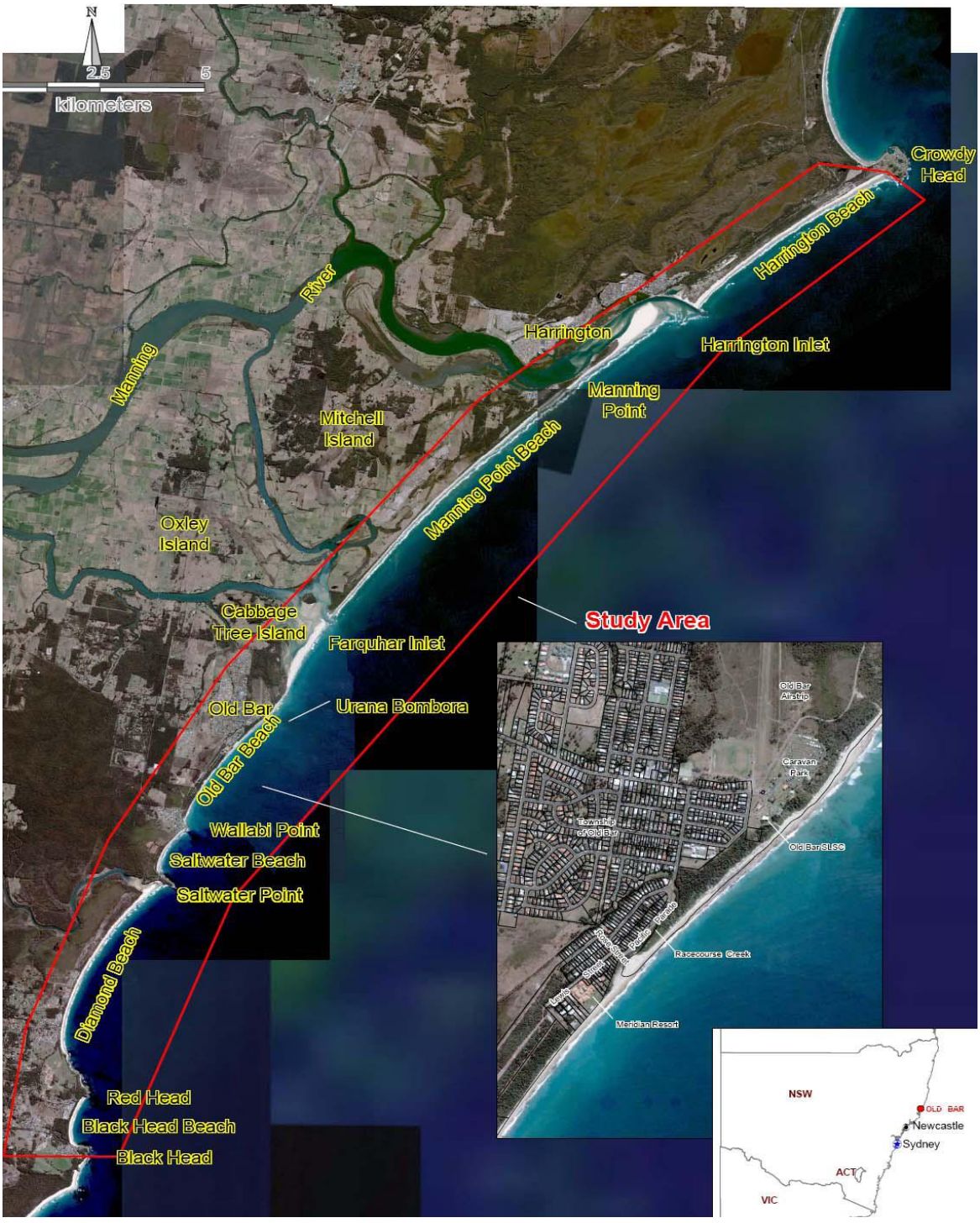

Figure 1.1: Locality Map

2 PHYSICAL AND CULTURAL SETTING

2.1 Coastal Processes

2.1.1 Climate change impacts

Climate change impacts were considered in determining the hazard lines which include a 0.4m sea level rise over the 2050 planning period and 0.9m sea level rise over the 2100 planning period, i.e. consistent with the NSW Government Sea Level Rise Planning Benchmarks. A generally conservative approach was used in estimating coastal erosion and recession rates to allow for other possible climate change impacts (e.g. changes in wave climate) which are not yet quantifiable. This estimation was undertaken over seven areas in the study area, and further information is provided below.

2.1.2 Black Head Beach

Black Head Beach is a relatively stable, closed system with minor long term accretion. Isolated locations of minor historical recession (0.1 to 0.2 m/year) have occurred in the central to northern portion of the beach, possibly due to persistent rips in these locations and/or anthropogenic changes associated with pedestrian access. The long term minor accretion is likely to be due to leaky bypassing around Black Head supplying sediment from the south (Nine Mile Beach), consistent with the net northerly littoral transport potential along the NSW coast. This bypassing is most likely to occur during large southerly storm wave events.

2.1.3 Diamond Beach

Diamond Beach is generally stable with minor, long term recession occurring in the south and north. The beach has historically been relatively stable in the centre in recent times, however; the presence of exposed indurated sands, ‘soft rock’ or ‘coffee rock’ is evidence of significant recession in the past. Diamond Beach may be described as almost being a closed system. There is little net longshore drift along this part of the NSW coastline; beaches are close to swash-aligned. The amount of sediment moving into and out of the embayment is therefore small. The large reef system off Red Head appears to be acting as a submerged barrier. Subsequently, there is likely to be negligible sand supply from the south and refracted wave energy reaching the beach, stabilising the southern end and reducing the net northward movement of sediment. Similarly, the reef system at Saltwater Point (between Diamond Beach and Saltwater Beach to the north) acts as a submerged barrier at the northern end of the beach minimising the likely bypassing of sediment around this headland. Bypassing may occur under certain conditions such as a major flood event where Khappinghat Creek breaks through, moving sufficient entrance bar material seaward; or a large southerly storm wave event, followed by predominantly southerly waves. This would represent a net loss of sediment from the embayment.

A negligible amount of Holocene sediment, on or behind, the foredune indicates that aeolian (wind born) sediment transport does not contribute significantly to the sediment budget. Similarly, offshore

sediment sampling indicated a negligible amount of sediment is being lost offshore (Riedel & Byrne1981).

2.1.4 Saltwater Beach

Saltwater Beach is a relatively closed system. It has experienced historical recession of 0.2 m/year in the central portion and is generally stable at the ends. Minor long term sediment loss is likely to be due to leaky bypassing of Wallabi Point to the north, or offshore losses during less frequent storm wave events.

2.1.5 Old Bar Beach

Old Bar Beach has historically been receding at an increasing rate with limited periods of recovery. The most rapid recession has occurred just to the north of the exfiltration ponds (on average approximately 1 m/year). Recession at locations either side of Urana Bombora has been on average 0.5 m/year.

Detailed hydrographic survey undertaken by the Department of Environment, Climate Change and Water (DECCW) showed that, despite appearances, the area between Wallabi Point and Farquhar Inlet is not part of a single beach system. Urana Bombora (and associated reef) limits but does not prevent the exchange of sediment. In addition there is another reef feature just to the north of Wallabi Point. These features act to form a beach compartment (albeit incomplete) between Wallabi Point and Urana Bombora and accordingly influence wave, hydrodynamics and subsequent sediment transport processes at Old Bar Beach.

Analysis of these bathymetric features and numerical modelling of specific wave events indicated the possible formation of a large rip cell with potential to carry sediment offshore during major storms from the south-east quadrant. When modelled, the rip cell head generally formed in the central to southern portion of the beach adjacent to where the most significant recession rates have been identified. Storm wave direction was indicated as a significant factor in whether sediment carried by the rip cell was predominately lost to the offshore zone or partially recirculated within the near shore beach compartment. During storm events from the south-east and east-south-east direction, modelling indicated the possible permanent loss of sediment offshore, i.e. sand was deposited in deep water where it could not return to the beach under natural processes.

This loss mechanism is supported by the observation of a large rip cell of high turbidity (high suspended sediment load) during an event where significant erosion of Old Bar Beach occurred (*Black Head to Crowdy Head Coastline Hazard Definition Study,* WorleyParsons 2010a). The recorded wave direction during this event at Sydney was east-south-east (the Crowdy Head wave rider buoy within the study area does not record wave direction). Additionally, comparison of cross-shore profiles along Old Bar Beach and Manning Point Beach indicated a significant flattening of the offshore slope at depths of around 8m below mean sea level for Old Bar Beach (indicating possible deposition of sediment). At 8m in depth, sediment usually moves back onto the beach under lower swell wave conditions.

Although offshore transport may be the dominant mechanism for the ongoing sediment loss at Old Bar Beach, there is also likely to be alongshore sediment bypassing, both north and south of Urana Bombora under storm waves with directions other than from the south-east and east-south-east sectors. The amount of sediment bypassing Urana Bombora is likely to be influenced by the beach state on either side (including the open/closed status of the entrance to Farquhar Inlet).

The Wallabi Point - Manning Point embayment is close to being aligned to the predominant south-east wave direction and so net loss of sediment due to longshore drift is not likely to be a significant factor in beach recession.

2.1.6 Manning Point Beach

Manning Point Beach generally appears to prograde in the north (northern third of the beach) while the southern two-thirds of the beach recedes. However, this trend can be reversed through short-term fluctuations as a result of refracted wave patterns influenced by of the state of Farquhar Inlet entrance and Urana Bombora. The state of Harrington Inlet entrance and estuary flow is an added complexity influencing the northern portion of Manning Point Beach.

As noted in the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a) it was observed that when Farquhar Inlet was open, the southern end of Manning Point Beach accreted whilst the northern end eroded. Harrington Beach also accreted significantly. If Farquhar Inlet entrance is open due to catchment flow, Harrington Inlet would also be in a state of high catchment flow and relatively 'open'. This would favour net bypassing of the Harrington Inlet entrance rather than estuary infilling, growth of the ebb tide delta, reduction of Manning Point Beach spit (on the southern side of the entrance as the entrance widens), recession of the northern portion of Manning Point Beach and progradation of Harrington Beach north of the Harrington Inlet entrance.

The state of Manning Point Beach may be affected by the relative state of the entrances at Farquhar and Harrington. Some possible processes include:

- Entrance sediment sink;
- Offshore losses due to flood flows;
- Refraction around the ebb tide delta/bar, and;
- Beach rotation due to medium term fluctuations in wave direction climate.

However, these processes are extremely complex and no consistent behaviour could be discerned from the record.

2.1.7 Harrington Beach

Harrington Beach has historically shown stability, with net accretion occurring between 1965 and 2006. Harrington Beach is supplied with sand from the Harrington entrance bar.

The planform of the southern portion of the beach is determined by wave diffraction patterns in the lee of the northern training wall and is hence stable.

2.1.8 Crowdy Bay

The coastal processes of Crowdy Bay (Crowdy Head to Diamond Head) have not yet been analysed and this area is not currently addressed by this Coastal Zone Management Plan. Much of this coast is national park and there is unlikely to be any assets at immediate risk from coastal hazards north of Crowdy Head. Should the hazard lines be required to assess any development proposals in the area, they will be prepared and issued as an addendum to the plan.

2.2 Public Access

The current access arrangements to beaches identified in the plan's area are considered adequate; however the access at Old Bar Beach is in need of upgrade. In the Greater Taree Coast Emergency Action Plan, this access is the only authorised point for the transportation of materials to locations where owners are permitted to construct emergency protection works. This access is occasionally damaged and repaired by Greater Taree City Council. The access could be upgraded to ensure that the beach can be continually accessed for transporting materials to construct emergency protection works. If funding without a requirement for co-contribution from Council were available, all of the current access arrangements would be upgraded. The upgrades would have to be designed by an engineer to alleviate environmental impacts and ensure continued safe access to the coastline. Described below are the beaches identified in the Coastal Zone Management Plan's area and their current access arrangements.

2.2.1 Black Head Beach

Black Head Beach is patrolled during the summer months. Permits are required for vehicle access to the beach with the exception of boat launching from the boat ramp. A pedestrian bridge links Black Head Reserve/Black Head Lagoon Flora Reserve to the beach, crossing Black Head Lagoon. Red Head Beach, which is located at the northern end of Black Head Bay, is an unpatrolled beach. There is a Rainforest Nature Walk (with a loop walking track) at Red Head (off the end of Red Head Road) and a viewing platform and stairs to the beach. There are also informal beach access points (sand tracks) from the Holiday Resort and houses along Scenic Drive.

A dune 'blow out' has been observed about two-thirds of the way up the beach from Black Head, possibly associated with informal access from the Red Head Big 4 Beachfront Holiday Resort (*Black Head to Crowdy Head Coastline Hazard Definition Study,* WorleyParsons 2010a).

2.2.2 Diamond Beach

Diamond Beach south is patrolled during the summer school holidays. A small car park, lookout and beach access is situated at the eastern end of Diamond Drive. There is also a beach access way within the Diamond Beach Holiday Park at the northern end of Golden Drive and several informal tracks through the dune from beachfront properties to the south.

Access to an area of coastal rainforest is via a walking track off Golden Drive and from the beach via a sand track and includes a section of boardwalk.

Most resorts at north Diamond Beach have constructed beach access ways. There are also a number of informal tracks through the dune in this area which have resulted in erosion and the loss of dune vegetation (*Black Head to Crowdy Head Coastline Hazard Definition Study,* WorleyParsons 2010a).

2.2.3 Saltwater Beach

Saltwater Beach, within Saltwater National Park (at the southern end of the beach) features a headland walking track. There is a car park at the southern end of the beach within the National Park, three formal timber access ways/lookouts and boat launching facilities (concrete ramps) on Khappinghat Creek and at the beach. Midway along the beach there are a couple of formal and informal access ways and informal car parking areas (*Black Head to Crowdy Head Coastline Hazard Definition Study,* WorleyParsons 2010a).

On the southern side of Wallabi Point there is vehicle access to the beach and a small car park, lookout and stairs to the beach. On the northern side of the point there is vehicle/pedestrian access to the beach.

2.2.4 Old Bar Beach

Old Bar Beach access is focused in the area around the Taree-Old Bar Surf Life Saving Club (SLSC) where there is patrol/emergency vehicle beach access. Formal pedestrian access ways to the beach are located at the Caravan Park and SLSC. Informal access to the beach near the SLSC has resulted in dune erosion. The surfing beach is patrolled in summer. North of the SLSC and adjacent caravan park are a number of 4WD access tracks to the beach and a wooden lookout structure. Under Appendix A of the Greater Taree Coast Emergency Action Plan, the Taree-Old Bar SLSC emergency vehicle access is the only authorised point for transportation of materials to locations where owners are permitted to construct emergency protection works.

2.2.5 Manning Point Beach

Manning Point Beach is not patrolled. Formal beach access from the village of Manning Point consists of a 4WD track and adjacent pedestrian track at Vic Shoesmith Reserve at Manning Point.

2.2.6 Harrington Beach

Harrington Beach is not patrolled. There are three 4WD access tracks to the beach. Pedestrian access is available through the Harrington Beach Holiday Park.

2.2.7 Crowdy Head Beach

Crowdy Head Beach near the Crowdy Head Surf Life Saving Club (SLSC) is patrolled during the summer months. There is a car park adjacent to the SLSC and 4WD access to the beach to the north.

Note: Approval for new access points along the coastline are subject to assessment, are required to consider any adverse impacts at existing access points and require approval from the Department of Primary Industries - Crown Land Division.

2.3 Cultural and Heritage Significance

2.3.1 Aboriginal Sites

The original occupiers of the Manning Valley were speakers of the Biripi Aboriginal language. This name is now used to signify the people. Although distinct groups inhabited a range of environments from coastal, estuarine, riverine and inland areas, they shared this common language. The Biripi moved between neighbouring lands for ceremonial activities and episodic and periodic food gathering (Klaver & Keffernan 2009).

Many Aboriginal sites (e.g. scarred trees, artefact scatters, shell middens, stone tool manufacturing sites and ceremonial sites) are located in coastal areas of Greater Taree LGA. A number of Aboriginal burial sites occur along beaches (Klaver & Keffernan 2009). Artefacts including 'flakes', remnant 'cores' and 'stone axes' have also been recorded (Orogen 2007).

2.3.2 Natural and Non-Indigenous Cultural Heritage

Pockets of coastal rainforest are present in a number of areas along the Greater Taree coast. These areas are protected under *SEPP No. 26 Littoral Rainforest* and are considered an Endangered Ecological Community (EEC) under the NSW *Threatened Species Conservation (TSC) Act 1995* (i.e. Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions). In addition, Littoral Rainforest and Coastal Vine Thickets of Eastern Australia are listed as Critically Endangered under the Federal *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*.

Several coastal wetlands listed under *SEPP No. 14 Coastal Wetlands* are located at Farquhar and Harrington Inlets. Saltmarsh associated with these wetlands is listed under the *Threatened Species Conservation (TSC) Act 1995* (i.e. Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions). Mangroves and seagrasses are protected under the *Fisheries Management (FM) Act 1994*.

Some areas of the Greater Taree coast are listed on the Register of the National Estate for these and other natural and cultural heritage values. Following is a summary of these taken from the Australian Heritage Database (DEWHA 2009).

Old Bar – Farquhar Inlet

No significant habitation occurs at the Farquhar Inlet entrance, unlike many other river entrances in NSW. Therefore the entrance remains in a natural state, with sand islands, intertidal mud flats and mangroves lining the bank.

