Appendix B

Conceptual Sediment Transport Model – Batemans Bay

Inner Batemans Bay
Conceptual Sediment Transport Model

Eurobodalla Open Coast Coastal Management Program - Stage 2: Vulnerability Assessments

Baird.
Innovation Engineered.

Rhelm
engineering | environmental | economics | engagement

Historical Timeline

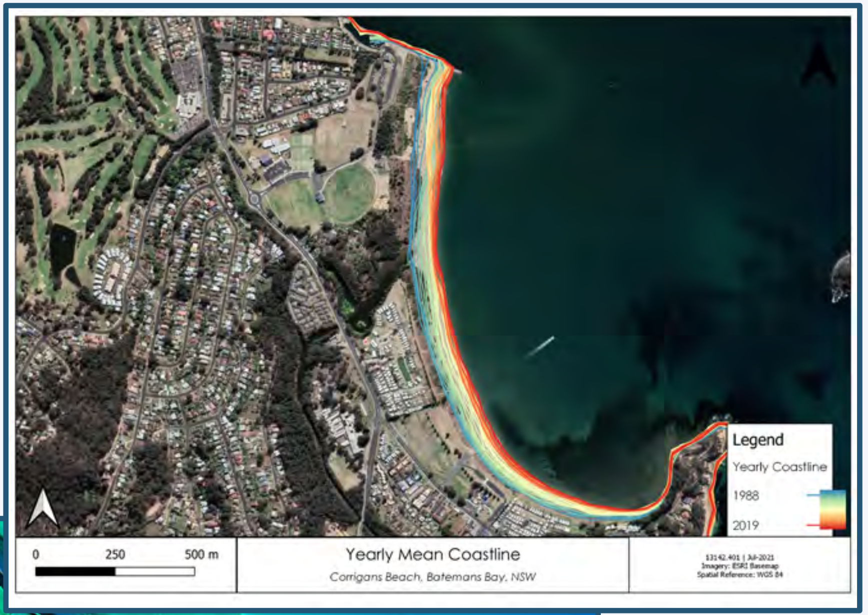
- Development
  - 1899 to 1905 – Training wall constructed (low crested structure)
  - 1950s – Princes Highway Bridge constructed
  - circa 1950s/60s – Training wall upgraded (higher crest)
  - circa 1960s/70s – Construction of Seawalls (various) including at Wharf Road
  - 1989 – Extension of training wall
- Dredging
  - Regular dredging of the entrance shoal up until early 1950s (then 1957-8, 1961-2, 1964)
  - Recent dredging of entrance shoal included 2013, 2016 and 2020
- Nourishment
  - Dredged spoil typically placed on Corrigans (up until 60s)
  - Dune Nourishment at Northern Surfside East, circa 1996
  - Nourishment at Surfside West, 2016
  - Nourishment of shoal offshore of Surfside, 2020

