BMT WBM

Technical Memorandum

From:	Matthew Barnes	To:	Michael Anderson
Date:	21 June 2016	CC:	
Subject:	Maroochy River Mouth Coastal Management - Preliminary Options Assessment		

This technical memorandum provides a preliminary option assessment for enhanced coastal management at the Maroochy River entrance and Maroochydore Beach. Four broad options are considered:

(1) Formalisation of the existing geofabric sand container groynes with rock

(2) Construction of a new rock groyne and removal of the existing geofabric sand containers

(3) Construction of a northern river entrance and construction of a beach connecting Pincushion Island to Cotton Tree

(4) Construction of a northern river entrance and construction of a new rock breakwater connecting Pincushion Island to Cotton Tree

The common objective of each option is to mitigate shoreline erosion at Cotton Tree and Maroochydore Beach. Each option would be supported by beach nourishment program and other coastal management activities consistent with the Sunshine Coast Shoreline Erosion Management Plan (SCC, 2014).

This document includes the following:

- Section 1 provides background to the study area and describes the migration pattern of the Maroochy River mouth since the 1940s.
- Section 2 considers the existing coastal assets and summarises the management actions recently implemented in an effort to maintain environmental, social and economic values.
- Section 3 provides a preliminary assessment of the coastal management options at Cotton Tree listed above. Planning issues, environmental values and the capital costs to implement the options are considered.

It is noted that the construction of an entrance channel to the north of Pincushion Island to mitigate shoreline erosion at Cotton Tree was previously investigated by the former Maroochy Shire Council during the late 1990's. At the time, the state departments did not support the proposal. A summary of the previous correspondence with state regarding this matter is provided in Attachment A. Under the current legislative regime such works are not specifically prohibited; however, significant justification that no other feasible options are available would need to be provided.

1 Background

The Maroochy River entrance position naturally migrates in response to the prevailing coastal and estuarine processes. Since the 1940s the entrance has been located both to the north and south of Pincushion Island which is a rocky outcrop on the coastline. A series of historical aerial photos are presented in Figure 1-1 through Figure 1-5.

The historical record shows significant sand accumulation in the river mouth during the 1940s and 1950s that effectively closed off the southern channel connection to the sea. This led to the formation of a dominant northern channel. The ongoing erosion of the northern spit eventually caused a breakthrough during the 1960s, just south of where Twin Waters is located today.

From the late 1970s, the northern entrance channel commenced migrating southwards and the northern spit grew. During this period the southern channel also reconnected to the sea. By the early 1990s, the southern channel had become very dominant and erosive pressure on the river bank near the Cotton Tree Holiday Park resulted in the construction of two geotextile groynes in 1995. Continued erosive pressure resulted in a breakthrough to the south of Pincushion Island in 1999[1]. Ongoing recession at the Cotton Tree Holiday Park resulted in the construction of the southern geotextile groyne and some geotextile seawall sections in 2001. A further three geotextile groynes and seawalls were constructed in 2003. The intention of these groynes and seawalls was to protect the Cotton Tree Holiday Park whilst maintaining some amenity on the beaches between the groynes.

The entrance position to the south of Pincushion Island has remained dynamically stable over the past decade. Presently, both the northern and southern channels are open. The northern spit is vegetated and connected to Pincushion Island. The lower estuary naturally infills with sand delivered from the south and transported by Maroochydore Beach littoral processes.

Council continues to maintain the geofabric coastal protection structures and since 2012/13 has nourished Maroochydore Beach using sand dredged from the river mouth and delivered to the beach via a pipeline. The suite of coastal management activities relevant to the study area are discussed further in Section 2.

[1] During the 1990s and prior to the breakthrough the (then) Maroochy Shire Council investigated options to reconfigure the river entrance to relieve southern channel erosion and mitigate a breakthough to the south of Pincushion Island. Permits were not granted for the proposed entrance reconfiguration works (and approval for the geofabirc groynes and seawalls was subsequently granted). A summary of the previous investigations and consideration of the proposed works in the current legislative context is provided in Attachment 1 (BMT WBM, 2015).

Figure 1-1 Maroochy River Entrance in 1940 (left), 1958 (middle) and 1961 (right)

Figure 1-2 Maroochy River Entrance in 1967 (left), 1974 (middle) and 1979 (right)

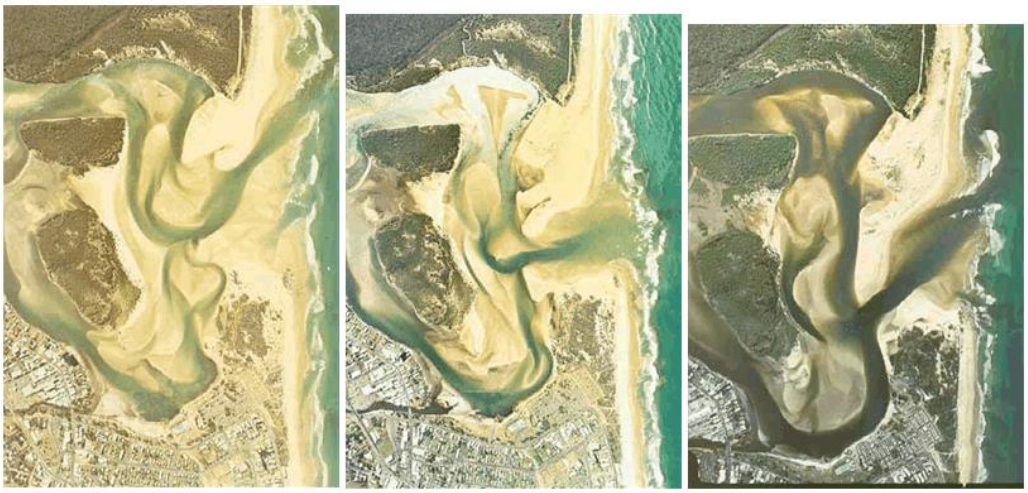

Figure 1-3 Maroochy River Entrance in 1982 (left), 1985 (middle) and 1988 (right)

Figure 1-4 Maroochy River Entrance in 1992 (left), 1995 (middle) and 2003 (right)

Figure 1-5 Maroochy River Entrance in 2005 (left), 2008 (middle) and 2015 (right)

2 Existing Condition and Coastal Management

The Sunshine Coast SEMP (SCC, 2014) describes coastal management priorities over a 10-year planning period. Following the SEMP, Council undertakes a coordinated suite of activities at the Maroochy River entrance and Maroochydore Beach in order to maintain the social, economic and environmental values associated area. These activities include:

- Annual maintenance of the existing geofabric sand container groyne field at Cotton Tree;
- The Maroochydore Beach Renourishment Program (three stages between 2013 to 2016);
- Dune maintenance and revegetation; and
- An erosion trigger-based approval for a future seawall between the Alexandra Headland and Maroochy Surf Clubs.

The present condition of the coastal assets and recent management activities within the project area are summarised in this Section.

2.1 Maroochy River Entrance

The lower estuary of the Maroochy River is a complex system of channels, intertidal shoals, islands and coastal bars. The entrance is dominated by a large spit which extends southwards from the north shore. Within the estuary Goat and Channel Islands (presently connected) divide the river into two main channels.

The river entrance is an important controlling factor on the tidal regime in the estuary. The shoals and sand bars at the entrance generally restrict the propagation of the tide from the ocean into the estuary with corresponding reduction in the tidal range when the entrance area is relatively small. Natural river entrances on sandy coastlines have been shown to exhibit a dynamic equilibrium wherein there is a relationship between the tidal prism and the cross-sectional area of the entrance (e.g. O'Brien, 1969). The present river entrance is likely to be in such dynamic equilibrium.

As part of the process of the Maroochy River entrance relocating to the south of Pincushion Island in 1999 (e.g. Andrews and Witt, 1999), a large quantity of sand, which was the beach and dune system connecting to Pincushion Island, moved into the entrance. This caused substantial shoaling in the lower part of the estuary. This sand has largely remained within the estuary and is reworked by the prevailing coastal and estuarine processes. Under major riverine flood conditions much of this material would be scoured and naturally distributed back to the sea with the flood flow discharge. Such river conditions have not been experienced in the lower Maroochy River since 1992, an event that caused the river mouth bed level to scour and deepen by up to 4 m (e.g. BMT WBM, 2008).

At the Maroochy River entrance there is a strong relationship between coastal and estuarine processes. Coastal sediment transport plays a significant role in the development of coastal spits and the migration of the entrance channels. It is also an important factor in the overall dynamic behaviour of the lower river by suppling sand which is transported into the estuary under the influence of the prevailing tide and south-easterly wind and wave conditions.

As described in Section 1, the ongoing recession at the Cotton Tree Holiday Park resulted in the construction of the southern geotextile groyne and some geotextile seawall sections in 2001. A further three geotextile groynes and seawalls were constructed in 2003. These relatively small structures (approximately 70 m length) remain in place and intercept some of the net northerly littoral processes as intended. The groyne field, which plays an important role in limiting shoreline recession at the Cotton Tree

Holiday Park, is indicated in Figure 2-1. This figure also identifies some of the environmental values associated with Maroochy River entrance. These are considered further in Section 3.

Sand that bypasses the Cotton Tree groynes enters the Maroochy River mouth. This material typically forms as a spit connected to the Cotton Tree Holiday Park shoreline before a breakthrough of the spit occurs and the sand enters the lower estuary. The aerial imagery presented in Figure 2-2 shows the ongoing cycle of spit formation, subsequent breakthrough into the entrance and spit reformation between 2013 and 2015.

2.2 Maroochydore Beach

For the purpose of this technical advice, Maroochydore Beach refers to a 2 km stretch of shoreline between Alexandra Headland and Cotton Tree. Historically, this sandy beach has been observed to naturally erode and accrete in response to the prevailing coastal processes.

Coastal processes studies previously undertaken by BMT WBM on behalf of SCC (BMT WBM, 2014) calculated an average design storm erosion width of 45 m for this beach unit. The total design storm erosion volume for the beach unit is estimated to be 240,00m^3. Erosion of this volume could cause extensive damage to existing land-based assets and infrastructure, depending on the pre-storm beach and shoreline position. Built assets currently within the 45 m design storm erosion width include:

- Aerodrome Road/Alexandra Parade, a State-controlled road;
- Maroochydore Beach Holiday Park;
- Beach access points;
- Public space including pedestrian and cycle pathways; and
- Subsurface water and electricity utilities.