The estuarine habitats of the Old Bar-Farquhar sandbar islands are important habitat and breeding sites for a number of rare or threatened migratory and wading birds, including the little tern (*Sterna albifrons*) and the beach stone-curlew (*Escacus neglectus*). The Old Bar-Farquhar population of the little tern comprises approximately 30% of the estimated NSW population. Eight bird species listed on the Japan Australia Migratory Bird Agreement (JAMBA) and the China Australia Migratory Bird Agreement (CAMBA) have been recorded in the area including the great knot (*Calidris*

tenuirostris), broad billed sand piper (*Limicola falcinellus*) and the lesser sand-plover (*Charadrius mongolus*). The area also supports at least ten species of birds listed as vulnerable in NSW under the *Threatened Species Conservation (TSC) Act 1995*.

Old Bar Airfield (circa 1925) is of historical significance (listed as State Significance in the heritage schedule to the Greater Taree Local Environment Plan 2010) because of its key role in the development of Australia's air mail and aerial passenger services. It was the site of an historic air pageant in 1930 and was subsequently used by the military during WWII as a refuelling and coastal mapping and surveying station for the RAAF. The windsock, which is located off site, is a significant element of the significance of the airfield. The airfield is directly associated with aviation pioneers Sir Charles Kingsford-Smith, Captain C.T.P. Ulm, Jean Batten and Nancy Bird Walton who often used the airstrip. Kingsford-Smith and Ulm also had planes in the 1930 air pageant and used the airfield as a refuelling point.

Harrington Inlet - Manning Point

Estuarine habitats like the Harrington Inlet sandbar islands are important habitat and breeding sites for a number of rare or threatened migratory and wading birds, including the nationally endangered little tern (*S. albifrons*), the beach stone-curlew (*Escacus magnirostris*) and black-necked stork (*Ephippiorynchus asiaticus*) which are listed as endangered in NSW. Ten listed vulnerable bird species have been recorded in the area. In addition, bird species recorded in the area which are listed on JAMBA and CAMBA include the great knot (*C. tenuirostris*), little tern (*S. albifrons*), lesser sand-plover (*C. mongolus*) and broad-billed sandpiper (*L. falcinellus*), in addition to the sanderling (*Calidris alba*) which is listed on JAMBA only.

Harrington Inlet is important for its association with John Oxley, who discovered the inlet in 1818; Assistant Surveyor John Armstrong, whose report opened up the northern bank of the Manning River to settlement; and British civil engineer Sir John Coode, who made recommendations to improve that safety of the entrance in 1889. Between 1824 and 1941 over 50 ships were lost, with the wrecks of the *Burrawong 1909, Minimbah* 1910 and *Coolon* 1917 located within the entrance. Sir John Coode's recommendations resulted in construction of the northern training wall and breakwater by the Public Works Department to improve navigation.

North Harrington Littoral Rainforest

The rainforest at North Harrington is a significant invertebrate habitat. The site is the only known locality for five species of beetle. These include a member of a primitive genus, *Helferella manningensis*, two beetles belonging to the Lagriidae and Rhipiphoridae families, the jewel beetle *Paratrachys australia* and *Trachys blackburni*, which has not been found anywhere else since its discovery last century. A neocuris jewel beetle (*Coleoptera buprestidae*) is also known only from this site and a littoral rainforest remnant at Manning Point immediately to the south.

Crowdy Head Lighthouse

Crowdy Head Lighthouse, built in 1879, is a significant lighthouse designed by the Colonial Architect James Barnet. It shows typical characteristics of this style such as the oversailing bluestone platform supported by corbels. The lighthouse is significant as one of five small lighthouses built on the NSW

north coast in the late nineteenth century and is listed in the Greater Taree Local Environment Plan 2010 as being of local heritage significance.

2.3.3 Socio-economic Values

Recreational activities associated with the Greater Taree beaches, coastal rainforest, national parks and nature reserves include bushwalking, fishing, surfing, swimming, four wheel driving and whale/dolphin watching. For further information see www.gtcc.nsw.gov.au or www.manningvalley.info.

Old Bar is often the venue for surfing contests and Saltwater/Wallabi Point is a popular surfing spot when the swell is up from the east to south. At Black Head there is a beach break and a short point break (Warren 1999).

Beach fishing is widespread along the Greater Taree coast. Harrington is particularly popular for beach fishing and river fishing along the breakwater. Similarly, its seaside and riverside location makes Manning Point popular for recreational fishing activities.

Manning Point is a major centre for oyster production in the Manning Valley. Crowdy Head provides the only deep sea boat harbour between Coffs Harbour and Port Stephens, utilised by commercial fishing vessels.

Tourism is a key industry and directly reflects the 'image' and placement of Greater Taree within the broader region and the State (Hunter Valley Research Foundation 2005). The North Coast region (which includes Port Stephens, Coffs Harbour, Greater Taree and Port Macquarie) receives millions of overnight visitors every year (recent statistics are available at www.tourism.nsw.gov.au).

There are many camping options along this stretch of coast ranging from tourist/holiday parks to basic bush camping sites.

3 POLICY AND LEGISLATIVE CONTEXT

The objectives, goals and principles of key legislation and policy for management of the coastal zone are reproduced below.

3.1 Coastal Protection Act 1979

The objects of this Act are to provide for the protection of the coastal environment of the State for the benefit of both present and future generations and, in particular:

(a) to protect, enhance, maintain and restore the environment of the coastal region, its associated ecosystems, ecological processes and biological diversity, and its water quality, and

(b) to encourage, promote and secure the orderly and balanced utilisation and conservation of the coastal region and its natural and man-made resources, having regard to the principles of ecologically sustainable development, and

(c) to recognise and foster the significant social and economic benefits to the State that result from a sustainable coastal environment, including:

(i) benefits to the environment, and

(ii) benefits to urban communities, fisheries, industry and recreation, and

(iii) benefits to culture and heritage, and

(iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water, and

(d) to promote public pedestrian access to the coastal region and recognise the public's right to access, and

(e) to provide for the acquisition of land in the coastal region to promote the protection, enhancement, maintenance and restoration of the environment of the coastal region, and

(f) to recognise the role of the community, as a partner with government, in resolving issues relating to the protection of the coastal environment, and

(g) to ensure co-ordination of the policies and activities of the Government and public authorities relating to the coastal region and to facilitate the proper integration of their management activities, and

(h) to encourage and promote plans and strategies for adaptation in response to coastal climate change impacts, including projected sea level rise, and

(i) to promote beach amenity.

3.2 NSW Coastal Policy 1997

The overriding vision of the Coastal Policy is the ecologically sustainability of the NSW Coast. In order to give expression to this vision, nine goals have been adopted which represent a commitment to:

- *protecting, rehabilitating and improving the natural environment of the coastal zone*
- *recognising and accommodating the natural processes of the coastal zone*
- *protecting and enhancing the aesthetic qualities of the coastal zone*
- *protecting and conserving the cultural heritage of the coastal zone*
- *providing for ecologically sustainable development and use of resources*
- *providing for ecologically sustainable human settlement in the coastal zone*
- *providing for appropriate public access and use*

- *providing information to enable effective management of the coastal zone, and*
- *providing for integrated planning and management of the coastal zone.*

3.3 NSW Sea Level Rise Policy Statement 2009

The objective of this Policy is to see coastal communities adapt to rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. The Policy promotes an adaptive risk-based approach to managing the impacts of sea level rise. This approach recognises that there are potentially significant risks from sea level rise and that the accuracy of sea level rise projections will improve over time.

Planning and investment decisions should therefore consider the sea level rise projections over timeframes that are consistent with the intended timeframes of the decision. For example, these decisions should consider likely sea levels over the expected life of an asset in order to decide on how the asset can be located or designed, thereby avoiding or minimising any associated impacts.

The NSW Government has adopted sea level rise planning benchmarks to support this adaptive risk-based approach. The use of the benchmarks is required when undertaking coastal and flood hazard assessments. The benchmarks are an increase above 1990 mean sea levels of 40cm by 2050 and 90cm by 2100. They were established by considering the most credible national and international projections of sea level rise and take into consideration the uncertainty associated with sea level rise projections. The Government will continue to monitor sea level rise observations and projections and will periodically review these planning benchmarks, with the next review likely to coincide with the release of the fifth International Panel on Climate Change (IPCC) report, which is due in 2014.

The Policy includes the statement that '*coastal hazards and flooding are natural processes and the Government considers that the risks to properties from these processes appropriately rests with the property owners, whether they be public or private'*.

When allocating funding assistance to local councils for coastal protection works, the Government will give priority to public safety and protecting valuable publicly-owned assets, and then to private land. The criteria that the Government will use to allocate any funds to local councils to protect or voluntarily purchase private property will include the:

- magnitude of current and future hazards;
- cost-effectiveness of management actions;
- contribution to the project's costs from the local council and benefiting landowners, taking into consideration genuine hardship for affected coastal residents;
- effectiveness of the proposed arrangements for maintaining any proposed works, and;
- ability of the project to accommodate sea level rise.

3.4 Guidelines for Preparing Coastal Zone Management Plans 2010

In December 2010, DECCW released the NSW Government's *Guidelines for Preparing Coastal Zone Management Plans.* The guidelines set out the process for gazettal of Coastal Zone Management

Plans (see **Figure 3.1** reproduced from the Guidelines), Coastal Management Principles and minimum requirements for the preparation of Coastal Zone Management Plans.

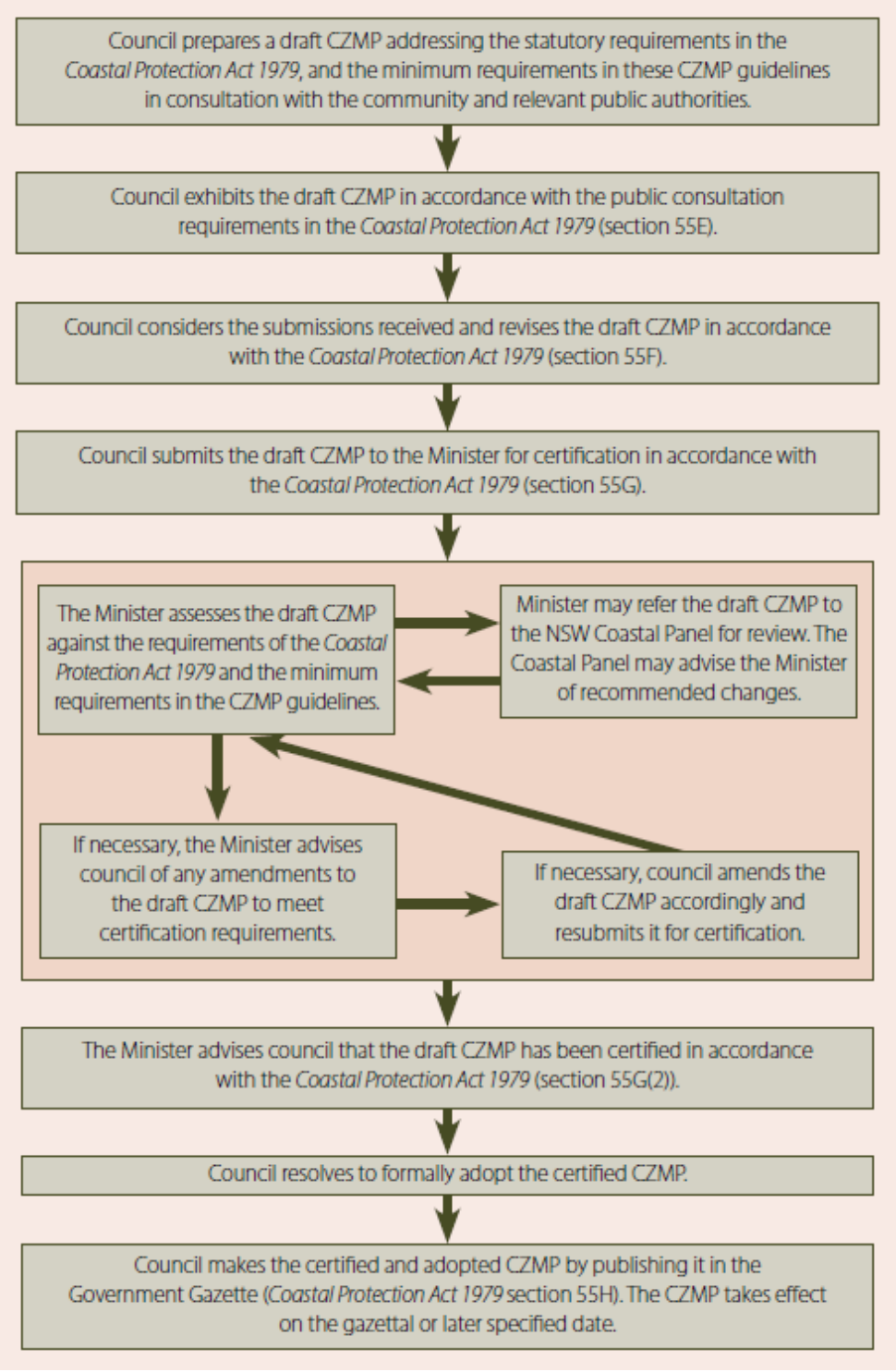

Figure 3.1: CZMP Preparation and Certification Process

3.5 Changes to NSW Coastal Management Flagged September 2012

A media release from Chris Hartcher MP Minister for Resources and Energy, Special Minister for State and Minister for the Central Coast, dated 8 September 2012, flagged upcoming changes to the NSW coastal management and planning system intended to:

- make it easier for landowners to install temporary works to reduce the impact of erosion;
- remove compulsory application of state-wide sea level rise benchmarks;
- clarify to preparation of section 149 notices; and
- provide local government with information and advice on sea level rise relevant to the local government area.

Detail of the proposed changes and the local sea level rise advise are not currently available. As such, this Coastal Zone Management Plan has been prepared in accordance with the NSW Government's *Guidelines for Preparing Coastal Zone Management Plans* (2010) (refer **section 3.4**). The sea level rise benchmarks provided in the NSW *Sea Level Rise Policy Statement* 2009 (refer **section 3.3**) remain as the most relevant predictions for the Greater Taree area and have been used in this plan.

3.6 Local Government Act 1993

Provides for an annual levy for rateable land benefiting from coastal protection works/service (whether or not the works are constructed by council, land owners or jointly constructed, regardless of where they are constructed, i.e. private or public land, neighbouring land). Charges are outside the system of rate pegging, and cover the private benefit share of design, construction and operational costs.

Exemption from liability for councils is extended to cover: anything done or omitted to be done regarding beach erosion or shoreline recession on public land; failure to upgrade coastal management works in response to projected or actual impacts of climate change; failure to enforce the removal of illegal or unauthorised structures on public land; and provision of information relating to climate change or sea level rise. The Act requires that Council must act in good faith, which may be demonstrated by substantially following the principles set down in the *Guidelines for Preparing Coastal Zone Management Plans.*

Coastal protection works/service is defined as the maintenance of coastal protection works (which include beach nourishment) and the management of the impacts of these works (such as increased erosion elsewhere).

3.7 Local Government (General) Regulation 2005

Specifies that a coastal protection service must ensure that works do not result in any significant long term coastal erosion impacts on beaches.

3.8 State Environmental Planning Policy (Infrastructure) 2007

The proposed amendments to this State Environmental Planning Policy (SEPP) would permit landowners to apply for approval to erect long-term coastal protection works. Approval of these works may be granted where the potential offsite impacts of the works can be managed and the landowner will fund any ongoing works, including beach nourishment.

129 Development permitted without consent

(1) Despite clause 129A, development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority without consent on any land.

(1A) To avoid doubt, subclause (1) does not permit the subdivision of any land.

(2) In this clause, a reference to development for the purpose of waterway or foreshore management activities includes a reference to development for any of the following purposes if the development is in connection with waterway or foreshore management activities:

(a) construction works,

(b) routine maintenance works,

(c) emergency works, including works required as a result of flooding, storms or coastal erosion,

***Note.** Emergency coastal protection works within the meaning of the Coastal Protection Act 1979 are excluded from the operation of the EP&A Act and therefore are not development to which this clause applies.*

(d) environmental management works.

(2A) The following provisions apply in relation to the carrying out of new coastal protection works by or on behalf of a public authority on the open coast or entrance to a coastal lake:

(a) if a coastal zone management plan is in force in relation to the land on which the development is to be carried out-the public authority (or person carrying out the works on behalf of the public authority) must consider the provisions of that plan before carrying out the development,

(b) if a coastal zone management plan is not in force in relation to the land on which the development is to be carried out-the public authority (or person carrying out the works on behalf of the public authority) must:

(i) notify the Coastal Panel before carrying out the development, and

(ii) take into consideration any response received from the Coastal Panel within 21 days of the notification.

(2B) For the purposes of subclause (2A):

***new coastal protection works** means coastal protection works other than:*

(a) the placement of sand (including for beach nourishment) or sandbags, or

(b) the replacement, repair or maintenance of any such works.

(3) Development for the purpose of temporary works for or associated with drought relief may be carried out by or on behalf of a public authority without consent, but only if the development is:

(a) carried out on land publicly identified by the Minister for Primary Industries as being in drought, and

(b) removed, and the area rehabilitated, within 4 months after the date on which the area is no longer so identified.

Note. *Areas of NSW that are in drought are identified on the website of the Department of Primary Industries.*

129A Development with consent

(1) Development for the purposes of a sea wall or beach nourishment may be carried out by any person with consent on the open coast or entrance to a coastal lake.

(2) If a coastal zone management plan does not apply to the land on which any such development is to be carried out, the Coastal Panel has the function of determining a development application for development to which this clause applies.

(3) Before determining a development application for development to which this clause applies, the consent authority must take the following matters into consideration:

(a) the provisions of any coastal zone management plan applying to the land,

(b) the matters set out in clause 8 of State Environmental Planning Policy No 71-Coastal Protection,

(c) any guidelines for assessing and managing the impacts of coastal protection works that are issued by the Director-General for the purposes of this clause and published in the Gazette.

