Tweed NSW01.01.01

Regional Setting

The dominant regional processes influencing coastal geomorphology in this region are the humid warm to cool temperate climate, micro-tides, south-easterly Tasman Sea swells, easterly seas, dominantly quartz (terrigenous) sediments with northerly longshore transport in the northern part, and the El Nino Southern Oscillation (driving beach erosion/accretion cycles, cyclone frequency).

Regional hazards or processes driving large scale rapid coastal changes include: East Coast Lows (extra-tropical cyclones), mid-latitude cyclones (depressions), and storm surges (<1m).

This compartment extends from Point Danger to Cape Byron.

Justification of sensitivity

Overall sensitivity rating is a 4. Within the compartment, several sections are already rated as 5, although if onshore sand supply is maintained for some sections, the sensitivity rating could be 3 for extended periods. The southern ends of several of these beaches are sensitive and undergoing erosion as a result of differential rates of littoral drift on adjacent beaches. Overwash from cyclonic storms has occurred in places where foredunes are low and narrow.

Other comments

This compartment comprises several tertiary compartments, characterised by northwards longshore drift, influenced by both tropical cyclones and East Coast lows (PWD, 1978; Helman, 2007).

It terminates to the north at the training walls of the Tweed River on Letitia Spit. Sand accumulation on the southern side of this training wall, following extension 1962-1965, deprived Gold Coast beaches to the north of sand. It also led to the installation of the Tweed River bypassing project, which pumps ~500,000 m^3 of sand a year (552,682 m^3 in 2015) from NSW to nourish Kirra and other beaches on the Gold Coast. See http://www.tweedsandbypass.nsw.gov.au/.

Patterson (2013) indicates that there is only a modest gradient in the longshore sand transport, increasing from about 200,000 m^3/yr at Ten Mile Beach, Iluka, to about 550,000m^3/yr at northern Stradbroke Island (Patterson, 2013, p. 82; see also Patterson et al., 2011).

The supply of river sand to the coast is limited on the section of coast to the south, and the source of sand to sustain northwards drift is inferred to be from onshore transport from the shelf (Boyd et al., 2008, Mariani et al., 2013). If maintained as sea level rises, it is possible that the shoreline position for long stretches of beaches facing generally east could be maintained as sea level rises (sensitivity 3) until an unknown threshold is reached (Cowell et al., 2000). However, there is likely to be some degree of short-term recession in the tertiary embayments during periods when sand feed from the south is restrained.

Sand moves around headlands, such as the basaltic Fingal Head, and Norries Head, as a slug (see example at Cudgen in Short, 1999, p244). Here, the training walls along Cudgen Creek create a permanent but variable sand shoal in the northern lee of Cudgen Headland, with associated erosion problems for Kingscliff. Tweed Council is developing a long-term strategy to manage the erosion threat at Kingscliff (see Coghlan et al., 2011, WRL report).

The southern ends of several of these beaches are undergoing periodic erosion as a result of differential rates of littoral drift on adjacent beaches. Cabarita Beach is experiencing ongoing shoreline recession due to by littoral drift imbalance (Mariani et al., 2013). Headlands at Norries and Cudgen both act like groynes protruding through the active surf zone. Sand tends to build up on their south (updrift) sides until bypassing occurs when the updrift areas are filled to capacity. During times of elevated wave action a pulse or slug of sediment can be moved around the headland (Figures 1 and 2), often partially depleting the updrift area, which has to re-fill before bypassing is again fully established (Short, 2007; Mariana et al., 2013). Cabarita

Beach appears to undergo an recession of 1m/year, when explained as a result of the differential of 110,000 m^3/y, as a consequence of the loss around Cudgen Head of 350,000 m^3/yr compared with a gain around Norries of only 240,000 m^3/yr. Unless this imbalance is offset by onshore drift as shown in Figures 3 and 4, the shoreline in this tertiary compartment will recede under climate change and cut into the foredune buffer built after mining operations ceased in the 1980s.

