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Restoration of Navigable Entrance to Richmond River Feasibility Study

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Restoration of Navigable Entrance to Richmond River

Feasibility Study

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Prepared By:	BMT WBM Pty Ltd (Member of the BMT group of companies)

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BMT WBM Pty Ltd

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane 4000
Queensland Australia
PO Box 203 Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

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Project Manager :	Malcolm Andrews
Client :	Department of Primary Industries
Client Contact:	Andrew Ling
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Author :	Malcolm Andrews, Lyn Leger, Dean Patterson
Synopsis :	This report presents the findings of a feasibility study into the implications of dredging the Richmond River entrance to provide better and safer navigation of the entrance.

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1 INTRODUCTION

The Infrastructure and Coastal Services Branch of the NSW Department of Primary Industries (DPI) are interested in the feasibility of restoring a navigation channel at the entrance to the Richmond River. This navigation channel would benefit both commercial users (fishing trawlers) and recreational users. The location, arrangement and maintenance requirements will be informed by consultation with stakeholders (refer Section 3) and the understanding and modelling of coastal processes and the possible impacts (refer Section 4). The study will also identify relevant legislation and the approvals that may be necessary for dredging and disposal options (refer Section 5).

2 BACKGROUND INFORMATION

The Richmond River estuary has a long history of boating and waterway use. Prior to the establishment of the rail link to the area in the early 1900's (connection to Brisbane only at this stage, with connection to Sydney in about 1930), nearly everything was transported by sea and river. Accordingly, the major residential areas have established near the river (i.e. Ballina, Wardell, Broadwater, Coraki, Lismore, Casino, etc) and there were many accesses located onto the river for the shipping of timber and produce out and people and supplies in, with a major port precinct existing in Ballina.

The entrance to the Richmond River estuary was recognised as being very dangerous in the earliest surveys of the area dating back to the early 1800's. The entrance was trained in the early 1900's to facilitate safer boat passage into and out of the estuary.

With the advent of rail, the usage of the river changed dramatically. The desire to ship materials decreased due to the inherent danger and potential time implications of this form of transport. Rail had introduced a faster and more economical means of transporting goods. Accordingly, the usage of the river has slowly changed since these times. River training walls were constructed around 1889 to 1911 to provide safer navigation (Figure 2-1 and Figure 2-2).

Today, the primary waterway usage is recreational (swimming, shore based fishing, water-skiing, jet-skiing, passive recreation, etc), however, there are still a number of commercial boats using the estuary for estuary and ocean fishing and charters.

A timeline of significant events is given in Table 2-1 below.

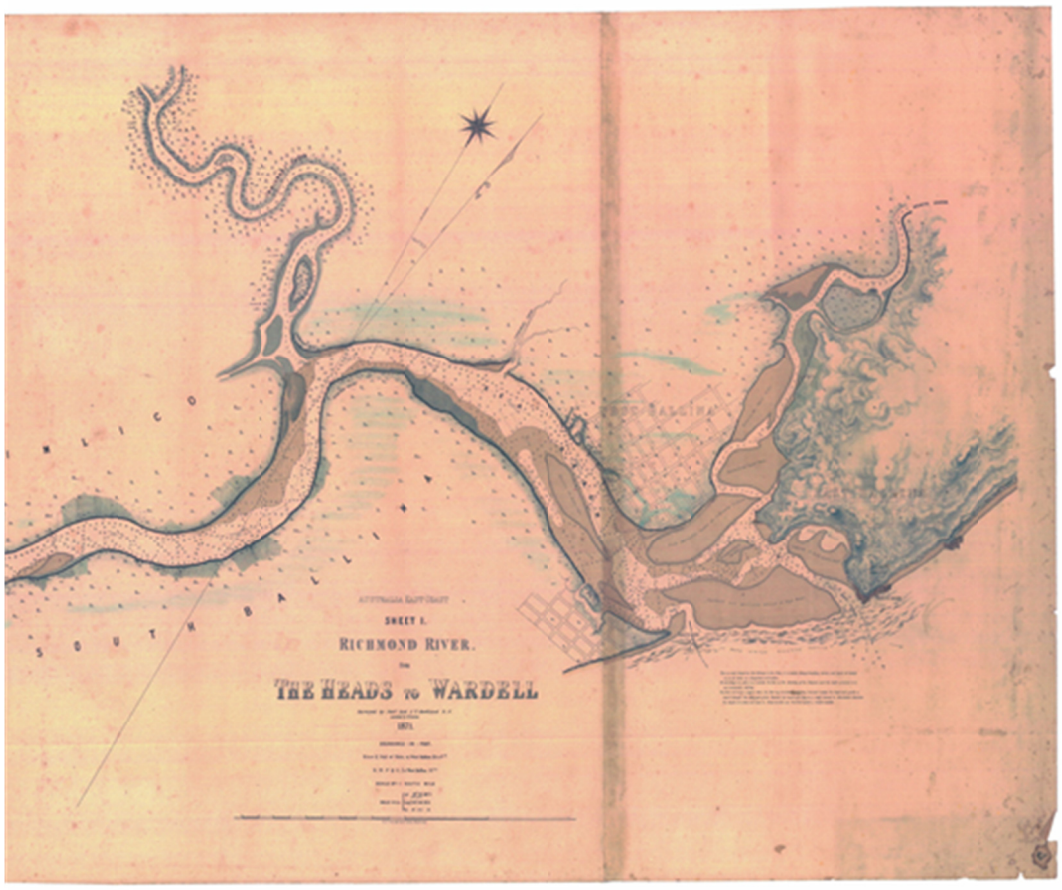


Figure 2-1 1871 Survey of Lower Richmond River

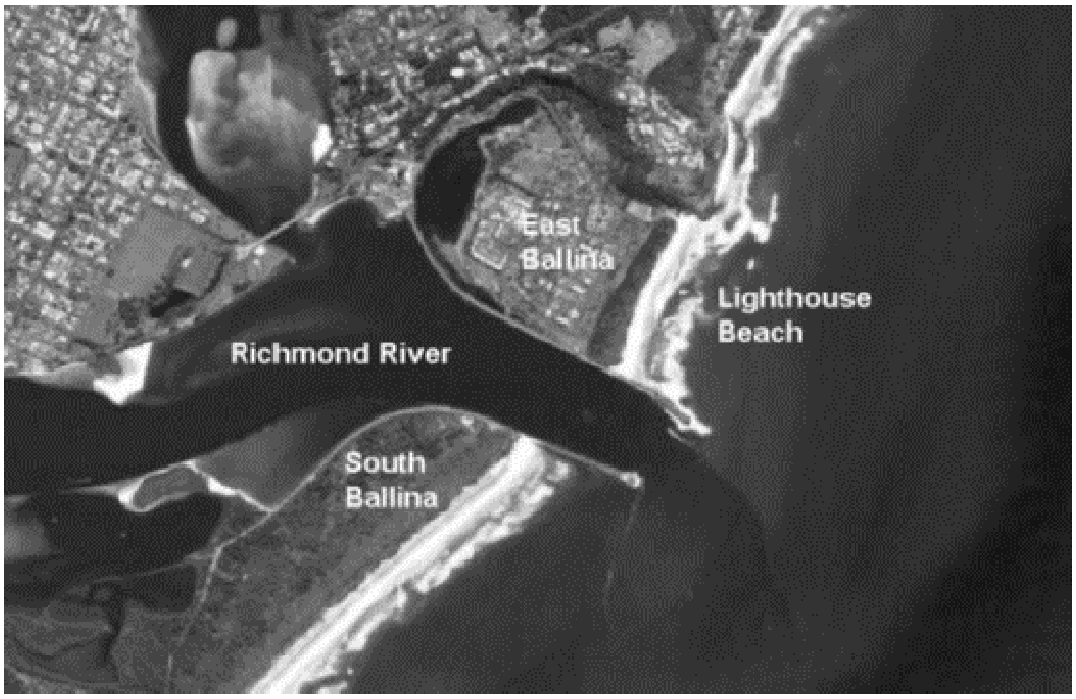


Figure 2-2 Current Richmond River Training Walls

Table 2-1 Timeline of Major Events

Year	Event
1828	Captain Henry Rous "discovered" the area on 26 April 1828
1839	First white settlers 'Big Scrub' rainforest covered ~75,000 ha
1840's	Commencement of large scale clearing associated with cedar logging
1852	Most 'handy' cedar removed from the banks of the Richmond and its tributaries (1), cedar getters move into 'Big Scrub'
1958 or 1960	Major flooding (1)
1863	Commencement of sugar cane cultivation
1871	Large areas of cane planted at North Creek, South Arm, Coraki & Woodburn (2)
1879	Lismore declared a municipality
1885-1887	Practice of slashing & burning, followed by seeding of pasture/maize (2)
1889	Ballina seawall construction commenced, finished in 1911
1892	Paspalum grass planted, beginning of major development of dairy pastures
1893	Major flooding
Early 1900's	• Drainage unions commence flood mitigation works, including wetland draining • Tuckombil canal constructed for flood mitigation purposes, linking Richmond River with Evans River • Major clearing of 'Big Scrub' continues, but most rainforest had by now been cleared.
1903	Casino rail station open and Casino and Lismore were then connected to the North Coast Railway line which at that stage extended to Queensland
1912	Water hyacinth prevents navigation in Richmond & Wilson Rivers
~1930	Works completed on the North Coast Railway Line which connected Sydney and Brisbane
1931	Major flooding
1945	Major flooding
1954	Major flooding
1955	Large scale flood mitigation works commence
1959	Formation of the Richmond River County Council
mid-1960's	Tuckombil canal enlarged Expansion in area of sugar cane farms
1970's	Major decline in dairying, replaced by other agriculture
1971	Construction of Bagotville Barrage (Tuckean Swamp) completed
1974	Major flooding End of use of the estuary for the transport of cane to mills
2001	First report of major fish kills in the river following flooding
2003	Floodgates constructed on Bagotville barrage to improve flushing of Tuckean Swamp
2005	Existing flood mitigation infrastructure: • 76 drainage canals with a total length of 140 km; • 391 flood control structures; • 33 levees with a total length of 75 km; • Tuckombil Canal. 'Big scrub' remnants cover <400 ha (<1% of pre-European area) Population size: 138885 in the entire Richmond River Valley as at 2001

2.1 Current Survey of the Entrance

As part of this study the entrance was surveyed in August 2011. This survey shows minimum depths along the navigation leads of around 3.5m AHD or around 2.7m LAT. A part of the plan of this survey is shown in Figure 2-3 below.

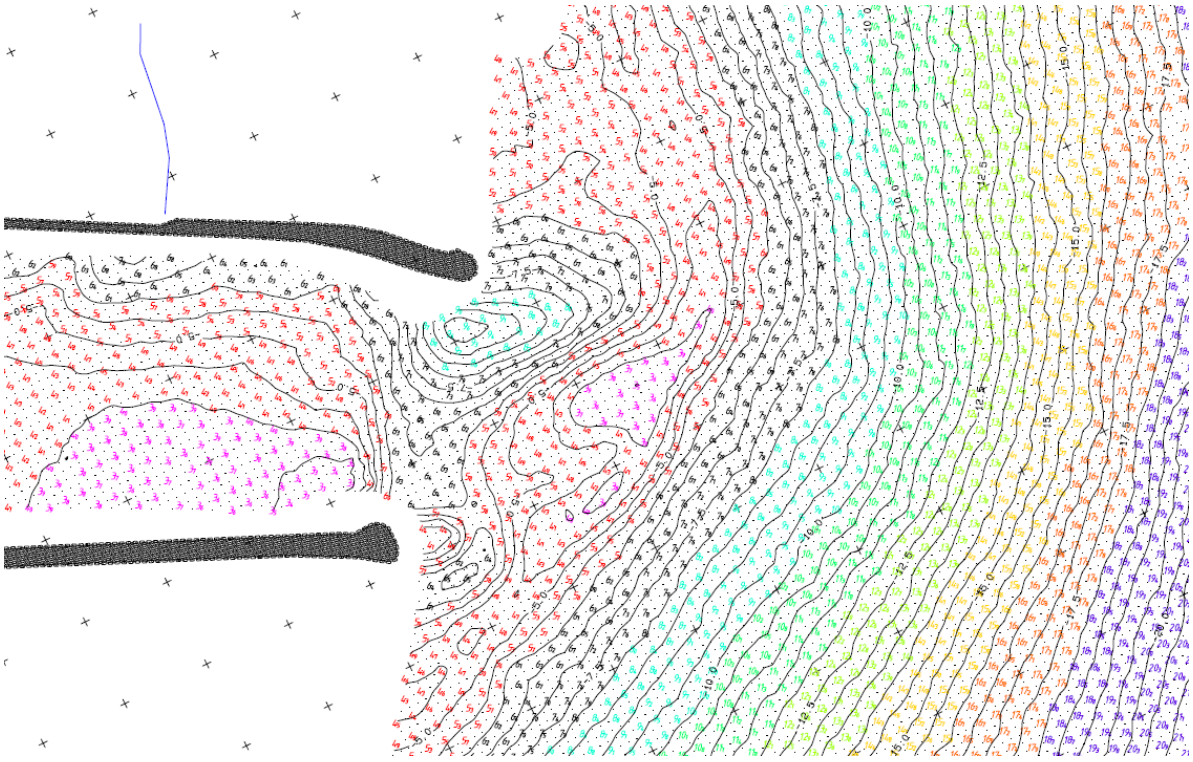


Figure 2-3 2011 Survey of Richmond River Entrance

2.2 Dredging

Previous reports (Webb, McKeown & Assoc. 1993) have indicated that extensive navigational dredging of the lower Richmond River, particularly the entrance area, has occurred since 1883. Before 1911 dredging operations in the lower Richmond River were largely associated with the entrance training works and a navigation channel through the entrance and past the town shoal with much of the dredged material used for landfill at Ballina and hence lost to the active beach system.

Between 1911 and 1974 periodic dredging was undertaken across the entrance bar and in other locations further up the lower estuary where increased depths were required for navigation purposes. Much of this material was side cast onto the shore or used for land reclamation at Ballina or on Pimlico or Cabbage Tree Islands again mostly lost to the active beach system.

Since 1974 (cessation of coastal entrance dredging in NSW) dredging has occurred in North Creek for oyster leases and the extraction of 200,000m^3 in the early 1990's for bridge abutments and associated road works. Currently the only sand extraction occurs upstream around Woodburn/Coraki.

2.3 Coastal Processes

A brief description of the longshore sand transport processes adjacent to the river entrance and further north is given below along with a brief introduction to individual beach units as background to the likely impacts of the proposed dredging described in Chapter 4.

2.3.1 Beach System and Sand Transport

The shoreline of eastern Australia has been naturally evolving over about the last 6,000 years since the sea reached its present level. The geological concept of shoreline evolution between control structures as a result of differentials in longshore transport rates is well known. Artificial structures such as groynes, breakwaters and seawalls can influence such processes through the introduction of new control features or modifications of existing ones. While such features may not alter the broader regional processes, they will cause a change in the local sediment budget and may induce a perturbation which will flow through the system in terms of shoreline response.

The beach system at and north from the Richmond River mouth is shown in Figure 2-4. It comprises a series of compartmented sandy beaches between controlling headlands with underlying bedrock reefs as far north as Lennox Head. Further north, Seven Mile Beach is a long embayed sandy shoreline to Broken Head.

Figure 2-4 Beach System North of Richmond River Training Walls

The construction of the river training walls has modified the local sediment budget as they have acted as a groyne and trapped sand leading to accretion of the beach to the south as well as localised accretion immediately to the north. Insufficient information in available to accurately quantify the volume of sand trapped. However, the shoreline immediately to the south has accreted by more than 200m in width.

This accumulation of sand will have influenced the local sediment budget and needs to be considered in the context of the broader regional sediment budget as well. Nevertheless, it is likely that such accumulation will be causing erosion or slowing recovery of the beaches to the north.

The longshore transport rates at and near the river mouth have been calculated as part of the modelling undertaken for this assessment. The shoreline evolution model (Patterson 2009) has been used to determine daily transport rates over a period of 10 years, as illustrated for the River mouth and Lennox Head in Figure 2-5. This shows that the local shoreline alignment relative to the direction of the prevailing waves has a substantial effect on the short term daily rates even though the longer

term net rates are similar along this beach system. Waves from east to east-southeast will tend to cause southward transport at and south from the river whereas they cause northward transport at a low rate at Lennox Head (northwards transport is in the positive direction in the figure).

The implication of this is that there is a much higher gross sand transport at the river mouth, with substantial daily movements of sand both northward and southward. The plot indicates that a major storm can move up to 15,000m^3 per day and hence substantially infill any previous dredging. This transport has the potential to infill the entrance channel from both sides and/or possibly cause the channel to migrate northward or southward depending on the predominant direction of transport over the medium term (weeks to months).

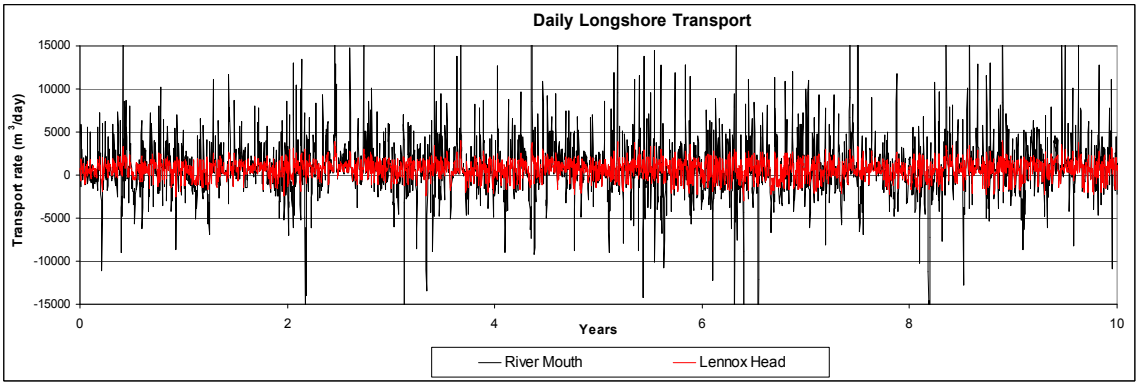


Figure 2-5 Longshore Sand Transport at Richmond River Mouth and Lennox Head

2.3.1.1 Sharpes Beach, Flat Rock and Angels Beach

This beach unit extends between the rocky shoreline at the northern end of Sharpes Beach to Black Head at the southern end of Angels Beach. The rock platform and tombolo formation known as Flat Rock that separates Sharpes and Angels beaches is critical in determining the alignment of these beaches. This tombolo may be lost to coastal erosion (see discussion below) therefore these areas are considered here as one beach unit.

The coastline values ascribed to this beach unit that are considered to be under specific coastal erosion hazard threat are discussed further below.

2.3.1.2 Sandy Beach at Sharpes Beach

The northern end of Sharpes Beach is backed by cobbles which are periodically covered with sand depending on prevailing conditions. This cobble field extends for approximately one-third of the length of the beach.

The sandy beach is currently lost or reduced periodically, particularly following storm events. The frequency and duration of periods when the beach is lost or reduced will increase as the shoreline recedes.