These are indicated in Figure 2-3.

The dune and foreshore buffer between the Alexandra Headland skate park and the Maroochydore Beach Holiday Park are relatively narrow, reaching 20-30 m at parts. To the north the dune and vegetation buffer gradually widen, reaching approximately 50 m prior to the Maroochy Surf Lifesaving Club car park.

The height of the main dune throughout this area is typically less than 6 m AHD while the elevation of the foreshore area behind the dune is approximately 4 m AHD. The slope of the upper beach profile is approximately 1 in 20 (between an elevation of 2 m AHD and -2 m AHD).

During erosion events, particularly prior to the Maroochydore Beach Renourishment Project (refer Section 2.2.2), areas of indurated sands become exposed across the foreshore. This most commonly occurs between 1 m AHD and -1 m AHD. Concrete and other 'fill material' also becomes exposed at the toe of the sand dune. It is uncertain how much of this fill material has been placed on the beach but it is suspected to occur across the dune/foreshore between the Alexandra Headland Surf Lifesaving Club and Maroochydore Beach Holiday Park. The beach in an eroded state is shown in Figure 2-4.

LEGEND

- Remnant Vegetation
- Maroochy River [Rev.1] FHA
- Shorebird Habitat of High Importance
- Shorebird Habitat of Moderate Importance
- Potential Turtle Nesting Area (extremely rare)

Title:
Maroochy River Entrance Existing Condition and Environmental Values

Figure 2-1 Rev: A

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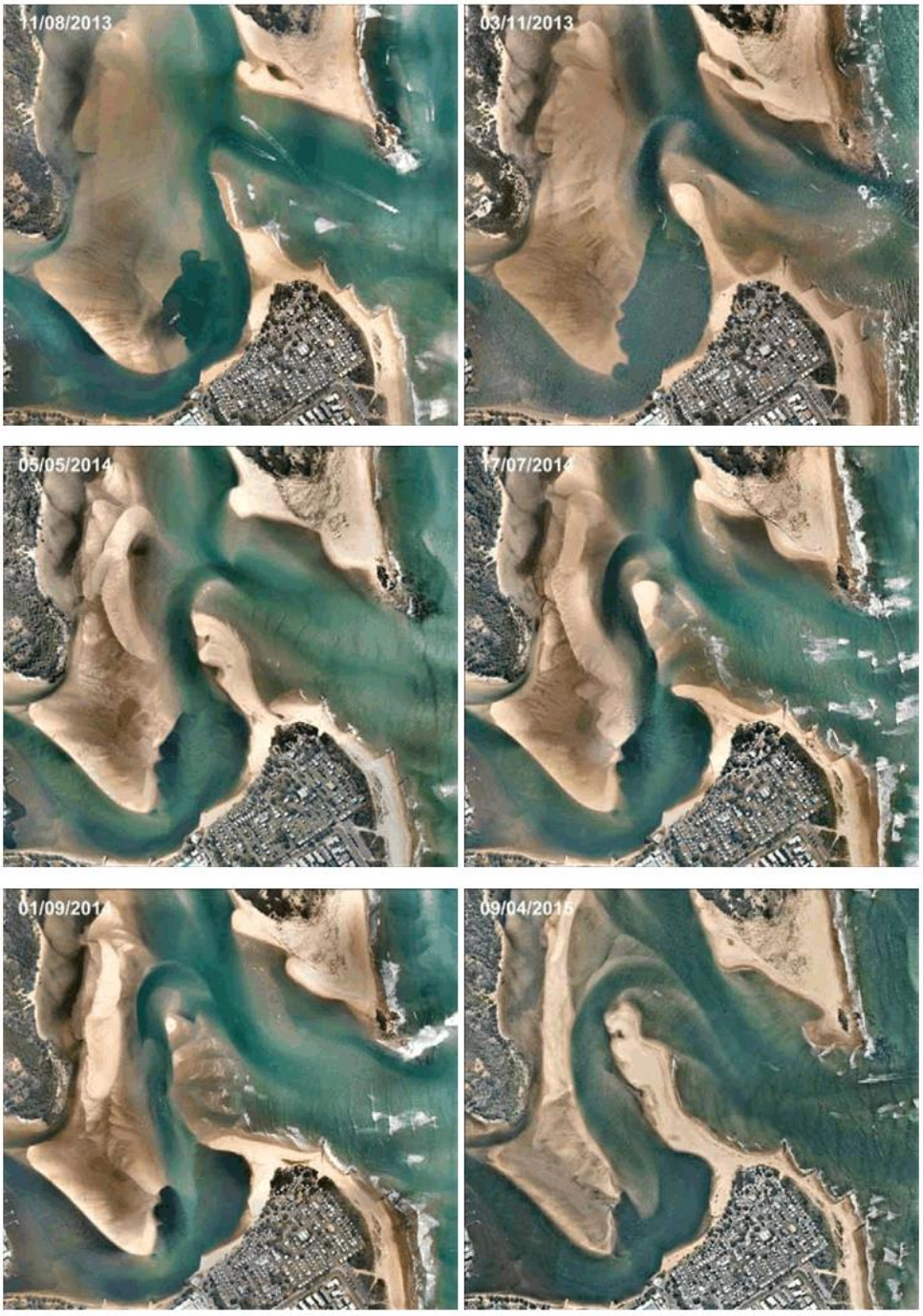

Figure 2-2 Maroochy River Mouth Morphology 11/08/2013 to 09/04/2015 (NearMap, 2015)


Maroochy Surf Club
Areodrome Road
Sea Breeze Caravan Park
Water and Electrical Utilities (subsurface)
Extent of aerial image
Okinja Road
Public Space Pedistrian and Cycle Pathways
Alexandra Parade
LEGEND
Existing Erosion Prone Area
Beach Access
Alexandra Headland Skate Park
Alexandra Headland Surf Club
image source: Nearmap
Title:
Maroochydore Beach Assets
Figure:
2-3
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Figure 2-4 Examples of eroded beach with exposed coffee rock and fill material, prior to the Maroochydore Beach Renourishment Project (photo courtesy of SCC, 2011)

2.2.1 Relationship between the Maroochy River Mouth and Maroochydore Beach Alignment

The available historical data suggests the Maroochydore Beach alignment is shaped by the position of the Maroochy River channel. This influence is estimated to extend up to 1.5 km south along the coastline from Cotton Tree to the Okinja Road beach access point (Beach Access 154). Figure 2-5 presents a comparison of the historical dune vegetation at the northern section of Maroochydore Beach and suggests a more northerly shoreline alignment when Pincushion Island is connected to Cotton Tree.

The benefit of the more northern aligned shoreline is a seaward extension of the beach width and the additional volume of sand that remains in the nearshore zone (thereby improving beach amenity and resilience to storm erosion). This is demonstrated in Figure 2-6 which compares historical beach profiles at Maroochydore. During the 1970s, 80s and 90s (i.e. when Cotton Tree and Pincushion Island were connected) a milder offshore gradient was measured through the nearshore zone (between approximately -1 m AHD and -15 m AHD). The offshore profile in 2011 is steeper which suggests a reduced volume of sand in the nearshore zone.


LEGEND
Historic Vegetation Line Obtained from Aerial Photography
Most Landward Vegetation Line Position
Most Seaward Vegetation Line Position
Title:
Maroochy River Entrance and Northern Maroochydore Beach Historical Positions
Figure:
2-5
Rev:
A
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The difference in the volume of sand stored in the Maroochydore Beach nearshore zone can be approximated from the historical profile datasets. The cross-sectional area[2] between the 2011 and the earlier beach profiles shown in Figure 2-6 is estimated to be at least 700m^2. Extrapolating this area along a 1.5 km stretch of coastline (i.e. from Cotton Tree to Okinja Road beach access) suggests that more than 1 million m^3 of additional sand was stored within the Maroochydore Beach nearshore zone when Pincushion Island was connected to Cotton Tree. This additional material would have contributed to the maintenance of wider beach (on average). In addition, the milder offshore seabed gradient would act to dissipate wave energy further offshore and therefore reduce shoreline erosion during storm events.

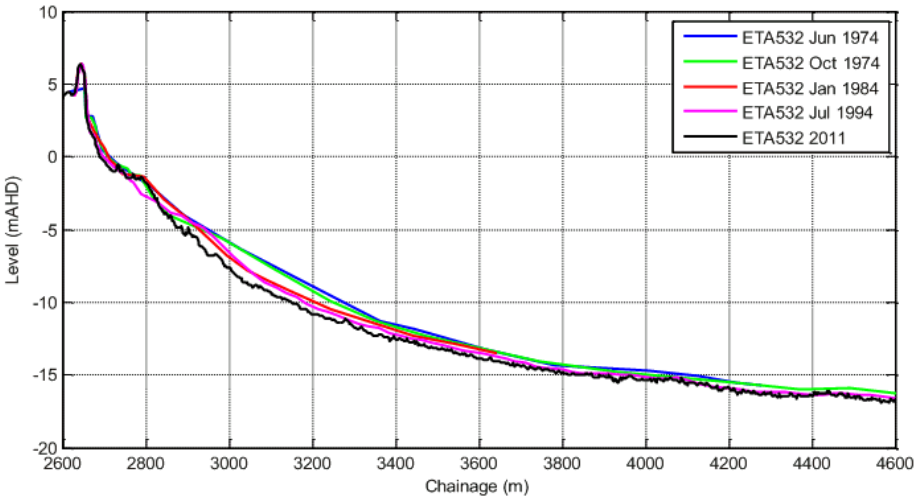


Figure 2-6 Maroochydore Beach Historical Beach Profiles

2.2.2 Maroochydore Beach Renourishment Project (2013 – 2016)

Stage one of the Maroochydore Renourishment Project was completed in 2013 and involved relocation approximately 125,000 m^3 of sand from a permitted area within the lower Maroochy River to Maroochydore Beach. The sand was relocated via a Cutter Suction Dredge (CSD) and pipeline. The dredge can be seen working within the permitted area in aerial image dated 11/08/2013 in Figure 2-2. Before and after renourishment photos are shown in Figure 2-7.

