



## Macquarie Harbour TAS02.03.01

### Regional Setting

This compartment extends from Cape Sorell to Braddon Point.

Macquarie Harbour is fully sheltered from ocean swells. However, strong westerly winds blowing over long fetches within the harbour can generate large waves capable of eroding the north-eastern and eastern shores, and strong north-westerly wind-waves may similarly erode beaches on the south-western shore.

The shoreline is micro-tidal, with water levels within the harbour affected by tides propagating through the narrow entrance, and also by variable output from the high-discharge Gordon and King Rivers. Complex water stratification and currents occur within the harbour owing to the effects of both tidal and large river discharge currents.

The dominant regional processes influencing coastal geomorphology in this region are the Mediterranean to humid cool-temperate climate, micro-tides, high energy south-westerly swells, westerly seas, carbonate sediments, interrupted swell-driven longshore transport, and the Southern Annular Mode (driving dominant south-westerly swells and storms).

Regional hazards or processes driving large scale rapid coastal changes include: mid-latitude cyclones (depressions), storm surges and shelf waves.

### Justification of sensitivity

The sensitivity ratings in this compartment range from 3 to 5. The receding soft-rock cliffs on the NE shore are rated 5. In contrast, the hard rocky shores on the SW shore are resilient. Pocket beaches with a sand source and close to the harbour mouth may be stable (rating 3). Other beaches with a limited sand supply are likely to be more sensitive (rating 4).



Although the King and Gordon Rivers probably transported abundant glacial outwash sands from glaciated highlands through the Macquarie Harbour graben to the continental shelf during glacial low sea stands, it is likely that little of this is returned to the harbour during post-glacial marine transgressions, but rather accumulates in the Ocean Beach barrier at the harbour mouth. Numerous narrow, bedrock-backed, sandy pocket beaches around the harbour (see **Figure 2**) have probably derived most of their sand from wave-erosion of the soft Tertiary sandstones that form large sections of the harbour shore during interglacial high sea-stands, such as the present. Present-day rivers supply negligible sand to the shore, with the exception of the King River, which has transported large amounts of metalliferous sand and silt to a large anthropogenic delta at its mouth, as a result of extensive mining disturbance in its catchment. This delta may be supplying small amounts of sand to nearby beaches, albeit this is not certain.

Beaches close to the harbour mouth have a potential sand source in the large flood-tide deltas inside the harbour mouth (which themselves are gaining sand from Ocean Beach). Although the current condition of these beaches is uncertain, with the potential of gaining sand supplies, these beaches may be late recessional responders to sea-level rise (Sensitivity 3). Two of these beaches in the well-embayed Betsy's and Liberty Bays are also immediately backed by soft Tertiary-age sandstones, whose erosion by waves as sea-level rises will supply additional sand and possibly help these beaches to 'keep up' with sea-level rise for longer, rather than being quickly squeezed out against their sloping backshores.

It is unclear whether bottom currents transport significant amounts of sand from the flood-tide delta deeper into the Harbour, and it is likely that most of the small, bedrock-backed pocket beaches around the harbour have limited sand supplies, with only minor gains from shoreline erosion and wave-driven littoral drift. The current condition of these beaches is uncertain. However, with limited sand supplies and no swells to rebuild beaches after erosion events, it is likely many of these beaches will be medium-term (Sensitivity 4) if not early responders, as rising seas squeeze them out against rising backshore bedrock slopes.

Along much of the northern, north-eastern and eastern shores of Macquarie Harbour, as well as small sections of the south-western shore, the shoreline comprises actively eroding scarps in Tertiary-age, clayey sandstone, 'soft-rock' shores (see **Figure 3**). Large slumps are notable along parts of these commonly



steep shores. Although these shores have probably been slowly receding since post-glacial sea-levels reached close to their present level about 6,500 years ago, the rate of recession of these shores is expected to be increasing with sea-level rise ([Trenhaile 2011](#)), and these shores are probably early responders to sea-level rise (Sensitivity 5).

Hard Cambrian and Precambrian-age sedimentary and volcanic rocks form much of the moderately sloping to cliffed rocky, south-western shore of Macquarie Harbour; these rocky shores are likely to be mostly resilient and will probably show little physical change in response to sea-level rise on decadal to century time-scales.

### **Other comments**

Apart from the tourism and fishing supported township of Strahan, the shores of Macquarie Harbour are almost entirely uninhabited and have little infrastructure.