Note. *Section 55M of the Coastal Protection Act 1979 sets out preconditions to the granting of development consent relating to coastal protection works.*

4 COUNCIL'S STRATEGIC APPROACH AND POLICY

Council expects public and private assets along the coastline will continue to be vulnerable to coastal hazards both now and into the future.

It is likely that the intensity of coastal hazards along the coastline will increase over time, as will the risks to public and private assets as the effects of climate change are realised. Even with the current best available information the true impacts/risks resulting from climate change and coastal hazards on the Greater Taree coastline still remains uncertain, although some of these risks have been modelled and used to produce coastal hazard lines.

Council recognised by adopting the planned retreat policy stance that a coastal strategy which favours the retreat of public and private assets out of the coastal hazard zone represents the best strategic approach to manage the uncertainty of impacts to assets resulting from coastal hazards over the long term.

4.1 Principles and Objectives for Coastal Zone Management

In considering the best way to manage planned retreat Council will be guided by the following Coastal Management principals from the *Guidelines for Preparing Coastal Zone Management Plans* (DECCW 2010a) and Council's objectives in relation to these principals. These principles and objectives will guide how Council responds to coastal hazards.

Table 4.1 Guiding Principles and Council Objectives

Principle		Council's Objectives	Section of CZMP
1	Consider the objectives of the *Coastal Protection Act 1979* and the goals, objectives and principles of the NSW Coastal Policy 1997 and the NSW Sea Level Rise Policy Statement 2009.	To meet all legal responsibilities	Refer to **Section 1.4**
2	Optimise links between plans relating to the management of the coastal zone.		Refer to **Table 7.1** coastal and floodplain management

3	Involve the community in decision-making and make coastal information publicly available.	Council will inform and consult with residents, landholders and the community about coastal zone management issues that have the potential to affect their utilisation of the coast.	Refer to **Appendix A**
4	Base decisions on the best available information and reasonable practice; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach.	This plan is underpinned by best practice hazard definition techniques including comprehensive examination of the historical record and conceptual models of coastal processes supported by numerical modelling.	Refer to **Section 1**
5	The priority for public expenditure is public benefit; public expenditure should cost effectively achieve the best practice long-term outcomes.	In the management of risks associated with coastal hazards, Council will give priority to actions that can be implemented within its current resourcing capacity and are effective in addressing immediate and long term threats. Planning controls for new developments and triggers for retreating existing public and private assets that come under threat from coastal hazards is seen as a priority. The *Coastal Protection Act 1979* provides private landowners with the ability to implement and maintain protection works that benefit them.	Refer to **Table 7.1**

6	Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risks where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented.	Council will apply retreat strategies for coastal assets and infrastructure that will require the relocation or abandonment of assets and infrastructure to outside the coastal hazard lines. Council will use planning tools (LEP and DCP clauses, design guidelines) to ensure that new development does not result in an increased risk to life and property on land that is likely to be impacted by coastal hazards. Council will develop additional planning controls for land at risk from coastal hazards, which will apply to new residential development, major infrastructure, new subdivisions and strategic studies on appropriately zoned land.	Refer to **Section 2** Planned Retreat Policy and Emergency Action Plan
7	Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions.	Council will seek to avoid unnecessarily sterilising land within the coastal zone unless such land poses a risk to human life or property as a result of coastal hazards. Council will look at implementing flexible options to manage hazards and risks in the coastal zone that will allow ongoing use of land affected by coastal hazards until the risks to human life and public and private assets become unacceptable.	Refer to **Section 2** Planned Retreat Policy and 2050 and 2100 hazard lines in **Appendix C**

8	Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded ecosystems.	Council accepts that to maintain coastal biodiversity, coastal ecological communities must have room to migrate and adjust to sea level rise and coastal recession.	Refer to **Table 7.1** regarding dune restoration/ access ways and stormwater outlets and **Section 5**
9	Maintain and improve public safe access to beaches and headlands consistent with goals of the NSW Coastal Policy.	Council will not approve property protection works for existing public and private assets where the works are likely to increase coastal hazard risks/impacts on adjoining land, the environment or impact on the community's access and use of the beach.	Refer to **Table 7.1** regarding beach access ways
10	Support recreational activities consistent with the goals of the NSW Coastal Policy.		Refer to **Table 7.1** regarding beach access ways and surf life saving clubs

4.2 Arriving at a Policy Stance of Planned Retreat

The policy stance of planned retreat is based on principles of governance, social, environmental and economic sustainability. The stance adheres to the principles for an environmentally sustainable coast and adaptive risk management adopted in the *NSW Coastal Policy 1997* and articulated in the DECCW *NSW Sea Level Rise Policy Statement 2009*.

In arriving at planned retreat, Council evaluated the governance, environmental, social, economic and technical aspects of each of the management options presented in the Coastline Management Study. This multi-criteria analysis guided the decision making process. The approach ensures the ongoing responsible and sustainable management of the Council coastline for the benefit of the whole community.

Similarly, Council has taken into account the *Coastal Protection Act 1979* in arriving at planned retreat. This Act has a number of provisions that Coastal Zone Management Plans must consider. In recognition of these provisions, property protection management options outlined in the Coastline Management Study that do not include beach nourishment will not be considered sustainable under this Coastal Zone Management Plan for two reasons:

- they do not protect and preserve beach environments and beach amenity, and
- they do not ensure continuing and undiminished public access to beaches.

This means that property protection management options, whether included in the Coastline Management Study or not, that do not include beach nourishment are contrary to the *Coastal Protection Act 1979*. For this CZMP to be able to consider such management options would require a policy shift from the NSW Government and a change in the current coastal protection legislation.

Table 4.2 below is a summary of the multi-criteria evaluation of each of the management options identified in the Coastline Management Study and how these have been evaluated by Council in arriving at planned retreat. A summary of the economic analysis of each option may be found in the Coastline Management Study. Further details may be found in the Coastline Management Study (WorleyParsons 2010b). It is possible that future changes in State or Federal Government policy may accommodate additional components of planned retreat, including property purchase. In evaluating the management options, Council has identified potential adverse impacts in some of the categories as a full feasibility study for the options has not been undertaken.

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study															
Location	**Manage-ment Option**	**Governance**		**Social**		**Economic**		**Environmental**		**Technical Confidence in Providing Protection**		**Technical Confidence in Predicting Impacts and Effectiveness**	**Council Preferred Option**
Entire Coastline	**Planned Retreat**	✓	• Can be achieved under current legislation • Provides an equitable solution for the entire community • Does not prevent development on the coastline but restricts the types of developments that will be approved and the nature of the approval (trigger bounded) through appropriate planning controls	✓	• Maintains beach access and amenity for continued enjoyment by the wider community • Maintains intergenerational equity by not restricting the use, access and enjoyment of the beach by future generations • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Possible loss of community function • Losses are borne by the respective asset owner	✓	• Costs associated with the relocation/removal of private assets would be borne by the landowner • Does not require Council or other public authority to find additional funds to acquire land • Retreat of Council assets can be planned in advance so that there is reduced impact on Council's revenue base	✓	• Allows coastal processes to continue unrestricted • Will not have adverse offsite environmental impacts associated with it • Potential loss of dune ecosystems and littoral rainforest	✓	• Removes assets at risk from storm erosion and coastline recession	High	✓

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Entire Coastline	**Property Purchase/ Acquisition/ Partial Acquisition**	✓	• Can be achieved under current legislation but would require a policy shift from the Federal and State Governments so that it could be funded	✓	• Maintains beach access and amenity for continued enjoyment by the wider community • Maintains intergenerational equity by not restricting the use, access and enjoyment of the beach by future generations • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Removes assets at risk from storm erosion and coastline recession • Includes owners in the decision making process (in voluntary acquisition), and other owners may follow suit • Landholders compensated • Allows owners to move on • Possible loss of community function • Depending on the source of funds, spreads the cost across the entire community e.g. taxes	X	• State and Federal governments do not have a policy/program to compensate landholders affected by coastal erosion • Significant cost beyond Council's capacity to resource	✓	• Allows coastal processes to continue unrestricted • Will not have adverse offsite environmental impacts associated with it • Potential loss of dune ecosystems and littoral rainforest	✓	• Removes assets at risk from storm erosion and coastline recession	High	X
Diamond Beach	**Geo-textile bag Seawall**	X	• Does not include beach nourishment and therefore would be contrary to the *Coastal Protection Act 1989*	X	• Liability issues if structure fails • Loss of visual amenity • Impacts on public access and enjoyment of the beach	X	• Only temporary, therefore ongoing expenditure	X	• Potentially only allows for natural coastal processes until assets are at immediate threat • Potentially changes natural sand movement • Potential environmental impacts if structure fails or is not properly maintained • Disruption of sand dunes and vegetation during construction phase • Potentially increases erosion at adjacent, unprotected areas.	✓	• Emergency response (geobag seawall) may ensure protection (level of protection would be compromised if structure was damaged during storm event)	Moderate – relying on emergency placement of coastal protection compromises decision making, structural integrity/quality, Health, Safety and Environmental issues, impact mitigation and liability	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Diamond Beach	**Buried Seawall - sand from creek to maintain beach amenity**	X	• Borrow site lies in a National Park which would require a policy shift by the NSW Government and changes to legislation to implement	✓	• Provides ongoing protection for assets at risk from storm erosion and coastline recession • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Maintains beach access and amenity	X	• Ongoing expenditure to maintain structure • Not cost effective to use • Costly to implement (transport and extraction)	X	• Potential for adverse impacts on external borrow sites and ecosystems	✓	• Provides terminal protection for assets at risk from storm erosion and coastline recession • Limited sand reserves in creek	High	X
Diamond Beach	**Buried Seawall - sand trucked in to maintain beach amenity**	✓	• Can be achieved under current legislation as long as impacts can be minimised and managed	✓	• Provides ongoing protection for assets at risk from storm erosion and coastline recession • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Maintains beach access and amenity	X	• Significant cost beyond Council's capacity to resource	X	• Potential impact on offshore ecology • Potential loss of beach due to erosion in front of wall if insufficient buffer maintained • Potential change to natural sand movement • Potential environmental impacts if structure fails or is not properly maintained • Potential disruption to sand dunes and vegetation during construction phase • Potential increased erosion longshore or in other areas away from seawalls if nourishment is inadequate	✓	• Provides terminal protection for assets at risk from storm erosion and coastline recession	High	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Diamond Beach	**Nourishment - sand from creek**	X	• Borrow site lies in a National Park which would require policy shift by the NSW Government and changes to legislation to implement	✓	• Provides ongoing protection for assets at risk from storm erosion and coastline recession • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Maintains beach access and amenity • Impact of truck movements • Temporary access restrictions during placement	X	• Only temporary, therefore ongoing expenditure • Relies on the maintenance of the sand buffer by replacing sand lost offshore and alongshore; and additional sand to account for sea level rise over 50 years • Significant cost beyond Council's capacity to resource	X	• Proposed borrow site for beach nourishment located in a National Park (high conservation value) • Potential impact on offshore ecology • Potential impacts on source/mining areas ecology	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Limited sand reserves in creek	High	X
Diamond Beach	**Nourishment - sand trucked in**	✓	• Can be achieved under current legislation as long as impacts can be minimised and managed	✓	• Provides ongoing protection for assets at risk from storm erosion and coastline recession • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Maintains beach access and amenity • Impact of truck movements • Temporary access restrictions during placement	X	• Only temporary, therefore ongoing expenditure • Relies on the maintenance of the sand buffer by replacing sand lost offshore and alongshore; and additional sand to account for sea level rise over 50 years • Significant cost beyond Council's capacity to resource	X	• Potential impact on offshore ecology • Potential impacts on source/mining areas ecology	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years	High	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Diamond Beach	**Groynes - sand from creek for beach amenity**	X	• Borrow site lies in a National Park which would require policy shift by the NSW Government and changes to legislation to implement	X	• Potentially does not maintain continuous beach access and amenity for enjoyment by the wider community • Relies on on-going nourishment to protect against storm erosion and sea level rise recession (offshore losses)	X	• Groynes do not prevent offshore losses; therefore on-going nourishment is required • Significant cost beyond Council's capacity to resource • Not cost effective	X	• Proposed borrow site for beach nourishment is located in a National Park (high conservation value) • Potential impact on offshore ecology • Potential impacts on source/mining area ecology • Potential change to natural sand movement • Potential environmental effects if structure falls apart or not properly maintained • Potential disruption to sand dunes and vegetation during construction phase • Potential for increased erosion in other areas away from groynes	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Limited effectiveness of groyne field in reducing storm erosion and sea level rise recession (offshore losses) • Possible exacerbation of storm erosion (offshore losses) • Limited sand reserves in creek	High	X
Diamond Beach	**Groynes - sand trucked in for beach amenity**	✓	• Can be achieved under current legislation as long as impacts can be minimised and managed	X	• Potentially does not maintain continuous beach access and amenity for enjoyment by the wider community, therefore requiring more sand to be trucked in	X	• Does not provide ongoing protection due to limited effectiveness of groyne field in reducing storm erosion and sea level rise recession (offshore losses) • Significant cost beyond Council's capacity to resource	✓	• Potential impact on offshore ecology • Potential impacts on source/mining areas ecology • Potential change to natural sand movement • Potential environmental effects if structure fails or not properly maintained • Potential disruption to sand dunes and vegetation during construction phase • Potential increased erosion in other areas away from groynes	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Limited effectiveness of groyne field in reducing storm erosion and sea level rise recession (offshore losses) • Possible exacerbation of storm erosion (offshore losses)	High	X
Old Bar	**Revetment**	X	• Does not include beach nourishment and therefore would be contrary to the *Coastal Protection Act*	X	• Does not maintain beach access and amenity for continued enjoyment by the wider	X	• High capital cost and ongoing maintenance cost, beyond Council's capacity to	X	• Potential modification (training) of Racecourse Creek	✓	• Provides terminal protection for assets at risk	High	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
			*19*79		community • Loss of beach • Individual property owners protected		resource • Capital and maintenance costs could be borne by the benefitting landholders • Potential impact on tourist trade due to loss of beach and amenity		• Eventual loss of beach in front of revetment • Potential exposure of revetment • Potential end effects of revetment wall would cause increased recession at either end of structure, including the SEPP 26 littoral rainforest and on adjacent unprotected parts of the beach • Potential change to natural sand movement • Potential environmental effects if structure fails or not properly maintained • Disruption to sand dunes and vegetation during construction phase		from storm erosion and coastline recession		
Old Bar	**Revetment + nourishment to maintain beach amenity**	✓	• Could be achieved under current legislation if it can be shown that there are no adverse environmental impacts and impacts can be minimised and managed • Would require a change in government policy if an offshore sand source was to be utilised	✓	• Potentially will provide ongoing protection for assets at risk from storm erosion and coastline recession • Allows for the occupation of the coastline by property owners for as long as it is safe to do so • Maintains beach access and amenity for continued enjoyment by the wider community, provided that maintenance nourishment is carried out when required	X	• High capital cost and ongoing maintenance cost, beyond Council's capacity to resource • Requires ongoing commitment to maintenance nourishment in perpetuity	X	• Construction may affect SEPP 26 littoral rainforest • Potential periodic loss of beach due to erosion in front of wall. • Potential exposure of revetment and increased erosion on unprotected areas if an adequate sand buffer is not maintained • Potential change to natural sand movement • Potential environmental impacts if structure is not properly maintained • Disruption to sand dunes and vegetation during construction phase • Potential impact on offshore ecology • Potential impacts on source area ecology	✓	• Provides terminal protection for assets at risk from storm erosion and coastline recession	Moderate - effectiveness of maintenance nourishment may be limited due to rapidly receding beach system. The high rate of erosion in this area makes is difficult to predict if nourishment has been effective.	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Old Bar	**Nourishment**	✓	• Could be achieved under current legislation if it can be shown that there are no adverse environmental impacts and impacts can be minimised and managed • Would require a change in government policy if an offshore sand source was to be utilised • May be difficult to respond quickly to an erosion event (regulatory and plant mobilisation)	✓	• Potentially provides ongoing protection for assets at risk from storm erosion and coastline recession if an adequate buffer is maintained • Protects amenity and public access • Potentially protects private assets	X	• Only temporary, therefore ongoing expenditure • High capital cost and ongoing maintenance cost, beyond Council's capacity to resource	X	• Potential impacts on beach ecology • Potential impacts on offshore ecology • Potential impacts on source/mining areas ecology • Potentially will protect SEPP 24 littoral rainforest	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Requires ongoing commitment to maintenance nourishment in perpetuity	High	X
Old Bar	**Entrance structure + nourishment**	✓	• Could be achieved under current legislation if it can be shown that there are no adverse environmental impacts and impacts can be minimized and managed • Would require a change in government policy if an offshore sand source was to be utilised • May be difficult to respond quickly to an erosion event (regulatory and plant mobilisation)	✓	• Potentially provides ongoing protection for assets at risk from storm erosion and coastline recession if an adequate buffer is maintained • Potentially will protect amenity and public access • Potentially will protect private assets	X	• Only temporary, therefore ongoing expenditure • High capital cost and ongoing maintenance cost, beyond Council's capacity to resource • Requires ongoing commitment to maintenance and nourishment in perpetuity • Not cost effective	X	• Potential changes in the hydraulic regime of the Manning River which may have significant and unpredictable consequences • Potential minimisation of the estuary entrance compartment • Potential for significant alteration to the hydraulic regime of Farquhar Inlet and the Manning River • Potential impacts on beach ecology • Potential impacts on offshore ecology • Potential impacts on source/mining areas ecology	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Erosion on Manning Beach due to change to entrance and alongshore sediment transport regime	Low – changes in hydraulic regime of the Manning River may have significant and unpredictable consequences similarly for the impact of the entrance structures on surf character	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study