A subsequent campaign involving the relocation of 75,000 m^3 of sand was completed in 2015. The final stage of the project was completed in March 2016 and involved the relocation of a further 20,000 m^3. These works provide significant benefit to beach amenity and help to maintain important social and recreational values attributed to the area (including hosting the 2016 Australian Surf Life Saving Championships). The nourishment program has also led to the increase of the foreshore buffer in some parts of the project area. Despite this, the nourishment program has not provided a permanent solution to erosion threats. Many of the assets adjacent to the project area remain within the design storm erosion buffer. In this regard, the risk of damage to these assets remains despite the success of the renourishment campaigns.

[2] Trapezoidal numerical integration methods have been used to estimate the cross-sectional area between the beach profile curves shown in Figure 2-6

Figure 2-7 Before (left) and After (right) Maroochydore Beach Renourishment Project Stage One (photos courtesy of Birdon Pty Ltd)

2.2.3 Alexandra Headland to Maroochydore Seawall Approval (2015)

Council has developed a preliminary detailed design of a revetment seawall between the Alex Heads and Maroochy Surf Clubs and established an approved footprint for the structure. The seawall will only be constructed along the approved alignment when the existing coastal management strategy (currently underpinned by beach nourishment) is no longer able to mitigate the risk to land-based assets and values.

The unique aspect to this shoreline erosion management activity is the trigger-based approval that was obtained. The approval will only come into force once an erosion trigger has been reached, activating the need for further detailed documentation to be provided to the regulatory authority for compliance approval prior to development. The 35-year approval allows for confirmation of a preferred alignment/footprint for a seawall but defers the need for final detailed design until a later date.

3 Options Assessments

3.1 Assessment Options

Four broad options are considered in this section, each designed to enhance the management of shoreline erosion at Cotton Tree and Maroochydore Beach:

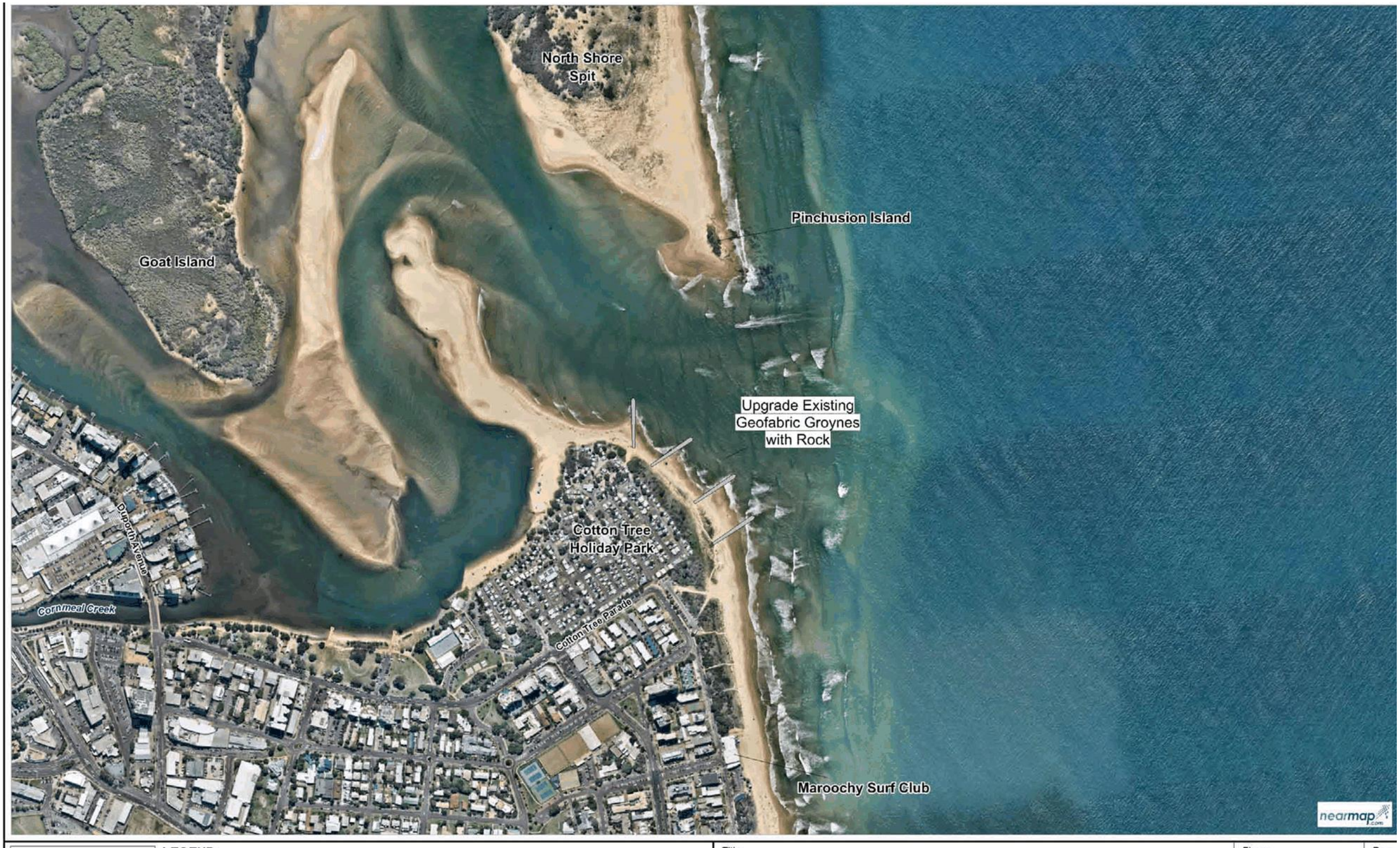
(1) Formalisation of the existing geofabric sand container groynes with rock and continue beach nourishment using sand from the permitted dredge area. This option is consistent with the Sunshine Coast SEMP (SCC, 2014); however, was not identified as a priority action (assuming the geofabric sand container groynes continued to perform as intended).

(2) Construction of a new 200 m (indicative length) rock groyne at Cotton Tree. Approximately 100,000 m^3 of beach nourishment would be required as part of the capital works. This option is likely to include the removal or reconfiguration or the existing geofabric sand container groynes.

(3) Construction of a northern river entrance and construction of a beach connecting Pincushion Island to Cotton Tree. This option requires dredging of approximately 300,000 m^3 of sand from within the Maroochy River mouth and at North Shore Spit.

(4) Construction of a northern river entrance and construction of a new rock breakwater connecting Pincushion Island to Cotton Tree. This option assumes that the material dredged to create the northern entrance would be placed on the ocean side of the breakwater

The common objective of each option is to mitigate shoreline erosion at Cotton Tree and Maroochydore Beach. The three options are conceptualised in Figure 3-1, Figure 3-2, Figure 3-3 and Figure 3-4.



LEGEND

Upgrade geofabric groynes with rock

Title:
Option 1 - Formalisation of existing geofabric groynes

Figure 3-1

Rev: A

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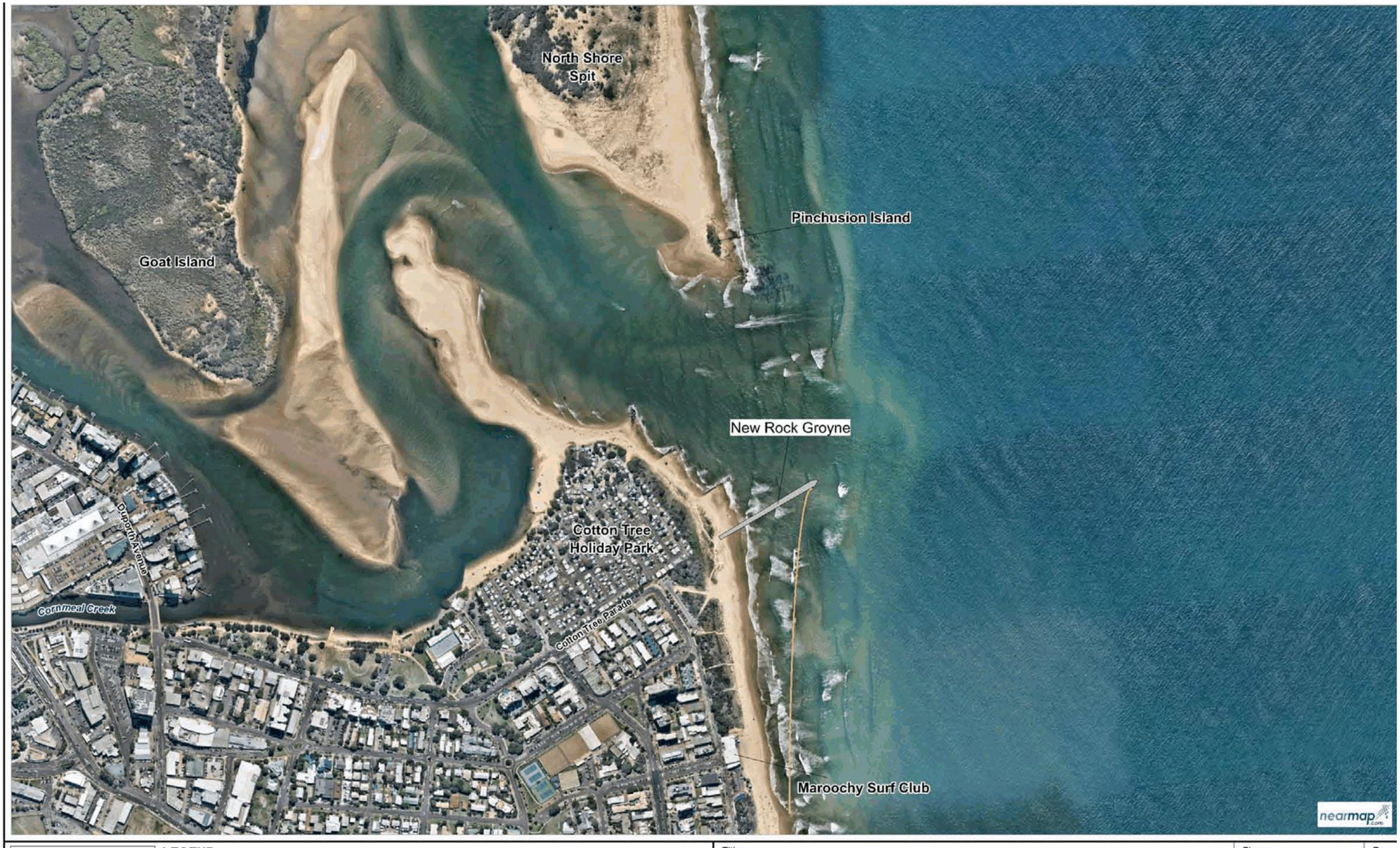

LEGEND

New rock groyne

Fully developed shoreline alignment (indicative)

Title:
Option 2 - New Rock Groyne at Cotton Tree

Figure 3-2

Rev: A

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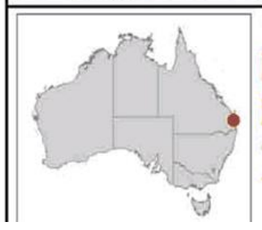

LEGEND

- Dredge area (constructed channel)
- Fill area (constructed beach)
- Bund wall (if required)
- Fully developed shoreline alignment (indicative)

Title:
Option 3 - Construction of River Entrance North of Pincushion Island with Constructed Beach

Figure 3-3 Rev: A

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LEGEND

- New breakwater
- Dredge area (constructed channel)
- Fill area (constructed beach)
- Fully developed shoreline alignment (indicative)

Title:
Option 4 - Construction of River Entrance North of Pincushion Island with Breakwater

Figure 3-4 Rev: A

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3.2 Rock Estimates

Groyne and breakwater design on open coasts must consider wave loading, currents and sediment transport rates. The potential for scour at the toe of the structure is a critical consideration. This influences the maximum depth and therefore maximum wave loading that the structure may be exposed to, which in turn determines the required rock armour characteristics.

