Surf Coast VIC03.02.01

Regional Setting

This compartment extends from Point Lonsdale to Split Point.

It is exposed to south-westerly swells and experiences micro-tides (approx. 1.0 to 1.5m tidal range).

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).

Justification of sensitivity

The large swash-aligned Thirteenth Beach and Ocean Grove Beach (to the west and east of Barwon Heads respectively) are partly backed by lithified (hardened) calcareous dunes (calcarenite) that were originally sourced from substantially biogenic marine sands (shell fragments, etc.), transported from the Bass Strait shelf by winds, during glacial-phase low sea stands, and by waves during post-glacial marine transgressions during the last million and more years of the Pleistocene. Younger unconsolidated sands brought shore-wards by the last post-glacial marine transgression or produced by wave-erosion of calcarenite at the present shoreline form the beaches, while windblown sand sheets and dunes mantle the older and harder calcarenite in backshore areas.

A series of swash-and drift-aligned beaches from Split Point to Breamlea are composed of sands brought shore-wards by the last post-glacial marine

transgression, and sand produced by wave-erosion of exposed calcarenites and the cohesive, but erodible, Tertiary-age sedimentary 'soft-rocks' that back many of the beaches and form some intervening bluffs and shorelines (Bird 1993).

There is no significant supply of sand from rivers at the present time. Sand mobility modelling (Harris & Heap 2014) suggests there may be some degree of ongoing wave-driven transport of sand from Bass Strait onto the large beaches either side of Barwon Heads, but there is probably little such onshore transport of sand to the beaches between Split Point and Breamlea. These latter beaches are probably slowly losing sand transported by alongshore swell-driven drift towards the Barwon Heads beaches (while continuing to gain some sand from wave erosion of interspersed and backing 'soft-rock' shores). There is probably also some loss of sand from Ocean Grove Beach into the large flood-tide delta inside the mouth of Port Phillip Bay, and minor losses into the Barwon River estuary may occur as sea-level rise increases the accommodation space available there.

With a likely ongoing supply of sand from offshore and alongshore (from the beaches south-west of Breamlea), and with exposure to swells allowing beach recovery after erosion events, Thirteenth Beach and Ocean Grove Beach are likely to be late responders to sea-level rise in respect of shoreline recession (sensitivity 3), despite some loss of sand into Port Phillip Bay. When progressive shoreline recession into these beaches and dunes does occur, it will be limited in areas where the underlying hard lithified calcarenite barrier rises well above present sea-level. However, this is not the case everywhere (see Rosengren (2010).

The sandy beaches between Split Point and Breamlea are mostly probably both losing and gaining sand by alongshore drift, from south-west to north-east, as well as gaining sand from erosion of 'soft-rock' shores. As they are also capable of swell-driven recovery after erosion events, most of these beaches are thus likely to be late responders to sea-level rise (sensitivity 3). However, with little onshore sand supply, and little sand available from most of the rocky coast southwest of Split Point, it is possible that the south-westernmost beaches near Split Point will exhibit significant net losses of sand in the medium term, and so may be medium-term rather than late responders to sea-level rise (Sensitivity 4). It is important to note that this depends on whether or not increased erosion of 'soft-rock' shores at the south-western end of this compartment, in response to sea-level rise, is capable of supplying sufficient sand to replace that lost to alongshore drift.

The exposed soft-rock shorelines and scarps between and backing many of the beaches from Split Point to Breamlea are already exhibiting active erosion scarps and slumping (Bird 1993); with no capacity for shoreline recovery and a likelihood that higher sea-levels will increase their rates of erosion (Trenhaile 2011), these are probably early responders to sea-level rise (sensitivity 5).

Other comments

Infrastructure, including roads and residences, are located close to the shore in large portions of this compartment and in some areas are potentially susceptible to increased shoreline recession and flooding, consequent on sea-level rise.

Potential future shoreline recession distances behind the Barwon Heads beaches, in response to sea-level rise, may be quite variable, depending on the hard calcarenite topography under the recent soft dune sands backing the beaches, but can be determined using drilling or geophysical methods such as ground-penetrating radar. Areas landwards of and above the distances at which underlying hard calcarenite surfaces rise several metres or more above present sea-level are unlikely to be at risk from shoreline recession or inundation before 2100 at least.

Parts of this compartment coast are potentially susceptible to coastal inundation at present and will be increasingly so with ongoing sea-level rise.

Confidence in sources

Medium to high confidence: Previous geomorphic and coastal hazard studies have been reported for parts of this compartment; good geological, topographic and other data is readily available.