Location	Manage-ment Option	Governance		Social		Economic		Environmental		Technical Confidence in Providing Protection		Technical Confidence in Predicting Impacts and Effectiveness	Council Preferred Option
Old Bar	**Groyne field + nourishment**	✓	• Could be achieved under current legislation if it can be shown that there are no adverse environmental impacts and impacts can be minimised and managed	X	• Potentially does not maintain continuous beach access and amenity for enjoyment by the wider community • Potentially provides ongoing protection for assets at risk from storm erosion and coastline recession if an adequate buffer is maintained	X	• Does not prevent offshore losses and so requires ongoing commitment to maintenance nourishment in perpetuity • High capital cost and ongoing maintenance cost, beyond Council's capacity to resource • Not cost effective	X	• Potential impacts on beach ecology • Potential impacts on offshore ecology • Potential change to natural sand movement • Potential environmental effects if structure falls apart or not properly maintained • Potential disruption to sand dunes and vegetation during construction phase • Potential for increased erosion in other areas away from groynes if nourishment inadequate	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Limited effectiveness of groyne field in reducing storm erosion and sea level rise recession (offshore losses) • Possible exacerbation of storm erosion (offshore losses)	Low – complexity of coastal processes ensures predicting resultant impacts and effectiveness of option would be uncertain	X
Old Bar	**Offshore reef + nourishment**	✓	• Could be achieved under current legislation if it can be shown that there are no adverse environmental impacts and impacts can be minimized and managed • Obtain Ministerial concurrence under the *Coastal Protection Act 1979* • Would also have to resolve the issues of ownership and responsibility for maintenance and rectification if adverse impacts become apparent	✓	• Potentially provides ongoing protection for assets at risk from storm erosion and coastline recession if an adequate buffer is maintained by nourishment • Potential for rip creation/enhancement – public safety issue	X	• High capital cost and ongoing maintenance cost, beyond Council's capacity to resource • Requires ongoing commitment to maintenance nourishment in perpetuity • Not cost effective	X	• May cause increased recession on either side of structure • Reef is likely to act as a fish attractor/aggregator • Potential impact on offshore ecology • Change to natural sand movement	X	• Does not provide terminal protection • Relies on maintenance of sand buffer by replacing sand lost offshore and alongshore + additional sand to account for sea level rise over 50 years • Limited effectiveness of reef in reducing storm erosion and sea level rise recession (offshore losses) • Reef unlikely to significantly reduce nourishment requirements. • Possible exacerbation of storm erosion (offshore losses)	Low – complexity of coastal processes means that impacts and effectiveness of this option is highly uncertain	X

Table 4.2: Multi-criteria Evaluation of Management Options from Coastline Management Study													
Location	**Manage-ment Option**	**Governance**		**Social**		**Economic**		**Environmental**		**Technical Confidence in Providing Protection**		**Technical Confidence in Predicting Impacts and Effectiveness**	**Council Preferred Option**
Black Head	**Review Adequacy of Rock Protection to SLSC**	✓	• Council does not manage these assets and therefore it would be up to the Crown Lands Division, which manages the asset to implement	✓	• Provides ongoing protection for Black Head SLSC	✓	• Structures are already in place, therefore cost associated with upgrade and maintenance of structure would be limited	✓	• This structure is already implemented, therefore environmental impacts are likely to be minimal	✓	N/A	N/A	✓*
Harrington	**Maintain Training Wall at Harrington**	✓	• Council does not manage these assets and therefore it would be up to the Crown Lands Division, which manages the asset to implement	✓	• Provides some ongoing protection for Harrington	✓	• Structures are already in place, therefore cost associated with maintenance and upgrade of structure would be reduced	✓	• This structure is already implemented, therefore environmental impacts are likely to be minimal	✓	High	High	✓*

4.3 Implementing Planned Retreat

Planned retreat is a planning approach whereby development can remain until the coastal hazard risk becomes unacceptable. Removal or relocation of at risk development is controlled by triggers outlined in this section. New development may also have additional consent conditions imposed to facilitate future removal or relocation. The planned retreat policy stance adopted by Council allows for the temporary occupation and development of coastal lands.

4.3.1 New Development and Structures

Planned retreat recognises the need to protect human life and property from coastal hazards by managing the duration, type and intensity of development within the 2100 year hazard line. It also recognises the principles of Ecologically Sustainable Development (ESD) and their application to the coastline. Planned retreat for development at risk from coastal hazards can be implemented through:

- The voluntary removal/relocation of a development or structure by the property owner, and/or
- By enforcement of the triggers by Council for demolition/relocation/ removal under recognition of risk to people and the environment from asset collapse.

Planned retreat for all new development within the hazard lines shown in **Appendix C** will be implemented by Council using the development controls outlined below.

- All approvals for new development located wholly or partially seaward of the 2100 year hazard line will include a condition of consent requiring removal of structures if any of the three triggers mentioned in **Section 4.3.2** below occur.

- For all new development located wholly or partially seaward of the 2050 year hazard line:
  - development must be modular and relocatable in construction as certified by a practicing structural engineer so that it can be relocated or removed off-site by the property owner;
  - the maximum size of any addition or alteration is 10% of the structure approved prior to this document coming into force, or 30m^2, whichever is the lesser, unless additions or alternations are relocatable and/or demountable;
  - subdivision of land to create separate additional dwelling entitlements will not be permitted;
  - only one dwelling is to be permitted on each separate lot; and
  - development applications will need to include a suitable relocation strategy.

- No development is to occur seaward of the immediate hazard line or subject to a minimum of 25 metres from the current erosion escarpment, whichever is the greater.

When coastal development is approved, a condition will be specified that consent will lapse when the triggers identified below are activated. Council will impose a covenant on the title of the land under the provisions of Section 88E of the *Conveyancing Act 1919*, requiring the relocation or removal of

the development, unless engineer's certification has been obtained for trigger 1 (see **Section 4.3.4**) or if triggers 2 or 3 are reached.

As Council intends to maximise the time that assets under threat from coastal hazards can be used safely without unnecessarily sterilising land within the coastal hazard lines, Council will seek to:

- Revise the road and boundary setbacks in locations that have been identified as being at risk of coastal hazards. This will enable future development to remain as long as possible.
- Allow the relocation of any relocatable assets on the same property once an Order has been served or the conditions of consent have lapsed as a result of trigger 1 for the demolition/removal/relocation being activated. The assets will need to be relocated greater than 25m from the most landward part of the erosion escarpment.

4.3.2 Removal of Development and Structures

Planned retreat enables coastal land to be safely used and occupied for as long as possible. The following triggers will be enforced by Council for the demolition/removal/relocation of development and structures when they are at risk from coastal hazards:

Trigger 1. Where the most landward part of an erosion escarpment is within a predefined trigger distance[1] of the most seaward point of a development or structure.

Trigger 2. Where a public road can not provide legal access, unless it can be shown that legal access to the lot can be achieved by other means.

When the most landward part of an erosion escarpment is within the predefined trigger distance of the most seaward point of a public road providing legal access to the lot, Council will commence routine monitoring of the structural integrity of the road. The public road will be closed when safe access for fire fighting vehicles cannot be achieved, requiring legal access to be achieved by other means. The road closure will occur when it is assessed as being structurally unsound and/or when a two way road with a minimum width of 8 metres or a single lane road with a minimum of width 4.5 metres is unavailable for fire fighting vehicles. These measurements are the minimum widths for fire fighting vehicles to safely access urban areas and provided in Table 4.1 of the guideline *Planning for Bush Fire Protection 2006*.

Trigger 3. When water, sewage or electricity to the lot is no longer available as they have been removed/decommissioned by the relevant authority due to coastal hazards.

Once these triggers have been reached, Council will serve a Notice of Intention to serve an Order to demolish/remove/relocate within 14 days of issuing the Notice of Intention. The notice will identify which of the triggers have been reached.

[1] The trigger distances for each locality are given in **Table 4.3**

Where triggers 2 and/or 3 are activated, the owner of the development or structure will be advised that they will be served an Order to demolish/remove/relocate their assets. The owner will then have 90 days after the Order has been served to comply with the Order.

In the case that only trigger 1 has been activated the owner of the asset has two options after being served with a Notice of Intention from Council.

Option 1
The owner of the development or structure can comply with any Order that will be served by Council for the demolition/removal/relocation of the asset.

OR

Option 2
Within 14 days of the date of the Notice of Intention to serve an Order for demolition/removal/relocation the landowner can advise Council they intend to provide Council with additional information in respect to the safety of the asset that is at risk. This information must be provided within 60 days of the date of the Notice of Intention to serve and Order and will include a structural engineer's certificate indicating that the asset is not at risk of collapse and can be safely occupied and stating the exact distance of the erosion escarpment from the asset at risk.

Council will then consider the information that has been provided by the owner of the development or structure in determining whether or not to serve an Order to demolish/remove/relocate. If after considering this information Council decides not to serve an Order, the owner of the property will be notified of the decision. By allowing the asset to remain, Council will place additional requirements on the development or structure which the owner will have to undertake, to avoid being served with an Order in the future. These additional requirements will be in the form of conditions for the development or structure to remain and may include but not be limited to the following:

- That the property owner provide Council with a structural engineers certificate within 30 days after every major erosion event or a series of erosion events over a 12 month period in which the most landward part of the erosion escarpment has moved in excess of two (2) metres landward of its previous position,
- That the property owner provides a structural engineer's certificate every two years after being notified of Council's intent to allow the asset that is at risk to remain in place,
- That the property owner provides to Council the exact distance from the development or structure that is at risk to the most landward part of the erosion escarpment with any structural engineer's certificate, and
- The property owner is to provide Council with a structural engineer's certificate specifying the distance from the structure to the escarpment in which the structure would be deemed structurally unsound.

This means that the owners of development or structures at risk from coastal hazards will be permitted to use the land and assets until one or more of the following occurs:

- A structural engineers report indicates that the development or structure is no longer structurally safe, and/or
- Triggers 2 or 3 above for the demolition/removal/relocation of a development or structure have been activated.

If the structure is no longer structurally safe and/or trigger 2 or 3 are activated, Council will serve a notice advising the owner of the development or structure that an Order to demolish/remove/relocate will be served. The owner of the development or structure will then have 90 days from the date of the Order to demolish/remove/relocate the asset.

In summary, owners of development or structures will be permitted to use their land and assets until an Order is served by Council under Section 121 of the *Environmental Planning and Assessment Act 1979.*

In all cases the demolition/removal/relocation of a development or structure will occur at the owner's expense and in accordance with the *Environmental Planning and Assessment Act 1979* in accordance of the conditions with the Order.

Where owners of development or structures through the coastal engineering certification process (as identified in **Section 4.3.4**) can provide evidence to Council that the development will be unaffected by coastal hazards, the triggers for demolition/removal/relocation will not apply.

4.3.3 Process for Implementing Planned Retreat

A flowchart has been prepared to depict the process for implementing planned retreat diagrammatically and in a simple manner (see **Figure 4.1)**. The removal of development or structures is discussed in detail in **Section 4.3.2**.

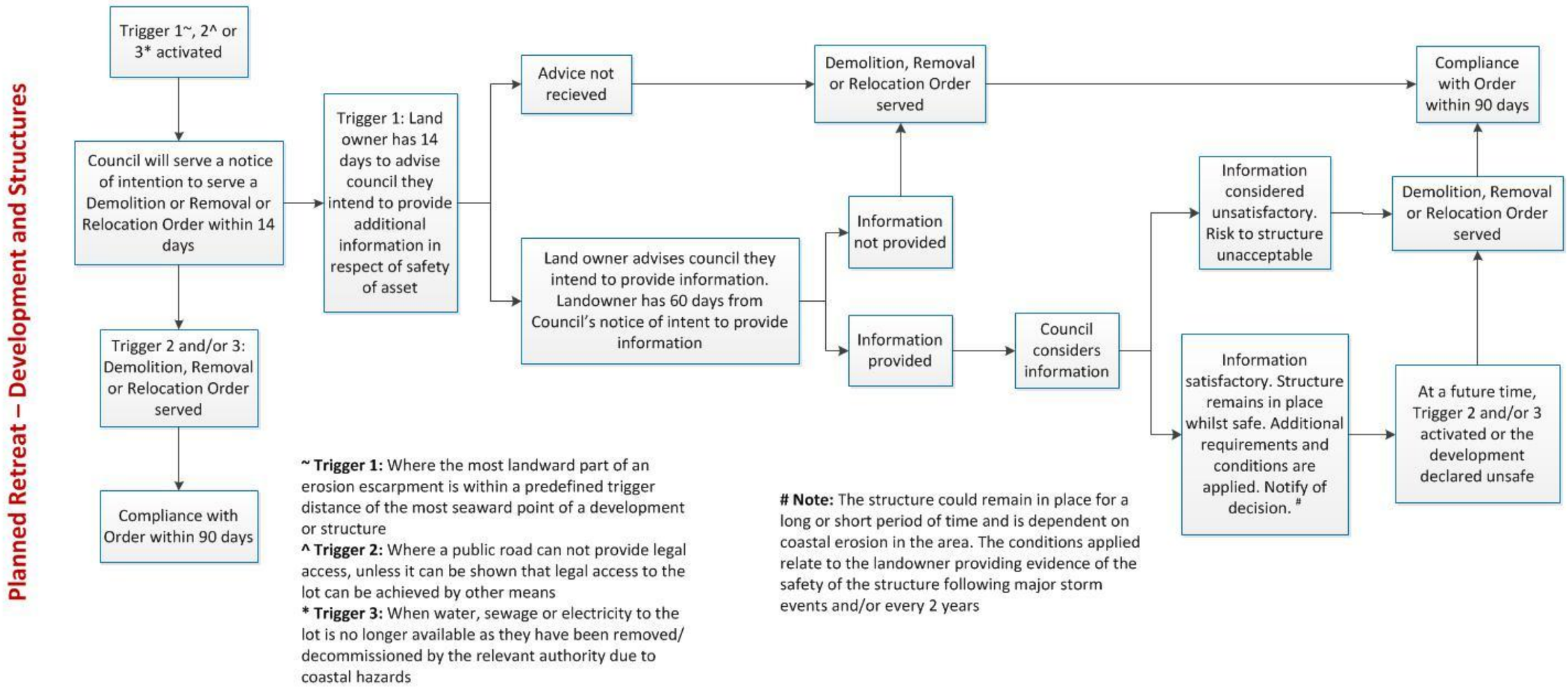

Figure 4.1 Implementing Planned Retreat

4.3.4 Coastal Engineer Certification

The coastal engineering certification process (see **Section 4.3.7**) recognises the limitations of the techniques used to determine the location of coastal hazard lines. The process recognises that development should be permitted to continue or exist on certain land unaffected by coastal erosion, recession and seaward of the 2100 hazard without having the triggers applied to it (see **Section 4.3.2**).

Where a coastal engineer (see **Section 4.3.8**) can certify that the structure, public road providing legal access to the lot and essential services (water, sewage and electricity) will not be affected by coastal recession, the development controls in **Section 4.3.1** and the triggers in **Section 4.3.2** will not apply to the development.

Example 1: The coastal engineer would have to certify that the development is on a geological formation that will be unaffected by coastal erosion, recession or inundation, and that public road access and essential services (water, sewage and electricity) to the lot will be similarly unaffected.

Example 2: The coastal engineer would have to certify that legal coastal protection works present at the site will protect the development from coastal erosion, and that public road access and essential services (water, sewage and electricity) to the lot will be similarly unaffected.

Locations of where **Example 1** potentially could apply are Main Street, Black Head; Scenic Avenue, Red Head; and Marine Drive and Ocean Drive, Wallabi Point.

4.3.5 Information Sharing- Hazard Risk Restrictions

Planned retreat also involves the provision of advice to prospective purchasers of coastal property, or existing owners (where requested) of a coastal property of the risks associated with that land.

Where a property is to be purchased and any part of the property is located seaward of the 2100 Coastal Hazard Line, a planning certificate pursuant to Section 149(2) or 149(5) of the *Environmental Planning and Assessment Act 1979* is issued to the prospective purchaser. Current owners of a property may also request such planning certificates at any time from Council.

Section 149(2) planning certificates contain information relating to the hazard risk restrictions associated with the land, as identified in an adopted policy by the Council or any other public authority.

Advice to prospective purchasers via Section 149(2) certificates satisfies Council's obligation to inform potential purchasers of any restrictions applying to the land and of any known hazards affecting the land. Purchasers in proceeding with the purchase are deemed to accept those risks. Once this Plan is certified by the Minister, Council is required by the *Coastal Protection Regulation* (Part 4) (pursuant to Section 56B(d) of the *Coastal Protection Act 1979*) to encode the Section 149(2) certificates with information on the hazard and likely public authority response.

Prospective purchasers of coastal development will also be warned of restrictions applying to development on that land in the form of a covenant under the provisions of Section 88E of the *Conveyancing Act 1919* for new development approved following certification of this document. This also alerts purchasers of the requirement to remove development that has been approved by Council seaward of the 2050 coastal hazard line, subject to the triggers and processes outlined in **Section 4.3.1** and **Section 4.3.2**.

4.3.6 Trigger Distances

The trigger distances determine when planned retreat is activated for a particular development. Trigger distances have been set by Council based on consideration of the predicted immediate hazard zone and the history of erosion in each area. The trigger distances are measured from the most landward part of an erosion scarp to the most seaward part of a development or structure, as shown in **Figure 4.2** below.