Armour stone and core material requirements for the Option 1 and Option 2 groynes and Option 4 breakwater are estimated in Section 3.3, 3.4 and 3.6 using a 'typical' cross-section. The estimates are based on a number of assumptions that are described below.

A typical rock groyne profile and cross-section is shown in Figure 3-5. Considering the geometry and configuration of the existing geofabiric groynes at Cotton Tree, and the rock size adopted for nearby breakwater structures at Mooloolaba Harbour entrance (summarised in BMT WBM, 2014), the following approximate design characteristics have been assumed:

- Crest elevation = 3 meters above AHD
- Toe elevation = 5 metres below AHD (to account for scour)
- Crest width = 4.8 meters
- Armour stone weight = 4.9 tonne
- Armour stone diameter = 1.2 meters
- Armour rock layer thickness = 2.4 meters
- Core = quarry run material from 0.2m diameter up to 0.8m diameter adjacent to armour layer
- Rock mass density = 2,800 kg/m^3 (basalt)
- Permeability value = 0.4 (rock structure with a relatively impermeable core; e.g. CIRIA, 2007).

Following Hudson's (1953, 1959) design methods, structures with 4.9 tonne armour units (and 1.2 m diameter) would be expected to remain stable under wave attack for nearshore significant wave heights up to approximately 3 m. This is expected to be an appropriate depth-limited design wave height criterion for Maroochydore Beach; however, additional design wave and armour layer assessments would be required as part of the concept and detailed design of a preferred option. These assessments would require consideration of storm tide conditions and climate change induced sea level rise.

Considering the above, the typical cross-sectional armour stone and core material requirements are:

- Armour stone layer area ≈ 43 m^2
- Core material area ≈ 50 m^2

This corresponds to approximately 156 tonne per linear meter assuming a rock mass density of 2,800 kg/m^3 and a structure with a relatively impermeable core.

Capital works cost estimates were recently developed for the Department of Transport and Main Roads (TMR) investigation of options to extend the Mooloolaba Harbour eastern breakwater (BMT WBM, 2014). These estimates assumed basalt rock would be sourced from the state-owned quarry on Commercial Road, Kuluin (Sunshine Coast). The indicative cost for the transport, delivery and placement of rock onsite was $55 per tonne. This estimate has been used to derive indicative capital costs for Option 1 and Option 2 groynes and Option 4 breakwater structures (Sections 3.3.4, 3.4.4 and 3.6.4).

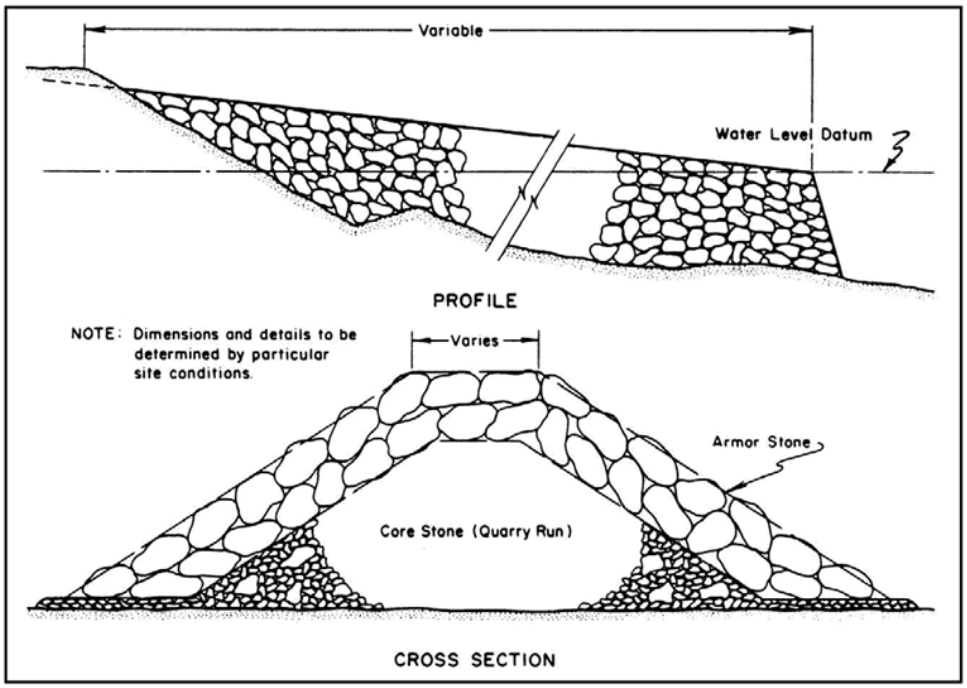

Figure 3-5 Typical Rock Groyne Profile and Cross Sections (USACE, 2002)

3.3 Option 1 – Formalisation of Existing Groynes

3.3.1 Description

Option 1 is conceptualised in Figure 3-1 and involves formalising the existing geofabric sand container groyne field with rock. The upgraded structures would provide the same benefit to the Cotton Tree shoreline and Maroochydore Beach Holiday Park as the existing geofabric groynes. No significant changes to the beach width or shoreline alignment to the south would be expected. There would be an ongoing requirement to nourish Maroochydore Beach using material from the Maroochy River entrance (or other sand source).

The main benefit of this option is a reduction in ongoing annual maintenance requirements. Over time it is anticipated that a rock groyne field, built to the appropriate design standard, would require less maintenance than the existing geofabric sand container groyne field.

Considering the assumptions and groyne cross section described in Section 3.2, and the 310 m total length of the four groynes, approximately 48,000 tonne of rock is required for Option 1.

3.3.2 Planning and Legislative Framework

Upgrading the existing Cotton Tree groynes with rock would be considered 'prescribed tidal works' for the purposes of the *Sustainable Planning Act 2009* (SP Act). Prescribed tidal works require a Development Permit supported by a detailed design study and drawings, and would be subject to assessment against

the *Coastal Protection and Management Act 1999*. However, as no significant changes to the current coastal environment are expected, no additional assessments of impacts would be required.

3.3.3 Environmental Values

There are no significant environmental values in the vicinity of the groynes that would be impacted by works. In addition, as the upgrade of the groynes would not cause any changes to coastal processes, none of the environmental values within the Maroochy River and along Maroochydore Beach would be affected.

3.3.4 Capital Works and Cost Estimate

Formalisation of the Cotton Tree groyne field (310 m total length) with rock would be undertaken using standard earth works equipment. Based on the 156 tonne per linear metre rock quantity estimates provided in Section 3.2, approximately 48,000 tonne of rock would be required.

Considering the above and other anticipated project needs the following costs are associated with Option 1 capital works:

- Concept and detailed design = $75,000
- Planning and approval = $ 50,000
- 310 m total length of four groynes (transport, delivery and placement of rock) = $2,640,000
- Site clearing and rock sorting = $ 100,000
- Rock blasting at quarry (if required) = $ 200,000
- Road access and repair (if required) = $ 300,000

The total cost estimate for implementation of Option 1 is $ 4,711,000. This estimate considers the above costs with a 40% contingency.

3.4 Option 2 – New Rock Groyne at Cotton Tree

3.4.1 Description

Option 2 is illustrated in Figure 3-2 and involves formalising the existing southern geofabric groyne with rock and extending its length. It's anticipated that the total length of the new structure would be approximately 200 m; however, the optimum length would be determined through a concept design study. The new groyne would intercept littoral processes causing sand accumulation on the updrift side of the structure. The orientation of the beach to the south would adjust to a new equilibrium. Beach nourishment downdrift of the new groyne would be required to maintain amenity at Cotton Tree. The optimal configuration and need for the remaining three Cotton Tree groynes would be determined as part of a concept design study. The impact to coastal processes, including sand supply to North Shore Spit and other northern beaches, would require careful consideration during the design phase.

The main benefit of this option is the widening of the beach to the south of the new groyne. This would lead to a more stable shoreline to the south (beyond Maroochy Surf Club) and the accumulation of more sand in the nearshore zone. This option would help to maximise the benefit of future beach nourishment campaigns. Overtime, the requirement for sand nourishment at Maroochydore Beach may decrease; however, the need to nourish the shoreline south of the Okinja Road beach access would remain. The reduction in sand supply to areas downdrift of the new groyne may lead to shoreline recession and would need to be mitigated in order maintain shoreline amenity at Cotton Tree Holiday Park. Ultimately, a rock seawall may be required to protect this land based asset.

Approximately 31,000 tonne of rock is required for Option 2. This estimate is based on the assumptions and groyne cross-section described in Section 3.2 over a 200 m length. A groyne of similar dimensions located at Kirra, Gold Coast, is shown in Figure 3-6.

Figure 3-6 Kirra Groyne Extension Works (WRL Coastal Imaging, 2013)

3.4.2 Planning and Legislative Framework

Construction of a new groyne would be considered prescribed tidal works under the SP Act and would require a Development Permit. A Development Permit application would need to be supported by a concept/detailed design study and drawings of the structure, and an assessment of impacts to coastal processes (e.g. numerical modelling assessment). The Development Permit would be assessed against the *Coastal Protection and Management Act 1994*.