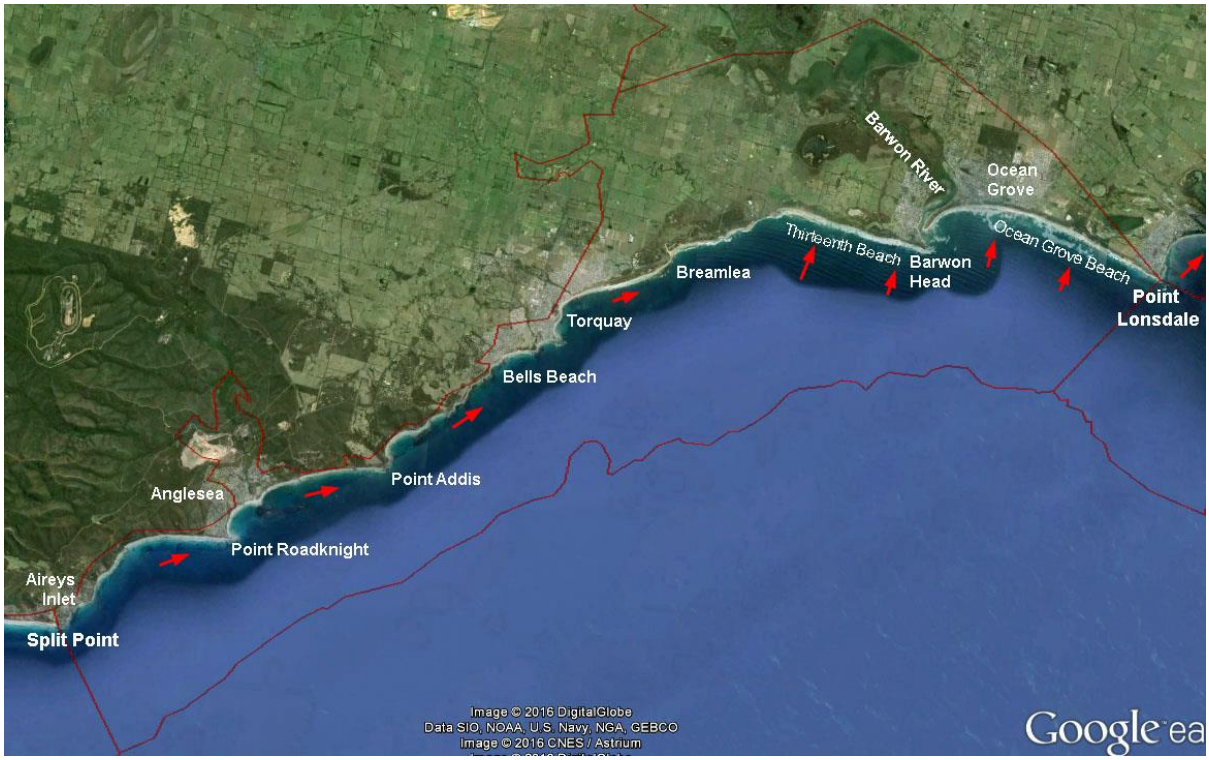

Figure 1: *Compartment VIC03.02.01 Surf Coast. Red arrows indicate likely dominant sand transport directions (largely swell-driven).*

Figure 2: *Rocky calcarenite shore platform at the east end of Thirteenth Beach. Similar calcarenite rises well above sea-level under parts of the dunes backing Thirteenth Beach and Ocean Grove Beach, and where it does so, will limit the landwards shoreline recession of the beaches that can occur in response to sea-level rise over the foreseeable future. However, the topography of the calcarenite 'base' beneath the dunes is variable and may not rise high enough to provide protection against shoreline recession everywhere. Photo by C. Sharples (2010).*

Figure 3: *Recent active shoreline recession is indicated by the protruding roots of mature still-living trees in this soft-rock scarp at the south end of Point Roadknight Beach. The distant bluff in soft Tertiary-age bedrock (backing part of the sandy beach) also exhibits evidence of large recent slumps (landslides). These cohesive but erodible Tertiary-age sediment shores are actively receding now and likely to continue doing so at an increasing rate in response to sea-level rise. Photo by C. Sharples (2010).*

Additional information (links and references)

Geological mapping at several scales is available for this compartment. A number of previous coastal hazard studies have been undertaken for this compartment, particularly in the Barwon Heads area. For example, Rosengren (2010) provides detailed geomorphic information about Ocean Grove beach and surrounding areas. Cardno Victoria Pty. Ltd. provided a recent hazard assessment of Thirteenth Beach and Ocean Grove Beach for the City of Geelong and the Victorian Department of Sustainability and Environment (DSE) during 2013 – 2014, as one of four Victorian Local Coastal Hazard Assessments (Cardno 2014). Bird (1993) provided a useful geomorphic description of this compartment.

The following references are cited above:

Bird, ECF 1993, *The Coast of Victoria: the Shaping of Scenery*, Melbourne University Press, Melbourne.

Cardno 2014, *Bellarine Peninsula Corio Bay Local Coastal Hazard Assessment*, Report for City of Greater Geelong by Cardno Victoria Pty. Ltd.

Harris, PT & Heap, A 2014, 'Geomorphology and Holocene Sedimentology of the Tasmanian Continental Margin', in KD Corbett, PG Quilty & CR Calver (eds), *Geological Evolution of Tasmania*, Geological Society of Australia (Tasmania Division), pp. 530-539.

Rosengren, N 2010, *Buckley Park Foreshore Reserve: Context, Morphology, Evolution, Environmental Processes*, Report for Friends of Buckley Park.

Trenhaile, AS 2011, 'Predicting the response of hard and soft rock coasts to changes in sea level and wave height', *Climatic Change*, vol. 109, pp. 599-615.