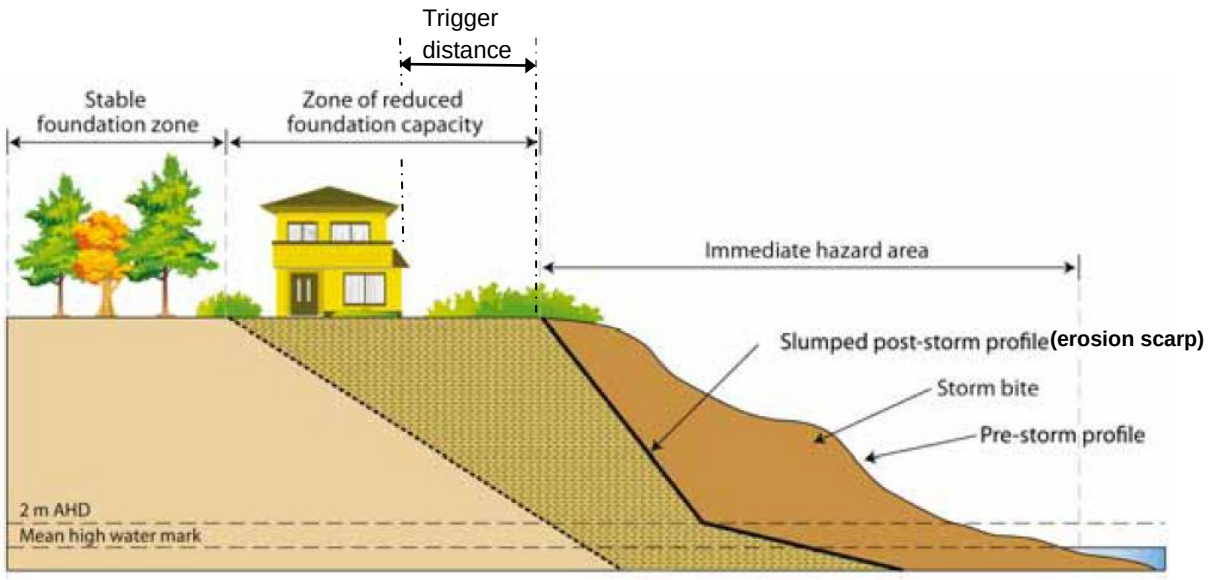

Figure 4.2 Schematic representations Trigger Distances and of Coastal Hazard Zones (modified from DECCW (2010b)

To define hazard zones, the theoretical position of the post-storm erosion scarp and the 'zone of reduced foundation capacity' were calculated using the method of Nielsen et al (1992), as described in the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a). This method considers the erosion of a design 'storm cut' (or 'storm bite') volume from the pre-storm profile, followed by immediate slumping of the erosion scarp to a natural angle of repose. The area seaward of the resulting post-storm profile (defined by the 'zone of slope adjustment') is termed the

'hazard zone'. The 'hazard line' is the landward limit of this zone, i.e. the top of the (slumped) post-storm scarp. The 'zone of reduced foundation capacity' is the distance behind the post-storm scarp where structures may be at risk of foundation failure due to the reduced bearing capacity of the soil adjacent to the scarp.

Hazard lines were mapped in the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a) for the immediate (2008) case, and the 2050 and 2100 cases considering retreat due to sea level rise (refer **Appendix C)**.

To illustrate the potential maximum scarp movement during a storm, the hazard zone and zone of reduced foundation capacity (ZRFC) have been calculated for a typical profile from each section of the study area as shown in **Figures 4.3** to **4.10** below. The starting point is taken from the most recent available beach profiles; July 2012 survey for Old Bar Beach and 2006 photogrammetry in other areas. The design storm cut volume used represents the worst case erosion that may occur at single location, such as the head of a rip cell[2]. This level of erosion would not be expected to occur uniformly along the beach.

Note that the size of the hazard zone is a function of the storm cut volume and dune profile, which varies along the beach. Therefore the profiles and hazard zones illustrated below are not necessarily indicative of other areas of the beach. To locate the hazard line for any section of beach, refer to hazard line maps in **Appendix C**.

[2] 100 year storm cut of 180 to 220 m^3/m and angle of repose of 30 degrees were used as per the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a)

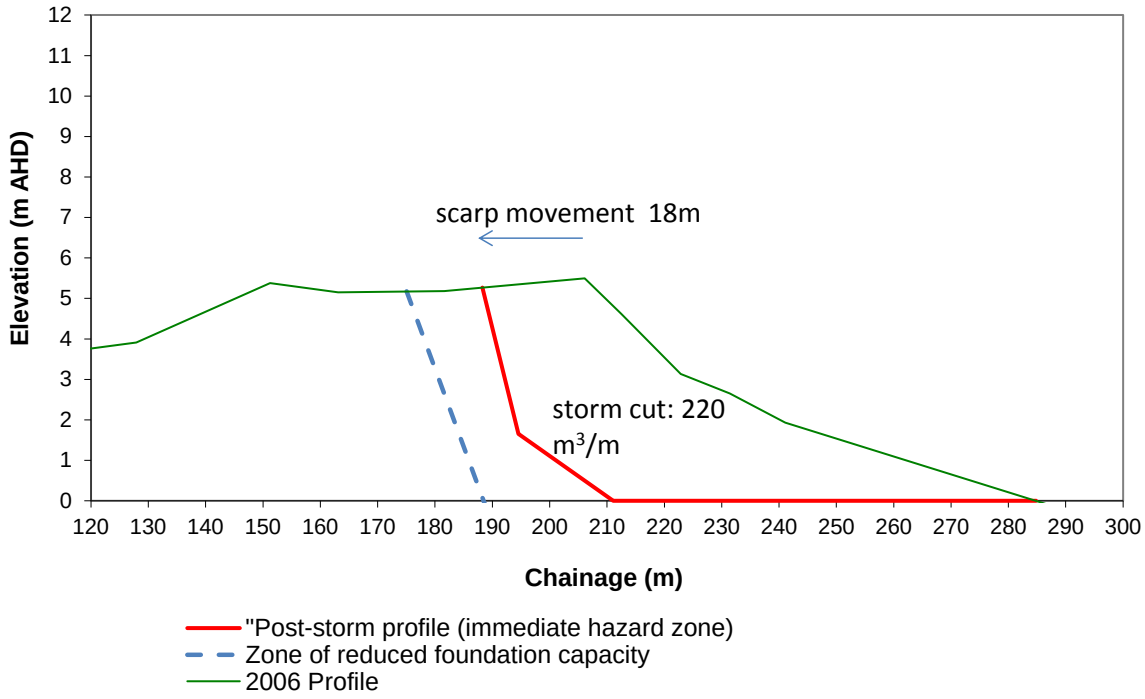

Figure 4.3 Predicted hazard zones for typical profile at Caravan Park, north end of Black Head Beach (photogrammetry block BH03, profile 4, WorleyParsons 2010a)

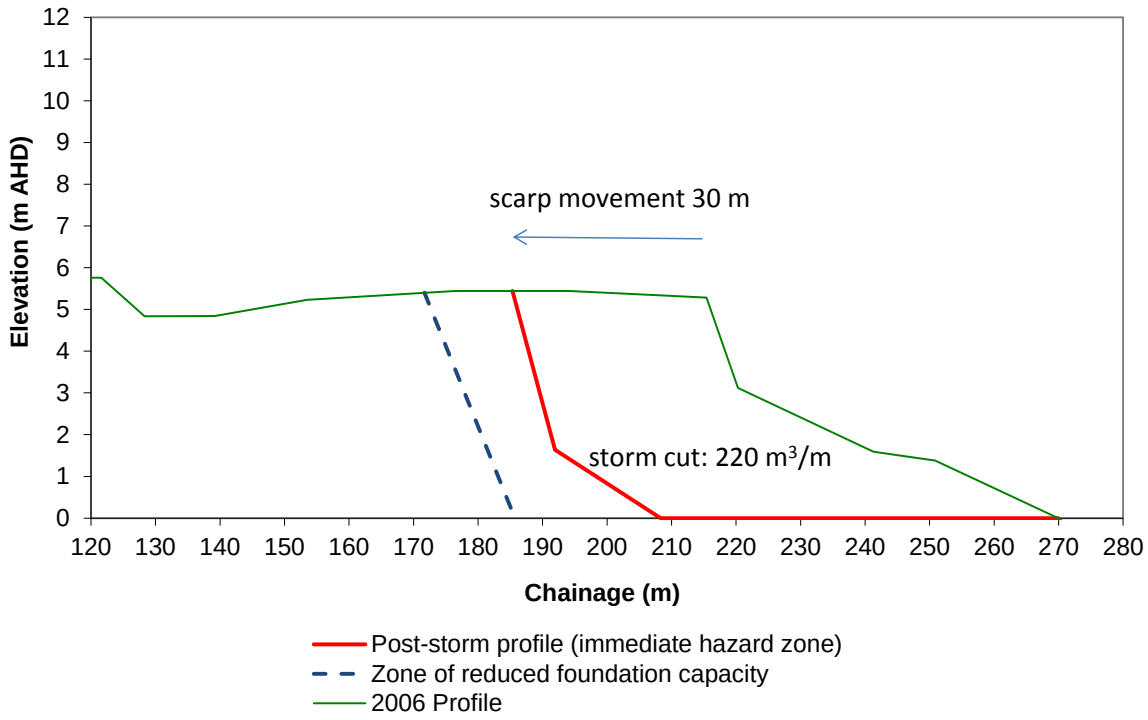

Figure 4.4 Predicted hazard zones for typical profile at Jubilee Parade, south part of Diamond Beach Village (photogrammetry block D03, profile 3, WorleyParsons 2010a)

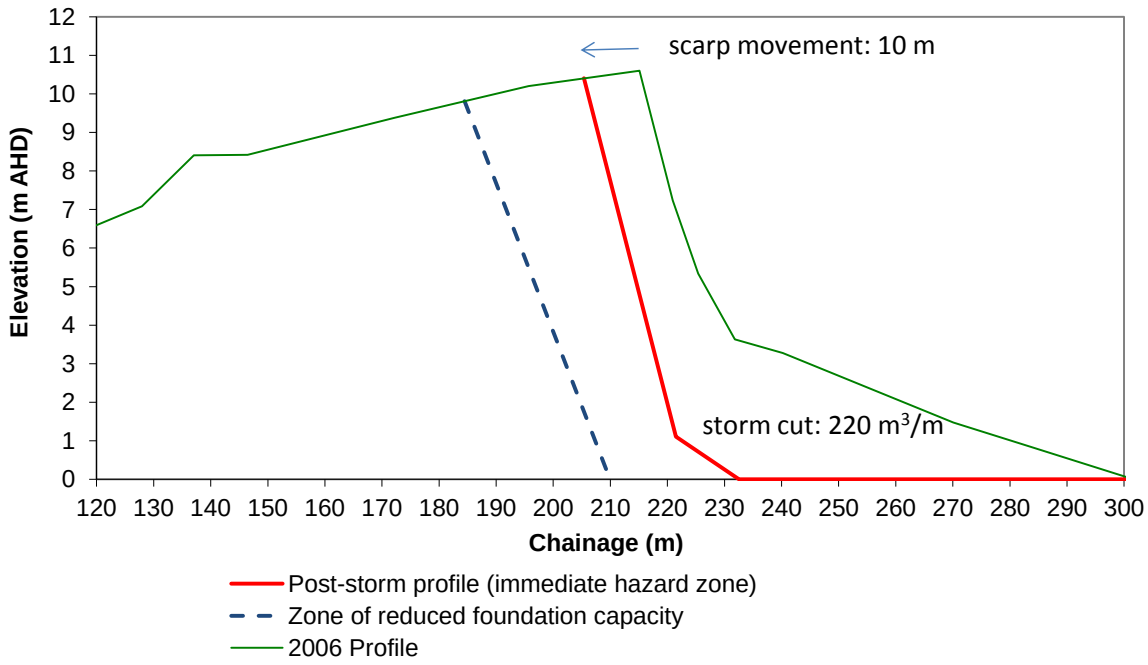

Figure 4.5 Predicted hazard zones for typical profile north end of Diamond Beach Village (photogrammetry block D05, profile 14, WorleyParsons 2010a)

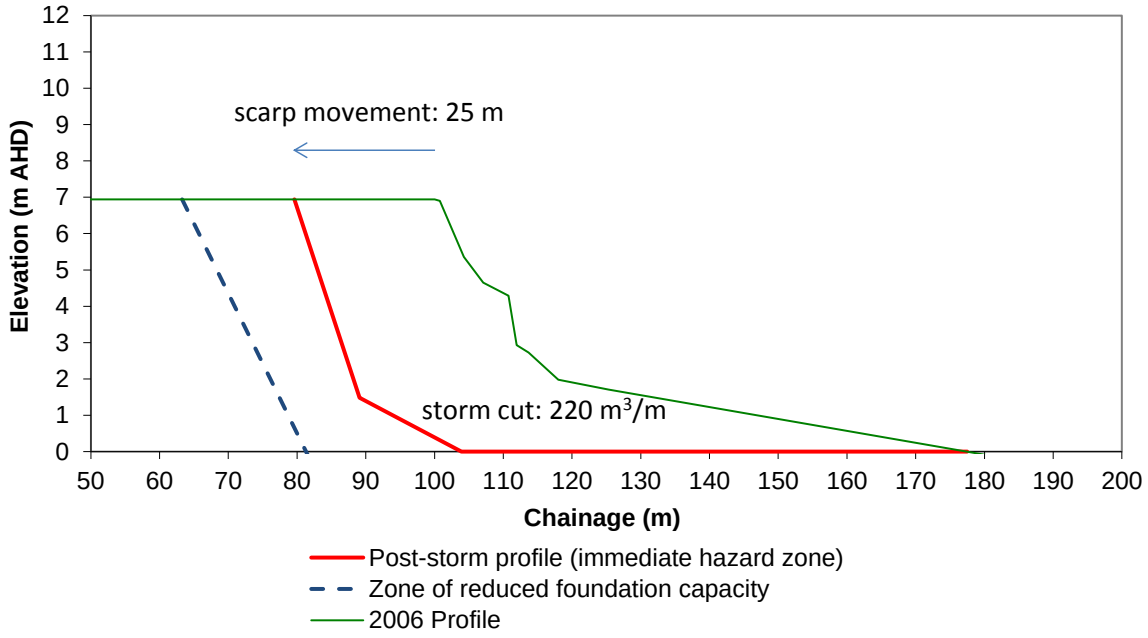

Figure 4.6 Predicted hazard zones for typical profile at Wallabi Point Village, north end of Saltwater Beach (photogrammetry block SW02, profile 15, WorleyParsons 2010a)

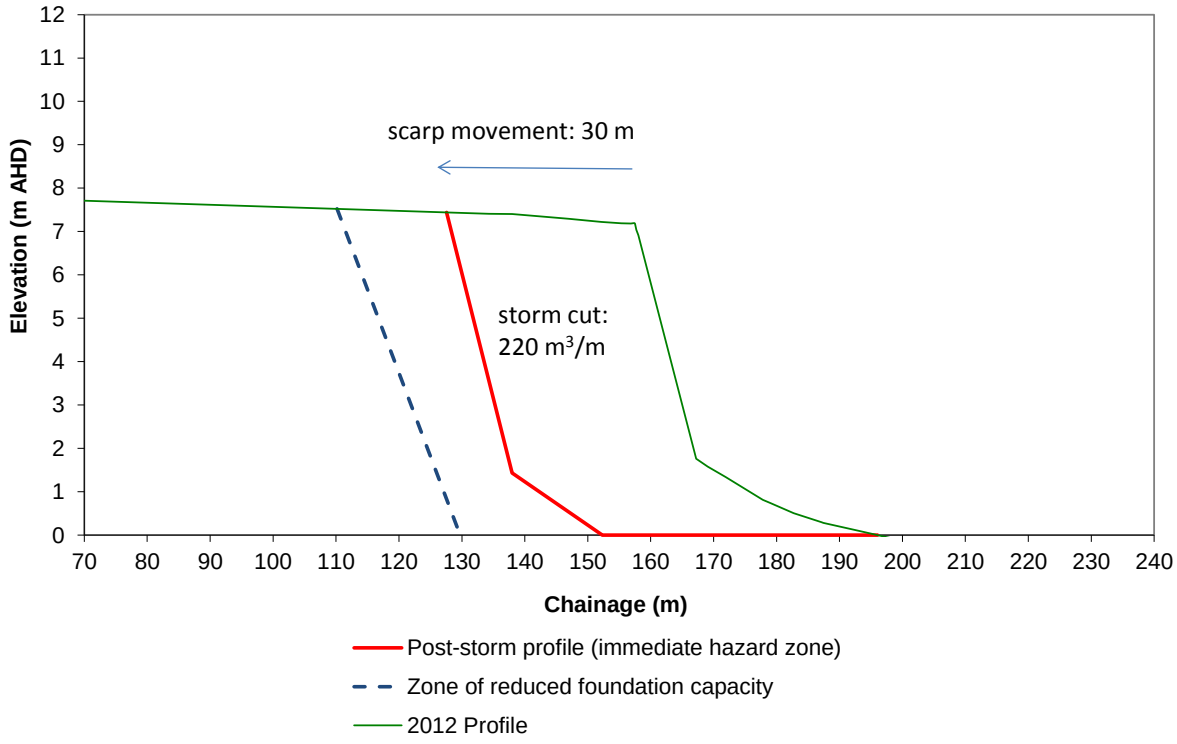

Figure 4.7 Predicted hazard zones for typical profile at Meridian Resort, Lewis Street, Old Bar (photogrammetry block OB05, profile 10, WorleyParsons 2010a)