As Cotton Tree Holiday Park is listed on the Queensland heritage register (see below) it will be important for an approval application to specifically consider potential impacts to Lot 1/CP862576. While no specific heritage approval is required for these works, it is recommended that consultation be undertaken with the park managers and the State Government to ensure appropriate management actions (e.g. long-term management commitments) are in place.

As no other significant environmental effects are expected, there are no other relevant approvals.

3.4.3 Environmental Values

Cotton Tree Holiday Park (Lot 1/CP862576) is listed on the Queensland heritage register. This site has been listed on the basis of 'demonstrating the evolution or pattern of Queensland's history' (Criterion A) and 'demonstrating the principal characteristics of a particular class of cultural places' (Criterion D). While subject to ongoing erosion pressures, the site requires protection in order to preserve these heritage values. The construction of a new groyne is expected to cause erosion downdrift of the groyne, which could threaten some of the waterfront lots in the park. While these impacts are not expected to eventuate immediately management options will need to be developed to ensure the ongoing protection of the site (e.g. seawall structure).

Erosion of this area will also cause the loss of some dune vegetation and landform. However, dunes in this area are currently heavily modified and thus no significant environmental values would be lost.

No other environmental values are expected to be affected by the development of the groyne.

3.4.4 Capital Works and Cost Estimate

Construction of the 200 m groyne would be undertaken using standard earth works equipment. Based on the 156 tonne per linear metre rock quantity estimates provided in Section 3.2, approximately 31,000 tonne or rock would be required.

Option 2 capital works would also require approximately 100,000 m^3 of beach nourishment downdrift of the new structure and at Maroochydore Beach. Recent dredging campaigns of a similar scale at this location have been completed at a rate of \$8/m^3 of sand.

Considering the above and other anticipated project needs the following costs are associated with Option 2 capital works:

- Concept and detailed design = \$ 300,000 (including numerical and physical modelling)
- Planning and approval = \$ 50,000
- 200 m groyne (transport, delivery and placement of rock) = \$1,705,000
- Site clearing and rock sorting = \$ 100,000
- Rock blasting at quarry (if required) = \$ 200,000
- Road access and repair (if required) = \$ 300,000
- Beach nourishment = \$ 800,000

The total cost estimate for implementation of Option 2 is \$ 4,837,000. This estimate considers the above costs with a 40% contingency.

3.5 Option 3 – Construction of Northern Entrance with Beach

3.5.1 Description

Option 3 is conceptualised in Figure 3-3 and involves the relocation of the river entrance channel to a location north of Pincushion Island. The new entrance channel would be constructed using standard dredging equipment. The dredged sand would be used as fill material to close the existing entrance and restore a beach between Cotton Tree and Pincushion Island. Temporary or permanent bund walls and/or other structures may be required during construction in order to stabilise the link between Cotton Tree and Pincushion. Overtime, additional dredging and/or training walls may be required to maintain the entrance channel at a location north of Pincushion Island.

This option is expected to relieve the erosion threat at Cotton Tree, alter the shoreline alignment to the south of Pincushion Island, increase the width of Maroochydore Beach and lead to the accumulation of sand in the nearshore zone. Groyne structures at Cotton Tree would not be needed; however, holding an entrance channel to the north of Pincushion Island may require a high degree of maintenance (channel dredging and potentially structures located at the North Shore Spit). Any proposed works of this nature would require careful planning, design and assessment. The project area during recent dredging works is shown in Figure 3-7.

Analysis of an existing Digital Elevation Model (DEM) of the proposed cut area at North Shore Spit and fill area between Cotton Tree and Pincushion Island (refer Figure 3-3) suggests the following requirements:

- Cut volume (North Shore Spit) = 190,000 m^3
- Fill volume (Cotton Tree to Pincushion Island) = 300,000 m^3

The estimates above assume a cut depth to 3 metres below AHD and a fill elevation to 2.5 metres above AHD. The cut volume would be transferred to the fill area via cutter suction dredge (CSD) and slurry pipeline. Additional sand (approximately 110,000 m^3) from other locations within the Maroochy River mouth would be required to achieve the design fill volume.

Figure 3-7 Maroochy River Mouth Dredging Works (photo courtesy of SCC, 2015)

3.5.2 Planning and Legislative Framework

Construction and maintenance of a new navigational entrance to the Maroochy River will require the following approvals:

- Environmental Authority (EA) to undertake an environmentally relevant activity (ERA) 16: dredging
- Development Permit to undertake tidal works (i.e. construction of a new navigation channel), prescribed tidal works (i.e. any temporary structures to secure the new beach), and remove marine plants/regulated vegetation (i.e. vegetation in the area to be dredged)
- Allocation of quarry material to place dredged sand in a new constructed beach area
- Development Permit under the Sunshine Coast Council Planning Scheme for the works above high water mark.

In addition, as the works could have an impact upon migratory shorebird habitat in the Maroochy River (see below) a referral under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is recommended. Where this impact could be significant, an assessment and approval under this Act would be required. The significance of an impact would need to consider the resulting morphology sandbars and intertidal areas within the Maroochy River.

An application for approvals under state legislation (i.e. EA, Development Permits, quarry material allocation) will be assessed under the SP Act, *Coastal Protection and Management Act 1995* and *Environmental Protection Act 1994*. It is unlikely that a formal Environmental Impact Assessment (EIA), and corresponding Environmental Impact Statement (EIS), would be required under these Acts however the supporting material required for approval applications is expected to consist of a number of technical studies similar to an EIA (e.g. coastal modelling, geotechnical investigations, marine ecology). At a minimum, conceptual numerical modelling would be required to inform project design, together with a detailed design study and drawings.

If the study is required to be assessed under the EPBC Act, an EIA may be required by the federal Department of the Environment.

Any permanent impacts to marine plants that may occur in the dredging area will require an environmental offsets package to be prepared under the *Environmental Offsets Act 2014*. In addition, if the project is found to cause a significant impact to matters under the EPBC Act, offsets would also need to be prepared under this Act.

Other legislative considerations in the study area include the Maroochy River fish habitat area (FHA) and the Maroochy River Regional Park. Neither of these protected areas occurs within the direct area of impact however both are expected to be subject to impact following the creation of the new entrance channel. A new channel would cause changes in morphology of the lower Maroochy River sandbars and channels, which is expected to change the conditions underpinning both of these protected areas. A change in the gazettal of these areas may be required following the establishment of the new river mouth, subject to consultation with the relevant government departments.

3.5.3 Environmental Values

The Maroochy River supports a number of important environmental values. These include important habitat for federally listed migratory shorebird species, including some species that are endangered and critically endangered, as well as the Maroochy River FHA and the islands of the Maroochy River Regional Park. In addition, the entire lower estuary has been mapped as a high ecological significance (HES) wetland. All of these values are expected to be subject to some change as a result of relocating the river mouth due to changes in lower estuary morphology. However, as no sand is being directly removed from the active system (simply relocated) the overall impacts are expected to be relocation of value areas, rather than actual loss. This would need to be confirmed as part of a coastal morphology study.

The foreshores north and south of the Maroochy River may provide turtle nesting sites, as well as potential feeding habitat for shorebirds and waders. In addition, vegetation near Pincushion Island includes regulated vegetation under the *Vegetation Management Act 1999* which may also include marine plants. This vegetation will be lost as part of the relocation work, though there will be revegetation opportunities on the new beach created at Cotton Tree.

The lower estuary is frequently used for primary and secondary recreation, including swimming, boating and fishing. The beaches either side of the mouth are popular swimming and recreational beaches. Overall impacts to these values are not expected.

3.5.4 Capital Works and Cost Estimate

Construction of the entrance channel to the north of Pincushion Island would require a combination of land based excavators and CSD equipment. The material would be transferred to the fill area via the CSD and slurry pipeline. This is the general dredging methodology adopted for the Maroochydore Beach Renourishment Project.

As described above, a temporary or permanent bund wall may be required during construction in order to stabilise the link between Cotton Tree and Pincushion. The need for and configuration of this structure would be established as part of the Option 3 concept design. An upper limit bund wall length is 370 m which would provide for a continuous link between Cotton Tree and Pincushion Island (as shown in Figure 3-3). The bund wall is estimated to cost $5,000 per linear metre; however, it is noted that a significant level of uncertainty (e.g. material type and geometry) is associated with this element of the Option 3 design. The bulk of the fill material (i.e. clean sand) may remain at the placement area without structural containment if the constructed northern channel becomes dominant and erosion pressure to the south of Pincushion Island is relieved.

Maintenance dredging of the northern channel is likely to be an ongoing annual requirement in order to mitigate channel migration back to the south of Pincushion Island. The maintenance material would comprise of clean sands suitable or nourishment of nearby beaches.

Option 3 would require approximately 300,000 m^3 of sand to construct a beach link between Cotton Tree and Pincushion. As discussed in Section 3.4.4, recent dredging campaigns at the Maroochy River mouth have been completed at a rate of \$8/m^3 of sand.

Considering the above and other anticipated project needs the following costs are associated with Option 3 capital works:

- Concept and detailed design = \$ 250,000 (including numerical modelling)
- Planning and approval = \$ 500,000
- 370 m breakwater (transport, delivery and placement of rock) = \$3,190,000
- Site clearing at North Shore Spit = \$ 100,000
- Road access and repair (if required) = \$ 300,000
- Dredging and sand placement = \$ 2,400,000
- Bund walls (if required) = \$ 1,850,000

The total cost estimate for implementation of Option 3 is \$ 7,560,000. This estimate considers the above costs with a 40% contingency.

3.6 Option 4 – Construction of Northern Entrance with Breakwater

3.6.1 Description

Option 4 also involves the relocation of the river entrance channel to a location north of Pincushion Island. This would be coupled with the construction of a rock breakwater to permanently close the southern channel and create a structural link between Cotton Tree and Pincushion Island as shown in Figure 3-4. Similar to Option 3, the sand dredged to create the northern entrance, together with additional sand from other locations within the Maroochy River mouth, would be used to construct a beach at the seaward side of the breakwater. Overtime the shoreline alignment to the south of Pincushion Island is expected to realign and lead to an increase in beach width.