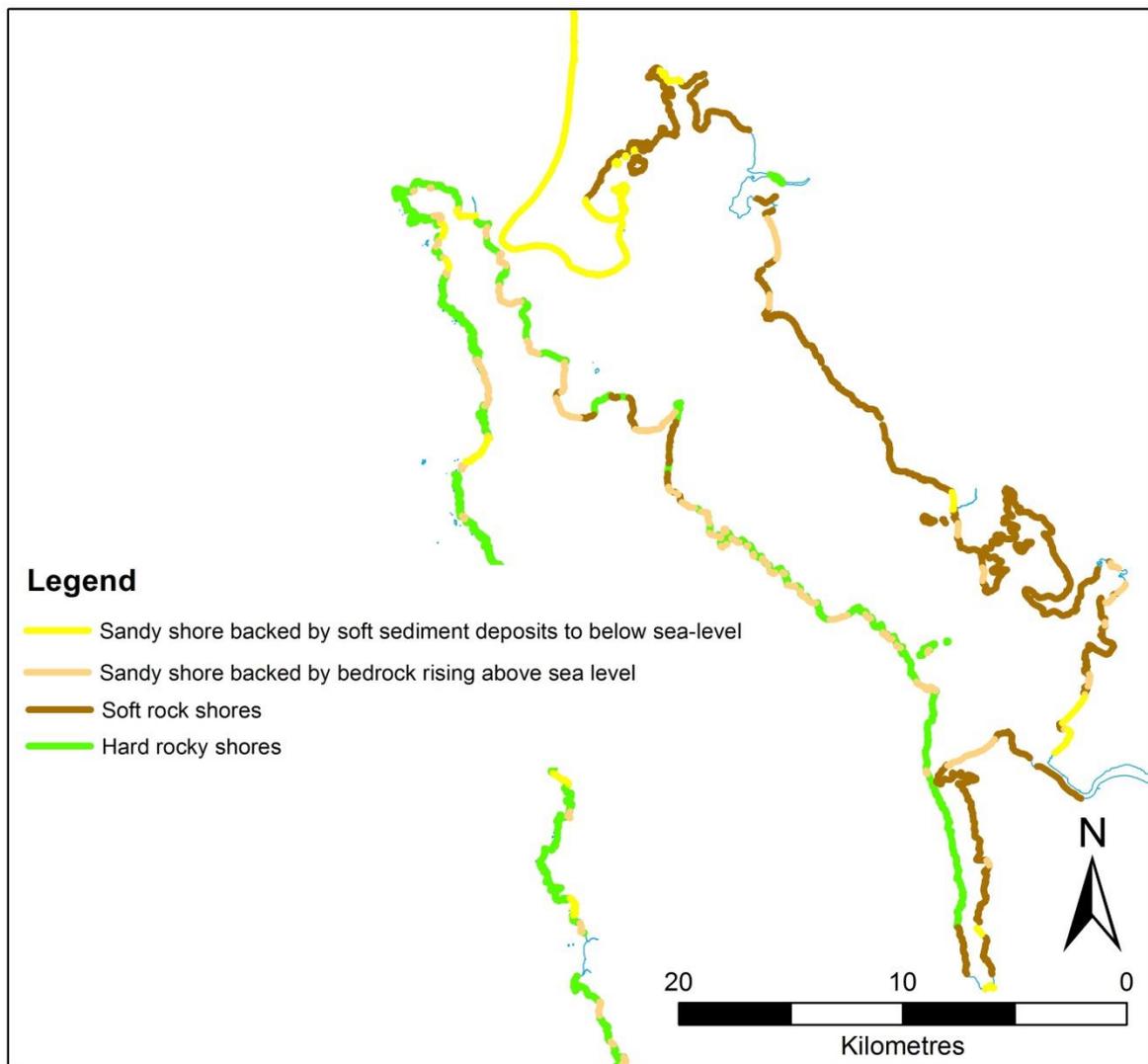
Some shoreline areas close to Strahan, and in Birches Inlet and elsewhere, include low-lying coastal flats that may be increasingly prone to coastal flooding with sea-level rise. However, most of the shores of Macquarie Harbour are moderately sloping to cliffed, with little susceptibility to coastal flooding.

### **Confidence in sources**

Moderate confidence: This assessment is based on available geological and topographic mapping plus several field visits. However, no detailed studies of coastal geomorphology or coastal erosion hazards are available for this compartment.



**Figure 1:** Compartment TAS02.03.01 Macquarie Harbour. Red arrows indicate likely sediment supply from the large flood-tide delta inside the harbour mouth to adjacent beaches, and possible supply of some sediment to nearby beaches from the anthropogenic King river delta.



**Figure 2:** Coastal landform substrates and types in Macquarie Harbour. Map derived from the Smartline map of Australia ([Sharples, Mount & Pedersen 2009](#)) with landform categories very coarsely defined.



**Figure 3:** Cohesive but soft, Tertiary-age, clayey sandstone shores on the north-eastern and eastern shores of Macquarie Harbour are exposed to large wind-waves generated by strong westerly and south-westerly winds across long fetches, and exhibit large slumps and recently active erosion scarps along much of that shore. This photo depicts recent minor slumping on this soft-rock shore near the Braddon River mouth. Photo by C. Sharples (2008).



### **Additional information**

Geological and topographic mapping at several scales is available for this compartment. The following references have also been used above:

Sharples, C, Mount, R & Pedersen, T 2009, *The Australian Coastal smartline Geomorphic and Stability Map Version 1: Manual and Data Dictionary*, School of Geography and Environmental Studies, University of Tasmania.

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.