Long term coastal erosion is not expected to proceed landward of the cobbles along the landward edge of the northern third of Sharpes Beach by virtue of their stability. The landward extent of permanent coastal erosion in the 50 and 100 year planning timeframes for this beach unit are estimated to be in the order of 20m to 35m respectively (sea level rise and long term shoreline recession). Therefore, the beach, which has a maximum width of around 50m, may be severely

depleted in the medium to long term as the shoreline recedes in much the same way as a beach may be lost 'against' a seawall.

Coastal erosion south of the cobble field (the southern two thirds of the beach) is not limited by cobbles and is likely to proceed landward without significant loss of the sandy beach, although there will be some loss of the coastal heath landward of the beach.

2.3.1.3 Flat Rock Tombolo

The large intertidal rock platform between Sharpes and Angels beaches, known as Flat Rock, and its tombolo are ascribed high recreational and ecological value primarily for their diverse intertidal habitat, relatively safe swimming conditions and important and extensive shorebird habitat.

WBM (2003) suggests the detachment of Flat Rock from the mainland, i.e. the loss of the tombolo, is possible, although the complexity of the system prohibits more detailed predictions. Currently, only a moderate storm can reduce the sand volume of the tombolo sufficiently to allow seawater to wash over it demonstrating that detachment is quite possible in a severe storm.

Loss of the tombolo would lead to loss of the ecological value of shorebird habitat and recreational values associated with this unique expanse of sand. It would also lead to substantial erosion and realignment of both Sharpes and Angels beaches, and *may* threaten the Flat Rock Tent Park camping ground, and the car park and small toilet block to its north. These facilities, however, are somewhat elevated and coastal erosion protection will still be offered by the rock platform even in the absence of the tombolo. Therefore, these facilities are not currently considered to be under coastal hazard threat.

While the alignment of the coast following detachment cannot be determined, the beaches themselves are likely to remain in some form due to the significant landward sand source and should not be considered to be under coastal hazard threat.

In the event of detachment, the ecological value of the rock platform will remain largely intact, although sea level rise may impact on the intertidal ecology separately from its influence on coastal erosion.

2.3.1.4 Shelley Beach and Lighthouse Beach

These two beach units, while distinct, are considered together as neither is expected to suffer significant coastal erosion and the values ascribed to them are largely unthreatened.

WBM (2003) estimates that both Lighthouse and Shelley beaches will experience relative stability into the future, with some possible rotation (shifting of sand from one end of the beach to the other in response to prevailing wave direction governed by La Niña and El Niño conditions). The report notes protection may be offered by the northern training wall of the Richmond River entrance.

While some coastal erosion is estimated, the extent of the foredunes of both beaches and the protection offered by Ballina Headland and the associated rocky reef (that separates the beaches) are expected to protect all of the values ascribed to these beaches.

2.3.1.5 South Ballina Beach, Beswicks Beach and Robins Beach

This beach unit extends from the southern training wall of the Richmond River entrance to a point immediately north of Patchs Beach settlement, approximately 10 km south along the coast.

The construction of the training wall at the northern extent of this beach unit captures sand travelling under the influence of the predominant northerly longshore drift on this coastline. As a result its northern section (around 3km) has not experienced the dominant regional effect of long term shoreline recession over the last 60 years, but rather has experienced accretion. Realignment effects, resulting in general accretion as far as 10-14km south of the training wall (beyond this beach unit) are also noted in WBM (2003) however it is not clear if this is solely due to the influence of the training wall, or if changing weather patterns (i.e. La Niña and El Niño) have also contributed.

WBM (2003) suggests that this slight ongoing accretion may continue for a period after which regional shoreline recession will begin to dominate local processes again. Therefore it recommends a precautionary approach for planning purposes.

While there will be some very small losses of coastal heath as a result of shoreline recession, it will be negligible relative to the total area. Two sites of Aboriginal cultural significance, an artefact scatter (DECC ref: 4-5-005) and a midden (DECC ref: 4-5-047), may be lost as a result of coastal erosion. None of the other values ascribed to this beach unit are considered to be under threat of coastal erosion hazard.

2.4 Estuarine Processes

As well as the impacts of the training walls on local sand distributions, the dredging of the lower estuary may have implications on loss of sand to the beach system. To further understand this potential the major processes are described below with the resultant sand distribution and transport pathways within the lower estuary.

2.4.1 Tidal Dynamics

2.4.1.1 Tidal Plane

The astronomical tide for Ballina is semi-diurnal with typical water level fluctuations as shown in Table 2-2, derived from tide tables published by the Australian Hydrographic Service, 2004.

Table 2-2 Tidal Planes at Ballina

Tidal Plane	Level m (LAT)
MHWS	1.4
MHWN	1.1
MWL	0.8
MLWN	0.5
MLWS	0.2

2.4.1.2 Flood and ebb Tide Flows

These water level fluctuations cause ebb and flood tide flows in the Richmond River and its tributaries. It has been reported (Webb, McKeown & Assoc. 1993) that there has been only one major tide flow gauging on the Richmond River. This occurred in May 1977 and it indicated that for an

ocean tidal range of 0.7m, the peak flood flow is of the order of 750m^3/s, and for a range of 0.5m in the peak ebb flow, is 550m^3/s. Cross-section averaged peak tidal velocities were 0.4m/s on the flood tide and 0.3m/s on the ebb tide respectively. The recorded peak surface velocity was in excess of 1.0m/s, but peak velocities approximately 1m above the bed were around 0.3m/s on the flood tide and 0.2m/s on the ebb tide respectively.

2.4.1.3 Tidal Prism Volumes

Tidal prism measurements during a spring tide on 3/11/94 (MHL Report-1200, June 2004) taken 870m upstream from the entrance indicated a flood tide volume of 25 x 10^6 m^3 for a tidal range of 1.56m and an ebb tide volume of 21.9 x 10^6 m^3 over a tidal range of 1.53m.

2.4.1.4 Tidal Range

Tidal gradients for the lower Richmond River for 1972 show the tidal range contracts from 1.36m at the ocean (Mean Spring Tide) to 1.06m at Missingham Bridge, Ballina. Figure 2-6 shows the tidal gradients in the lower estuary.

The tidal range is of interest in this study as a tidal range greater than 0.5m is will produce bed velocities exceeding 0.3m/s in the entrance area and this is the approximate threshold for bed sediment movement of medium grain sized sand. For the Ballina Bar the Mean Spring Tidal range is 1.2m and the Mean Neap Tidal Range is 0.6m indicating that sediment movement will occur on all tides. Also, as peak velocities are generally higher during the flood tide than during the ebb tide (due to shallow water and friction effects on the tidal wave), sand is moved into the lower estuary by tidal flows. This is later flushed back out in flood flows when peak velocities exceed 0.3m/s.

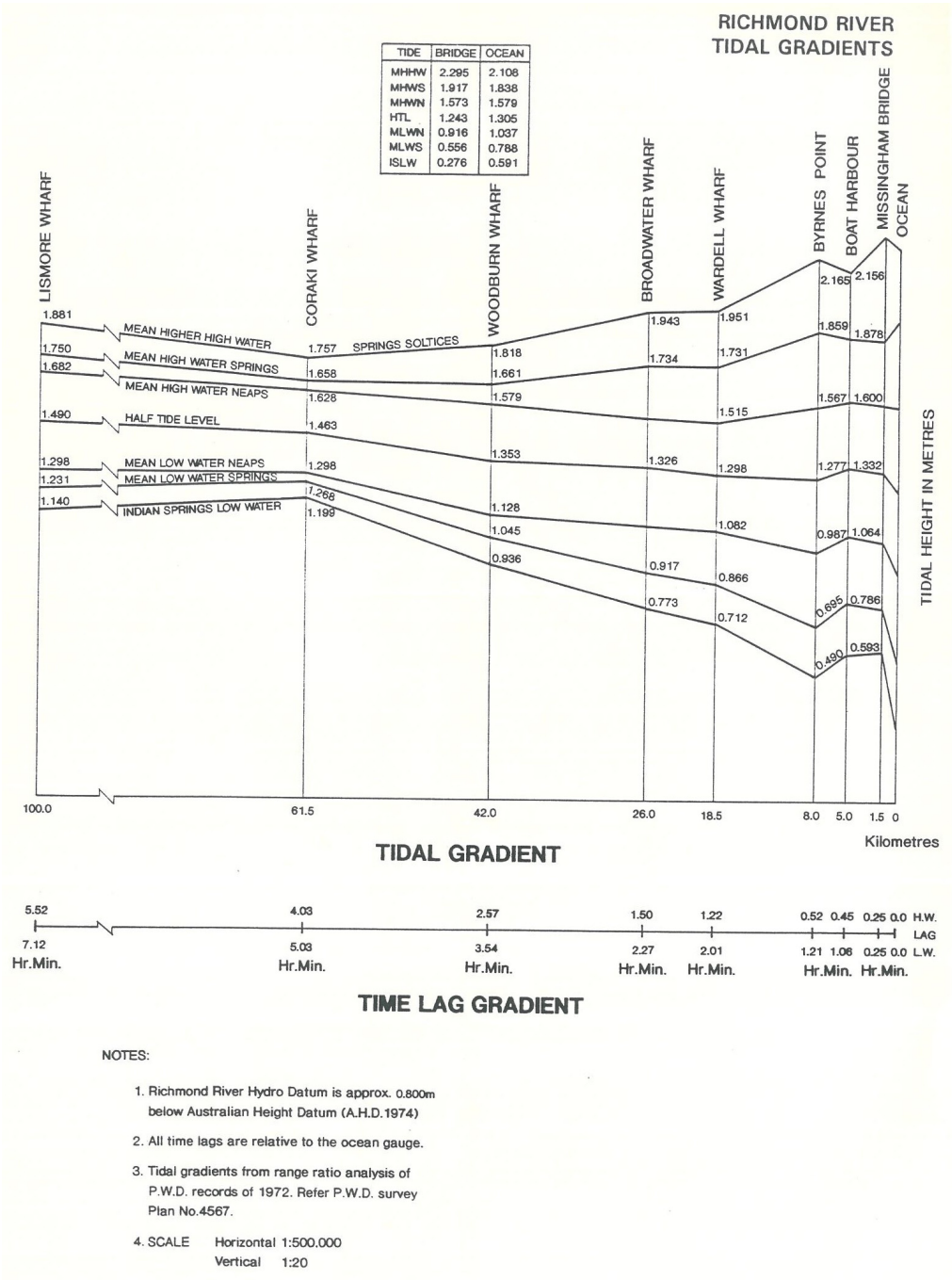


Figure 2-6 Tidal Gradients in the Richmond River Estuary

2.4.2 Elevated Water Levels

As well as daily tides there are other factors affecting water levels including:

- Storm surges associated with cyclones and low pressure systems;
- Wave setup; and
- Sea level rise associated with climate change (see Section 2.3.3).

Elevated water levels occur during storms as a combination of storm tide (tide plus surge due to barometric pressure and wind setup, including potential effects of climate change), wave setup and

wave runup. The dredging of the bar is unlikely to have a perceptible influence on storm surge propagation as the long wave length of a storm surge means that it will be experiencing bottom friction for many kilometres before reaching the shoreline.

Wave setup occurs at the beaches and in those estuaries with shallow entrances where wave breaking occurs. For the Richmond River little wave setup will be apparent upstream of the mouth. Wave runup will only occur on the beach/dune slope and may result in dune overtopping if the dune height is inadequate.

A previous study (WBM, 2003) has assessed the peak storm tide levels and wave set-up components for the open coast areas for various planning periods and probabilities of occurrence, based on the available wave data as presented above and storm tide statistics derived for the Gold Coast region (James Cook University, 1977). For this purpose, peak wave setup is taken as 15% of the significant wave height for the recurrence interval considered. Wave runup is only considered on the open coast. The results are outlined in Table 2-3.

Table 2-3 Storm Tide and Wave Setup Levels for Ballina Coast Region

Planning Period	Storm Tide and Wave Setup Levels for Recurrence Intervals Shown					
	1 in 20 years		1 in 50 years		1 in 100 years	
Total water level	Storm Tide Level (mAHD)	Wave Setup Level (mAHD)	Storm Tide Level (mAHD)	Wave Setup Level (mAHD)	Storm Tide Level (mAHD)	Wave Setup Level (mAHD)
Immediate	1.24	2.24	1.30	2.39	1.35	2.51
50 Years	1.44	2.44	1.50	2.59	1.55	2.71
100 Years	1.74	2.74	1.80	2.89	1.85	3.01

The increase in level for the different planning periods is related to predicted increases in mean sea level associated with the enhanced Greenhouse Effect as described further in the following section.

2.4.3 Climate Change

2.4.3.1 General Considerations

Current concerns with climate change arise from scientific research indicating that the balance of evidence suggests a discernible human influence on global climate. Increasing concentrations within the earth's atmosphere of various gases, largely derived from the burning of fossil fuels, are trapping solar radiation. The resulting global warming (enhanced Greenhouse Effect) has the potential to change weather systems, rainfall patterns, wind velocities and, significantly, cause mean sea level to rise. These factors all can have an impact on the environment within the coastal zone and lower estuaries.

In the section below the predicted sea level rise and its impact on the coastal zone and the lower estuary are given.

2.4.3.2 Sea Level Rise Prediction and Impacts

There are uncertainties as to the actual magnitude and rate of rise of sea level as a result of thermal expansion of the oceans and melting of glaciers and ice-sheets. This has led to various scenarios being adopted by the Intergovernmental Panel on Climate Change (IPCC). They are based on the range of model results available and dependent upon the amount of future emissions assumed.

The NSW government has released its own policy statement *NSW Sea Level Rise Policy Statement (New South Wales Government, 2009b).* A focus of this policy is addressing medium to long-term impacts of Sea Level Rise (SLR), providing guideline values for adoption in planning and design.

Based on the information considered by the authors to be the "*best national and international projections of sea level rise along the New South Wales Coast*", the New South Wales Government has adopted the following benchmarks:

- An SLR of 40 cm by 2050 (relative to 1990 levels); and
- An SLR of 90 cm by 2100 (relative to 1990 levels).

In a technical note accompanying the policy (New South Wales Government, 2009a), the SLR benchmarks are noted to include components relating to thermal expansion, accelerated ice melt and regional variation, caused by changes to ocean currents, water temperature and other more complicated factors. The technical note also refers to analyses of satellite data from 1993 to 2007 (Beckley et al., 2007), indicating that the recent average global SLR occurred at rate of 3.4 ± 0.4 mm per year. The policy notes that higher SLR values are possible.

The rise in mean water level will mean that there will generally be a greater depth of water in the estuary and the tide would be expected to propagate further up the estuary changing salinity gradings. This elevated water level and increased salinity in upper reaches will impact on the ecology of these areas.

The impact of rising sea level on the nearshore region is unclear at this stage but the changes are likely to occur at greater speed that geological changes. However, a conservative assumption would be that the coastal processes that form the bar at current water levels will also exist in the future and the bar will remain.

2.4.4 Sediment Dynamics

2.4.4.1 Surface Sediment Distribution

The surface sediment distribution within the lower Richmond River is set out in Figure 2-7. This distribution reflects a combination of the:

- Sedimentary geology of the valley;
- Natural sediment transport mechanisms; and
- The impact of human activity.

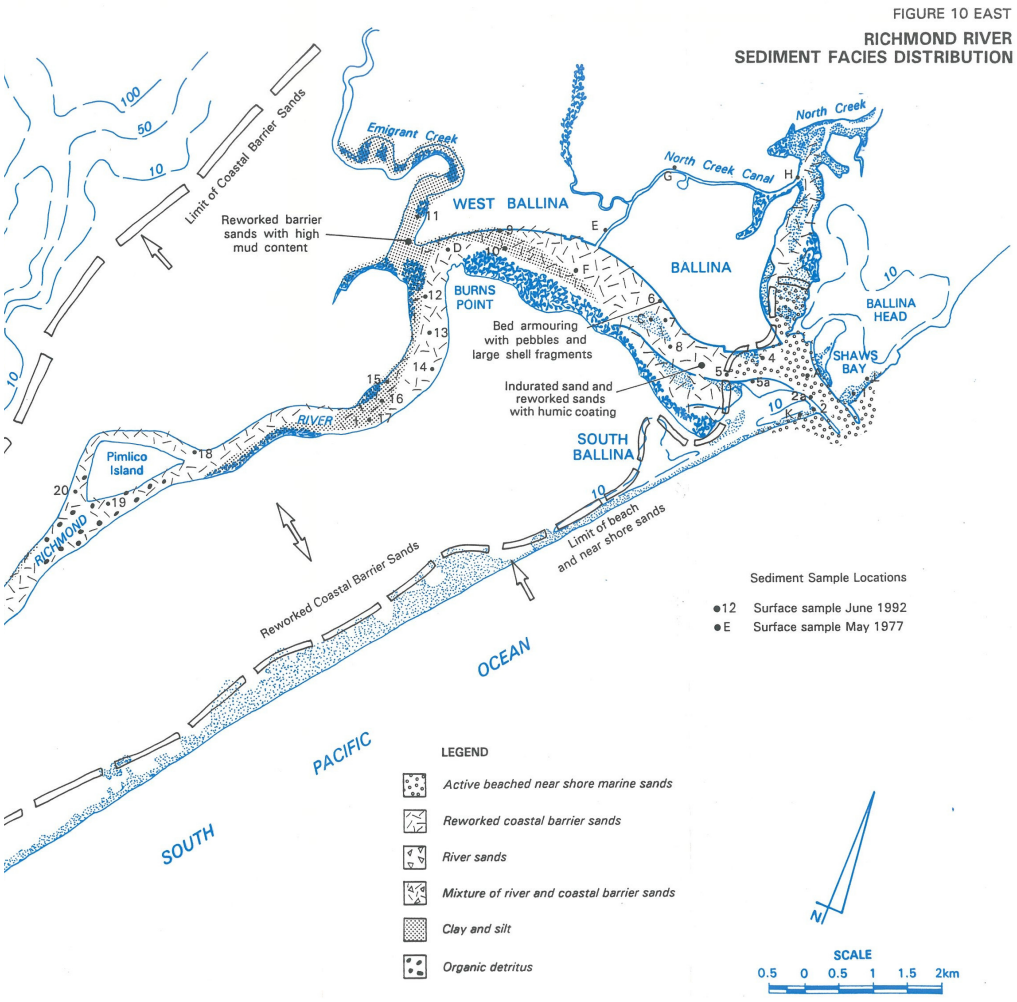


Figure 2-7 Lower Richmond River Sediment Facies Distribution

From sediment analyses, the extent of beach sands in the main river is the shoal near southeast Ballina (Kingsford Smith Drive). Marine sands also extend into North Creek, possibly as far upstream as the North Creek Boat Ramp. The beach and nearshore sediment facies distribution therefore largely corresponds with present day coastal zone (where wave and tidal currents dominate the depositional process).