The breakwater structure would prevent a southern entrance channel reforming. The entrance channel to the north of Pincushion Island would be expected to remain dominant; however, some maintenance dredging may be required in order to control undesirable channel migration and/or erosion patterns.

3.6.2 Planning and Legislative Framework

The Option 4 planning and legislative framework follows that described in Section 3.4.2 for construction of the breakwater structure and Section 3.5.2 for construction of the northern entrance channel.

3.6.3 Environmental Values

The environmental values previously described in Section 3.4.3 and Section 3.5.3 are also relevant to Option 4.

3.6.4 Capital Works and Cost Estimate

Construction of the 370 m breakwater would be undertaken using standard earth works equipment. Based on the 156 tonne per linear metre rock quantity estimates provided in Section 3.2, approximately 58,000 tonne or rock would be required.

Option 4 capital works would also require the relocation of approximately 190,000 m^3 of sand from the northern channel area to the seaward side of the breakwater. Additional sand (approximately 110,000 m^3) from other locations within the Maroochy River mouth would be required to achieve the design fill volume. This work would be completed using a combination of land based excavators and CSD equipment. The material would be transferred to the fill area via the CSD and slurry pipeline at an estimated rate of \$8/m^3 of sand (as discussed in Section 3.4.4).

Considering the above and other anticipated project needs the following costs are associated with Option 4 capital works:

- Concept and detailed design = $ 300,000 (including numerical and physical modelling)
- Planning and approval = $ 500,000
- 370 m breakwater (transport, delivery and placement of rock) = $3,190,000
- Site clearing and rock sorting = $ 100,000
- Rock blasting at quarry (if required) = $ 200,000
- Site clearing at North Shore Spit = $ 100,000
- Road access and repair (if required) = $ 300,000
- Dredging and sand placement = $ 2,400,000

The total cost estimate for implementation of Option 3 is $ 9,156,000. This estimate considers the above costs with a 40% contingency.

4 Summary

A summary of the preliminary options assessment is provided in **Error! Reference source not found.**. Each option represents an enhancement of the coastal management strategy for the project area.

Option 1 is considered relatively low risk and likely to gain environmental approval for the following reasons:

- The option has been 'trialled' using geofabric sand containers since 2003
- There would be no significant impact to the existing coastal processes or environmental values

Option 2 represents a relatively standard coastal engineering solution designed to accumulate sand and alter the shoreline alignment updrift of the structure. The 200 m groyne would also assist by maximising the benefit of future beach nourishment campaigns. Impact to sand supply downdrift of the structure (i.e. at Cotton Tree and North Shore Spit) will occur, particularly during the years immediately following the capital works while the groyne 'fills' and the area adjusts to a new dynamic equilibrium. The risks associated with a reduced sand supply downdrift of a groyne are typically mitigated with beach nourishment.

Option 3 is operationally the most challenging and carries significant environmental approval challenges. As summarised in Attachment A, similar previous proposals have not received support from the state agencies. Nevertheless, the proposed works are not prohibited under the current legislative regime and may receive support if the environmental risk could be managed and the benefit to erosion mitigation and social values clearly demonstrated.

Option 4 would attract similar planning and approvals challenges to Option 3, but is likely to be a more operationally viable method for creating and maintaining an entrance channel to the north of Pincushion Island. The implementation of the breakwater structure represents a permanent commitment to a northern entrance channel.

Additional structures, beyond those described in this memorandum, may be required to mitigate emerging erosion problems in response to a new coastal management strategy. This may include, for example, upgraded seawalls along the Cotton Tree Holiday Park shoreline. It is important to note that ongoing beach nourishment is required to support each option described herein. It is expected that a limited volume of sand from the lower Maroochy River will continue to be used for beach nourishment purposes. However, medium to long term beach nourishment requirements within the project area are likely to exceed to the volume available from the lower Maroochy River sand source. The Sunshine Coast Regional Sand Souring Study (BMT WBM, 2015) describes potential alternative sand sourcing options for the region.

Table 4-1 Summary of Preliminary Options Assessment

Option	Advantages	Disadvantages	Comments
Option 1 Formalisation of existing geofabric groynes	• Limited planning and design requirements • No impact to coastal processes or environmental values • High likelihood of gaining approval • High degree of confidence that the investment will perform as intended • Reduced maintenance effort	• No added benefit to Maroochydore Beach alignment	Essentially represents a 'maintain status quo' approach
Option 2 New rock groyne at Cotton Tree	• Widening of beach to the south of groyne • Maximise benefit of future beach nourishment campaigns • Possible reduction in beach nourishment frequency	• Reduced sand supply to north may need mitigation • High visual impact • Shoreline recession at Cotton may need mitigation through beach nourishment and/or seawall	Likely to improve beach width and sand storage offshore from Maroochy Surf Club Ongoing beach nourishment still required at Cotton Tree (downdrift of proposed groyne) and south of Okinja Road beach access
Option 3 Construction of northern entrance with constructed beach	• Relives the erosion pressure at Cotton Tree • Widening of beach to south • Increase in sand in nearshore zone • Possible reduction in beach nourishment frequency	• Significant planning and design phase • Challenging approvals framework • Similar proposed works not previously supported by state • Ongoing commitment to maintain northern entrance • High capital and maintenance costs	Represents a significant improvement to shoreline erosion and beach amenity at Cotton Tree Likely to improve beach width and sand storage offshore from Maroochy Surf Club Ongoing beach nourishment still required south of Okinja Road beach access
Option 4 Construction of northern entrance with constructed beach	• Relives the erosion pressure at Cotton Tree • Widening of beach to south • Increase in sand in nearshore zone • Northern entrance likely to remain dominant without significant maintenance dredging	• Challenging approvals framework • Similar proposed works not previously supported by state • High visual impact • High capital cost, approximately double Option 1 and Option 2	Permanent commitment to a northern entrance channel Overtime will trap sand and is likely to improve beach width and sand storage offshore from Maroochy Surf Club Ongoing beach nourishment still required south of Okinja Road beach access

5 References

Andrews, M. and Witt, C. (1999). The Maroochy River Entrance Management Opportunities & Constraints, Proceedings of 14th Australasian Coastal and Ocean Engineering Conference and 7th Australasian Port and Harbour Conference, Perth, Australia.

BMT WBM (2008). Twin Waters West Development: Integrated Water Management Plan, report prepared for Stockland.

BMT WBM (2013). Coastal Processes Study for the Sunshine Coast, report prepared for Sunshine Coast Council.

BMT WBM (2014). Investigation of Capital Works Options for the Management of Shoaling at the Mooloolah River Entrance, report prepared for the Queensland Department of Transport and Main Roads.

BMT WBM (2015). Sunshine Coast Sand Sourcing Study, report prepared for Sunshine Coast Council.

CIRIA (2007). The Rock Manual: The Use of Rock in Hydraulic Engineering, Construction Industry Research Information Association, 1268pp.

Hudson, R.Y. (1953). Wave forces on breakwaters, Transactions of the American Society of Civil Engineers, volume 118, 653-674.

Hudson, R.Y. (1959). Laboratory investigations of rubble mound breakwaters, Journal of Waterways and Harbours Division, American Society Civil Engineers, volume 85, no. WW3, paper no. 2171, 93-121.

Sunshine Coast Council (SCC) Shoreline Erosion Management Plan (2014). Accessed on 31 May 2016, https://www.sunshinecoast.qld.gov.au/en/Environment/Rivers-and-Coast/Coastal-Management/Shoreline-Erosion-Management-Plan

U.S. Army Corps of Engineers (USACE) (2002). Coastal Engineering Manual. Engineer Manual 1110-2-1100, U.S. Army Corps of Engineers, Washington, DC (in 6 volumes).

WRL Coastal Imaging (2013). Accessed on 31 May 2016, http://ci.wrl.unsw.edu.au/about-coastal-imaging/interesting-images/

Attachment A

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Our Ref: Document1

21 October 2015

Sunshine Coast Council
<<Electronic Transmission>>

Attention: Michael Anderson

Dear Michael

RE: MAROOCHY RIVER NORTHERN ENTRANCE FEASIBILITY DESKTOP REVIEW - LEGISLATIVE CONTEXT

This letter provides a review of consistency that a proposal to undertake works at the Maroochy River Northern Entrance would have with the policy outcomes sought under the current coastal planning legislative regime as set out in the State Development Assessment Provisions (SDAP) Module 10 promulgated under the *Sustainable Planning Act 2009* (SPA).