Cape Byron provides an obstacle at the southern end and only a limited quantity of sand makes it around the headland to contribute to the southern end of this compartment (PWD, 1978). A consequent drift differential can result in periodic erosion of the foreshore on the beaches north of Cape Byron. Some sand at Cape Byron can be lost to an offshore sand lobe (PWD, 1978; Patterson & Britton Partners, 2006) while there may be a component of cross embayment sand transport (Patterson, 2013, Figure 7-38). Various consulting reports prepared for Byron Shire Council, involving modelling of Byron Bay coastal erosion processes and hazards, have highlighted the vulnerability of this section of the coast, especially Belongil Spit, (for example BMT WBM , 2010). Hopley (1967, and PWD, 1978) also noted the impacts of overwash accompanying storm surges at the southern end of the compartment.

Several locations, such as Brunswick Heads, are sensitive where training walls have been built, with erosion becoming apparent downdrift after the storms in the 1970s. The Brunswick River is neither a source nor sink for sand (PWD, 1978). The settlement of Sheltering Palms to the north of the Brunswick River was severely eroded in the early 1970s and houses were abandoned and lost by 1977.

The area has been extensively explored and subjected to sand mining for heavy minerals (Gardner, 1955; Roy, 1999).

Figure 1. Erosion in front of surf club at Kingscliff (photo A. Short).

Figure 2. Sand slug moving around at Kingscliff (photo A. Short).

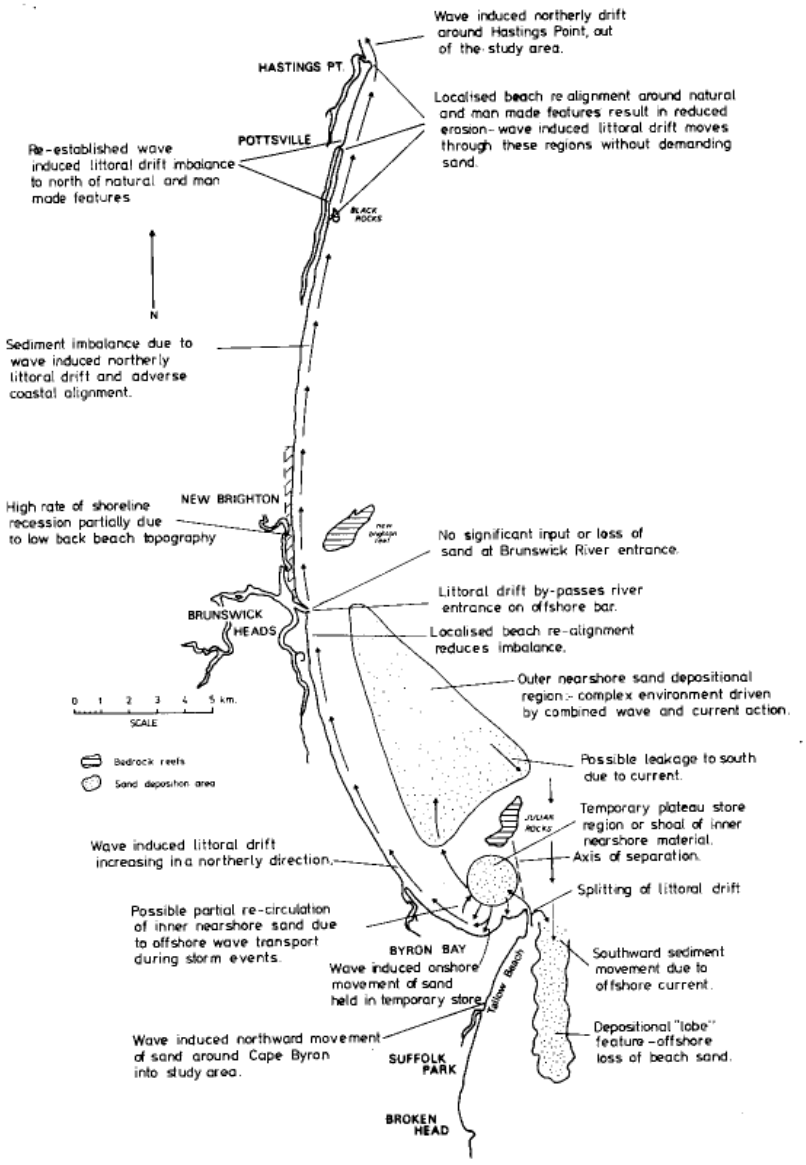

Figure 3. Conceptual model of Cape Byron (PWD, 1978)