2.4.4.2 Conceptual Model of Sediment Dynamics

A conceptual model of the sediment dynamics of the lower Richmond River is shown in Figure 2-8. The main features of the model are summarised as follows:

- The system is very stable with little sediment movement other than fluvial reworking during major floods and some wave stirring and tidal movement near the entrance;
- The bed sediments are mainly fine to medium quartz sands;
- The active marine delta extends some 2,200m upstream of the entrance to the shoal near south-east Ballina (Kingsford Smith Drive);

- Sediments of the active marine delta are fawn coloured, fine medium grained quartz sands, well sorted with some well-rounded shelf fragments and iron staining;
- Re-worked coastal barrier sands lie between the marine sands and river sands. They extend upstream from the town shoal at Ballina to the reach downstream of Woodburn (42km distant);
- Some re-working of the Ballina town shoal occurs due to locally generated wind waves and tidal currents. Sedimentologically it is not part of the active marine delta;
- Coastal barrier sands are predominantly quatzose, generally grey in colour (with a washed appearance) but some grains have a dark brown humic coating. There are fewer shell fragments. Grain size distribution and degree of rounding is similar to the marine sands except that silt and clay content can be high;
- Bank erosion does not contribute significantly to the sediment supply;
- Tributary streams do not contribute significantly to the sediment load other than clays and silts during rainfall runoff events;
- River sands occupy the upper reaches of the River and are sourced from erosion of the upper catchment. They are predominantly quatzose although the lithic content can be up 25%. Grain size generally decreases downstream;
- River sands stained with iron-cement are sourced from weathered sandstone in the upper catchment. Grain size varies but is generally fine to medium, grains are sub-rounded or sub-angular; and
- Clear river sand grains are angular and sourced from weathered igneous rocks, mainly from the Wilsons River catchment.

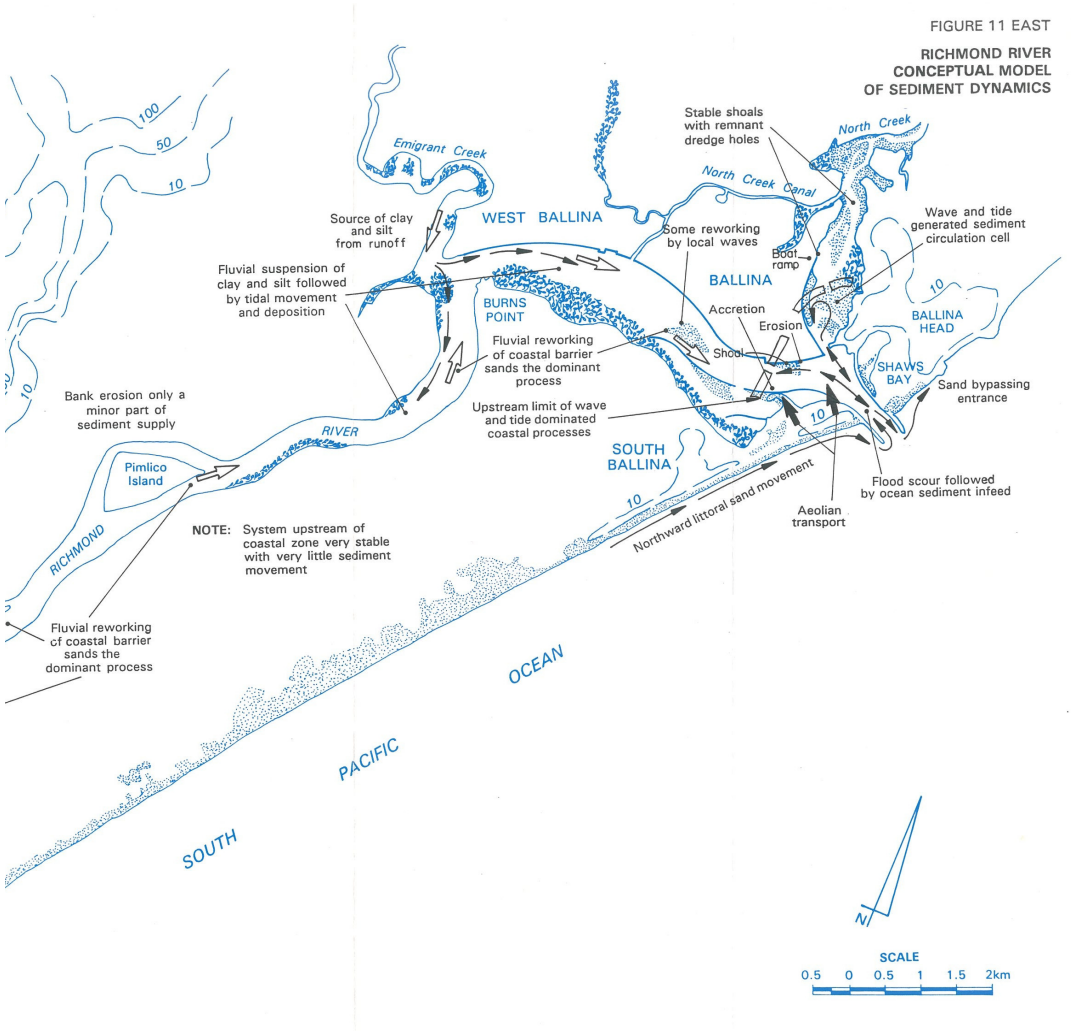


Figure 2-8 Lower Richmond River Conceptual Model of Sediment Dynamics

2.5 Historical Responses to Change

2.5.1 Lower Estuary Changes

The shoreline has been naturally evolving over about the last 6,000 years since the sea reached its present level. The geological concept of shoreline evolution between control structures as a result of differentials in longshore transport rates is well known. Artificial structures such as groynes, breakwaters and seawalls can influence such processes through the introduction of new control features or modifications of existing ones. While such features may not alter the broader regional processes, they will cause a change in the local sediment budget and may induce a perturbation which will flow through the system in terms of shoreline response.

The Richmond River training walls were constructed in the late 1800's/early 1900's. Hall (1983) reports the following sequence of events from the records in Public Works files:

1885	Inspection of the Site.
1887	The Report Presented.
1998	The Parliamentary Committee examination.
1892	Two quarries operating: one at Prospect, one at Riley's Hill.
1894 – 1895	South Wall 625 feet long.
1894	North Creek Guide Wall finished May.
1896	North Creek Canal opened.
1898	Forced to concentrate on South Wall because of sand blowing.
1899 – 1900	All work on South Wall.
1900 – 1901	Workmen back to the North Wall.
1905	Last work on the North Wall.
1910 – 1911	Still 71 feet short of Coode's recommended length, and subsidence at head of South Wall is troublesome.
1911 – 1912	Work ceased.
1937 – 1939	Repair work carried out.

Navigation channel dredging was carried out in the lower estuary until 1911 but had reduced significantly between 1911 and 1974 when it stopped. This dredging would have improved channel efficiency and allowed an increase in tidal range. However, it is likely that the impacts of this dredging have been attenuated over time and that sand shoals have re-established to near original conditions (some changes due to training works).

More recent dredging in North Creek has confirmed that estuarine processes are slow in this region although stakeholders report filling of North Creek.

One extractor removes 39,564m^3/a of material in the mid to upper reaches of the estuary. This extraction is regulated and monitored by the Department of Lands. The response of the estuary to this regular extraction is likely to be consistent with historical levels, however these have not been monitored.

It has been reported (Webb, McKeown & Assoc. 1993) that riverbed levels have been consistent since surveys commenced in 1871 indication little siltation or scour in the lower estuary.

2.5.2 Coastal Shoreline Responses

The Richmond training walls were constructed between 1889 and 1911 and the northern wall was also extended by about 200m between 1965 and 1968. The construction of the training walls has modified the local sediment budget as they have acted as a groyne and trapped sand leading to accretion of the beach to the south as well as localised accretion immediately to the north in the small pocket beach created in the form of Lighthouse Beach. Insufficient information in available to accurately quantify the volume of sand trapped. However, the shoreline immediately to the south has accreted by more than 200m in width.

This accumulation of sand will have influenced the local sediment budget and needs to be considered in the context of the broader regional sediment budget as well. Available photogrammetric survey profile data indicates that accumulation is still occurring to the south of the River training walls over a substantial distance. The volume changes from 1965 to 1981 and 2000 along the shoreline to the

immediate south of the Richmond River are in the order of 200-300m^3/m.. It is unclear as to the extent this increase is due to:

- Ongoing shoreline realignment due to the walls;
- Rebuilding of dunes previously depleted by aeolian losses onshore due to wind erosion; or
- Natural beach rebuilding due to the prevailing wave conditions.

Nevertheless, it is likely that such accumulation will be causing erosion or slowing recovery of the beaches to the north.

2.5.2.1 Previous Studies

Huang et al (1999) studied the adjacent shoreline changes between 1947 and 1991 from photogrammetric analysis and concluded that:

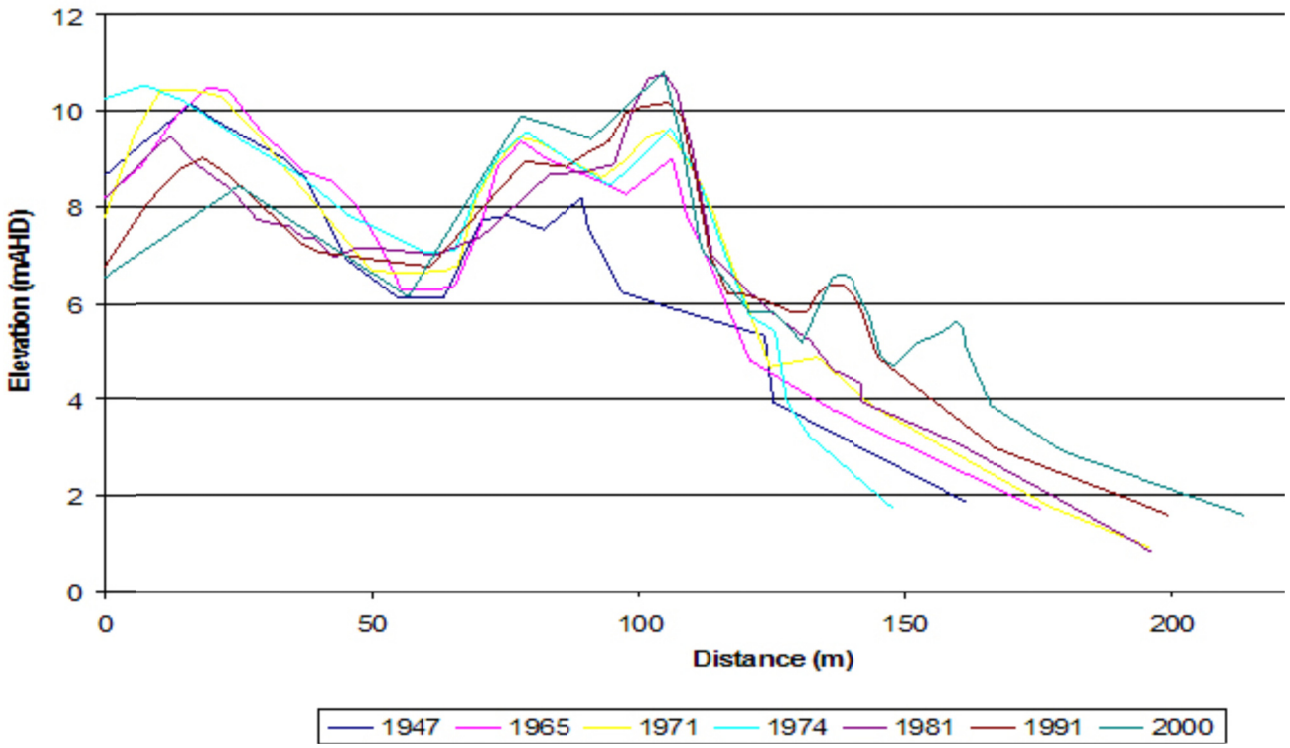
- The walls caused accretion at both South Ballina and Lighthouse Beach;
- Storm erosion in 1974 caused extensive erosion of all beaches in the area and temporarily disrupted the prevailing trend of adjacent shoreline changes;
- After an initial high rate of shoreline change, by 1981-1991 an equilibrium shoreline position was being approached; and
- By that time, total sand bypassing of the walls had been restored.

WBM (2003) analysed the photogrammetric data for the period between 1947 and 2000 and also reviewed other available information on changes following wall construction, finding that there was a significant northward net longshore sand transport, possibly as high as 350,000 m^3/year at the time of wall construction, with associated substantial accretion along about 8 to 10 km of the shoreline south of the walls. Patterson (2007) analysed longshore transport rates along the whole region from Iluka to the Gold Coast and found a consistent progressively increasing pattern of net transport, with a contemporary rate at South Ballina of about 260,000 m^3/year that may have been higher prior to training wall construction.

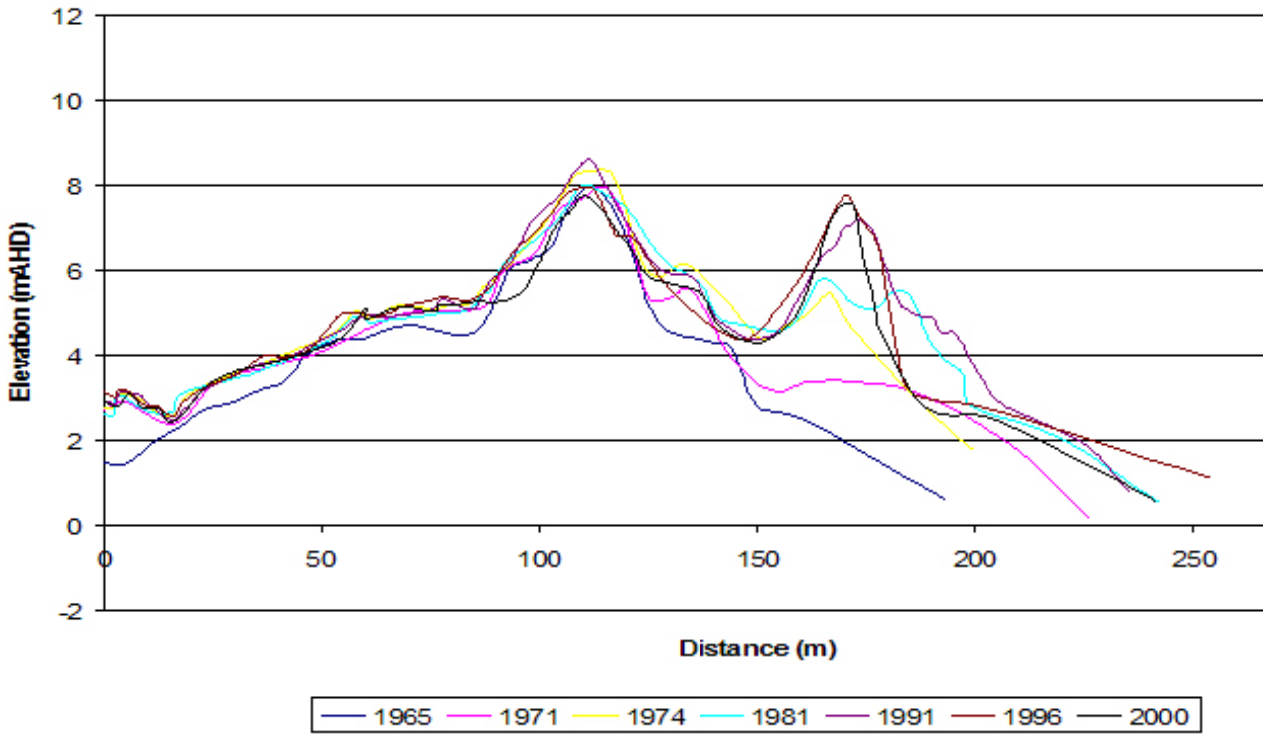
This pattern of significant northward net longshore transport and extensive shoreline accretion south of the walls suggests that there would have been a corresponding large-scale net loss of sand further north. This may have affected beaches north to Lennox Head. This was assessed by the modelling undertaken, as outlined below.

2.5.2.2 Measured Historical Shoreline Changes

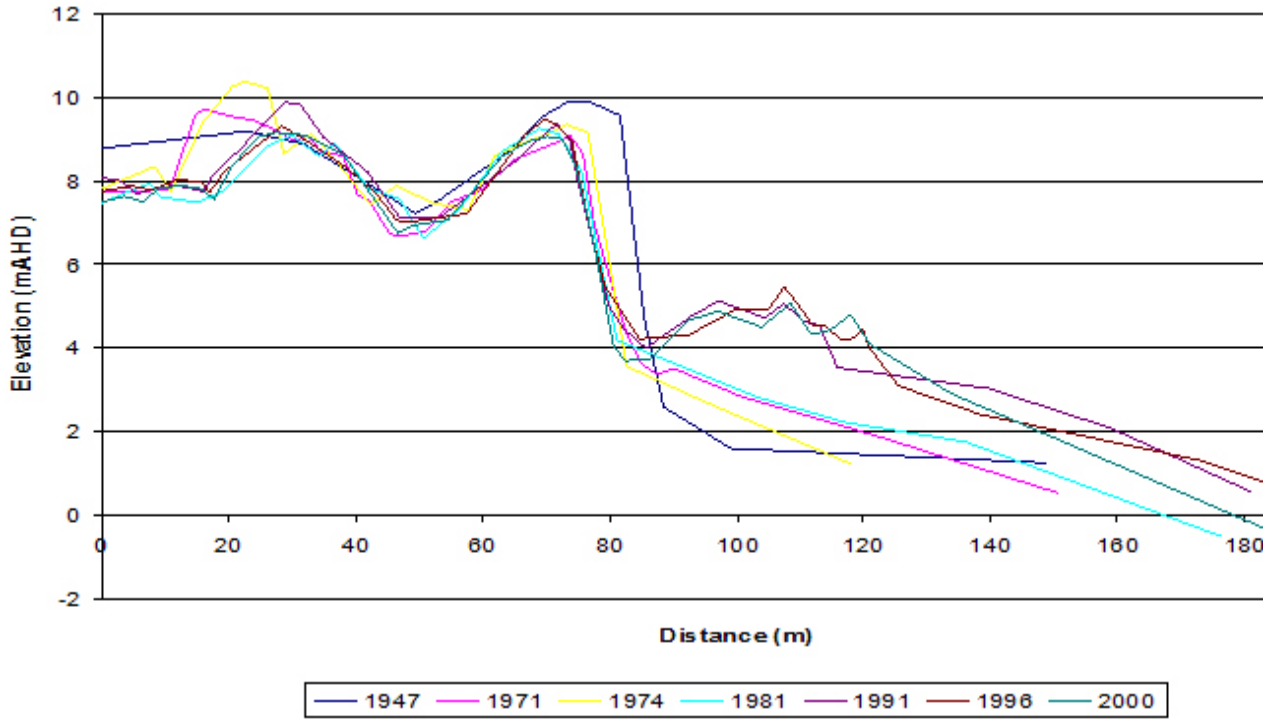
The photogrammetric data represents the only reliable source of quantitative information on shoreline changes in the region. The earliest date of suitable photography is 1947, some 55 years after commencement of the training wall construction. This data shows only the behaviour above the water level, potentially missing a large proportion of the total profile changes. Examples of the photogrammetry are shown in Figure 2-9 for South Ballina, Lighthouse Beach, Angels Beach and Seven Mile Beach (Lennox Head).