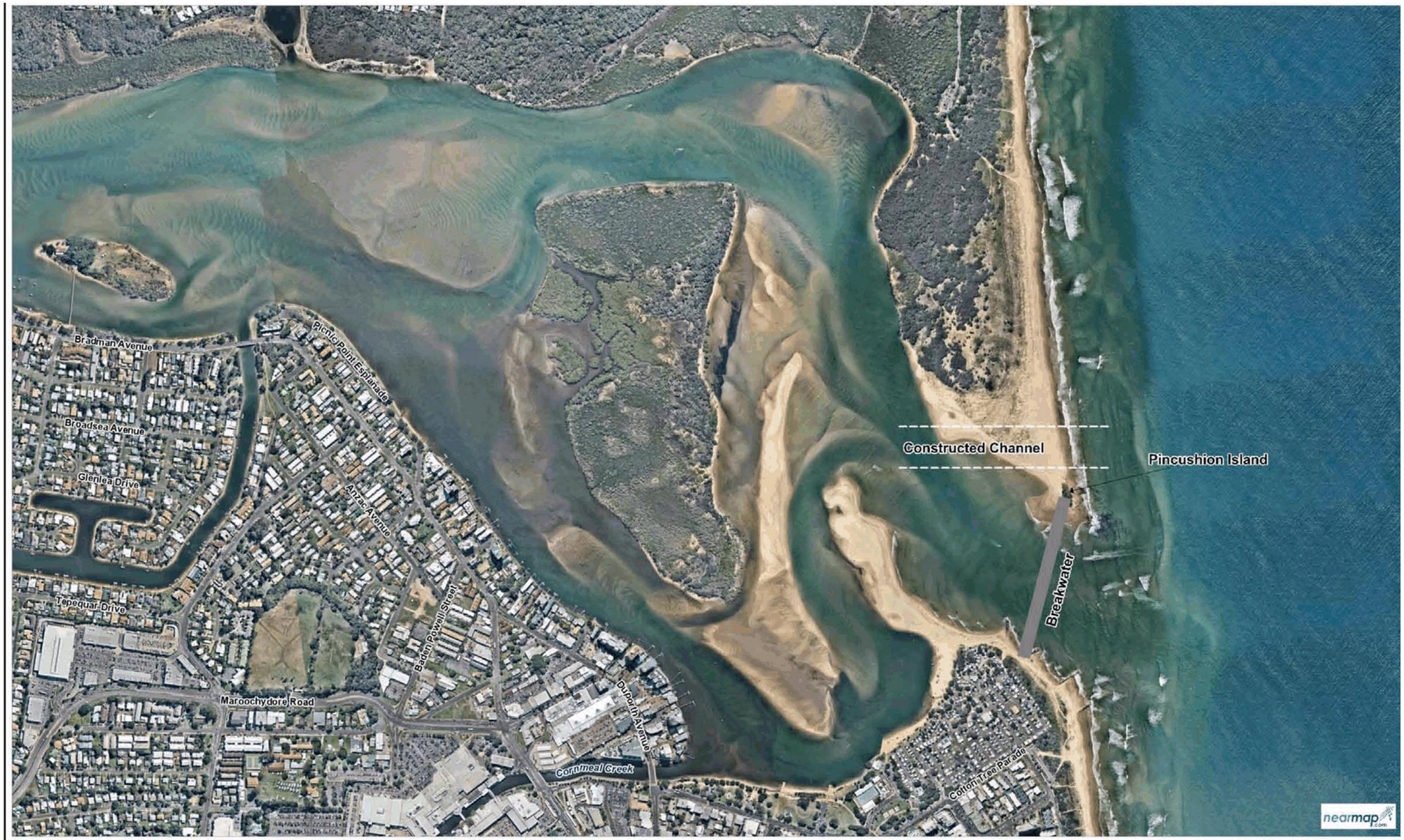
The information provided below is based on available desktop information using the indicative works shown in Figure 1 as the design; noting that further studies of impacts and consultation with approval agencies would be required to confirm findings of this initial assessment. Figure 1 illustrates a conceptual reconfiguration of the river entrance represented by a structural connection (rock breakwater) between Cotton Tree and Pincushion Island and the development of a main channel (via dredging and land based excavation) to the north of Pincushion Island.

Project History

A summary of the correspondence provided under the *Right to Information Act 2009* is provided as an attachment to this letter. This correspondence refers to investigations undertaken in the late 1990's and prior to the migration of the river entrance to a position south of Pincushion Island.

In the previous correspondence between the local government (Maroochy Shire Council) and the State, the relocation of the river entrance was not preferred and it was stated 'such action should only be considered a last resort' (Department of Environment and Heritage, 2000).

The correspondence indicates that permits were not granted when a major reconfiguration of the entrance was last proposed. An application under the repealed *Harbours Act 1955* was submitted to the State, however was not progressed due to a lack of information (and justification) being provided. Subsequently, approvals for groynes (constructed using geofabirc sand containers) and beach nourishment using material from the southern areas of the river mouth was granted in 2003 (and approvals for these works continue to the current time).



LEGEND

Breakwater (rock structure)

Title:
Indicative Reconfiguration of the River Entrance

Figure 1 Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Environmental Values

The environmental values and conservation planning constraints in the locality of the works are shown in Figure 2.

The proposed northern entrance area has been subject to frequent shoreline movement over time, however has been relatively stable in recent history, with significant dune revegetation occurring. It is mapped as regulated vegetation under the *Vegetation Management Act 1999* (VMA).

This vegetation would have enhanced the area's habitat values and there is some information to indicate it provides suitable habitat for migratory birds protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and prospective turtle nesting sites (site surveys would be required to confirm the presence of protected species).

The project area is located within the boundary of the Coolum Creek and Lower Maroochy River Nationally Important Wetland, a designation which provides no legislative protection, but indicates the relative importance of the area from a conservation perspective.

Accordingly, the area is mapped as an area of High Ecological Significance (HES) which is a Matter of State Environmental Significance (MSES) under the State Planning Policy and SDAP, a designation that is taken into account when determining development applications under the *Sustainable Planning Act 2009*.

The area is now also well established as a low intensity recreational location (e.g. fishing, nature-based activities), and it is considered likely that the works would result in major alternations to existing uses and access.

The site is not listed as being of cultural heritage significance on state or federal registers; however previous correspondence from the Department of Environment and Heritage recommended that a detailed survey be undertaken in consultation with the appropriate Aboriginal party to identify any potential cultural heritage places, objects or values.

LEGEND

- Dredging Footprint
- Maroochy River [Rev.1] FHA
- Maroochy River [Rev.1] FHA - 50m Buffer
- Maroochy River [Rev.1] FHA - 100m Buffer
- Remnant Vegetation
- Shorebird Habitat of High Importance
- Shorebird Habitat of Moderate Importance
- Potential Turtle Nesting Area (extremely rare)

Title:
Environmental Values and Conservation Planning Constraints in the Localisy

Figure 2 Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Current Legislative Regime

Coastal Protection State Interest

The project would occur within the Coastal Management District and Erosion Prone Areas declared under the *Coastal Protection and Management Act 1995* (Coastal Act). As such, the works would attract a number of approvals assessed by the State Government (through SARA) under the *Sustainable Planning Act 2009* (SPA), with the principal assessment document being Module 10 (Coastal Protection) of the SDAP. Various coastal development operational policies and guidelines of the Department of Environment and Heritage Protection would also be relevant to the works (e.g. operational work on State Coastal Land Operational Policy and Constructing Tidal Works Guideline).

Development triggers relevant to the Coastal Act that would require approval include:

- operational work that is tidal work (e.g. works in, on or over tidal lands or waters)
- works removing or interfering with coastal dunes
- interfering with quarry material on State coastal land above high water mark

Under the definitions of the SDAP in Module 10, the works would be considered to be **coastal dependant** (requiring a coastal location to function) and an **erosion control structure** (a structure designed to permanently alter sediment transport processes). Relevant guidance on performance outcomes from the SDAP for this class of development includes:

- The project should avoid the need for erosion control structures to protect permanent structures unless all other erosion measures have been investigated and are considered impractical;
- Coastal protection work should only to be undertaken to protect existing permanent structures from imminent adverse coastal erosion impacts;
- The project should avoid or minimise interference with existing coastal processes or ecosystems such as mangroves, seagrass beds, coastal wetlands, dune vegetation communities or nesting/breeding sites for wildlife;
- The project should not pose an unacceptable increase in the severity of a coastal hazard or significantly increase the potential for damage to adjacent property;
- The project minimises impacts on the physical characteristics of a waterway including flow regimes, hydrodynamic forces and riverbank stability;
- The project minimises and offsets and loss of access to and along the foreshore;
- The existing long term use of a locality or natural values is maintained e.g. recreational values of the north shore are maintained; and
- The project maintains or enhances the community's resilience to defined storm tide events.

These performance outcomes generally indicate that significant disturbance involving construction of a permanent northern entrance channel and associated breakwater would not be supported under the SDAP unless other 'softer' options to maintain the southern shoreline are demonstrated to be infeasible or impractical.

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Alternatively, a long term solution that minimises interference with natural coastal processes is the most likely option to be supported, provided that there is no imminent threat to property or essential community infrastructure.

Other Approval Authority Interests

In addition to coastal approvals under the Coastal Act and SPA, the project would also likely require approvals under additional legislation (including other State legislation, Commonwealth legislation and the local government planning scheme). Potential approvals required for the works could include:

- An environmental authority under the *Environmental Protection Act 1994* for Environmentally Relevant Activity 16 (for dredging);
- Approval to interfere or destroy marine plants under the *Fisheries Act 1994* and SPA;
- Approval to clear regulated vegetation under the *Vegetation Management Act 1999* and SPA;
- An allocation of quarry material to remove any sand from land under tidal water if the placement occurs above HAT under the *Coastal Protection and Management Act 1995*;
- Approval pursuant to the Sunshine Coast Council Planning Scheme for the component of the works that occur above high water mark and for prescribed tidal works for works in the local government tidal area under SPA;
- Prospective referral under the EPBC Act to address potential impacts to migratory birds and threatened species (turtles and shorebirds), if it is found that important habitat is likely to be significantly disturbed by the works.

The ability to obtain these additional approvals will be dependent on the final design and footprint of the works, the development of mitigation measures to minimise impacts and if relevant, the proposal of an acceptable environmental offset (particularly for residual impacts to regulated vegetation under the Vegetation Management Act and Fisheries Act or to habitat for threatened species). SCC may also be able to utilise exemptions under some of these acts depending on the design and scale of impact.

The project area is not currently within the boundaries of a Fish Habitat Area (FHA) declared under the Fisheries Act or the Moreton Bay Marine Park declared under the *Marine Parks Regulation 2006* and would not attract permits for interfering with these protected areas.

Conclusion

Whilst the current legislative regime does not specifically prohibit the proposed works, significant justification that no other feasible options are available would have to be provided.

This would take the form of a detailed feasibility assessment, as outlined in Stage 2 and 3 of our proposal dated 19th August 2015.