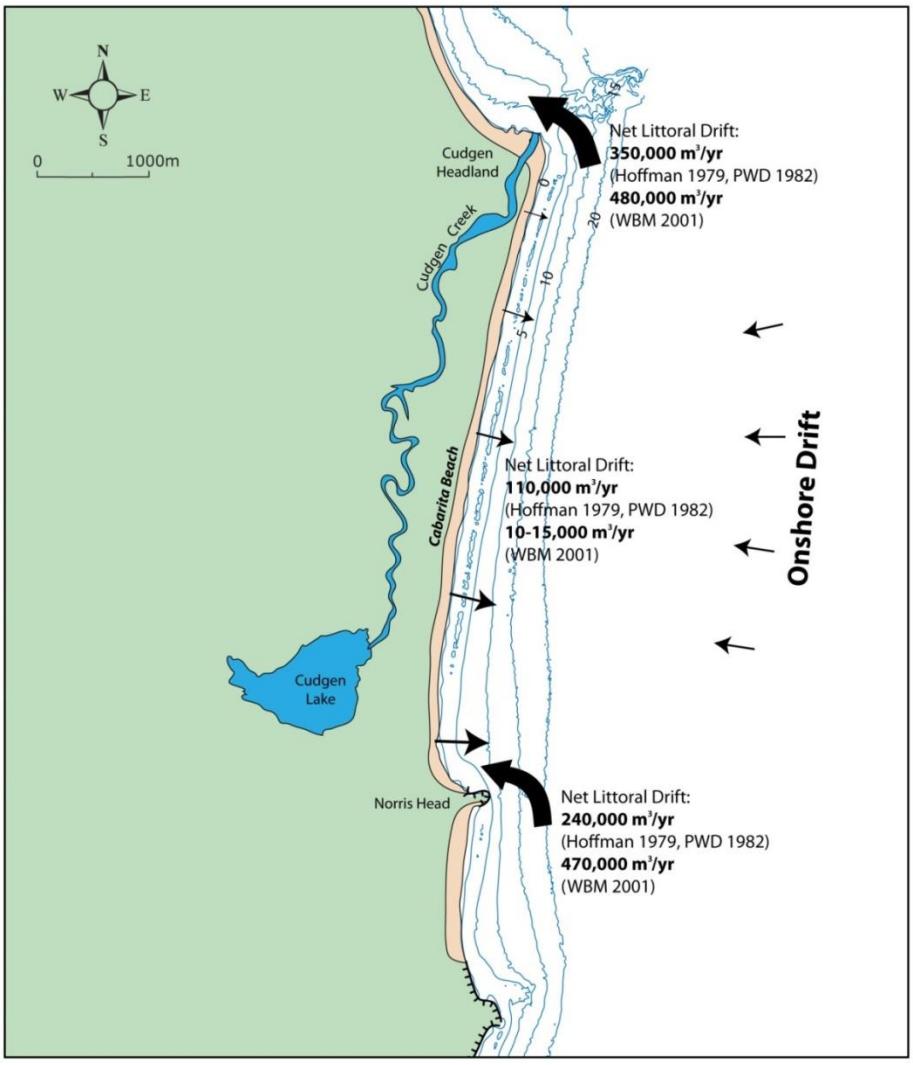

Figure 4, Conceptual sediment budget model (Fig 2.10 from Mariani et al., 2013)

Confidence in sources

High confidence: Longshore drift along the northern NSW coast has been the subject of numerous detailed studies, including several focused on erosion at Tweed Heads, Kingscliff, Cudgen and Byron Bay, especially Belongil Spit.

Additional information (links and references)

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