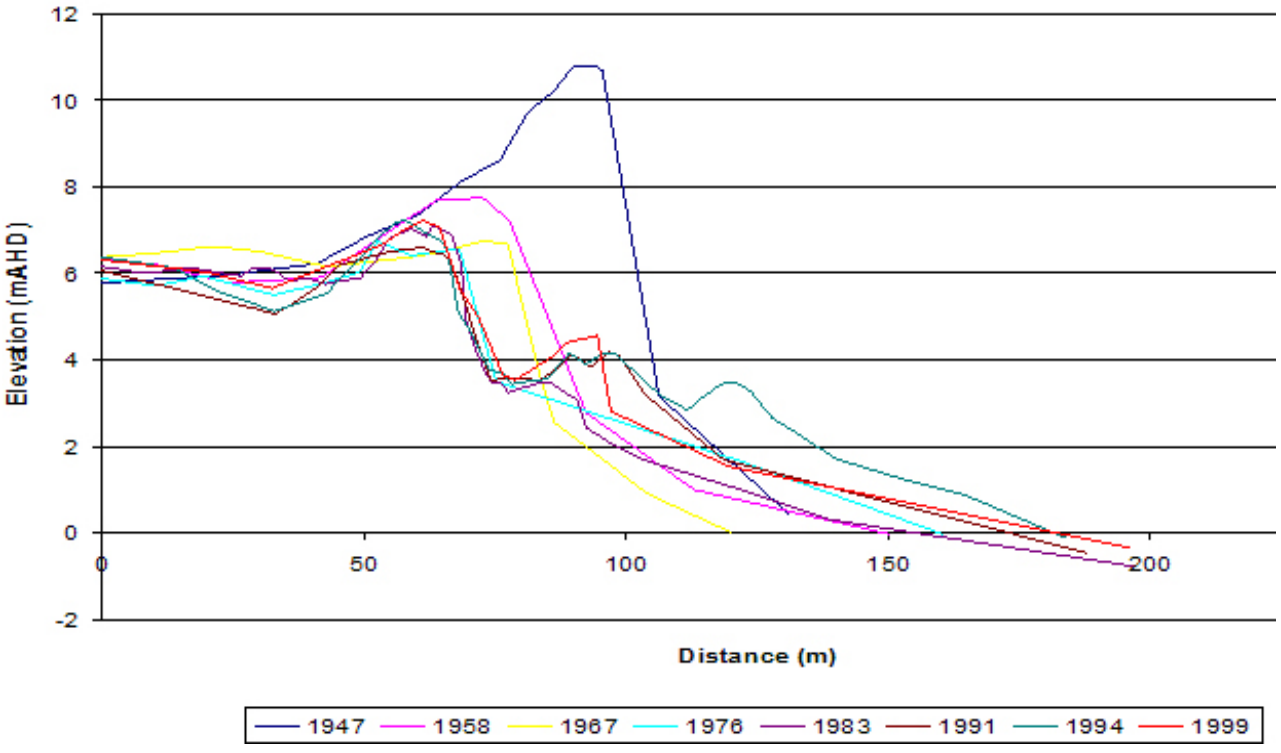
South Ballina



Lighthouse Beach



Angels Beach



Seven Mile Beach (Lennox Head)

Figure 2-9 Photogrammetric Analysis of Beach and Dune Changes Since 1947 (from WBM Oceanics Australia 2003)

This data shows that:

- There had been considerable erosion of the main 10m high dune system north from Angels Beach to Seven Mile Beach prior to 1947;
- There is a lag in the major dune erosion with distance north, Seven Mile Beach still showing progressive retreat well after the beaches closer to Ballina had reached their most landward position;
- The erosion of the beaches north of Ballina continued through to 1967 – 1974 after which the dune system has accreted at a lower level of about 5m;
- There was apparent erosion with a steep scarp at South Ballina through to 1974, after which that beach and dune system has shown steady accretion; and
- Lighthouse Beach has experienced significant accretion of a substantial dune system since 1947.

Patterson (2007) analysed longshore transport rates along the whole region from Iluka to the Gold Coast and found a consistent progressively increasing pattern of net transport, with a contemporary rate at South Ballina of about 260,000m^3/year increasing to over 400,000m^3/yr at Tallow Beach. This gradient in longshore transport would cause long term progressive recession of the shoreline at Seven Mile Beach. However, it is also likely that there is some residual shoreward supply of sand into this beach system, thereby at least partially offsetting the tendency for shoreline recession.

Patterson (2009) modelled the impacts of the training walls on the beach system and found that there has been a long term reduction in the annual average rate of transport past the Richmond River and the downdrift beaches. It was shown that the rocky and pocket beach nature of the coastline between Ballina and Lennox Head are such that:

- Only limited erosion occurs due to the bedrock controls of the headlands and underlying reefs; and
- A substantial proportion of the sand losses caused by the training walls are transferred north relatively quickly to Lennox Head and Seven Mile Beach.

The modelling indicated that the downdrift erosion from the training walls had a major effect on Lennox Head over several decades from prior to 1947, decreasing since about 1980 as the longshore sand transport supply resumed. There is evidence of shoreline recovery ay Lennox Head over the past decade, although this is most probably an effect superimposed on a longer term trend of recession. The modelling also indicated that the effects of the training walls have not yet affected the beaches at Suffolk Park or Tallow Beach, although there is potential for the erosion to be felt there over the next 100 years.

Therefore, it is evident from these studies that the works at the Richmond River mouth such as dredging or extensions to the walls will potentially impact on the beaches north to Lennox Head and Seven Mile Beach.

3 STAKEHOLDER CONSULTATION

3.1 Methodology

Consistent with our proposal, Damion Cavanagh, from the BMT WBM Bangalow office, has consulted local and state government agencies and external stakeholders as discussed with DPI at the initiation meeting. Stakeholders who have been consulted include NSW Roads and Maritime, Commercial Fishers, Volunteer Marine Rescue, Surfriders Association, NSW Office of Environment and Heritage and Ballina Shire Council.

The process of consultation has included:

- Initial letters to stakeholders (include example in Appendix A);
- Phone call to stakeholders; and
- Face-to-face meeting with stakeholders.

Generally either a phone call or face-to-face meeting was held with each of the stakeholders and no written submissions were received. A total of four face-to-face meetings were held with included representatives of NSW Roads and Maritime, Commercial Fishers, Volunteer Marine Rescue and Surfriders Association. Phone discussions were held with officers of NSW Office of Environment and Heritage and Ballina Shire Council, although no verbal or written input was received.

In the consultations, the representatives were informed of the bar dredging proposal being considered by DPI and the stakeholders were prompted to outline their ideas and concerns with the dredging and spoil disposal.

NSW Roads and Maritime (Darren Watson)

- The bar has a history of boating incidents including a fatality (23 documented incidents since 1992). In many of these incidents ebb or low tide has been implicated. RMS has information available to boaters to identify that ebb and low tide crossings are identified risk factors in boating incidents.
- The bar conditions have improved since around Christmas 2011.
- RMS may, in consultation with others, recommend temporary suspension of bar crossings if deemed unsafe to navigate. The leads may remain in place during this time and until safer conditions return.
- Generally dangerous wave conditions are found on inside of south wall on the ebb tide, also there may be some short sharp waves appearing near the bar (above typical wave height) which may have resulted in boat overturns. The wave action inside the south wall has been observed by RMS to be more consistent and frequent in its cycle of occurrence. These waves form and break very rapidly and extend further or travel further upstream from the river mouth.
- In terms of dredging, as much as possible should be dredged along the leads inshore and offshore if it assists in improving navigation and safety conditions.
- Other factors may be contributing to the current “bar” situation including rapid siltation in the lower estuary. This sand does not appear to have been removed by recent floods. Recent visual RMS observations indicate that siltation matters including the Richmond Bar and upper

estuary area may be very closely aligned. In particular around the Messingham bridge entrance to North Creek. Also the area from North Creek between Messingham Bridge and Munsie Point Bridge continues to shallow at a rapid rate with sand build up extending further south west almost adjacent to Namatjira place.

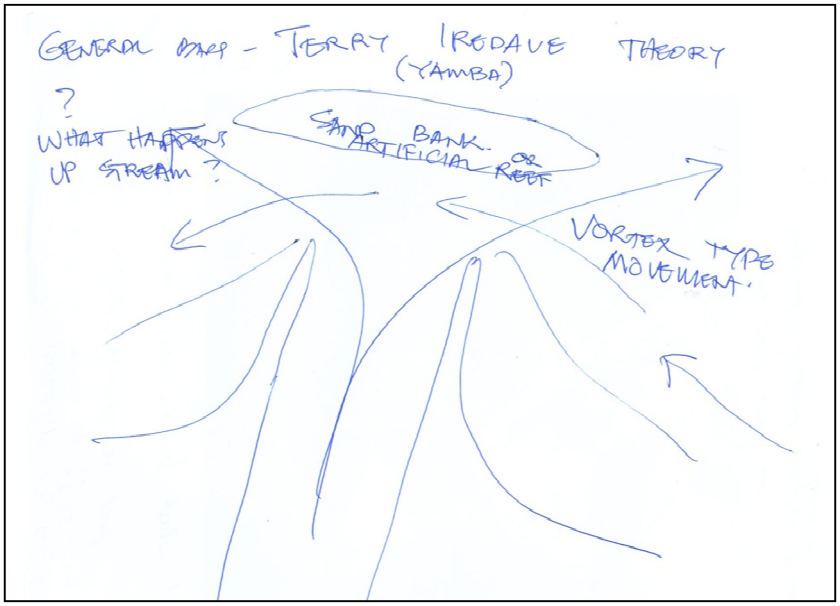
- In terms of offshore dumping, be aware of possible strong currents that head to the south along the coast. Over recent times in close off the Ballina township the current has been noted running strongly south to approximately 4 to 5 knots, it is unknown if this is a regular occurrence.

Volunteer Maritime Rescue (Norm Lannoy)

- The VMR maintain an 8.6m (twin 200hp) twin hull rescue boat. They generally complete deep water rescues with "Jetboat" (Mark Puglisi) completing any white water rescues.
- VMR are generally confident in alignment of existing leads, however pressure waves are an issue. Currently ocean access is recommended about 2hr either side of the low tide. High tide crossing can be OK as well.
- VMR recommend a 4m depth (relative to chart datum) for dredging. The dredge extent should go from the end of the wall out to the other side of the bar and be ~50m either side of the dredge centreline. Also, dredging of shallow areas of inner channel may improve water and sand movement through this region.
- Possible reasons for issues may relate to the fact that the training walls were never fully completed (as per original designs).
- Large extent of sand build-up in lower estuary and North creek. Sale of material if possible would be good. Possible areas for accepting sand include the industrial estate and areas behind the dune to the south of the southern breakwater.

Surfriders Association (Don Osborne)

- In terms of entrance design, consideration of design promoted by Terry Iredale (Yamba) may be worthwhile. In this concept a channel is dredged/maintained just seaward of the training walls to allow significant flows in this area resulting in reduced sand deposition. The provision/maintenance of a sand bank or artificial reef seaward of the channel helps to maintain flows. This concept is shown in the sketch below.



- Main focus of Surfriders is associated with recreational use of waters.
- At this stage Surfriders have no particular preferred area for spoil disposal. However, consideration should be given to dumping on beaches that need replenishment. Obviously the practice of dumping should avoid causing adverse impacts on surfing and other environmental receptors.
- If it were possible to form a surf break with the volume to be disposed, then Surfriders could possibly assist in identifying locations were material could be placed.

Commercial Fishers (David Fleming, Garry Joblin, Ian Garrett, Mario Puglisi, Shane Castle and Danny Kholo)

- Situation at bar has worsened, posing significant restrictions on access to ocean for work. Garry Joblin estimated he was down (i.e. not able to go out) 50 nights in 2011 as a result of bar issues.
- The "impact zone" exists in the sand mass (bar) ocean-wards of the end of the breakwaters.
- There has been a build-up of sand at the end of the southern breakwater. This seems to have commenced around the time the extension/stabilisation works were completed to the end of the southern breakwater ~10 years ago.
- The slow speed and deep draught of the trawlers (up to 10 ft draught) makes them vulnerable to damage at the Ballina Bar as they can't manoeuvre themselves out of danger. The damage bill resulting from issues on the bar can be significant, in addition to the obvious safety issues.
- The current direction of leads is regarded as being acceptable. The alignment can vary slightly to the south during drier periods and slightly to the north after rain which may have the effect of scouring along the north walls.
- Additionally, there has been a build-up of sand in the lower estuary, this may be due to bridge works and also be occurring as a result of reduced tidal prism (flushing) as a result of extensive floodgate construction on the floodplains. The reduced tidal prism would result in lower volumes and velocity of tidal waters potentially resulting in sand accumulation in the lower estuary. A possible mechanism to assist may be to complete construction of training walls in the lower estuary out from Kingsford Smith Park to provide a deeper channel through this area. There already has been a large amount of sand accumulation with a spit growing out from this area for a number of years.
- Provided with limited funds, the focus should be on addressing the sand mass that constitutes the "bar" i.e. at the ocean-wards end of the breakwaters. Secondary priorities would include addressing sand build-up inside the breakwaters and lower estuary.
- The exercise of maintaining the bar needs to completed regularly or it is a waste of time and money.
- If money could be raised from sand sale, then this could be used to fund continual pumping or other ongoing maintenance activities.
- In terms of dumping of spoil (if required), it would suit the commercial fishers for it to be north of Flat Rock, in greater than 10 fathoms of water (18m) so it does not interfere with shallow reefs that exist along the shoreline up to Flat Rock, and that it doesn't interfere with prawning activities which occur in waters shallower than 10 fathoms.

Office of Environment and Heritage (OEH)

Included in Appendix C is a copy of a letter provided by OEH in regards to the study. A summary of the key points included in this letter are as follows:

- Consider recommendations of the Richmond River CZMP in respect of dredging, and completion of a cost benefit analysis for any considered dredging projects in the lower estuary.
- Consider possible environmental effects of dredging operations on:
  - Water quality – turbidity, sediment quality, etc; and
  - Ecological receptors – aquatic and riparian habitats, benthic communities, birds and threatened species.
- There is a need to gain a clear understanding of sediment dynamics in the region to assist in defining and assessing the dredge program and disposal options.
- Dredged spoil remains should remain within the bounds of the littoral transport system and should be placed in reasonable close down-drift proximity to the estuary. A possible location includes NNE of the estuary entrance in the vicinity of southern Shelly Beach, with placement in sufficiently shallow areas to ensure that sediment remains in the active systems and is transported under average wave conditions. Coordination with Ballina Shire Council is recommended to determine if spoil placement may assist in alleviating identified coastal erosion hazards in this region.
- Key driving processes that contribute to the entrance bar state, e.g. La Nina and El Nino climate phases need to be understood/considered.
- Possibility of dredging increasing wave propagation into the lower estuary and resulting impacts of this on erosion sensitive locations needs to be considered.
- Determine appropriate entrance lead alignment in consultation with third parties, such as NSW Roads and Maritime.
- Dredge works should consider benefits and costs of over-dredging on the channel verges to allow for some infilling while maintaining a deep centre channel.
- OEH Ministerial approval may be required under the Coastal Protection Act and Regulations for the dredging and dredge placement operations.
- Longevity of any dredging works needs to be considered.

3.2 Summary of Stakeholder Input

The stakeholder consultation has raised the following points:

- Alignment of entrance leads is generally accepted as being safe;
- Dredging along the leads as an ongoing practice would be welcome and may improve dangerous bar conditions;
- A channel of around 100m wide and with a depth of 4m at low water would be necessary for safe navigation;
- The design option by Terry Iredale would appear to have positives but would require extensive dredging to maintain (similar to the proposed dredging in this report);

- Ongoing maintenance would be needed to keep the channel depth consistent; and
- Entrance conditions will be linked to siltation of the lower estuary and need to be considered in conjunction with the extensive flood gating of the estuary. It is unlikely that the proposed dredging will have any appreciable extra impact.

4 ANALYSIS OF SHORELINE IMPACTS DUE TO DREDGING

4.1 Modelling Approach

It is evident from previous studies that coastal works such as dredging at the river mouth will affect the beach system to the north. The degree and spatial extent of the impacts will depend on the nature and magnitude of the dredging undertaken. These have been determined by shoreline evolution modelling, utilising the existing model described in Patterson (2009), with refinement of the grid resolution for better detail at the river entrance. The dredging is simulated as an extraction of sand at the entrance area at a specified rate and duration equivalent to the quantity involved. The progressive effect on the adjacent shorelines is determined as an equivalent change in shoreline position over time.

4.1.1 Extraction Volume

The entrance surveyed in August 2011 showed that the minimum depth along the Line of Leads was about 2.7m below low water. The stakeholder consultation with fishing operators indicated that they would like to see all tide access with vessels of about 10 feet (3m) draft. Allowing for wave action this would indicate around 4m at low water (-5mAHD) or say 1.5m maximum dredged depth to allow some buffer. Referring to the 2011 survey plan this would require a dredging length of about 150m giving a dredged quantity of about 15,000m^3. To allow for over-dredging to the sides of the channel we have assumed 20,000m^3 per dredging episode.

4.1.2 Shoreline Evolution Modelling

The model is based on the fundamental one-line theory to describe variations in the cross-shore shoreline position based on changes in the volume of sand within each model grid cell due to gradients in the longshore transport and any gains or losses due to extraction or addition of sand by artificial means such as dredging or nourishment. The model is run in time-stepping increments driven by time series of deep water waves and sea level. The longshore transport Q is calculated using the conventional CERC formula which relates wave height and direction to longshore transport.

The modelling has been based on extraction of 20,000m^3. Impacts on the shoreline position are derived as an equivalent distance of movement based on a vertical active profile height of 14m, related to a dune height of 6m and closure depth at -8m. Clearly, in the river entrance this distance will have no physical meaning. Results are shown from 0 to 2 years post-dredging with sand extraction and no placement of the sand further along the beach (Figure 4-1) and with placement of the sand adjacent to Shelly Beach (Figure 4-2). The impacts of a smaller or larger quantity will be approximately proportional to actual quantity dredged relative to the results shown.