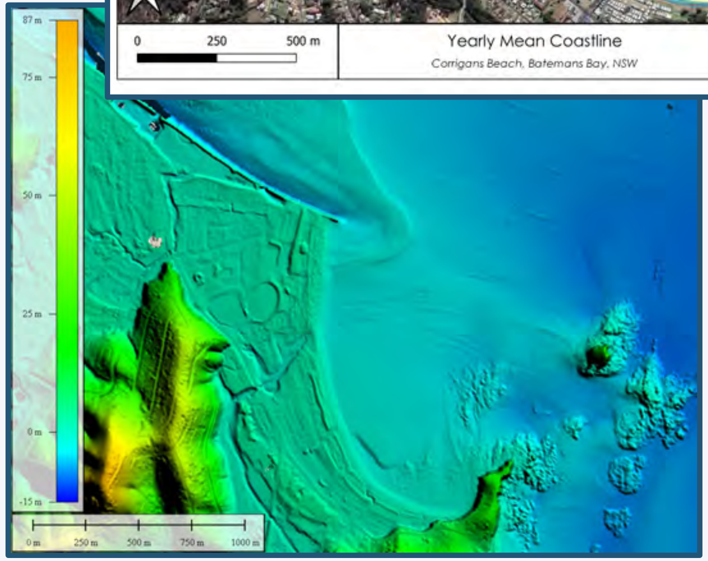
Sediments in the Inner Bay

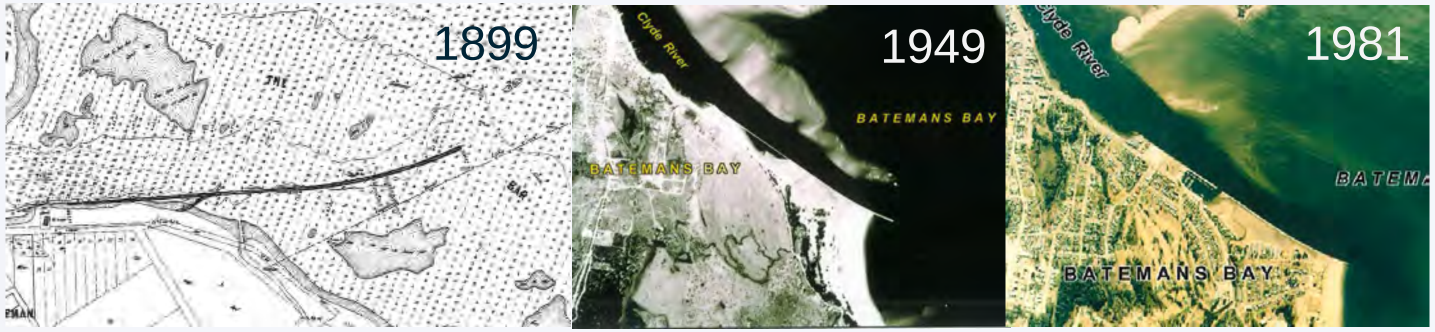
- WBM (2000) completed field sampling of surface sediments
- The sediments of inner Batemans Bay are:
  - Predominantly lithic sands
  - Higher proportion of angular (fluvial) quartz compared to well rounded (marine) quartz
  - Carbonate content increased further out into the Bay
- The predominance of fluvially derived sediments indicates flood events are the significant contributor of sediment to the Bay
- Annual average fluvial sand supply is estimated to be in excess of 22,000m^3 per year (WBM, 2000).

Corrigans Beach

- History
  - 1899 to 1905 – Training wall constructed (low crested)
  - circa 1950s/60s – Training wall upgraded (~+2mAHD crest)
  - 1991 – Extension of training wall
  - Significant accretion has occurred (~8,000m^3 /year since 1942)
- Sediment Transport
  - Accretion due to construction of training wall and subsequent upgrade and extension
  - Training wall (both pre- and post- upgrade) was an effective trap of bed load sediment transport (the principal mechanism of sediment transport/morphological change since 1900)
  - Longshore sediment movement of fluvially supplied sediments to the north, minor bypassing of training wall back into the shoal





