Cape Byron to Ballina NSW01.01.02

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 Cape Byron to Richmond River.

Justification of sensitivity

Sensitivity rating is a 4. Parts of this compartment are sediment-starved; Holocene sand accumulation has been limited, with Pleistocene dune sands exposed in places on the coast and seawall construction at Lennox Head indicating that it is likely already earning a sensitivity rating of 5.

Other comments

This compartment comprises two log-spiral or zeta curve tertiary compartments to the north, and a more rocky section of coast to the south, near the mouth of the Richmond River. There has been past mining on many of these beaches.

Historically there has been an erosion problem at Seven Mile Beach, especially near Lennox Head at the southern end of a tertiary compartment. In places, there is narrow Holocene sand accumulation, and peat outcrops have been described in the beach - a sign of a receding barrier (Chapman et al., 1982). The exposed nearshore reef of peat has been radiocarbon dated around 3700 years BP, suggesting a recession rate of at least 0.05m/year (Geomarine, 1990). Patterson (2013) notes that the shoreline at Lennox Head and northward along Seven Mile Beach is eroding; from the earliest date of aerial photos in 1947, foredunes up to 10m high have been lost in places between 1947 and 1976.

As with other parts of the north coast on NSW, the shoreline has stabilised since 1980 to a large degree during a period of inter-decadal post storm recovery. However, this is a sediment starved area and highly sensitive to climate change. Historical and late Holocene breaching of the narrow barrier into Lake Ainsworth is another indication of the fragility of the coast in this area.

The southern part of this compartment faces southeast and contains several short straight beaches between basalt headlands; there are two boulder beaches.

Patterson (2009, 2013, p.268) has modelled the impact of the training walls of the Richmond River on sand transport. His study of the present-day wave climate and longshore sand transport regime for this compartment and that to the south of Ballina indicates that the net rate of transport at Ballina is highly sensitive to the subtle balance between deep water wave direction and shoreline orientation north and south of the Richmond River. The training walls have trapped a large quantity of sand, altering the alignment of the coastline to the south, but having possible long term erosion effects to the north toward Suffolk Park (southern end of Tallow Beach), including erosion of Seven Mile Beach and in the vicinity of Seven Mile Beach.

Low-lying plains flanking the lower Richmond River are likely to be subject to inundation, and continued sand accumulation and trapping in shoals of the flood tide delta. But it is not clear as to whether this delta will continue to serve as a sink for sand as sea level rises. The long-term behaviour of entrance shoals under climate change, such as at the Richmond, is most uncertain at this stage.

Confidence in sources

Medium confidence: Similar processes of longshore transport occur as further north, but they have studied in detail in the Lennox tertiary compartment and around the mouth of the river, the subject of recent (2016) Coastal Zone Management Plans by Ballina Shire Council.

Additional information (links and references)

Chapman, D.M., Geary, M., Roy, P.S., Thom, B.G., 1982. Coastal Evolution and Coastal Erosion in New South Wales. Coastal Council of New South Wales, Sydney.

Geomarine Pty Ltd, 2000. Environmental Impact Statement for Beach Management at Lennox Head. Report for Ballina Shire Council.

Goodwin, I.D., Freeman, R., Blackmore, K., 2013. An insight into headland sand bypassing and wave climate variability from shoreface bathymetric change at Byron Bay, New South Wales, Australia. Marine Geology 341, 29-45.

Helman, P., 2007. Two hundred years of Coastline Change and Future Change, Fraser Island to Coffs Harbour, East Coast Australia. Unpublished PhD thesis, Southern Cross University.

Mariani, A., Flocard, F., Carley, J.T., Drummond, C., Guerry, N., Gordon, A.D., Cox, R.J., Turner, I.L., 2013. East Coast Study Project - National Geomorphic Framework for the Management and Prediction of Coastal Erosion, Water Research Laboratory, WRL Research Report. School of Civil and Environmental Engineering, UNSW Australia, Manly Vale, NSW.

Patterson, D.C. 2009. Modelling the shoreline impacts of the Richmond River training walls. 18th NSW Coastal Conference, Ballina, NSW.

Patterson, D.C., 2013. Modelling as an aid to understand the evolution of Australia's central east coast in response to late Pleistocene-Holocene and future sea-level change. Unpublished PhD thesis, University of Queensland.

PWD (1978) Byron Bay – Hastings Point erosion study. NSW Dept. Public Works, Coastal Engineering Branch Report, PWD 78026