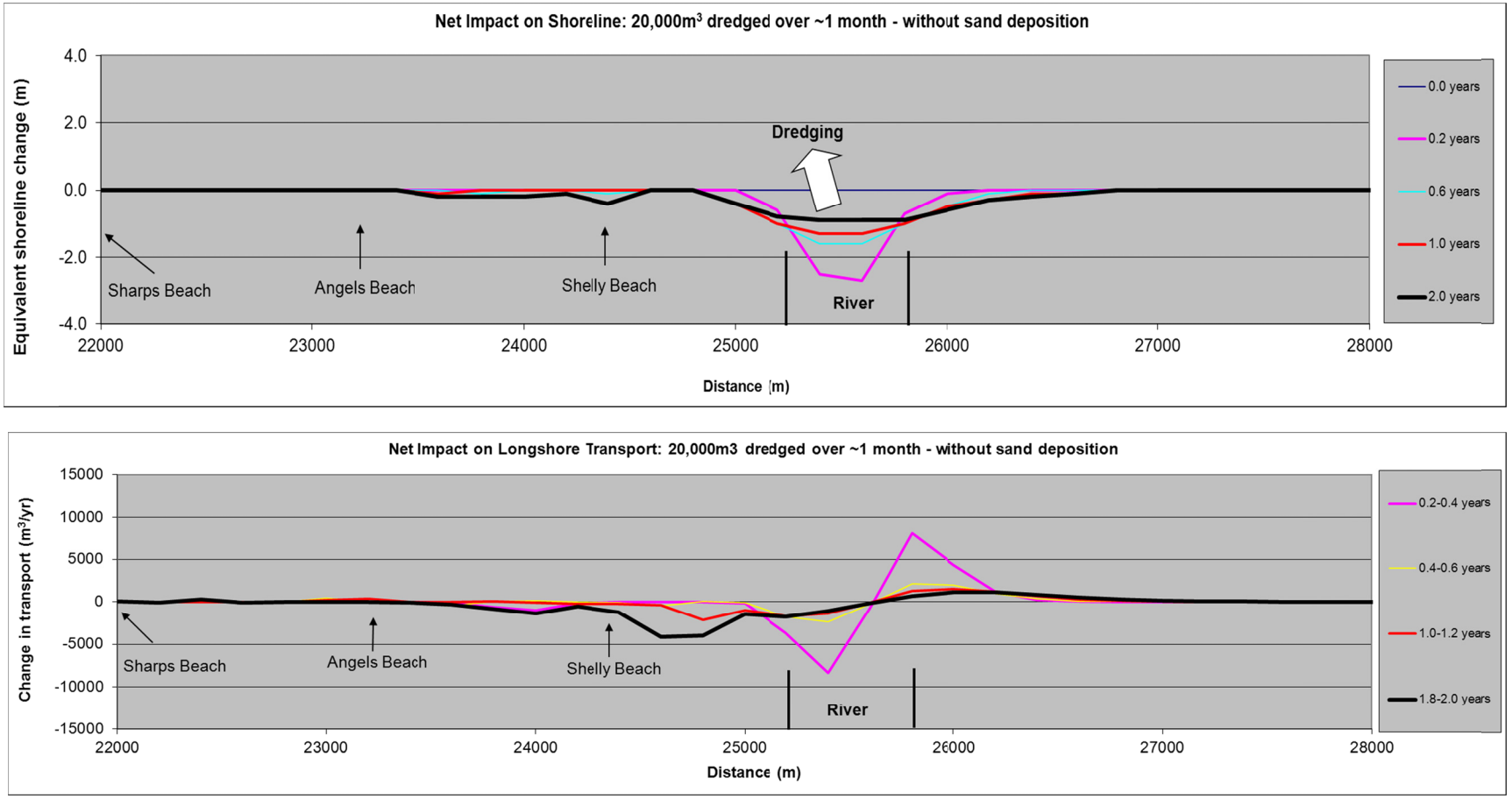


Figure 4-1 Modelled Net Impact on Shoreline (top) and Longshore Transport (bottom) with No Placement of Dredged Sand

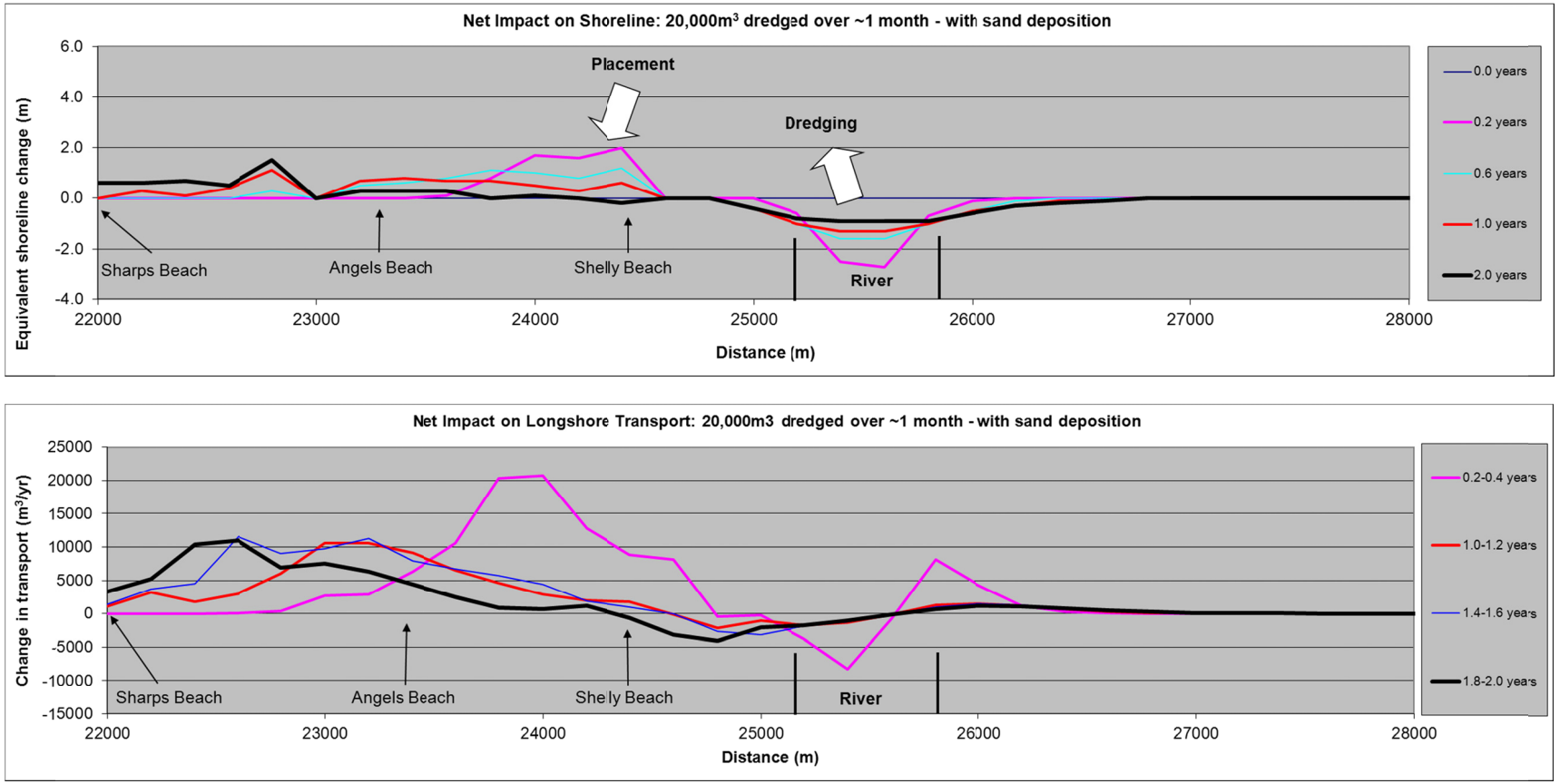


Figure 4-2 Modelled Net Impact on Shoreline (top) and Longshore Transport (bottom) with Placement of Dredged Sand Adjacent to Shelly Beach

The model results suggest that there will be a minor equivalent shoreline recession of about 3m at the entrance initially, diminishing as the impact becomes diffused along the shoreline. There will continue to be a slight effect after two years. If the dredged sand is placed directly into the upper beach area, the model results may be regarded as reasonably indicative of the associated effects. However, modelling the placement of the dredged material offshore in water depths of about 8-10m cannot be undertaken realistically, as the time taken for the sand to move into the upper active beach system is not catered for. The modelled results assume immediate benefit at the placed area adjacent to Shelly Beach, indicating an equivalent minor gain in beach width there and extending northward over time.

4.1.3 Discussion of Likely Impacts

It is apparent that dredging of a quantity of about 20,000m^3 will have only very minor impacts on the shoreline. The effects are probably too small relative to the assumptions of the modelling to be properly simulated. Nevertheless, the modelling provides a qualitative and semi-quantitative assessment of the magnitude and spatial extent of the likely effects. These will almost certainly be indiscernible at the beaches, although there will be significant readjustments of the nearshore seabed.

There will be infilling of the dredged channel over time particularly in the region of sand transport across the bar (approximately 2-4m depth). The nature and rate of infilling will depend largely on the prevailing wave conditions and any flood events following the dredging. It is worth noting that La Nina conditions, which presently prevail, will tend to cause a higher component of down coast (southward) transport. The channel may tend to infill from the north or, alternatively, the infill from the south may decline. El Nino conditions with strong southerly wave conditions will enhance the northward movement of sand, with increased infilling from the south.

At the entrance location, the direction and rate of longshore transport are sensitive to the wave direction as well as height. The modelled sediment transport rates described in Section 2.2.1 and shown in Figure 2-4 would indicate that events which induce 10,000m^3 of transport a day are likely to occur several times a year from the south and one or more times a year from the north. Given that the volume of proposed dredging is in the order of 10,000-20,000m^3 then these events are likely to infill the channel or compromise navigation safety. This is because only one point along the marked channel needs to shoal to the critical depth (around 3.5m AHD) for navigation in the channel to be affected.

If a safe navigation channel is to be maintained then dredging will likely occur several times per average year. Therefore, effectively more than 20,000m^3 will be dredged annually and if not returned to the active system then there will be a loss to the beach system. The modelling to date has indicated that a once-off dredging campaign will have an impact but this is unlikely to perceptible. Continued dredging over many years will have a significant impact if the dredged material is not returned to the active beach system.

4.2 Conclusion

Despite the relatively minor shoreline impacts indicated in the modelling, it is strongly recommended that the dredged sand be placed in the nearshore zone north of the river mouth to ensure no net loss

of sand from the system. The beneficial effects will be diffused and occur over a long period of time as the sand gradually migrates shoreward.

Also, the longshore transport modelling results indicate that maintenance dredging will be required several times per year on average to guarantee safe navigation. This will create a cumulative impact if the dredged material is not placed to the north in the active longshore transport zone. The placement site will need to be located at sufficient distance to the north of the entrance to reduce any southward transport of this material back into the dredged channel.

5 LEGISLATION AND APPROVALS

This section addresses the statutory approvals required under relevant State and Commonwealth legislation and notes any statutory plans or policies that must be addressed as part of the approval application and assessment process prior to the proposed dredging of a navigation channel at the entrance of the Richmond River.

The proposed dredging works involve the initial removal of 10,000- 20,000m^3 of sand from the river mouth, subsequent maintenance dredging 3-4 times per year and placement of the dredge spoil.

Placement options currently under consideration include:

1 Off-shore placement (>20m depth);

2 Inshore placement outside the 'active zone' (>10m depth);

3 Inshore placement within the 'active zone' (<10m depth); and

4 Land-based placement (e.g. Crown land adjacent to Ballina boat harbour) for beneficial reuse and/or commercial sale.[1]

The options being considered for placement of the spoil may be subject to different legislative and regulatory requirements and invoke different processes for approval. A summary of the approvals and permits required for the proposed dredging work and each placement option is contained in Section 5.2.3.

5.1 Legal Framework

5.1.1 Commonwealth

The following legislation at a Commonwealth level is relevant to the proposed dredging and placement options:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth); and
- *Environment Protection (Sea Dumping) Act 1981* (Cth).

5.1.1.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act*)* requires assessment and approval under Part 9 of the EPBC Act for activities or actions that have, or are likely to have a significant impact on a matter of National Environmental Significance (NES). An activity, or action, will require assessment and approval, if it is likely to have a significant impact on one or more of the following matters of national environmental significance:

- World Heritage Properties;
- Ramsar wetlands;
- Listed threatened species and ecological communities;

[1] NSW Department of Primary Industries (2011) Feasibility Study: Restoration of navigable depths at the entrance to the Richmond River, Ballina NSW. Consultants tender document, November 2011.

- Listed migratory species;
- The environment of the Commonwealth marine areas;
- National heritage places;
- Nuclear actions, and
- Actions on Commonwealth land or involving a Commonwealth agency.

A preliminary EPBC Act Protected Matters search was conducted for the area to give an indication of any potential matters of NES. The search showed that 42 threatened species and 63 migratory species are listed within a 1km radius of the Richmond River entrance (refer Appendix B).

A referral is required to be made to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for actions that will, may or are likely to significantly impact on a matter of NES, in this case for the relevant listed threatened and migratory species.

Sufficient information will be required to be provided with the referral to allow DSEWPaC to determine whether an action is likely to have a significant impact on a matter of national environmental significance. This will need to include:

- Identification of any matters of NES located in the area of the proposed action;
- Identification of whether the proposed action, at its broadest scope, has potential for impacts on matters of NES;
- Demonstration of any proposed measures to avoid or reduce impacts on matters of NES; and
- Identification of whether any of the residual impacts of the proposed action on matters of NES are likely to be significant impacts.

If it can be demonstrated in the referral that the project will not significantly impact on a matter of NES, DSEWPaC may declare the proposed works not to be a 'controlled action' and no further assessment or approval is required. In the situation the proposed works are declared to be a 'controlled action', approval will be required from DSEWPaC before the works can commence. The approval process varies depending on the extent of further assessment the Department deems necessary before an approval decision can be made.

Timing

Once an application for a proposed action is made the Minister must make a decision within 20 business days. The application may either be accepted as a controlled action or not controlled action, or found to be unacceptable. Controlled activities may be assessed by state/territory process (i.e. accredited EIS process), referral information, preliminary documentation, EIS/PER or public inquiry.

State/territory process requires a decision within 30 business days of receiving the assessment report. Referral information assessment includes a 30 business day period for the preparation of a recommendation. Once a recommendation is prepared, a decision must be made within 20 business days. Assessment by preliminary documentation, EIS/PER and public inquiry all have a 40 business day period for the Minister to make a decision following final documentation, EIS/PER and public inquiry, respectively.

5.1.1.2 Environment Protection (Sea Dumping) Act 1981 (Cth)

Through the Sea Dumping Act, the Australian Government assesses proposals to load and dump wastes and other matter at sea, permits acceptable activities, and places conditions of approval, to mitigate and manage environmental impacts.

The *National Assessment Guidelines for Dredging 2009*[2] set out the framework for the environmental impact assessment and permitting of the ocean disposal of dredge spoil. The relevant information requirements for obtaining approval for a sea dumping permit can be found in these Guidelines and in the application form for a sea dumping permit.[3]

The referral under the EPBC Act and the application under the Sea Dumping Act require coordination due to the need for DSEWPaC, in assessing the Sea Dumping permit application, to consider advice on whether there is likely to be a significant impact on a matter of NES as determined from the EPBC Act referral. If assessment under the EPBC Act is required, the granting of a sea dumping permit will be based on that assessment and relevant recommendations from the assessment.

The assessment and approval processes of the EPBC Act and Sea Dumping Act and the relationship between these Acts is outlined in Figure 5-1.

Coordination between the two processes is desirable, but it is not necessary that they are assessed at the same time. It is sufficient for the section on the Sea Dumping permit application relevant to the referral under the EPBC Act be filled out to detail:

- If the proposed action has been referred under the EPBC Act*;* and
- If a decision on the proposed action been reached. If the answer is 'Yes', details of the decision must be provided.

It is however suggested that the most efficient means of progressing with the applications is to liaise with DSEWPaC, advise that the applications will be submitted by the proponent at the same time, and request they be assessed concurrently by DSEWPaC.

[2] National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra, 2009.
[3] http://www.environment.gov.au/coasts/pollution/dumping/publications/dredge.html.

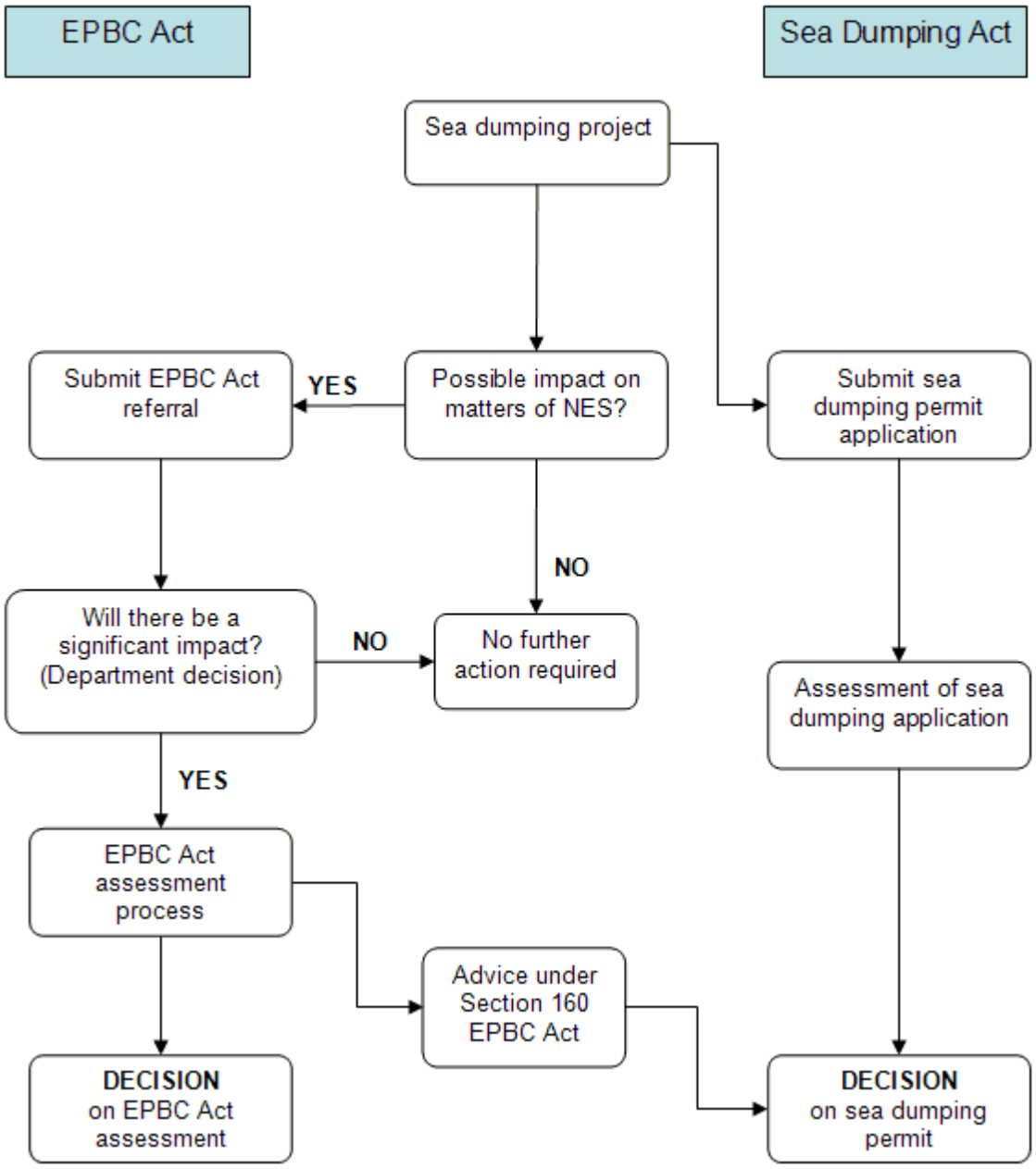


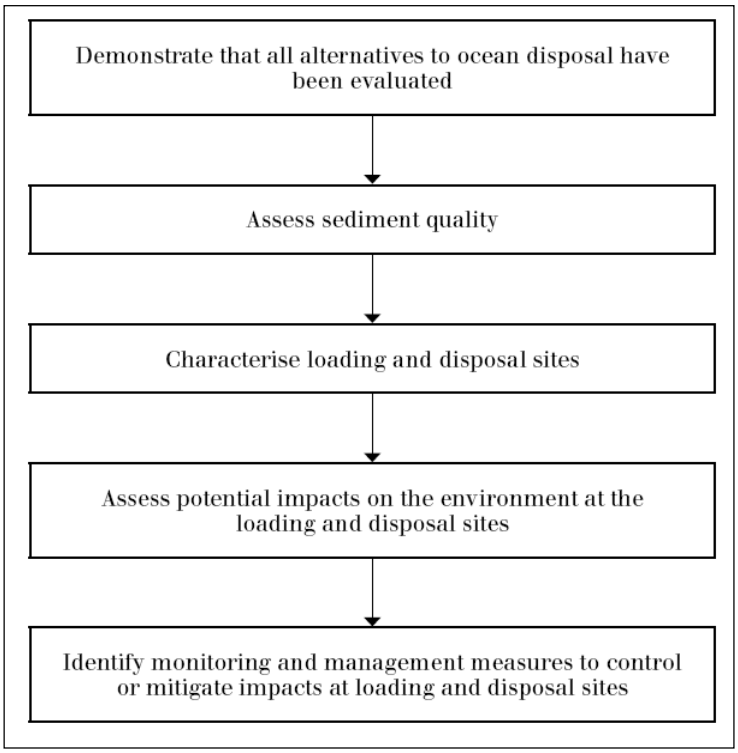
Figure 5-1 Relationship between the EPBC Act and Sea Dumping Act

Permit Process: Application and Assessment

The steps involved in assessing permit applications are given below and summarised in Figure 5-2:

- The proponent considers alternatives to ocean disposal and consults stakeholders;
- The proponent undertakes initial discussions with the Determining Authority (in this case DSEWPaC), to discuss the scope of the project and the anticipated assessment requirements;
- The proponent develops and submits a draft Sampling and Analysis Plan (SAP) to the Determining Authority for approval, unless an exemption from testing has been obtained;
- The Determining Authority assigns a project officer, who reviews the draft SAP and its methods, and who may request clarification or further information before the SAP can be approved;

- Once approved, the proponent implements the SAP;
- Once the SAP analysis and report, and any baseline monitoring, have been completed, the applicant submits a completed permit application, including SAP results and details of stakeholder consultation, together with all other relevant supporting documentation;
- The Determining Authority publishes notice of the application in the Commonwealth Gazette;
- The Determining Authority undertakes an initial assessment to determine whether sufficient information has been provided to enable the application to be assessed, if not, additional information is formally requested from the applicant; and
- The Determining Authority determines whether or not the proposed dumping activity is likely to have a significant impact upon the environment and, if so, advice is sought under Section 160 of the EPBC Act, including an assessment under that Act.[4]



(Source: National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra, 2009.)