Yours Faithfully
BMT WBM

Greg Fisk
Malcolm Andrews
Lisa McKinnon
Matthew Barnes

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Table 1. Summary of Correspondence provided to Council under the *Right to Information Act 2009 (reference to RTI - cotton tree groyne.pdf)*

pdf page number	Document	Date	Summary	Conclusion
1	Letter - EHP to SCRC	11-06-2014 (2)	Acknowledgement of Right to Information	Attached Documents
3	WBM Oceanics Report R11128	26-03-1998 (64)	Initial Advice – Maroochy River Entrance Breakthrough Study.	Breakthrough to south of Pincushion Island is likely and will have significant impact on shoreline locations. Aerial photography shows it has happened previously. Coffee rock is prevalent in the area and would likely be exposed if the entrance changed. Re-constructing a northern entrance is possible but would require major design input as it would be reversing a natural process.
17	Fax – MSC to BPA	16-10-2000 (74)	Asking for input to Council meeting of 19-10-2000.	Options for promoting flow in the northern channel.
21	MSC Memo to Councillors	25-09-2000 (73)	Asking for input to Council meeting of 19-10-2000. Includes minutes of meeting of 27-06-2000	Discussions on promoting flow in the northern channel
25	Letter DoE to MSC	30-11-2000 (79A)	Thanks you for meeting DoE representatives and Minister on 08-11 2000	Entrance relocation not approved lightly.
26	MSC Minutes	19-10-2000 (80)	Discussion of northern entrance option and protection of Pincushion Caravan Park.	WBM asked to measure flow distribution in the north and south channels and to carry out a desktop study and costing of options.
32	Letter – MSC to Minister	20-11-2000 (81)	Discussion of funding options for entrance modification / protection works.	Council will continue to communicate with agencies.
34	Letter – Reply Minister to MSC	20-12-2000 (84)	Discussion of likely approvals for options and funding mentioned in MSC letter (81)	Works funding are the responsibility of LGA – loan subsidy increases are supported.
36	Letter – DoE to MSC	20-12-2000 (86)	Similar content to Ministerial response (84).	Works funding are the responsibility of LGA – loan subsidy increases are supported.
38	MSC Report to MSC meeting	20-11-1999 (65)	History of Maroochy River mouth.	Recommends Physical Model Study
47	Letter Minister to MSC	30-11-2000 (87)	Similar content to letter (79A).	Entrance relocation not approved 12lightly.

pdf page number	Document	Date	Summary	Conclusion
48	Letter Minister to MSC	18-12-2000 (100)	Similar content to Ministerial response (84).	Works funding are the responsibility of LGA – loan subsidy increases are supported.
50	Fax – DoE briefing	20-01-1997 (1)	Briefing notes on history and action plan for Maroochy River entrance.	Supports entrance relocation by breaching the expanding northern spit. The southern progression of the spit was increasing erosion pressure on the spit joining Pincushion Island to the southern shoreline. Makes several recommendations about studies to initiate and approvals to gain.
55	Fax – DoE Internal	20-01-1997 (3)	Seeks regional input on the above briefing (1) and other communications.	Seeks urgent regional input.
62	Fax – DoE Internal	20-01-1997 (4)	Regional comment as requested by (3)	Consider broader environmental values.
64	SE Regional Office (SERO) Fax to HO	20-01-1997 (5)	Comments by (SERO) as requested by (3)	Recommends adding new requirements to the study brief on environmental impacts, DPI fisheries input, water quality and public consultation.
66	DoE Letter	29-01-1997 (8)	Response to letter regarding Maroochy River from "Concerned North Shore Residents"	Letter to "Concerned North Shore Residents" advising study is being undertaken by Council not DoE.
69	DoE Internal Memo	5-Febraruy-1997 (10)	Minutes of meeting regarding Pincushion Island	File note of meeting between DoE, DPI, Council and WBM. WBM to be commissioned to investigate a new northern entrance.
72	DoE File Note NCDO	27-February-1997 (16)	Community meeting held regarding Maroochy River Mouth Relocation	Public consultation but an exercise in telling the public what was going to happen as the terms of the study brief narrow.
73	DoE Letter	27 February-1997 (19)	SERO Reply to WBM fax regarding Maroochy River relocation study	No immediate cultural concerns.
75	Letter – MSC to DoE	23-July-1997 (25)	Maroochy River Relocation	Requests a meeting with SERO to discuss report.
76	Letter – MSC to DoE	5-September-1997 (24)	Confirming meeting	Confirms meeting on 24 September to discuss WBM report.

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78	Ministerial Request	21-July-1998 (28)	Local MLA requests advice from Minister about proposed Maroochy River dredging.	
81	Letter – DPI Fisheries Resource Management	13-October-1998 (29)	Response letter to support permit to remove or disturb marine plants	Application to be resubmitted with inclusions as suggested in the letter
83	Letter – DPI Fisheries to WBM	6-November-1998 (30)	Response to fax regarding sediment core samples to test toxicity to remove or disturb Marine Plants	All potential impacts to be sufficiently mitigated before going ahead
84	Email – DoE NC to HO	25-Nov-1998 (31)	Requests advice on TOR for study as initially requested by MSC	Request for information.
85	Draft Terms of Reference to relocate (attached to email above)	25-Nov-1998 (32)	Further detail required for proposed work to DoE	Discussion on TOR as requested by MSC.
91	Internal Email DoE	4-Dec-1998 (33)	Discussion on draft WBM report.	Include dredging issues in WBM report. Have dredging alternatives investigated.
95	Letter - MSC to DoE	27-November-1998 (34)	Application for Section 86 of the Harbours Act – for works in the Maroochy river entrance	Plan locating works with reference to surrounding property and giving potential dredge channel sections.
97	Letter - DoE to MSC	7-Dec-1998 (35)	Response to application for Environment Authority for dredging	Insufficient information has been provided to enable the authority to decide the application. Refers to the Tor (31 and 32). As the amount of information outstanding is considerable, your submission has been deemed an invalid application.
105	Letter DNR to Nall Payne Solicitors (Native Title Notification)	7-January-1999 (31)	Application for sanction to carry out works	Requesting approval for dredging and associated bunding
106	DoE Internal Application for Constructions of Works on Tidal lands or Waters (S86)	3-February-1999 (39)	Section 86 harbours Act Application form	Application to bund southern entrance and construct a channel to the north.
111	Letter DoE to MSC	3-February 1999 (40)	RE: S86 Application (39)	Asking for extra information to be provided, including revised plans, comments from concurrence agencies and native title acceptance.
112	DoE Internal memo	12-February 1999 (41)	Regarding impacts on indigenous cultural heritage	Developer (MSC) required to undertake a professional cultural heritage survey and assessment of the development

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				proposal.
113	Letter - DoE to MSC	15-February-1999 (42)	Reply regarding native title claim (follow on from (41) above)	Speak to the Undumbi people regarding the land and the archaeological material
118	Letter - DPI to WBM	25-February-1999 (48)	Response letter to issues concerning the proposal to relocate the mouth of the Maroochy River	DPI assessed report and found to have impact upon fisheries resources not to be in keeping with the Fisheries legislation. Must seek revocation of the FHA before works associated with the relocation of Maroochy river to be approved.
120	DoE Internal Memo	25-February-1999 (49)	Response to Undumbi's Native Title Claims	Applicate requested to deal with the Undumbi people directly to resolve issue.
127	Memo BPA to DoE	20-September-1999 (50)	Re: Application to bund the existing channel and dredge a new northern channel at the Maroochy River mouth	Concerns by the Sunshine Coast Environment Council regarding application and subsequent briefing by DoE have been noted by the BPA.
130	Ministerial briefing note	24-August-2000 (57)	Briefing to Minister including many background documents dating back to January 1997 (37 documents – mostly listed above + 2 WBM reports)	Key issues: dredging, location of current opening, potential threat to Maroochy Life Saving Clubhouse
141	Minister DNR to MLA Neil Turner	3-March-1997 (13)	MLA Turner wrote on behalf of concerned resident about dredging of Northern channel through Maroochy River Mouth	Request letter referred to the Honourable Brian Littleproud MLA for consideration
145	Minister DoE to unknown as above	26-March-1997 (17)	Reply to letter (13) regarding the Maroochy Shire Council to dredge the mouth the of the Maroochy River	Consultants to examine the following: coastal/hydraulic process model, water quality model, and surveys and mapping of ecological and fisheries resources. Including community consultation.
148	Letter Ministerial Adviser as above	11-March-1997 (15)	Acknowledge receipt of the letter dated 4 March 1997 regarding a proposal to dredge the Maroochy River	Mr Littleproud will write as soon as possible.
149	Letter unknown to Minister	4-March-1997 (14)	Writing regarding the dredge a northern channel through the sand bar zone of the Maroochy River. Attempt to stop the mouth	Concerns that the decision was rushed and no emergency exists in place. Department of Environment granted

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			of the river from moving south of Pincushion. Wash away Cotton Tree and/or Maroochydore Beach	temporary basis only to use Pincushion for camping purposes. Hoping to reject the application to dredge
150	Letter Minister to unknown as above	8-April-1997 (21)	Reply to letter advising decision of the Maroochy Shire Council to dredge the mouth the of the Maroochy River	Consultants to examine the following: coastal/hydraulic process model, water quality model, and surveys and mapping of ecological and fisheries resources. Including community consultation.
152	Ministerial Correspondence from Coastal Management Branch	25-March-1997 (20)	Reply to proposal to dredge a northern channel at the Maroochy River mouth	Issue with dredging will cause break through to the south of Pincushion Island.
156	Letter from MSC to DoE	5-Sept-1997 (25a)	Referring to presentation to the Engineering Services Committee Meeting on 19 August 1997	Confirming meeting for 24-sept-1997
157	Letter from MSC to DoE	12-May-1998 (28)	Acknowledgement of attendance at Maroochy River Entrance Working Party. Attached notes	WBM commissioned to carry out further studies. Will contact at later date to discuss proposals.
170	Letter MSC to BPA (DoE)	27-November-1998 (38)	Request for comments on works in the Maroochy River Entrance	Requesting comments on proposal from WBM. Attached plan of works.
172	Letter MSC to DoE	27-November-1998 (34)	Application for sanction pursuant to section 86 of the Harbours Act – for works in the Maroochy River Entrance	Submission of application to relocate the Maroochy River Entrance to the north of the existing entrance.
174	DoE Internal document	3-Feb-1999 (41)	Application received for the construction of bunding of block the existing entrance and dredging of new channels.	Recommending that the Beach Protection Authority advice of the views on proposed works.
196	Memo	20-Sept-1999 (42)	Construction of Bunding the Block the existing Channel and Dredging a New Channel situated at the Maroochy River Mouth	Attached views of the Beach Protection Authority from a coastal processes perspective.
199	Letter from Maroochy Shire Council to Minister of Natural Resources	29-Dec-1999 (43)	Submitting formal request for government assistance in funding the current model study and any further construction work	Requesting $1.0 to $2.5 million.
237	Letter from DoE to MSC	5-January-2000 (49a)	Response to funding assistance request	None of the agencies under the Minister's control have any funding available. Council would be eligible to

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				apply for subsidy for the works under the Local Governing Bodies' Annual Capital Works Program
239	Letter from MSC to DoE	6-March-2000 (60)	Minutes of Maroochy River Entrance Working Party meeting of 18 January 1999.	WBM "Last Line of Defence" study accepted by Council. Contains a copy of WBM report "Maroochy River Entrance Relocation Study" (B10374). WBM subsequently commissioned to undertake physical model study of entrance protection options. Nor further approvals to be sought for northern entrance option.