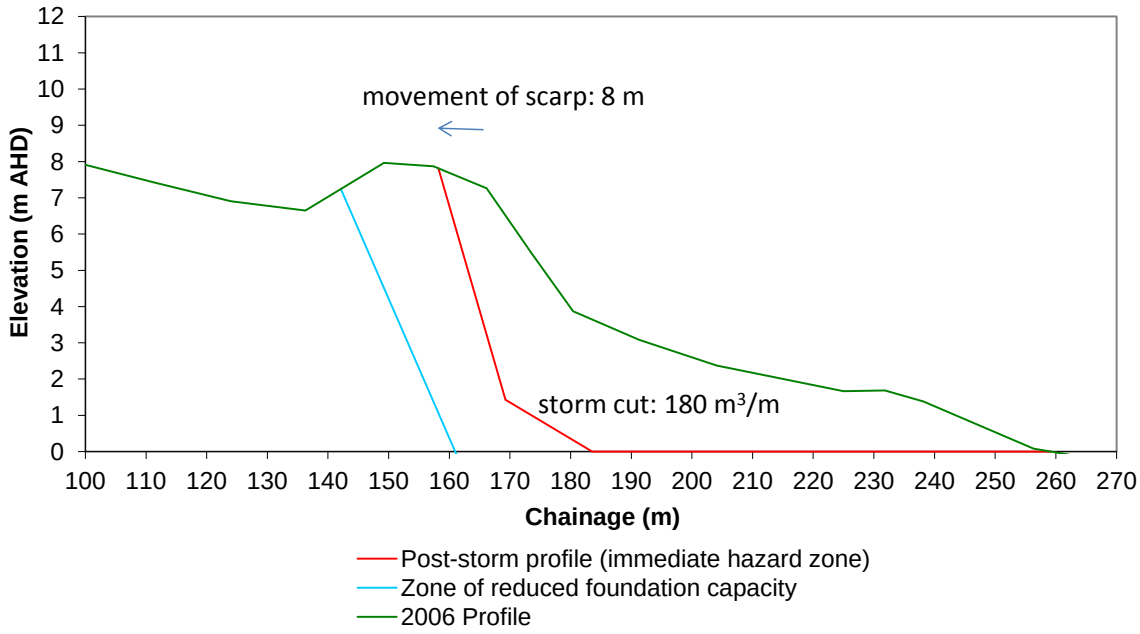

Figure 4.8 Predicted hazard zones for profile at Caravan Park immediately north of Surf Club, Old Bar (photogrammetry block OB07, profile 6, WorleyParsons 2010a)

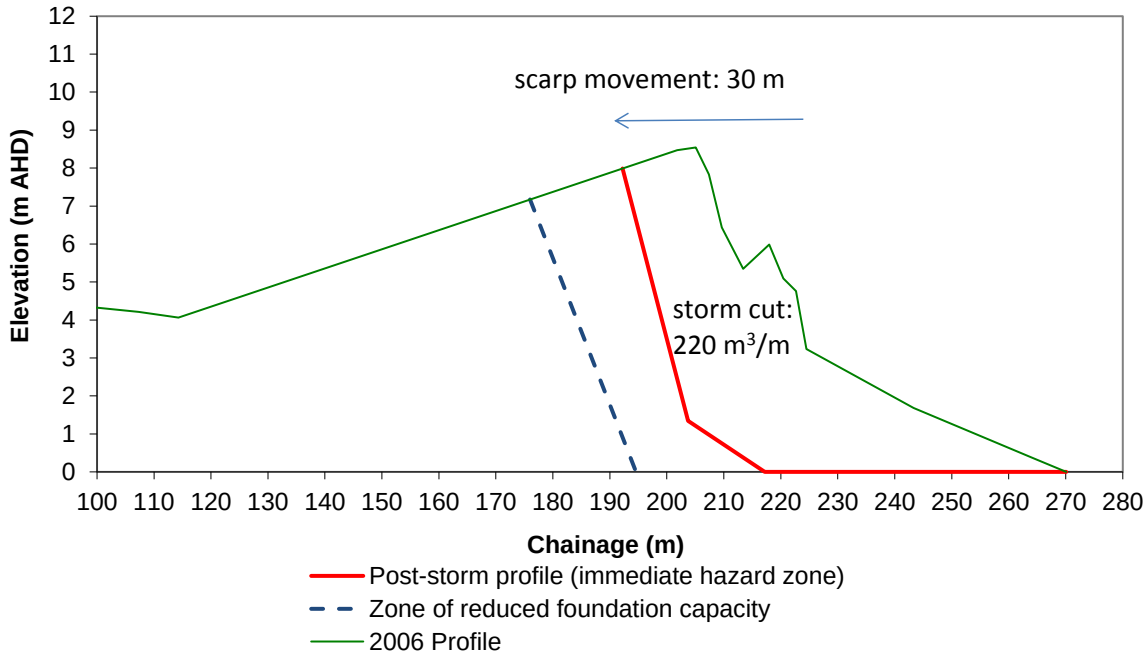

Figure 4.9 Predicted hazard zones for typical profile at village of Manning Point (photogrammetry block MP02, profile 21, WorleyParsons 2010a)

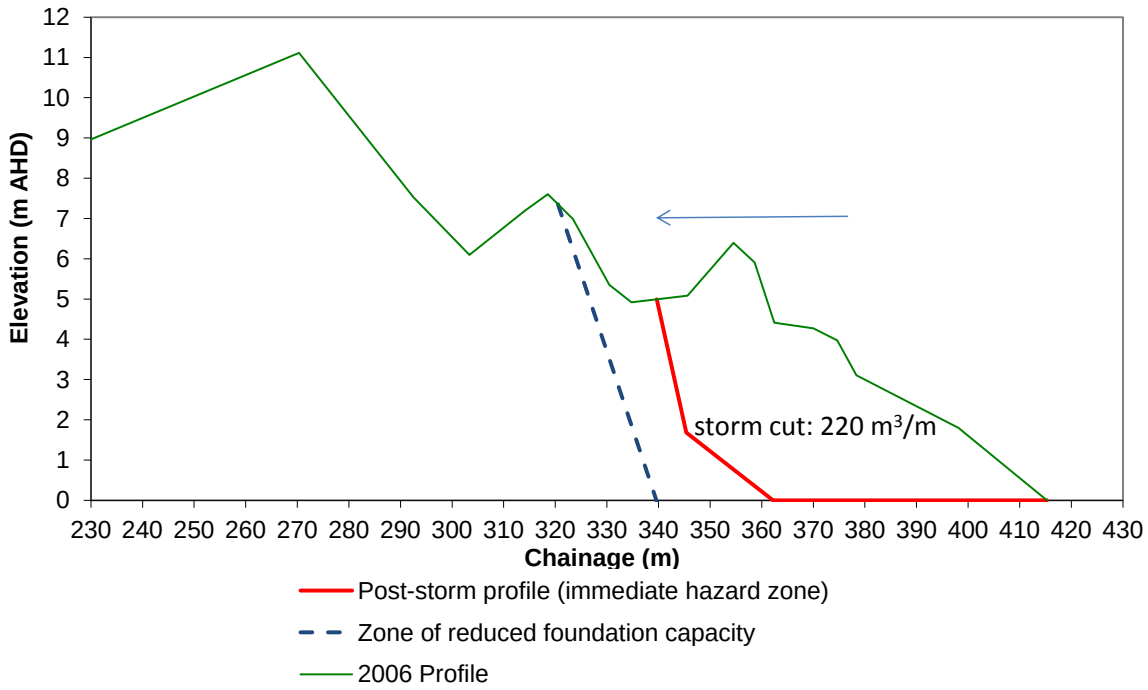

Figure 4.10 Predicted hazard zones for typical profile in middle of Harrington Beach (photogrammetry block H01, profile 14, WorleyParsons 2010a)

Trigger distances adopted by Council are given in **Table 4.3.** To provide context to the trigger distances, for each section of beach the typical dune height, the design storm-cut volume and some notes on the maximum historical storm cut/beach recession are also provided.

Table 4.3 Trigger Distances for Removal/Relocation of Structures (including roads)

Location	Typical Dune Crest (AHD)	Design Storm Cut Volume [1]	Max. expected scarp movement [2]	Historical Scarp Movement [3]	Council Adopted Trigger Distance
Black Head to Red Head	5 – 8m	220 m^3/m	35m	Generally prograding beach, little evidence of storm cut in photogrammetry	10m
Diamond Beach South (see **Figure 4.11**)	6 – 10m	220 m^3/m	30m	Beach recession of up to 16m between 1970 and 1972	18m
Diamond Beach North (see **Figure 4.11**)	9 – 11m	220 m^3/m	20m	Little evidence of storm cut in photogrammetry	10m
Saltwater Beach	6 – 8m	220 m^3/m	30m	Little evidence of storm cut in photogrammetry	15m
Wallabi Point to Old Bar Beach (see **Figure 4.12**)	7 – 10m	220 m^3/m	25m	25m recession at Old Bar between 2004 and 2012 (**Figure 4.13**)	18m
Old Bar SLSC to Farquhar Inlet (see **Figure 4.12**)	7 – 12m	180 m^3/m	20m	Little recession at SLSC, but increases towards Farquhar Inlet	15m
Manning Point Beach	6 – 10m	220 m^3/m	30m	Shoreline retreat of up to 30m has occurred within 5 year periods	13m
Harrington Beach	9 – 15m	220 m^3/m	20m	Generally prograding, recession of up to 40m occurred between 1965 and 1972	N/A – No assets within 2100 year erosion lines.

Notes:

1. Maximum predicted storm cut volume for 100 year ARI storm. Refer to *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a)

2. Estimated maximum landward movement of erosion scarp for design storm cut, from pre-storm scarp or dune crest. This is a function of the dune profile which varies considerably (refer **Figures 4.3** to **4.10**),

3. Little information on the scarp movement due to a single storm is available due to a lack of reliable pre-storm and post-storm surveys. This information is based on photogrammetry with an interval of 2 to 10 years.

Figure 4.11 Trigger Distance Zones for Diamond Beach

Figure 4.12 Trigger Distances Zones for Old Bar Beach

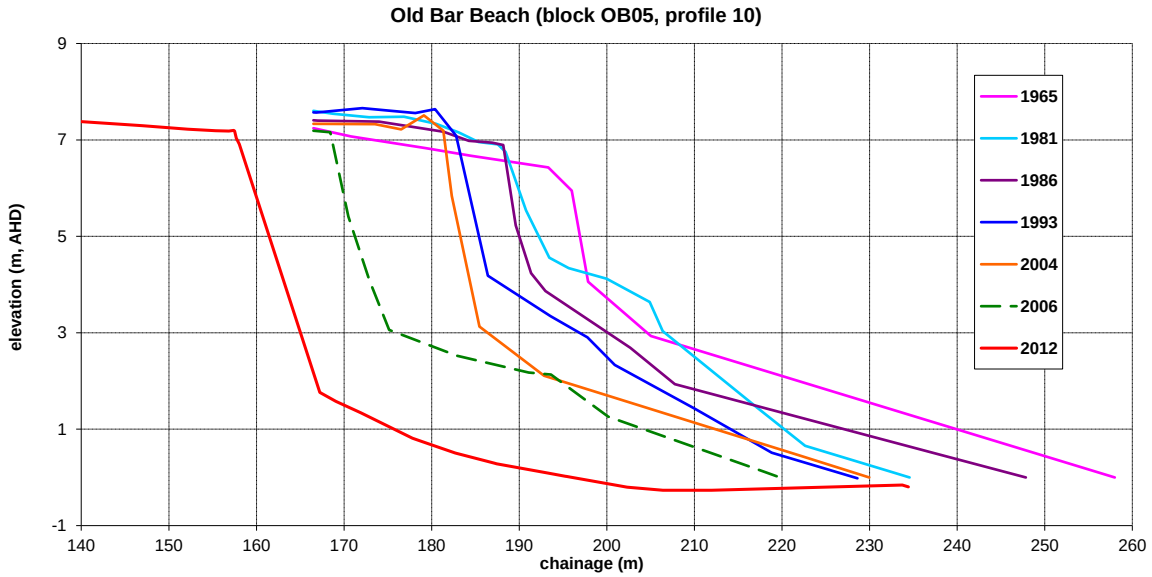

Figure 4.13 Photogrammetric and survey profiles at Lewis Street, Old Bar, showing erosion scarp movement

4.3.7 Coastal Engineer's Certificate

A coastal engineer's certificate is to be based on an assessment of the risk to the development from coastal hazards and should include:

- mapping showing site boundaries, location of any structures to be retained, proposed development and location of hazard lines affecting the property;
- identification and assessment of coastal hazards affecting the property and associated risks to the development including determination of the zone of reduced foundation capacity. The assessment must use the design storm cuts, long term recession rates and average profile slope (for Bruun rule) adopted in the Black Head to Crowdy Head Coastline Hazard Definition Study (WorleyParsons 2010a);
- geotechnical report indicating sub-strata and the type of foundations required;
- consideration of the effects of extreme storm events which are larger than the design storm event; and,
- floor levels and top and bottom levels of foundations, footings or piles.

4.3.8 Coastal Engineer

Coastal engineers are specialist professional engineers eligible for registration by the National Engineering Registration Board (or equivalent registration under the Queensland *Professional Engineers Act 2002*) and/or eligible for chartered status, i.e. Chartered Professional Engineer (CPEng).

A coastal engineer must possess appropriate academic qualifications (four year civil engineering degree and post graduate qualifications in coastal engineering) accredited or recognised by

Engineers Australia, or recognised equivalent overseas qualifications. In addition to their qualifications and general engineering experience, coastal engineering must be a significant part of their professional employment or practice, either undertaken independently or under general direction if their experience in coastal engineering is less than five years.

4.4 Area Covered by this Plan

As noted in **Section 1**, this Plan covers the Greater Taree coast from Black Head to Crowdy Head. It covers each of the beach embayments and extends landward to the projected 2100 hazard line (refer to **Appendix C** for the areas covered by the Plan and location of the immediate, 2050 and 2100 hazard lines).

5 PROPERTY RISK AND RESPONSE CATEGORIES FOR PUBLIC SAFETY AND BUILT ASSETS

It is a requirement of the *Guidelines for Preparing Coastal Zone Management Plans* that the Plan categorises all private lands according to the level of risk and the intended public authority response. That information is included below.

5.1 Property Risk Categories

The level of risk to public and private assets and property posed by coastal erosion and inundation inside the coastal hazard zone has been determined using the Hazard Vulnerability Categories in **Table 5.1**. The vulnerably of these assets is categorised according to the location of the property within the coastal hazard zone.

Table 5.1 Hazard Vulnerability Categories

Risk Category	Hazard area for property
1	Current hazard area
2	2050 hazard area (likely to be affected by erosion or recession in the next 40 years)
3	2100 hazard area (likely to be affect by erosion or recession in the next 40–90 years)

Risk Category 1 is the immediate (2008) hazard line. The immediate hazard line represents the predicted location of the erosion escarpment following a major storm, or series of major storms, centred off the Greater Taree coast, assuming the beach embayment is wholly comprised of erodible material (sand).

Risk Category 2 is the area likely to be affected by 2050 and Risk Category 3 is the area likely to be affected between 2050 and 2100.

Table 5.2 indicates the risk category for private and public assets within each beach embayment along the Greater Taree coast.