Figure 5-2 Summary Flowchart of Sea Dumping Permit Assessment Process

Sampling and Analysis Plan (SAP)

A SAP (and the subsequent sampling) is required if no sampling and assessment of the quality of the sediment proposed to be dredged has been undertaken in the 5 years prior to dredging. In order to be approved, the SAP must contain the following information:

- The objectives of the SAP, including data quality objectives;
- A brief description of the dredging proposal, including the planned dredging area or areas, the dredging depths, the types of sediments involved and the final volume of spoil to be removed (in cubic metres) for sea disposal;

[4] National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra, 2009.

- An evaluation of the history of the dredge area and its catchment, and available data on the sediments to be dredged. This will identify where further information is required and any potentially contaminated sediments. At this stage it may be possible to rank sites or depths for potential contamination status, so that sites with different contamination types or levels may be sampled separately;
- A table showing the amounts to be dredged for each separate dredge area, as well as differentiating between clean, contaminated and potentially contaminated materials;
- The Contaminants List, based on the history of the catchment and any previous sediment sampling;
- Consideration of environmental factors potentially affecting contamination in the sediments (such as currents, bathymetry, grain-size) or which may limit or hinder the sampling program (for example depth, currents or waves, rocky bottom, weather, wildlife such as sharks, crocodiles or stingers, remoteness);
- A rationale for the proposed sampling design, including maps showing the dredging area/s and the proposed sampling locations. This would include any necessary water quality or oceanographic sampling to be carried out concurrently as part of this assessment;
- A contingency plan in case of adverse weather or critical failure of equipment;
- The equipment (vessel, sampling, sub-sampling and testing gear, positioning equipment, sample containers, reports, charts and data forms) and personnel needed to implement the SAP, and a list of field measurements to be carried out;
- A list of sample numbers, including field replicates and quality assurance samples, the approximate sampling locations and details of the position-fixing method, the proposed length of cores and depths of sub-samples from cores; and
- Step-by-step procedures for sampling and sub-sampling consistent with Appendix D; the volume of sample required for analysis and the types and numbers of containers; procedures for collection of water and biota samples, where required; and procedures to ensure that samples (especially water samples for trace analysis) are not contaminated from pollution sources on the survey boat (for example lead weights, zinc anodes, galvanised or brass surfaces, metal-containing sunscreens, anti-fouling paints or exposure to fuels or engine exhausts).

Permit Conditions

Permits are granted with conditions which are appended to the permit and specify: approved activity, location and volume of the material to be dredged and location of the disposal site(s); loading and disposal methods and measures to mitigate impacts; environmental monitoring; and reporting. If a permit is granted, it is the responsibility of the permit holder to ensure any conditions required under the permit are incorporated into project planning and implementation. Permit implementation involves:

- Undertaking the approved activity in accordance with the details specified in the permit including the volume and type of material to be dumped, location of the placement site, loading and disposal methods;
- Development of an environment management plan or other plans (e.g. monitoring, contingency plans), to be approved by the Determining Authority (if required), before loading and dumping can commence;

- Providing monitoring, adaptive management and additional reporting (if required) during dredging and dumping, if adverse impacts are detected;
- Auditing of conditions or plans may be required, as may retention of records for audit purposes (the Determining Authority may also undertake its own audit), and
- Providing a summary report of the dredging activity to the Determining Authority by 31 January each year to facilitate annual reporting of all dumping permits.[5]

Fees

The fees involved with a submission of an application for a permit to dump dredged or excavated material into any part of the sea are prescribed under the *Environment Protection (Sea Dumping) Regulations 1983* (Cth) and vary according to the quantity of material:

- If the volume of the material does not exceed 100,000 m^3: $10 000;
- If the volume of the material exceeds 100,000 m^3: $23 500.[6]

Timeline

Without considering the timeframe for a decision for the referral under the EPBC Act, the following timelines for a decision on an application under the Sea Dumping Act are outlined as follows:

- 90 calendar days for a decision to grant, or to refuse to grant, a permit (from receipt of the application); and
- Where DSEWPaC requires further information, it will be requested in writing within 60 days.

The assessment process allows the statutory timeframe on the application to be stopped, pending receipt of the information requested. Following receipt of the requested information, the statutory timeframe will re-start from the beginning of the assessment period.[7]

5.1.2 State Legislation

The State and local government legislation, plans, policies and requirements relevant to the proposed dredging and placement options are:

- *Environmental Planning and Assessment Act 1979* (NSW);
- *Fisheries Management Act 1994* (NSW);
- Ballina Local Environmental Plan 1987;
- *Crown Lands Act 1989* (NSW);
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy No 71—Coastal Protection;
- *Protection of the Environment Operations Act 1997* (NSW);
- *Water Management Act 2000* (NSW);

[5] National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra, 2009.
[6] *Environment Protection (Sea Dumping) Regulations 1983* (Cth), s5 (2).
[7] National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra, 2009.

- *Coastal Protection Act 1979* (NSW);
- *Threatened Species Conservation Act 1995* (NSW);
- NSW Roads and Maritime Authority;
- *Heritage Act 1977* (NSW); and
- *National Parks and Wildlife Act 1974* (NSW).

5.1.2.1 Environmental Planning and Assessment Act 1979 (NSW)

The *Environmental Planning and Assessment Act* (EP&A Act) sets the framework for planning and environmental assessment in New South Wales through Parts 4 and 5 of the Act and is the principal piece of legislation overseeing the assessment and determination of development proposals. Planning instruments under this Act include State Environmental Planning Policies (SEPPs) and Local Environment Plans (LEPs).

Part 4 applies to development requiring consent and Part 5 to development not requiring consent under the Act but requiring some other approval or being undertaken by, or on behalf of a public authority. Parts 4 and 5 both include requirements for environmental impact assessments.

For Part 5 to be activated, there must be an 'activity' proposed to be undertaken by a determining authority or it must be an activity that requires the approval of a determining authority but does not require consent under the Act. The proposed works fall within the definition of an 'activity,' and are to be undertaken by the determining authority. Division 13 ss68(2) and 68(4) together with s(65)(b) of the State Environmental Planning Policy (Infrastructure) 2007 provides that maintenance dredging carried out by or on behalf of a public authority for the purposes of navigation facilities [8]or in relation to boating facilities is development that does not require consent. This includes the placement of dredge spoil as an activity ancillary to maintenance dredging. Nearshore placement of spoil for the purposes of beach nourishment is also development that does not require consent under Division 25, s129. Therefore the proposed dredging works and the options for placement of dredged material at sea and onshore are works to which Part 5 of the EP&A Act applies.

While this development does not require consent under Part 4, approval by the appropriate State development authority is still required under Part 5. The relevant authority is required to consider all environmental impacts of the proposed works before providing any approval (s111).

As the development is not development to which Part 4 of the EP&A Act applies, no integrated development is triggered under s91 although approval by relevant development (public) authorities is required regarding necessary approvals and permits under other State legislation.

Timing

The determining authority for a project must consider environmental impacts and aspects of the project in detail (s111). Where these will cause significant environmental impacts an EIS is to be submitted (s112). Upon submission, the determining authority will need to consult with the Minister administering the *Threatened Species Conservation Act 1995* and the Director-General of the Department of Environment, Climate Change and Water where these bodies are relevant (ss112A-

[8] Including navigation channels and facilities for safe navigation

112E). The EIS must be placed on public exhibition for at least 30 days, during which time the public can make submissions, and then a submission is to be made to the Director-General 21 days before approval can be offered (s113).

The minimum period of time for assessment of an integrated development proposal under the EP&A Act is 90 days. After this time, the application is deemed to be refused allowing for a challenge in the NSW Land & Environment Court.

5.1.2.2 Fisheries Management Act 1994 (NSW)

Under sections 200 and 201 of the Act, a permit is required from NSW DPI (Fishing and Aquaculture) by any person or local government authority performing dredging or reclamation work unless the work is authorised under the *Crown Lands Act 1989* or is authorised by a relevant public authority. As the proponent is a public authority, no permit is required under this section.

Under Section 199 of the Act, the Minister is required to be consulted over any dredging or reclamation works carried out, or proposed to be authorised, by a public authority (other than a local government authority).

Section 205 of the Act states that a person must not remove, damage or destroy marine vegetation except under the authority of a permit issued by the Minister. Removal or damage to seagrass is also covered by the Fish Habitat Protection Plan No. 2: Seagrasses (NSW DPI 1997). Once gazetted, the Minister and Public Authorities must have regard to any Fish Habitat Protection Plan that is relevant to the exercise of their functions. Both the 'Fish Habitat Protection Plan No.2 Seagrass' and the 'Fish Habitat Protection Plan No.1: General', apply to the dredging and placement activities.

The Fish Habitat Protection Plan No.2 Seagrasses states that: Applications to dredge areas containing Posidonia seagrass beds will generally not be approved. Applications to dredge areas containing other species of seagrass may be permitted for an essential public purpose (e.g. maintenance of navigation) but will generally not be permitted for private developments (including access to private property).Any permits issued will normally require that effective compensation is provided so that there is no "net loss" of seagrass.

DPI mapping shows the extent of seagrass in the study area in Figure 5-3. The entrance to the Richmond River does not contain any seagrass beds and Posidonia is not evident in the vicinity on the entrance. However in the event that seagrass will be removed, damaged or destroyed as a result of spoil placement, a permit from NSW DPI (Fishing and Aquaculture) will be required.

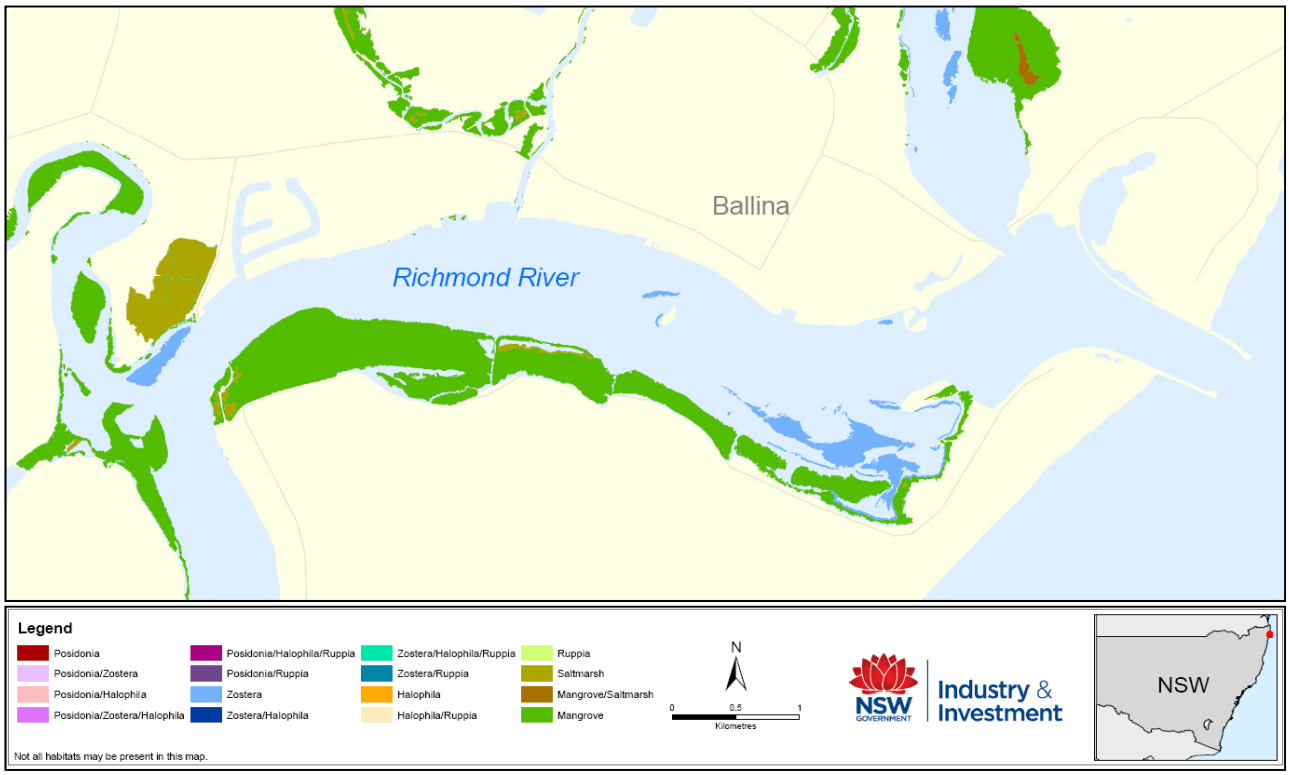


Figure 5-3 Estuarine Habitat Map

5.1.2.3 Protection of the Environment Operations Act 1997 (NSW)

Schedule 1 of the Act lists activities that require licences. The dredging of more than 30,000m3 annually of extractive material for sale or reuse constitutes a scheduled activity.[9] Therefore, the material proposed to be dredged is to be placed on Crown Land for sale or re-use, an Environment Protection License will be required. The licensing authority is the Office of Environment and Heritage.

Section 120 of the Act states that a person who pollutes any waters is guilty of an offence. To pollute waters includes causing or permitting any waters to be polluted.

However, it is a defence in proceedings against a person for an offence under this Part if the person establishes that (s122):

- The pollution was regulated by an environment protection licence held by the person or another person, and
- The conditions to which that licence was subject relating to the pollution of waters were not contravened.

5.1.2.4 Water Management Act 2000 (NSW)

A controlled activity approval under the *Water Management Act* is required for certain types of developments and activities that are carried out in or near a river, lake or estuary. A controlled activity as defined under the Act includes the deposition of material (whether or not extractive material) on

[9] *Protection of the Environment Operations Act 1997* (NSW) Sch. 1 s19(1). Note Schedule 1 Section 42(3)(d) may also invoke the licensing requirement: The activity to which this clause applies is declared to be a scheduled activity if: more than 30,000 tonnes of waste (other than waste referred to in paragraph (a) or (b)) is received per year from off site.

land, whether by way of landfill operations or otherwise. However, the water management regulation provides that a public authority is exempt from seeking approval to carry out controlled activities in, on or under waterfront land.[10]

5.1.2.5 Coastal Protection Act 1979 (NSW)

The *Coastal Protection Act* provides for protection of the coastal environment of the State. The Act defines the 'coastal zone' and outlines the types of development that are regulated including the clearing of vegetation and the carrying out of works regulated within the coastal zone.

The Act requires that a public authority shall not, without the concurrence of the Minister, carry out any development in the coastal zone if the development:

- Is inconsistent with the principles of ecologically sustainable development; or
- Will adversely affect the behaviour or be adversely affected by the behaviour of the sea or an arm of the sea or any bay, inlet, lagoon, lake…; or
- Will adversely affect any beach or dune or the bed, bank, shoreline, foreshore, margin or flood plain of the sea or an arm of the sea or any bay, inlet, lagoon, lake….[11]

The concurrence of the Minister is not required in a number of circumstances, including where the development requires development consent under the EP&A Act.

5.1.2.6 *Threatened Species Conservation Act 1994* (NSW)

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants.

Section 91 of the Act requires that a license be obtained should a development result in one or more of the following:

- Harm to any animal that is of, or is part of, a threatened species, population or ecological community;
- The picking of any plant that is of, or is part of, a threatened species, population or ecological community;
- Damage to critical habitat; and
- Damage to habitat of a threatened species, population or ecological community.

The Director-General administering the TSC Act has 120 days to decide upon the granting of a permit following the submission of a species impact statement (SIS). A SIS is required to identify the threatened species to be harmed or taken and what impact is expected as a result of these activities.

The requirement for a permit under Section 91 of the TSC Act will be determined following completion of a detailed impact assessment.

[10] *Water Management (General) Regulation 2011* (NSW) s38.
[11] *Coastal Protection Act 1979* (NSW) s38(1)(a).

5.1.2.7 Crown Lands Act 1989 (NSW)

As the Richmond River bed is Crown Land, administered under the *Crown Lands Act*, 'owners consent' for any proposed dredging must be obtained from the NSW Department of Crown Land. Before NSW Crown Land will issue a license to undertake dredging on Crown Land it will require evidence that other agencies have been consulted and concur with the proposal. The agencies to be consulted are:

- The NSW Office of Environment and Heritage- may be required to give concurrence under the *Coastal Protection Act*;
- The NSW Environment Protection Authority (EPA)- regarding control measures, need for licensing and other authorisations;
- NSW Roads and Maritime Authority - in relation to any navigation issues; and
- NSW DPI - in relation to likely impacts on aquatic life.

5.1.3 State Environmental Planning Policies

Environmental planning instruments (State environmental planning policies and local environmental plans) are legal documents that regulate land use and development.

The plan-making system in NSW is set out in Part 3 of the Environmental Planning and Assessment Act 1979.

5.1.3.1 State Environmental Planning Policy (Infrastructure) 2007

This policy provides that maintenance dredging and associated spoil placement activities carried out by or on behalf of a public authority is development that does not require consent.[12] Placement of spoil for the purposes of beach nourishment is also development that does not require consent.[13] These provisions override the Ballina LEP.

5.1.3.2 State Environmental Planning Policy No 71—Coastal Protection

The provisions of SEPP 71 must be taken into account by the consent authority when determining an application for development on coastal lands. The matters that must be considered include:

- Retaining public access to and along the coastal foreshore for pedestrians;
- Providing opportunities for new public access on the foreshore;
- Any detrimental impact that development may have on the amenity of the coastal foreshore;
- The scenic qualities of the NSW coast;
- Measures to conserve threatened animals, plants and fish;
- Protecting existing wildlife corridors; and
- The likely impact of coastal processes and coastal hazards on development.

[12] State Environmental Planning Policy (Infrastructure) 2007 Div. 13 ss68(2), 68(4) and (65)(b).
[13] State Environmental Planning Policy (Infrastructure) 2007) Div. 25 s129

SEPP 71 defines all development within 100m below mean high water mark as significant coastal development. Development controls can be put in place by the relevant authority to ensure the above considerations are enforced.

5.1.3.3 North Coast Regional Environmental Plan

The North Coast Regional Environmental Plan (REP) is the relevant REP for the Ballina area. Under Sch. 6 of the EP&A Act, all REPs are deemed to be SEPPs for the purposes of planning and assessment.

Clauses 32B of the REP provides for development controls for all development on coastal land. The local council providing consent for the application must consider the following:

- *NSW Coastal Policy 1997;*
- Coastline Management Manual; and
- North Coast Design Guidelines.

Clauses 36 provide similar controls regarding heritage items. No area of heritage significance can be damage, obstructed, removed or demolished without council consent. Council must undertake an assessment of the heritage item before giving consent.

No application for development on land within 100m of the ocean or a waterway will be approved unless there is a sufficient foreshore open space that is publically accessible within vicinity of the development[14]

5.1.4 Local Area Plan

5.1.4.1 Ballina Local Environmental Plan 1987

The Ballina Local Environmental Plan (LEP) 1987 provides the zoning for the land that is the subject of the proposed works and identifies the permissibility of development for each zone. While the 1987 LEP is the current, applicable plan for the area, a draft LEP has been submitted to DPI for approval. For this reason, the zoning constraints of both plans have been considered.

Under the SEPP (Infrastructure) no development consent is required under the Ballina LEP for dredging in navigation channels for navigation facilities or associated with boating facilities (see Section 5.1.2.1 above). This includes placement of dredge spoil, as ancillary to navigation dredging or as used for beach nourishment. No consent is required under the LEP, therefore, regardless of zoning constraints.[15]

5.1.5 Other Approvals

5.1.5.1 NSW Roads and Maritime Authority

NSW Roads and Maritime Authority is a State Government agency responsible for the safety of users of NSW navigable waters, the protection of the marine environment and the provision of waterways

[14] *North Coast Regional Environmental Plan* cl.81.
[15] State planning instruments override local planning instruments to the extent of any inconsistency.

infrastructure for vessels. Dredging works are likely to present navigational hazard, therefore NSW Roads and Maritime Authority approval should be sought.

5.1.5.2 Heritage Approvals

Natural, cultural and built heritage is protected under the *Heritage Act 1977* (NSW), while indigenous heritage items or places are protected under the *National Parks and Wildlife Act 1974* (NSW). Indigenous heritage items or places can also be protected through listing on the State Heritage Register or under an interim protection order. The Ballina LEP also identifies areas of heritage value.

A search of the State Heritage Register must be undertaken to determine if any of the following permits may be required:

- A permit to demolish, move, alter, or in some way develop a place or land covered by an interim protection order or a State Heritage Register listing under s57 Heritage Act 197.
- An excavation permit under s139 Heritage Act 1977 where, in undertaking the works, a relic may be discovered, exposed, moved, damaged or destroyed (i.e. for works, relics and places not subject to interim heritage orders or State Heritage Register listing).
- A permit may under s87 or s90 National Parks and Wildlife Act 1974 in relation to potential disturbance or destruction of Aboriginal objects or places.
- Division 3 of the North Coast Environmental Plan also includes provisions relating to heritage conservation and development restrictions, namely ss36-36F which states the heritage considerations that council must be take into account when considering development applications. Therefore council may require measures to be taken conserve heritage items within the conservation area or the heritage significance of the conservation area including, where appropriate, the preparation of a conservation plan for the whole or part of that area.

Dredging is not intended to exceed the depth undertaken by previous dredging operations. For this reason, it is unlikely that any heritage values will be included within the project area.

Where Aboriginal heritage items objects or places are discovered during operations, it is an offence under the *National Parks and Wildlife Act* to harm or desecrate these items. This offence is one of strict liability and therefore applies regardless of knowledge of the party causing the harm It is a defence to this provision to show that due diligence was undertaken in determining whether actions will harm Aboriginal heritage items. This requires all persons undertaking dredging and placement activities to exercise a duty of care towards Aboriginal heritage items and cease works upon discovery of these items.

5.2 Approvals

Necessary approvals required for undertaking dredging and placement activities are summarised in the following sections. Some approvals are required only in relation to particular methods for spoil placement. Further details regarding these approvals are provided in Section 5.1 above.

The following approvals/referrals/permits/licences have been identified as being, or potentially being, required:

5.2.1 Dredging

Dredging activities are the primary aspect of navigation development. Commonwealth and State approvals for dredging (but not placement) works are considered in Table 5-1. This action will require concurrence assessment by NSW DPI and Office of Environment and Heritage due to the need to obtain permits under the *Fisheries Management Act* and the *Protection of the Environment Operations Act*. This requirement would also be triggered if any heritage permits were also required.

Table 5-1 Approvals and Approval Timeframes for Navigational Dredging

Approval	Authority	Explanation	Timeframe
Required			
Referral	*Environmental Protection and Biodiversity Conservation Act 1999*	Referral of project to DSEWPaC to determine if there will be a significant impact on a matter of national environmental significance	20 business days for Minister to make decision on referral If controlled action, timeframe depends on required assessment process
Owners Consent	*Crown Lands Act 1989*	Consent of Department of Crown Lands to use State land	-
Works approval	*Environmental Planning and Assessment Act 1979*	Approval from nominated development authority to undertake works	90 day assessment period after which proposal is deemed refused If authority requires EIS to be prepared: 30 day public notification and submission to Director-General 21 days before approval
Marine Vegetation Permit	*Fisheries Management Act* 1994	Permit to remove seagrass communities in the dredge footprint	Part of the 90 day works consent assessment
Environment Protection Licence	*Protection of the Environment Operations Act 1997*	For sale/reuse of more than 30,000m^2 of dredge spoil	Part of the 90 day works consent assessment
NSW Roads and Maritime Authority Approval	NSW Maritime	Approval of NSW Roads and Maritime Authority regarding impact of dredging on navigation issues	-
Potentially Required			
Threatened species permit	*Threatened Species Conservation Act 1994*	Permit to remove protected marine vegetation (i.e. seagrass)	120 days after receiving species impact statement
Heritage Approval	*National Parks and Wildlife Act 1974;* *Heritage Act 1977*	If heritage search reveals items or areas of heritage value on the proposed spoil placement site permits are required: - Aboriginal heritage permit (AHP) - State heritage permit (SHP)	AHP 60 days SHP 21 days before deemed refusal

5.2.2 Placement

This section summarises the required approvals for each placement option, any further permits which may possibly be required and the reasons for uncertainty as to if they may be required or not. Timeframes for obtaining each approval are also outlined.

5.2.2.1 Onshore Placement

This placement option involves placement disposal of the dredge spoil onshore. An area of Crown Land adjacent to the Ballina Boat Harbour is being considered for this purpose. The intention of placement of this spoil onshore is for the sale or re-use of the dredge spoil. This option is unique to land-based disposal rather than at disposal at sea (see Sections 5.1.2.3 and 5.1.4.1). If works require a heritage permit, concurrence assessment by the Office of Environment and Heritage would be required.

Table 5-2 below summarises the approvals that will need to be obtained if this option is to be pursued.

Table 5-2 Approvals and Approval Timeframes for Onshore Placement of Dredge Spoil

Approval	Authority	Explanation	Timeframe
Required			
Works approval	Environmental Planning and Assessment Act 1979	Approval from nominated development authority to undertake works	90 day assessment period after which proposal is deemed refused If authority requires EIS to be prepared: 30 day public notification and submission to Director-General 21 days before approval
Owners consent	Crown Lands Act 1989	Consent of Department of Crown Lands to use State land	-
Potentially Required			
Threatened Species Permit	Threatened Species Conservation Act 1994	Permit to remove protected terrestrial vegetation	120 days after receiving species impact statement
Heritage Approval	National Parks and Wildlife Act 1974; Heritage Act 1977	If heritage search reveals items or areas of heritage value on the proposed spoil placement site permits are required: Aboriginal heritage permit (AHP) State heritage permit (SHP)	AHP 60 days SHP 21 days before deemed refusal

5.2.2.2 Near-Shore Placement

Concurrence for works involving the placement of dredge spoil in near-shore areas will be required from the Office of Environment and Heritage (administering the *Coastal Protection Act*), NSW DPI (administering the *Fisheries Management Act*) and the nominated development authority under the EP&A Act.. In addition, it would be necessary to consult with NSW Roads and Maritime Authority, NSW DPI, NSW EPA and the Office of Environment and Heritage to meet the requirements of the *Crown Lands Act*. Approvals required for these works are summarised in Table 5-3.

Other statutory instruments may be applied as part of approvals in the form of development conditions.

Table 5-3 Approvals and Approval Timeframes for Near-Shore Placement of Dredge Spoil

Approval	Authority	Explanation	Timeframe
Required			
Referral	*Environmental Protection and Biodiversity Conservation Act 1999*	Referral of project to DSEWPaC to determine if there will be a significant impact on a matter of national environmental significance	20 business days for Minister to make decision on referral If controlled action, timeframe depends on required assessment process
Sea dumping permit	*Environment Protection (Sea Dumping) Act 1981*	Permit to dispose of dredge spoil offshore	90 days
Owners consent	*Crown Lands Act 1989*	Consent of Department of Crown Lands to use State land	-
Works approval	*Environmental Planning and Assessment Act 1979*	Approval from nominated development authority to undertake works	90 day assessment period after which proposal is deemed refused If authority requires EIS to be prepared: 30 day public notification and submission to Director-General 21 days before approval
Marine Vegetation Permit	*Fisheries Management Act* 1994	Permit to destroy seagrass communities in the placement footprint	Part of the 90 day works consent assessment
Environment protection licence	*Protection of the Environment Operations Act 1997*	Licence to dispose of dredge spoil instream or offshore	Part of the 90 day works consent assessment
Potentially Required			
Threatened species permit	*Threatened Species Conservation Act 1994*	Permit to destroy protected marine vegetation (i.e. seagrass)	120 days after receiving species impact statement

5.2.2.3 Off-Shore Placement

Off-shore placement of spoil will also require concurrence assessment for works with various government agencies. These include the Office of Environment and Heritage (under the *Coastal Protection Act*), NSW DPI (under the *Fisheries Management Act*), and the development authority nominated under the EP&A Act, and NSW Roads and Maritime Authority and NSW EPA, in addition to NSW DPI and Office of Environment and Heritage, regarding *Crown Lands Act* matters.

Approvals required for this placement are summarised in Table 5-4.

Other statutory instruments may be applied as part of approvals in the form of development conditions.

Table 5-4 Approvals and Approval Timeframes for Off-Shore Placement of Dredge Spoil

Approval	Authority	Explanation	Timeframe
Required			
Referral	*Environmental Protection and Biodiversity Conservation Act 1999*	Referral of project to DSEWPaC to determine if there will be a significant impact on a matter of national environmental significance	20 business days for Minister to make decision on referral If controlled action, timeframe depends on required assessment process
Sea dumping permit	*Environment Protection (Sea Dumping) Act 1981*	Permit to dispose of dredge spoil offshore	90 days
Owners consent	*Crown Lands Act 1989*	Consent of Department of Crown Lands to use State land	-
Works approval	*Environmental Planning and Assessment Act 1979*	Approval from nominated development authority to undertake works	90 day assessment period after which proposal is deemed refused If authority requires EIS to be prepared: 30 day public notification and submission to Director-General 21 days before approval
Marine Vegetation Permit	*Fisheries Management Act* 1994	Permit to destroy seagrass communities in the placement footprint	Part of the 90 day works consent assessment
Environment protection licence	*Protection of the Environment Operations Act 1997*	Licence to dispose of dredge spoil instream or offshore	Part of the 90 day works consent assessment
Potentially Required			
Threatened species permit	*Threatened Species Conservation Act 1994*	Permit to destroy protected marine vegetation (i.e. seagrass)	120 days after receiving species impact statement

5.2.3 Summary of Option Approvals

Each of the above listed option has a different set of approvals required. A summary of these approvals based on the *minimum* requirements for each option is provided below. If any site constraints (e.g. threatened species, heritage areas) occur or if the project is deemed a controlled action under the EPBC Act, these minimum requirements will be altered.

The placement options, at a minimum, would require the following:

- Onshore placement – approvals required from both State government with a minimum timeframe of 90 business days for assessment;
- Near-shore placement – approvals required from both Commonwealth and State government with a minimum timeframe of 90 business days for assessment; and

- Off-shore placement – approvals required from both Commonwealth and State government with a minimum timeframe of 90 business days for assessment.

Further investigations of the site and site constraints (e.g. sediment sampling, flora and fauna surveys, heritage surveys) may identify constraints which delay the timing of these approvals. For this reason, the above recommended timeframes are purely indicative.

6 CONCLUSIONS

The summary conclusions are presented below in the following sequence:

- Stakeholder feedback;
- Entrance dredging and placement options;
- Coastal process modelling;
- Ease of approvals; and
- Final recommendations.

6.1 Stakeholder Feedback

The stakeholder consultation indicated the following points:

- Alignment of entrance leads is generally accepted as being safe;
- Dredging along the leads as an ongoing practice would improve dangerous bar conditions;
- A channel of around 100m wide and with a depth of 4m at low water would be necessary for safe navigation;
- Ongoing maintenance would be needed to keep the channel depth consistent; and
- Entrance conditions may be linked to rapid and ongoing siltation of the lower estuary.

6.2 Entrance Dredging and Placement Options

The entrance surveyed in August 2011 showed that the minimum depth along the Line of Leads was about 2.7m below low water. The stakeholder consultation with fishing operators indicated that they would like to see all tide access with vessels of about 10 feet (3m) draft. Allowing for wave action this would indicate around 4m at low water or say 1.5m maximum dredged depth to allow some buffer. Referring to the 2011 survey plan this would require a dredging length of about 150m giving a dredged quantity of about 15,000m^3. To allow for over-dredging to the sides of the channel we have assumed 20,000m^3 per dredging episode.

In terms of cost it is understood that dredging of the Tweed River entrance with a small Trailing Suction Hopper Dredge (TSHD) and placement to the north costs about $30 per cubic metre (including ancillary costs such as establishment, approvals etc). This means that each dredging episode is estimated to cost in the order of $0.6-1M. Given that this is likely to be required 4-6 times per year it is expected that the annual dredging cost will be $2-5M per annum.

Other placement options include disposal at sea which is likely to be at the same cost or slightly cheaper due to ease of dumping and land-fill at the marina which will require about 5km of pipelines and booster stations or barge operations and is likely to cost in the order of $35-50 per cubic metre. However, the cumulative maintenance dredging and the associated impacts to the shoreline to the north may preclude these options.

6.3 Coastal Process Modelling

The modelling has indicated that dredging of a quantity of about 20,000m^3 will have only very minor impacts on the shoreline. The effects are probably too small relative to the assumptions of the modelling to be properly simulated. Nevertheless, the modelling provides a qualitative and semi-quantitative assessment of the magnitude and spatial extent of the likely effects. These will almost certainly be indiscernible at the beaches, although there will be significant readjustments of the nearshore seabed.

There will be infilling of the dredged channel over time particularly in the region of sand transport across the bar (approximately 2-4m depth). The nature and rate of infilling will depend largely on the prevailing wave conditions and any flood events following the dredging. At the entrance location, the direction and rate of longshore transport are sensitive to the wave direction as well as height. The modelled sediment transport rates would indicate that events which induce 10,000m^3 of transport a day are likely to occur several times a year from the south and one or more times a year from the north. Given that the volume of proposed dredging is in the order of 10,000-20,000m^3 then these events are likely to infill the channel or compromise navigation safety. This is because only one point along the marked channel needs to shoal to the critical depth (around 3.5m AHD) for navigation in the channel to be affected.

It is worth noting that La Nina conditions, which presently prevail, will tend to cause a higher component of down coast (southward) transport. The channel may tend to infill from the north or, alternatively, the infill from the south may decline. El Nino conditions with strong southerly wave conditions will enhance the northward movement of sand, with increased infilling from the south.

Despite the relatively minor shoreline impacts indicated in the modelling, it is strongly recommended that the dredged sand be placed in the nearshore zone north of the river mouth to ensure no net loss of sand from the system. The beneficial effects will be diffused and occur over a long period of time as the sand gradually migrates shoreward.

Also, the longshore transport modelling results indicate that maintenance dredging will be required several times per year on average to guarantee safe navigation. This will create a cumulative impact if the dredged material is not placed to the north in the active longshore transport zone. The placement site will need to be located at sufficient distance to the north of the entrance to reduce any southward transport of this material back into the dredged channel.

6.4 Approvals and Timings

Each of the listed options has a different set of approvals required. A summary of these approvals based on the *minimum* requirements for each option is provided below. If any site constraints (e.g. threatened species, heritage areas) occur or if the project is deemed a controlled action under the EPBC Act, these minimum requirements will be altered.

The placement options, at a minimum, would require the following:

- Onshore placement – approvals required from State with a minimum timeframe of 90 business days for assessment;

- Near-shore placement – approvals required from both Commonwealth and State government with a minimum timeframe of 90 business days for assessment; and
- Off-shore placement – approvals required from both Commonwealth and State government with a minimum timeframe of 90 business days for assessment.

Further investigations of the site and site constraints (e.g. sediment sampling, flora and fauna surveys, heritage surveys) may identify constraints which delay the timing of these approvals. For this reason, the above recommended timeframes are purely indicative.

6.5 Final Recommendations

The conclusion from the above assessments is that the provision of a 100m wide channel with 4m depth clearance at low tide would satisfy all stakeholders as a reliable entrance configuration.

The dredging of this channel, relative to the August 2011 condition of the bar, would result in a relocation volume of about 15-20,000m^3. As a once-off exercise the removal of this volume of sand from the active system is unlikely to result in any significant beach erosion. Analysis of the last 10 years of longshore sand transport suggests that maintenance would be required 4-6 times per year at a cost of $2-5M per year and as a matter of best practice and to accommodate cumulative effects it is recommended that this sand be placed in the active zone north of the entrance to minimise long-term shoreline impacts.

Dumping the sand offshore would likely involve similar dredging costs however relocation to the land-fill site near the boat harbour would likely increase the costs substantially due to the 5km delivery distance.

With regard to approvals, in the best scenario with no severe impacts, there would appear to be little difference in the options.