Table 5.2 Coastal Hazard Risk Category

Black Head Beach		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Black Head SLSC and associated assets (boat ramp, rock pool etc.)	Main Street and properties between Albert Street and Ocean Street (9)	Main Street properties between Albert Street and southern corner (12)

Black Head Beach		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Stormwater outlets to Black Head Lagoon entrance Black Head Lagoon Park facilities and sewerage pumping station Pedestrian bridge over Black Head Lagoon to beach Main Street roadway at Black Head	Foreshore row of cabins at Beachfront Holiday Resort (Big 4) Red Head Properties at the seaward end of Scenic Avenue (4) Red Head Water mains along Main Street	Foreshore row and some second row cabins at Beachfront Holiday Resort (Big 4) Red Head Properties at the seaward end of Scenic Avenue (6) Stormwater drain at Red Head Black Head SLSC and associated assets Stormwater outlets to Black Head Lagoon entrance Black Head Lagoon park facilities and sewerage pumping station Pedestrian bridge over Black Head Lagoon to beach Water mains along Main Street

Diamond Beach		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Properties on seaward side of southern end of Jubilee Parade (6)	All properties on seaward side of Jubilee Parade (25) Seaward row of units/structures within Diamond Beach Holiday Park at northern end of Jubilee Parade Stormwater outlet to creek Car park at end of Diamond Drive Seaward edge of lots between the holiday park and Australis Resort	Jubilee Parade roadway and all properties on seaward side Seaward and second row of units/structures within Diamond Beach Holiday Park Stormwater outlet to creek Car park at end of Diamond Drive Diamond Beachfront Holiday Units, Diamond Beach Road, most easterly house/unit and eastern end of accommodation block Diamond Beach Resort, easterly most buildings and eastern end of building parallel to Diamond Beach Road Seaward part of Seashells Beachfront Resort building House/buildings on northern side of Seashells Resort main building Most seaward buildings in the Australis Diamond Beach Resort Water main along Jubilee Parade Water main to the Diamond Beach Resort and Diamond Beach Holiday Units

Saltwater Beach to Wallabi Point		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Stormwater outlet, south side Wallabi Point	Properties (4) at Wallabi Point (at seaward end of Marine Drive, Ocean Drive and Saltwater Road) Saltwater Road Water main to rural properties Frontage to rural properties Stormwater outlet, south side Wallabi Point	Properties (9) at Wallabi Point (at seaward end of Marine Drive, Ocean Drive and Saltwater Road) Stormwater outlet to First Rock Gully Creek entrance Saltwater Road Water main to rural properties Frontage to rural properties Stormwater outlet, south side Wallabi Point Sewer and water mains along Seaview Parade
Old Bar Beach		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
South end of Pacific Parade roadway Seaward yards (and building footprints of dwellings already demolished) of properties on seaward side of Lewis Street (14 plus Meridian Resort) Stormwater outlet near Taree Old Bar SLSC	Mid North Coast Water exfiltration ponds Properties on seaward side of Lewis Street (23 plus Meridian Resort) Sewer and water mains along Lewis Street, in vicinity of Pacific Parade and the eastern end of Rose Street Properties (12) at the southern end of Pacific Street Eastern frontage of Lani's on the Beach caravan park SLSC and associated amenities (toilet block/ change rooms,	Exfiltration ponds All properties on seaward side and landward side of Lewis St. Properties (4) on Rose Street All properties on Pacific Parade All properties on seaward side of Hall Street Properties on Ungala Road (6) Sewer and water mains along Lewis Street, in vicinity of Pacific Parade and the eastern end of Rose Street Old Bar Public School

	part of car park etc.) Stormwater outlet near SLSC	Eastern frontage of caravan park SLSC and associated amenities (including playground) and stormwater outlet

Manning Point Beach		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Nil	The eastern edge of rural land including several dams MidCoast Water's Sewage Treatment Plant and associated structures, Manning Point	The eastern edge of rural land including several dams Properties (2) on Beach Road (houses near middle of beach) Sewage Treatment Plant and associated structures Properties (16) on seaward side of Manning Street (north of Ocean Parade) including bowling club Properties on northern side of Manning St (9) and on Main Street at eastern end of block (5) Eastern half of East's Ocean Shores Holiday Park Manning Point Hideaway Holiday Cabins
Harrington Entrance to Crowdy Head		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
Nil	Nil	Nil
Crowdy Head to Crowdy Bay National Park		
Risk Category 1	**Risk Category 2**	**Risk Category 3**
To be assessed	To be assessed	To be assessed

5.2 Public Authority Response Categories

The *Guidelines for Preparing Coastal Zone Management Plans* (DECCW 2010a) include three response categories. The response categories below identify the intended responses by a public authority:

A	Coastal protection works are considered technically feasible and cost-effective:- funding is being sought for implementation
B	Coastal protection works are considered technically feasible but not cost-effective for public funding:- unlikely to be implemented by a public authority
C	Coastal protection works are not considered technically feasible:- no intended public authority works

The Guidelines require that "any action proposed to be implemented using external grant funding should have a reasonable likelihood of being funded (e.g. broadly within the range of past grants for similar projects)." Funding under the NSW Government's Coastal Management Program is limited and is conditional on a dollar-for-dollar council contribution. Accordingly, none of the property protection measures identified in **Section 4** could be allocated a Category A. As already identified, Council has adopted a policy stance of planned retreat which falls under Category A. The response categories for each of the property protection works identified in **Section 4** have been provided in **Table 5.3**

Table 5.3 Response Categories for Property Protection Management Options

Diamond Beach		
Management Option	***Response Category***	***Comments***
Geo-textile bag Seawall	C	This option is not technically feasible under the *Coastal Protection Act* 1979 as it does not maintain public access to the beach (would also need to include nourishment).
Buried Seawall - sand from creek to maintain beach amenity	C	This option is not legislatively feasible under the *National Parks and Wildlife Act 1974* as the borrow site is located within a National Park.
Buried Seawall - sand trucked in to maintain beach amenity	B	Although technically feasible the cost of implementation exceeds the benefits of protection.
Nourishment - sand from creek	C	This option is not legislatively feasible under the *National Parks and Wildlife Act 1974* as the borrow site is located within a National Park.
Nourishment - sand	B	Although technically feasible the cost of implementation

trucked in		exceeds the benefits of protection.
Groynes - sand from creek for beach amenity	C	This option is not legislatively feasible under the *National Parks and Wildlife Act 1974* as the borrow site is located within a National Park.
Groynes - sand trucked in for beach amenity	B	Although technically feasible the cost of implementation exceeds the benefits of protection.
Old Bar		
Management Option	***Response Category***	***Comments***
Revetment	C	This option is not legislatively feasible under the *Coastal Protection Act* 1979 as it does not maintain public access to the beach (would also need to include nourishment).
Revetment + nourishment to maintain beach amenity	B	Although technically feasible the cost of implementation exceeds the benefits of protection.
Nourishment	B	Although technically feasible the cost of implementation exceeds the benefits of protection.
Entrance structure + nourishment	B	Although potentially technically feasible, significant studies will be required to investigate the impact of an entrance structure on coastal processes. Costs likely to exceed benefits.
Groyne field + nourishment	B	Uncertainty about the effectiveness of groynes. Likely to rely heavily on nourishment therefore implementation is likely to be costly.
Offshore reef + nourishment	B	Although technically feasible the cost of implementation exceeds the benefits of protection. Uncertainty about the effectiveness of offshore reefs. Likely to rely heavily on nourishment.
Blackhead		
Management Option	***Response Category***	***Comments***
Review Adequacy of	B	Technically feasible but would require the Department of

Rock Protection to SLSC		Primary Industries - Crown Lands Division, which owns the asset to agree to implement.
Harrington		
Management Option	***Response Category***	***Comments***
Maintaining Training Wall at Harrington	B	Technically feasible but would require the Department of Primary Industries - Crown Lands Division, which owns the asset to agree to implement.

Although planned retreat (by itself) and planned retreat (with land acquisition) are not property protection works they have included in the **Table 5.4** below so that they can be compared against the categorisations for the property protection works in **Table 5.3**.

Table 5.4 Response Category for Planned Retreat

Entire Coastline		
Management Option	***Response Category***	***Comments***
Planned Retreat	A	Considered feasible and sustainable and does not require substantial investment of public money.
Planned Retreat + Property Acquisition	B	Considered feasible and sustainable for a public authority to undertake. This would require a change in public policy by governments and a substantial allocation of funds.

6 COASTAL PROTECTION WORKS

In accordance with the planned retreat approach, this CZMP does not support the construction of new coastal protection works or maintenance of existing coastal protection works. Construction or maintenance of such works would be inconsistent with planned retreat.

Although this inconsistency exists, Council has allowed coastal protection works from the Coastline Management Study to be included in this CZMP. In doing so, Council has provided an opportunity for those coastal protection works that fall within Category B for the locations identified (see **Section 4.2**) to be considered through the Development Assessment process. This does not include the maintenance of existing coastal protection works.

SEPP Infrastructure currently allows for development of coastal protection works for the purpose of a seawall or beach nourishment to be carried out by a person on the coast with consent. In determining an application for such developments under *SEPP Infrastructure*, Council would have to take into account provisions in this CZMP. Beach nourishment and seawalls have already been considered in this CZMP (and found to be technically, financially or environmentally unsustainable/unfeasible). In determining development applications for coastal protection works, Council is required to consider the matters identified in Clause 8 of *SEPP 71 - Coastal Protection.* Also Council cannot grant development consent for coastal protection structures unless satisfied that they meet all the requirements in Clause 55M of the *Coastal Protection Act 1979*.

What this means is that Council will only consider development applications for coastal protection works that meet the following conditions:

- must not limit or restrict public access to or use of a beach or headland over the life of the works (Section 55M of the *Coastal Protection Act 1979*),
- must be shown not to pose or likely to pose a threat to public health and safety over the life of the works (Section 55M of the *Coastal Protection Act 1979*),
- must be shown not to impact on the scenic qualities of the Greater Taree coast (Section 55C of the *Coastal Protection Act 1979*),
- must be shown not to increase the risks or impacts of coastal hazards on the beach or land adjacent to the beach over the life of the works (Section 55M *Coastal Protection Act 1979*)
- must be shown not to have adverse impacts on coastal processes over the life of the works. This includes both direct and cumulative impacts (Section 55M of the *Coastal Protection Act 1979*),
- must be shown not to adversely impact on threatened aquatic and terrestrial flora and fauna (within the meaning of the *Threatened Species Conservation Act 1995* or within the meaning of *Part 7 of the Fisheries Management Act 1994* or within the meaning of the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*), their life cycles and their habitats
- must be shown not to adversely impact on threatened ecological communities both terrestrial and aquatic (within the meaning of the *Threatened Species Conservation Act 1995* or within the

meaning of *Part 7 of the Fisheries Management Act 1994* or within the meaning of the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*)

- must be shown not to adversely impact on wildlife corridors (Section 8(i) of *State Environmental Planning Policy No 71 – Coastal Protection*),
- must show that satisfactory arrangements, for the life of the works, have been made for the restoration or rehabilitation of the beach or the land adjacent to the beach if increased erosion of the beach and adjacent to the beach is caused by the presence of the works (Section 55M of the *Coastal Protection Act 1979*),
- must show that satisfactory arrangements have been made for maintenance of the works over the life of the works (Section 55M of the *Coastal Protection Act 1979*), and
- must take into account and show how the matters identified in *SEPP 71* and the *Coastal Protection Act 1979* have been addressed.

6.1 Landowner Constructed Emergency Coastal Protection Works

The *Guide to the Statutory Requirements for Emergency Coastal Protection Works* (DECCW 2011) lists authorised locations where emergency coastal protection works may be installed by, or on behalf of private land owners. Within the Greater Taree Local Government Area, this is restricted to Old Bar Beach. Additional information in relation to Emergency Protection Works is provided in the *Greater Taree Coast Emergency Action Plan*, the *Coastal Protection Act 1979 Code of Practice* and the *Guide to the Statutory Requirements for Emergency Coastal Protection Work.* Landowners should refer to these documents and obtain the necessary certificates from the consent authority prior to placing any Emergency Coastal Protection works at the authorised location. Approval from the appropriate consent authority for any landowner constructed coastal protection works is required. In the case of Emergency Coastal Protection Works a certificate is required from Office of Environment and Heritage. Council is the consent authority for all other Coastal Protection Works.

The placement of any coastal protection works, including the placement of any material on the beach or erosion escarpment to protect against coastal erosion by a landowner or on behalf of a landowner without consent (with the exception of Emergency Coastal Protection Works in accordance with Part 4C of the *Coastal Protection Act 1979*) is illegal and removal will be enforced by Council and Office of Environmental Heritage under the provisions contained in *Part 4A Coastal Zone Management Plans Division 2 Enforcement* and *Part 4D Powers with respect to materials and structures on beaches* of the *Coastal Protection Act 1979*. Penalties for any breaches under Part 4A and Part 4D of the *Coastal Protection Act 1979* will also be enforced.

7 MANAGEMENT ACTIONS

The management actions included in **Table 7.1** generally relate to planning and development controls, investigations to address coastal risks to surf lifesaving clubs and beach access way improvements/rehabilitation.

Table 7.1 Implementation Schedule

Action	Implementation	Responsibility
Advise owners and prospective purchasers of Council's Planned Retreat Policy	Send letter to owners of properties located seaward of the 2100 hazard line. Update Section 149 Certificates for properties seaward of the 2100 to include information on the CZMP.	Council
Ensure future development and subdivision is compatible with coastal hazards	Amend the Greater Taree Development Control Plan (DCP) to include the Planned Retreat Policy wording and to refer to the current hazard lines (i.e. delete the current hazard area maps). Consider amending DCP setback requirements to include consideration of varying minimum setbacks from road frontages for lots affected by the immediate and 2050 hazard lines. The next review of the *Mid North Coast Regional Strategy* should take into consideration proposed urban area boundaries to reflect the 2100 hazard line or ensure that only land uses (e.g. open space) compatible with the coastal hazard are located seaward of the 2100 hazard line.	Council Council Council/ Department of Planning and Infrastructure
Maintain utility services (water, sewage and electricity) to coastal villages/areas affected by coastal hazards for as long as practical	Develop a servicing strategy to cover the relocation, modification or redesign of utilities etc to maintain services (in particular MidCoast Water's Old Bar sewage exfiltration ponds and the Manning Point sewage treatment plant and associated structures).	MidCoast Water/Council/other service providers

Action	Implementation	Responsibility
Enable owners of properties classified as Risk Category 1 to construct emergency protection works	Review authorised locations in the *Guide to the Statutory Requirements for Emergency Coastal Protection Works* and consider including the southern end of Diamond Beach.	Office of Environment and Heritage/Council
Ensure public structures are protected or are compatible with coastal hazards	Review adequacy of rock protection to Black Head SLSC and Crowdy Head SLSC.	Crown Lands Division Department of Primary Industries
	Review condition and crest level of northern training wall at Harrington in view of future sea level rise.	Infrastructure and Coastal Directorate, Crown Lands Division, Department of Primary Industries
	Consider modifications to stormwater outlets to reduce beach scour (e.g. near the Taree Old Bar SLSC).	Council
	Improvement works for beachfront reserves to take into account hazard lines.	Crown Lands Division Department of Primary Industries/Council
Minimise impacts on dune vegetation associated with recreational use	Review beach access requirements and formalise additional access tracks (where required) and close off and revegetate informal tracks. Dune works to be consistent with the *Coastal Dune Management: A Manual of Coastal Dune Management and Rehabilitation Techniques* (DLWC 2001).	Crown Lands Division Department of Primary Industries and Council in consultation with caravan park operators, tourism accommodation providers and other stakeholders
Ensure consistency and avoid overlap between the CZMP and Floodplain Management Plans	Consider findings of the *Black Head to Crowdy Head Coastline Hazard Definition Study* (WorleyParsons 2010a) in relation to coastal inundation when revising the Manning River flood planning levels to include the NSW Government's sea level rise benchmarks.	Council Infrastructure and

Action	Implementation	Responsibility
	Assess adequacy of training wall crest levels to address sea level rise as part of floodplain management planning.	Coastal Directorate, Crown Lands Division, Department of Primary Industries
Maintenance of roads as long as practical	Reduce to a one way road and move the road within the road reserve.	Council

Implementation of most of the actions in **Table 7.1** would involve internal Council and agency/service provider staff time. Investigations may be eligible for State Government funding assistance and dune/access way works may be able to be implemented through dune care programs.

No specific monitoring and reporting measures have been included due to the nature of the actions (mainly planning and investigations). Although, in the case of beach access ways ongoing monitoring to assess the success of informal track restoration and adequacy of formal access ways is recommended.

8 REVIEW OF THIS PLAN

The CZMP should ideally be reviewed in approximately five years' time, taking into account the findings of the release of the fifth International Panel on Climate Change (IPCC) report and any associated policy changes.

The Plan may also be reviewed should extraordinary funding become available that would permit the implementation of property protection measures that have been assigned a "B" categorisation in **Table 5.3** and **Table 5.4**. Funding would have to be provided without a requirement for a co-contribution from Council and without imposing any potential future liability on Council.

Likewise, the Plan may be reviewed in the light of any policy and legislative changes that materially affect its evaluation of alternative management strategies.

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www.tourism.nsw.gov.au –Travel to the Mid North Coast

Appendix A Consultation

Consultation Process

The following public consultation has been undertaken as part of Greater Taree's coastal planning process:

- Public meeting at Old Bar in December 2008 to identify values and issues (included survey questionnaire),
- Study updates on Council's website (including survey questionnaire for entire study area), and
- Public exhibition of Coastline Management Study and Hazard Definition Study from 29 October to 26 November 2010 including :
  - notice in local paper of public exhibition period,
  - media release advising of exhibition of Studies,
  - letter to residents seaward of the 100 year hazard line - total of 289 properties,
  - information fact sheet and submission form sent to all residents seaward of 100 year hazard line,
  - submission form sent to all residents seaward of 100 year hazard line, and
  - three community information sessions over the weekend of 6-7 November 2010, one each at Harrington, Old Bar and Hallidays Point. A total of 46 people attended the sessions.

Note: The studies were also placed on Council's website and at Council libraries during the exhibition period along with the submission form and fact sheet.

- Post exhibition:
  - Letter advising submissions had been received (219 letters sent out). Of the 219 submissions, 32 made comment on the content of the *Hazard Definition Study* and *Coastline Management Study,* the remainder identified a preferred management option,
  - Summary of submissions and responses/comments provided to the ECMCAC, and
  - Letter to people that sent in a submission advising of the report going to Council on 16 February 2011.

Key Issues Raised

Issues that were raised during the public meeting at Old Bar and through the questionnaire included:

- erosion of beach,
- increased rates of erosion since 2005,
- dune stability,
- loss of much of the foredune,
- undermining and loss of trees,
- long term loss of beachfront and hind dune vegetation,
- much of the beach/foredune becoming privately owned,
- beach walking unsafe at high tide and under moderate seas,
- unable to walk along the beach at high tide,
- protection for landowners and the public,
- loss of property,

- effluent management and disposal – the current effluent infiltration system sits within the dune system, and
- maintaining areas for Little Terns.

Consideration of Key Issues

The issues identified in above were considered in developing management options. Refer to the *Coastline Management Study* (WorleyParsons 2010b) for a description of options considered and the measures incorporated to address public access and beach amenity (mainly beach nourishment). The assessment of options also included comment on environmental values (e.g. shorebird habitat) that could be impacted by particular options (see **Table 4.2**).

As Council has adopted a policy of planned retreat, no preferred property protection options have been identified in this CZMP, in response to submissions from the public. Other issues raised during the public exhibition period largely related to the technical content of the reports and the derivation of hazard lines. A summary of submissions and responses to these was considered by the ECMCAC and included in the report to Council on 16 February 2011 which was publicly available, where Council resolved to adopt the policy stance of planned retreat.

Appendix B Public Consultation Information

[FEEDBACK FROM THE PUBLIC EXHIBITION PHASE TO BE INCLUDED IN APPENDIX B]

Appendix C Hazard Lines

Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

WorleyParsons
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Immediate, 2050 and 2100 Hazard Lines

October 2010

Figure A1.1

Coastal Inundation Lines

- 2008 1% AEP Coastal Inundation Line
- 2100 1% AEP Coastal Inundation Line

- Sewer Network
- Water Network
- Stormwater Outlets on to Beach

WorleyParsons
resources & energy

Greater Taree City Council

Potential Coastal Inundation and Stormwater, Sewer and Water Infrastructure

October 2010

Figure A1.2

Hazard Lines

2008 (Immediate) Hazard Line
2050 Hazard Line
2100 Hazard Line

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Immediate, 2050 and 2100 Hazard Lines

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Figure A2.1

Coastal Inundation Lines

2008 % AEP Coastal Inundation Line

2100 % AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

WorleyParsons
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Figure A2.2

Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

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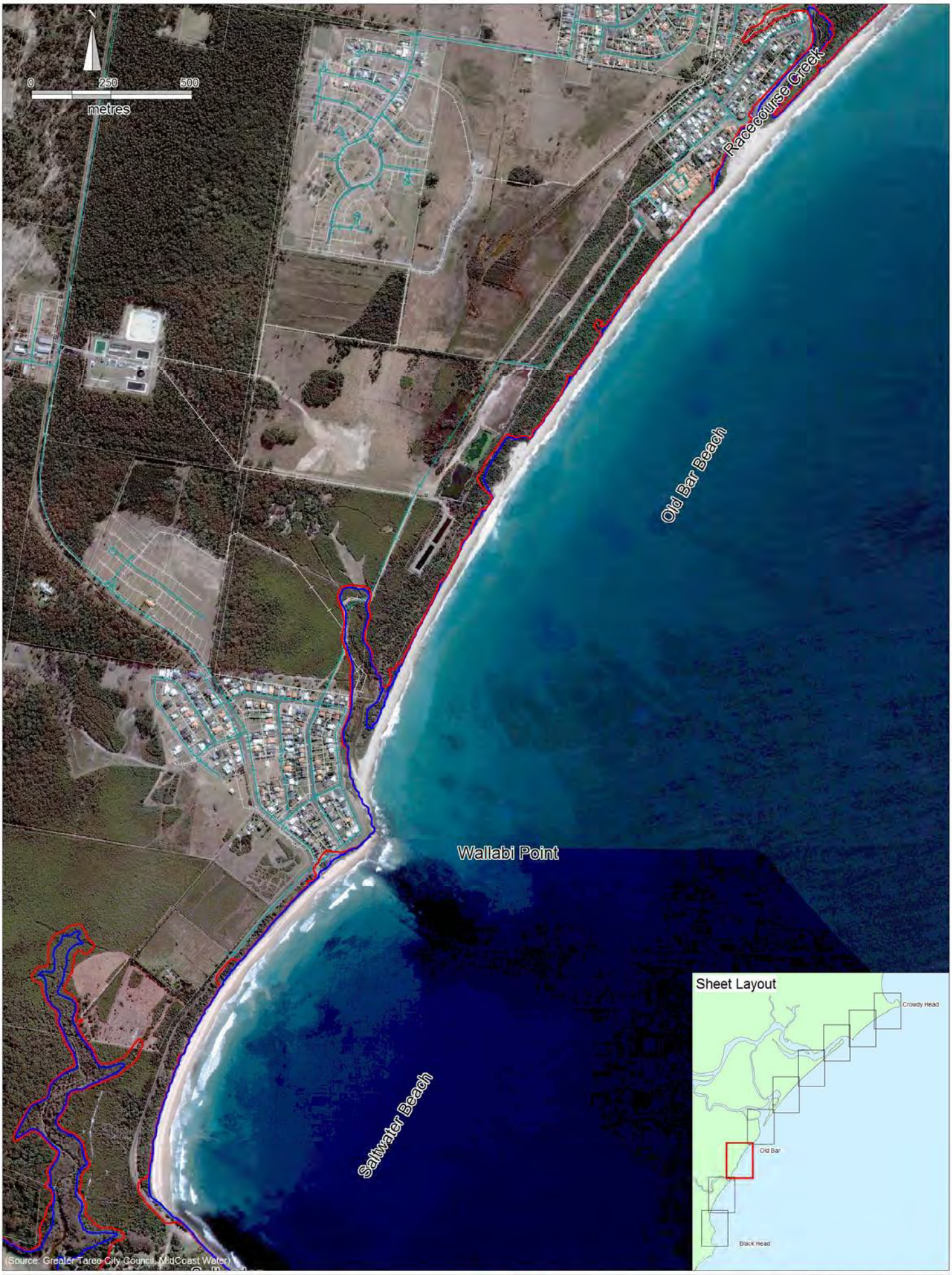
City Council

Immediate, 2050 and 2100
Hazard Lines

October 2010

Figure A3.1



Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

WorleyParsons
resources & energy

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Figure A3.2

Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

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City Council

Immediate, 2050 and 2100
Hazard Lines

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Figure A4.1

Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

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Figure A4.2

Hazard Lines

2008 (Immediate) Hazard Line
2050 Hazard Line
2100 Hazard Line

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Immediate, 2050 and 2100 Hazard Lines

October 2010

Figure A5.1

Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

WorleyParsons
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Greater Taree City Council

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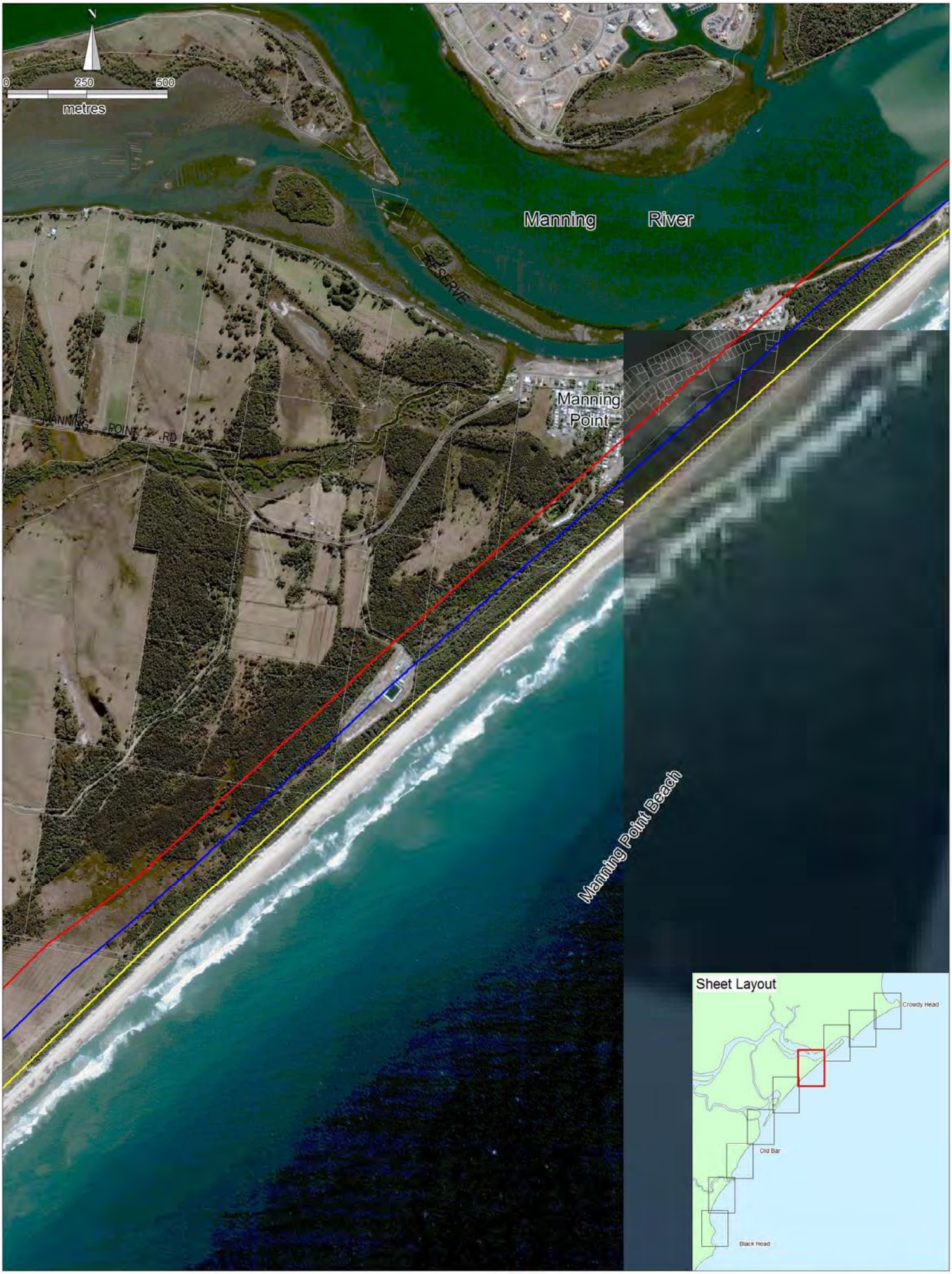
Figure A5.2



Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

WorleyParsons
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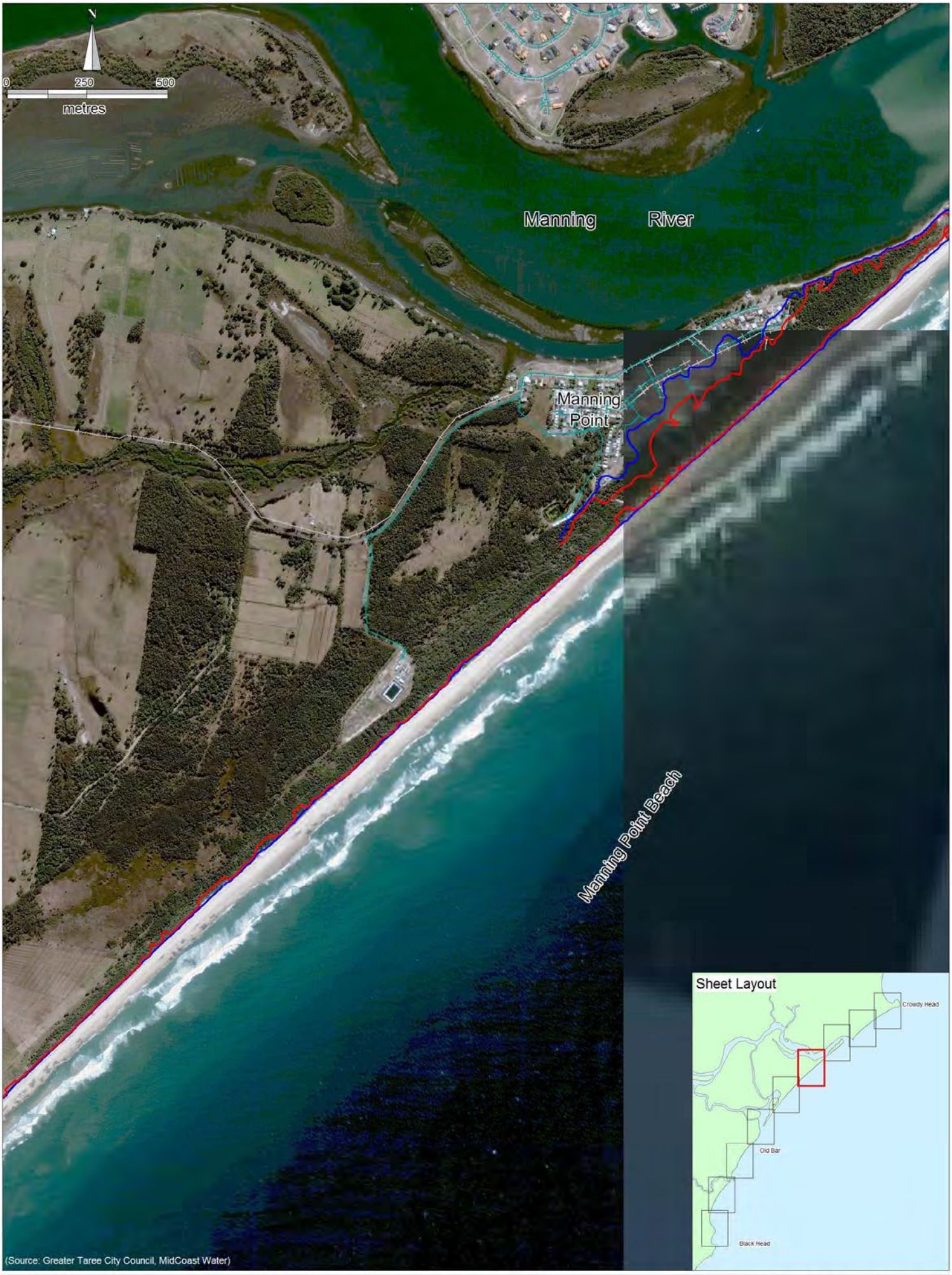
Greater Taree
City Council

Immediate, 2050 and 2100
Hazard Lines

October 2010

Figure A6.1



Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

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Figure A6.2

Hazard Lines

2008 (Immediate) Hazard Line
2050 Hazard Line
2100 Hazard Line

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Immediate, 2050 and 2100 Hazard Lines

October 2010

Figure A7.1

Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

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Potential Coastal Inundation and Stormwater, Sewer and Water Infrastructure

October 2010

Figure A7.2

Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

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City Council

Immediate, 2050 and 2100
Hazard Lines

October 2010

Figure A8.1

Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

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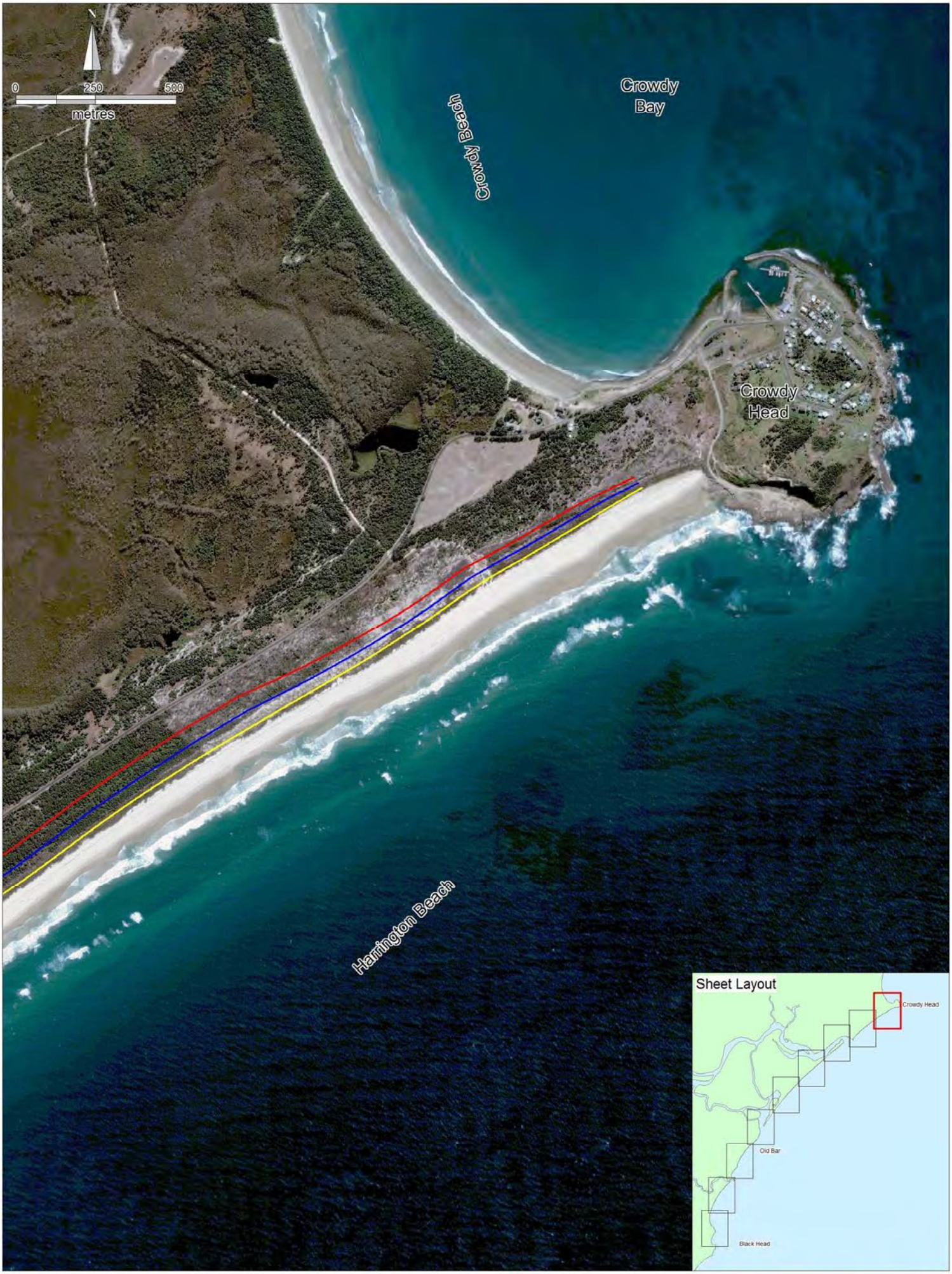
Greater Taree City Council

Potential Coastal Inundation and Stormwater, Sewer and Water Infrastructure

October 2010

Figure A8.2



Hazard Lines

- 2008 (Immediate) Hazard Line
- 2050 Hazard Line
- 2100 Hazard Line

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Immediate, 2050 and 2100 Hazard Lines

October 2010

Figure A9.1

Coastal Inundation Lines

2008 1% AEP Coastal Inundation Line

2100 1% AEP Coastal Inundation Line

Sewer Network

Water Network

Stormwater Outlets on to Beach

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Figure A9.2