Therefore, in summary, it is likely that maintenance of a safe entrance as indicated would require the entrance to be dredged 4-6 times per year at a cost of $2-5M per year with the sand relocated to the nearshore zone to the north of the entrance.

7 REFERENCES

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APPENDIX A: STAKEHOLDER CONSULTATION EXAMPLE

BMT WBM Pty Ltd
6/20 Byron Street
BANGALOW NSW 2479
Australia

Tel: +61 2 6687 0466
Fax: +61 2 6687 0422

ABN 54 010 830 421

www.bmtwbm.com.au

Our Ref: DCC: L.B18820.01.docx

13 February 2012

Recipient Details
Recipient Details
Recipient Details
Recipient Details

Attention: Recipient

Dear Recipient

RE: BALLINA BAR DREDGING FEASBILITY STUDY

The Coastal Infrastructure Program (CIP) within Crown Lands has responsibility for managing 25 coastal harbours and 21 trained river entrances in NSW. The Richmond River entrance at Ballina is one of several projects that have been given a high priority for investigation.

In this regard, BMT WBM has recently been appointed by Crown Lands to complete a feasibility study for the restoration of navigable depths at the entrance to the Richmond River. The study is intended to inform the government on the most practical solution to restore a navigation channel at the entrance to the Richmond River which provides value for money and long term benefits. An outcome could be that ongoing maintenance costs could preclude entrance deepening.

The feasibility study will include a detailed assessment of coastal processes at this location and will specifically take into consideration the impacts of any proposed dredging and spoil placement options in terms of their potential to interrupt longshore sand transport processes (which affects the rate of sand supply to beaches to the north of the breakwater). Subsequent to this an options assessment phase (i.e. for dredging and spoil placement options) will be undertaken that will consider factors such as navigability, safety, longevity, approvals, cost and potential for adverse impacts. The study will conclude with the most suitable options, if any, being identified.

At this early stage of the study, BMT WBM on behalf of Crown Lands has identified your stakeholder group for further detailed consultation in respect of this feasibility study. At this stage we are seeking input on your requirements in terms of channel dredging, i.e., alignment, depth required for safe navigation as well as any effects the dredging campaign may have on your respective operations. We would also seek input on where you consider spoil would best be placed, i.e. beach, nearshore, offshore or for land reclamation.

We appreciate that it has been a long time since the Richmond River entrance was dredged (approximately 40 years) and that you may not have a recent experience to draw upon, but your ideas and concerns may bring to light an important matter that may require consideration during the options assessment phase. All ideas and options put forward (by yourself and other stakeholders) will be considered.

To facilitate the transfer of ideas and knowledge, I would like to make a time to meet with you and discuss your input to the study. If a meeting is difficult we would equally welcome either a phone discussion or a written letter.

I will contact you personally within the coming weeks either by phone or email to arrange a time to meet. Alternatively, you can contact me on 02 6687 0466 to discuss your input to the study or send a letter to Damion Cavanagh at Suite 6/20 Byron Street, Bangalow, 2479.

We thank you in advance for your input to the study and look forward to your input on the study. However, please note that at this stage the study aims to assess the feasibility of options and it should not be taken as an indication that specific actions will occur.

Yours Faithfully
BMT WBM Pty Ltd

Damion Cavanagh
Associate

CC:

- NSW Crown Lands
- NSW Maritime
- NSW Marine Rescue (VRA)
- Fishermans Cooperative
- Surfrider Foundation Ballina/Byron

APPENDIX B: EPBC PROTECTED MATTERS REPORT

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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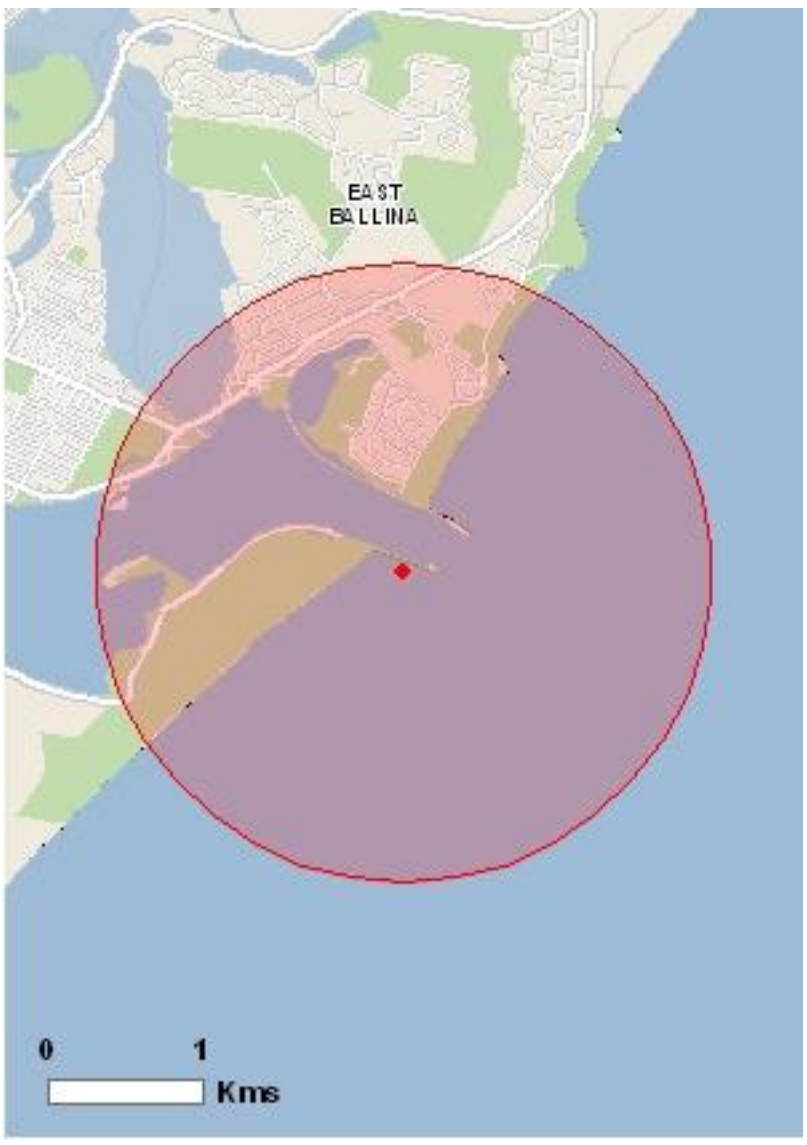

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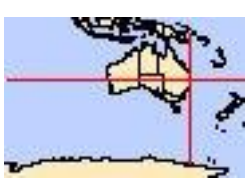

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	42
Migratory Species:	63

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	92
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	2
State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	13
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia		
Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Foraging, feeding or related behaviour may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
FROGS		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria olongburensis Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat likely to occur within area
MAMMALS		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides Water Mouse, False Water Rat [66]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Acronychia littoralis Scented Acronychia [8582]	Endangered	Species or species habitat likely to occur within area
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Baloghia marmorata Marbled Balogia, Jointed Baloghia [8463]	Vulnerable	Species or species habitat may occur within area
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Syzygium hodgkinsoniae Smooth-bark Rose Apple, Red Lilly Pilly [3539]	Vulnerable	Species or species habitat likely to occur within area
Taeniophyllum muelleri Minute Orchid, Ribbon-root Orchid [10771]	Vulnerable	Species or species habitat may occur within area
Tinospora tinosporoides Arrow-head Vine [5128]	Vulnerable	Species or species habitat likely to occur within area
REPTILES		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
SHARKS		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered*	Foraging, feeding or related behaviour may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Puffinus leucomelas		
Streaked Shearwater [66541]		Species or species habitat may occur within area
Sterna albifrons		
Little Tern [813]		Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Foraging, feeding or related behaviour may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus kelloggi Kellogg's Seahorse, Great Seahorse [66723]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Microphis manadensis Manado Pipefish, Manado River Pipefish [66258]		Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse [66271]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Historic		
Shaws Bay Hotel	NSW	Indicative Place
Richmond River Lighthouse	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Richmond River	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Genista sp. X Genista monspessulana](#) Broom [67538]		Species or species habitat may occur within area
[Lantana camara](#) Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
[Lycium ferocissimum](#) African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
[Pinus radiata](#) Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
[Salvinia molesta](#) Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Coordinates

-28.8777 153.58814

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX C: OEH RESPONSE LETTER

NSW GOVERNMENT | Office of Environment & Heritage

Your reference: DCC: L.B18820.01.docx
Our reference: AL300062
Contact: Ben Fitzgibbon
(02)66270226

Damion Cavanagh
Manager Northern Rivers
BMT WBM Pty Ltd
6/20 Byron Street
Bangalow NSW 2479

Dear Damion

RE: BALLINA BAR DREDGING FEASBILITY STUDY

I refer to your letter of 13 February 2012 concerning the proposal to dredge the Richmond River entrance bar at Ballina. Thank you for the opportunity to contribute to the Ballina bar dredging feasibility study being carried out by BMT WBM and the following comments are provided for consideration.

The Richmond County Council acting on behalf of the constituent councils (Ballina Shire, Lismore City and Richmond Valley) has recently completed the Coastal Zone Management Plan for the Richmond River Estuary (CZMP). The Plan outlines the future strategic management of the Richmond River Estuary and has been certified by the Minister for Environment under the *Coastal Protection Act 1979*.

The CZMP identifies a management action relevant to undertaking a cost benefit analysis of dredging operations in the lower estuary (Action 9b). The management action is included at **Attachment A**. It is recommended that this action be reviewed and considered in undertaking the dredging feasibility study.

Specific issues for consideration in undertaking the dredging feasibility study include the following:

Water Quality
Dredging operations can cause elevated turbidity levels at the point of dredging and at the disposal site. The potential for fuel and lubricant spills from the dredge into the waterway also exist.

Ecological
Dredging can damage ecological communities and its impact on the following needs consideration:

- aquatic and riparian habitats; e.g. seagrass beds, mangroves, subtidal sandy shoals and rocky reefs
- benthic communities
- threatened species
- shore birds

Sediment Dynamics
Impacts on bed sediment mobility and the mobility of deposited material.

PO Box 856, Alstonville NSW 2477
75 Main Street
Alstonville NSW
Tel: (02) 6627 0000 Fax: (02) 6628 3937
ABN 30 841 387 271
www.environment.nsw.gov.au

Sediment Quality
The presence of fine material within the dredge spoils needs to be determined. The possible impact of fines on the spoil placement environment needs to be considered.

Disposal Site
The Richmond River entrance bar is mainly comprised of marine sediments that are part of the regional littoral sand transport system. Removing sand from the system by artificial means (dredging) may result in exacerbated down drift erosion impacts until the system re-establishes. It is therefore recommended that the dredge spoil disposal site remains within the bounds of the littoral transport system and in reasonably close down drift proximity to the estuary entrance. It is recommended that investigation into the dredge spoil placement location considers the following scenarios:

- spoil placed to the NNE of the estuary entrance in the vicinity of southern Shelley Beach
- spoil placed in water depths sufficiently shallow enough to ensure the sediment remains in the active system as transported under average wave conditions (i.e. inner near shore zone ~ 5-8m deep)

Ballina Shire Council (BSC) is currently in the process of preparing a Coastal Zone Management Plan (CZMP) for the Ballina Shire Coastline. The Plan will outline the coastal hazards management approach for the Shire's various beaches. Consultation with BSC is encouraged on the potential use of dredge spoil to aid in beach nourishment as a possible recommendation of the CZMP.

Coastal Processes
The entrance bar is no doubt relatively shallow at present as evidenced by hydrographic surveys carried out by NSW DPI (Catchments and Lands) between 1996 and August 2011, provided at the stakeholder workshop held in Ballina on 28 September 2011 (refer **Table 1**).

Table 1: NSW DPI (Catchments and Lands) Hydrosurvey Data for Richmond River Estuary Entrance Bar between May 1996 and August 2011.

Hydrosurvey	Min. Clearance along Leads at Entrance	Min. Clearance over Bar (note position & size changes)
May 1996 (post flood)	4.8m (3.2m inside)	2.7m
September 1996	4.4m	3.7m
March 1997	4.4m	3.4m
August 2000	4.0m	3.3m
Sept 2004 – May 2005	5.3m	4.9m
June 2010	3.9m (2.9m inside)	3.6m
August 2011	2.6m	2.6m

It is clear in the hydrosurvey record shown in **Table 1** that the minimum clearance over the entrance bar varies over time. The drivers into this variation at the Richmond entrance bar are little studied but may relate to: variations in sediment transport, deposition, and erosion rates at the entrance as influenced by seasonal and climate influenced wave regimes and/or inshore current regimes, and; the estuaries hydraulic regime, as influenced by catchment rainfall.

Consideration in the feasibility study should be given to the processes driving the changes to entrance bar state including those factors listed above and including:

- La – Nina and El – Nino climate phases
- Large coastal storm events such as the May 2009 storm event

Dredging of the entrance bar will possibly lead to enhanced wave propagation and energy into the lower estuary. Consideration should be given to possible changes in tidal celerity and wave height and energy resulting from the proposed dredging that may result in exacerbated erosion of Mobbs Bay and other lower estuary locations.

Dredging Works Design
It is acknowledged that navigational leading markers have been in place at the Richmond entrance for several years and have been relied upon for navigation of the entrance bar. None the less, it is expected that the feasibility study will investigate and assess the preferred alignment for a proposed

dredge channel. This preferred alignment may differ in position to the route delineated by the navigational leading marks. Consultation with NSW Roads and Maritime Authority should be undertaken to canvas the possibility of moving the position of the leading marks to fit with the alignment of the dredge channel.

Consideration of the lateral movement of sand across the entrance bar predominantly from south to north should also be considered with respect to the width of a dredge channel as being able to absorb some infilling on the channel verges, whilst still maintaining a reasonably deep centre-line. A channel width of at least 30m is recommended for consideration in this regard.

Ministers Concurrence

OEH administers the *Coastal Protection Act, 1979*. Pursuant to Part 2(5) of the Coastal Protection Regulation 2011 the concurrence of the Minister for Environment is required for development on any part of the coastal zone to which the part applies. Specifically, proposed dredging works in depths less than 30m, and the placement of sediment in depths of less than 30m where the volume to be placed is more than 10,000m^3 per year require the Minister's concurrence.

Dredging Longevity

It is recognised that the Richmond River Estuary entrance bar currently presents a relatively elevated risk to safe navigation of the estuary entrance by both commercial and recreational vessels. Whilst this is an undesirable situation, the shallowing and deepening of the entrance bar is a natural process that occurs under the influence of the prevailing physical processes at the time.

Any investigation into the feasibility of dredging of the entrance bar should consider the expected longevity of the works in meeting the proposed objectives. Whilst the feasibility study may provide an assessment of the expected longevity, a monitoring campaign may be necessary to clearly quantify the benefits and aid in assessing future dredging proposals.

I trust the above comments are of assistance. Should you have any further queries on this matter, please call Ben Fitzgibbon at the OEH Alstonville office on telephone (02) 66270226 or at ben.fitzgibbon@environment.nsw.gov.au .

Yours sincerely

Richard Hagley
Unit Manager North Coast Unit
Urban and Coastal Water Programs

19. 3. 2012

Action 9b: Cost benefit analysis of dredging operations in lower estuary

Desired Outcome	Logical consideration of the costs and benefits of dredging in the lower estuary based on fact, not perception (to be conducted only if deep water access is proposed)
Lead Organisation	BSC
Support Organisation	DPI-Crown Lands, DPI-Fisheries, OEH, NSW Maritime
Cost Estimate (10 year)	$50,000
Potential Funding	NSW Estuary Management Program and Coastal Management Program, BSC
Timing	Short-term (Year 3)
Management Zones	Zones 1 & 2

DESCRIPTION OF TASKS:

There is a recurring perception within the community that dredging is required in the lower estuary to improve navigation safety at the Richmond River bar as well as other specific points in the estuary such as Emigrant Creek. Boat users in the estuary are generally well aware of navigability risks and either defer travel or exercise appropriate caution in adverse conditions. The lack of deep water access does limit the type of vessel that can utilise facilities in the Richmond and therefore has an influence on the development of marine support facilities within the estuary. It is considered that any detailed review of dredging costs, impacts and benefits would only be progressed if sufficiently justified by future navigability requirements.

The key tasks to be undertaken are:

- Confirmation of recreational and commercial boating requirements including the future transit requirement for deep (e.g. >2.5m) draft vessels. Particular reference should be made to the recommendations provided in the Lower Richmond River Recreational Boating Study (GHD, 2005) and future directions regarding marine precinct facilities in the lower estuary.
- A review of the technical feasibility and effectiveness of dredging. This review should refer to previous dredging operations in the Richmond and consider sediment movement patterns, infill rates and dredging frequency required to maintain the required channels as well as other factors such as spoil disposal.
- An assessment of the environmental and social effects of dredging in the lower estuary. Preliminary studies have indicated that dredging may exacerbate oceanic flooding within Ballina (reduced retardation of high tides and storm surge up the estuary) and this should be considered in concert with predictions for sea-level rise. Other issues that need to be evaluated include, but are not limited to, the impact on estuarine habitats, particularly shorebird habitat and seagrasses in the vicinity of dredging operations, impact on recreational users and commercial activities (e.g. surfers and learn to surf businesses using the sandbar at the entrance to North Creek) and increased wave erosion of threatened species habitats of the lower estuary including Mobbs Bay. A key issue that needs to be addressed is the likely reduction in sand supply to northern beaches and therefore the likely effect of sand extraction (as a result of dredging) in the Richmond River estuary on coastal erosion.
- An investigation into the potential commercial return that could be gained from the utilisation of dredged spoil as a resource (e.g. sand for the building industry or beach nourishment) or the social benefit that may result from dredging. This investigation should consider the costs and benefits of the operation with a view to determining the long-term economic sustainability of operations relying on dredging.

KPIs No KPIs are recommended. Progression of this action would be dependent on the results of the above tasks, or receipt of firm proposals for enhanced marina facilities within the estuary.

BMT WBM Brisbane
Level 8, 200 Creek Street Brisbane 4000
PO Box 203 Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Denver
8200 S. Akron Street, Unit 120
Centennial Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email denver@bmtwbm.com
Web www.bmtwbm.com.au

BMT WBM Mackay
Suite 1, 138 Wood Street Mackay 4740
PO Box 4447 Mackay QLD 4740
Tel +61 7 4953 5144 Fax +61 7 4953 5132
Email mackay@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Melbourne
Level 5, 99 King Street Melbourne 3000
PO Box 604 Collins Street West VIC 8007
Tel +61 3 8620 6100 Fax +61 3 8620 6105
Email melbourne@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Newcastle
126 Belford Street Broadmeadow 2292
PO Box 266 Broadmeadow NSW 2292
Tel +61 2 4940 8882 Fax +61 2 4940 8887
Email newcastle@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Perth
Unit 6, 29 Hood Street, Subiaco 6008
Tel +61 8 9322 1577 Fax +61 8 9226 0832
Email perth@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Sydney
Level 1, 256-258 Norton Street Leichhardt 2040
PO Box 194 Leichhardt NSW 2040
Tel +61 2 9713 4836 Fax +61 2 9713 4890
Email sydney@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Vancouver
401 611 Alexander Street Vancouver
British Columbia V6A 1E1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email vancouver@bmtwbm.com
Web www.bmtwbm.com.au