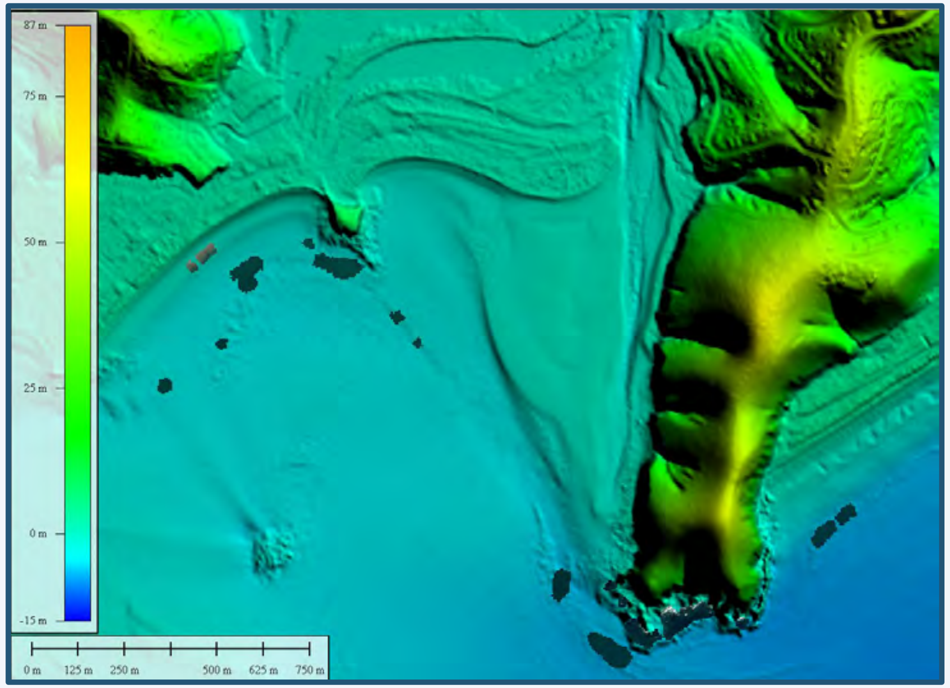


Original training wall

Upgraded training wall

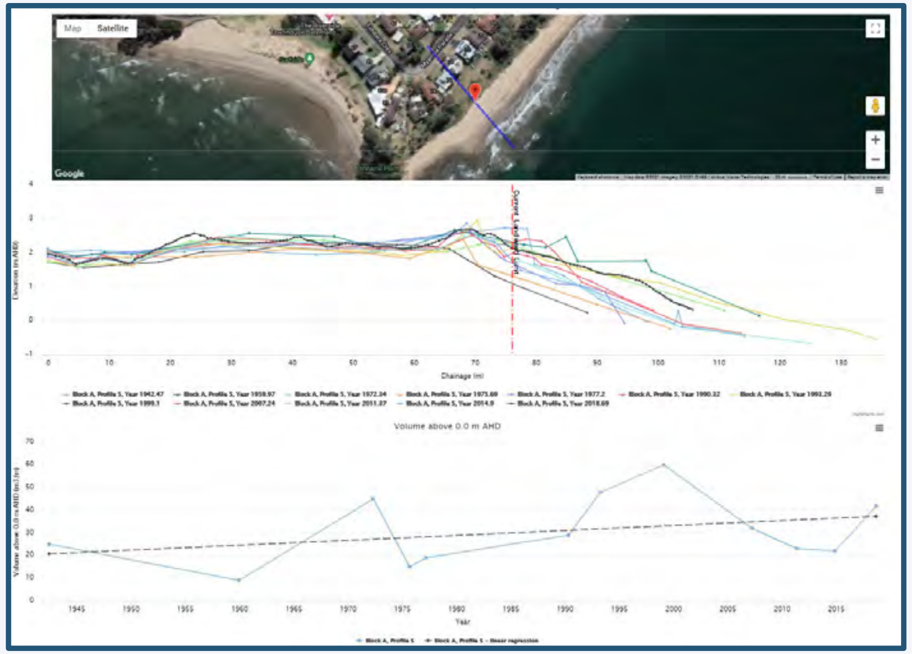
Cullendulla Beach

- History
  - Embayed by Square Head and Hawk's Nest Head.
  - Chenier Plains to the rear (variably spaced - a function of the variable rate of falling sea level over ~6000 yrs).
  - Significant flood delta (Square Head Shoal) from Cullendulla Creek fed by flood flows/runoff. Protected from incident waves.
  - Limited human interference.
- Sediment Transport
  - Eastern longshore transport.
  - Ongoing recession at the western end (90 m between 1942 to 2018) following end to seaward progression of the beach ridge system after stable/rising sea levels over the last ~1000 years.
  - No direct mechanism of fluvial sediment from Cullendulla Creek to reach the adjacent shoreline to the west.



Surfside East

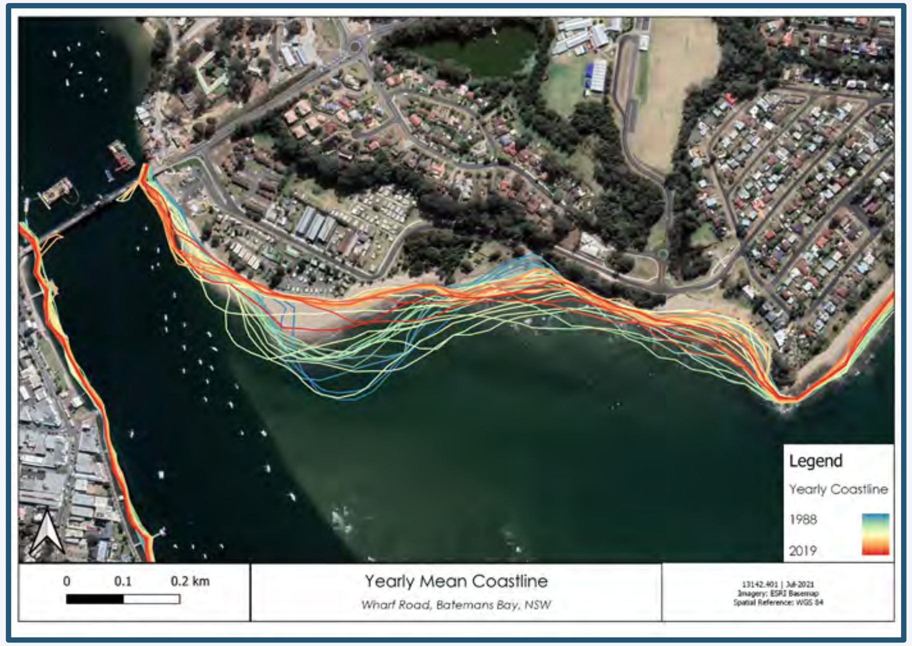
- History
  - Surfside development, circa 1940s
  - Sand nourishment at Northern End (1996) – ~12,000m^3
- Low to negligible net longshore transport (shoreline in alignment with incident waves)
- Limited transfer of sand to/from Cullendulla Beach
- Onshore transport likely from nearshore bars (when configuration allows)
- Otherwise marginal SW transport (Nth to Sth)
- Generally dynamically stable
  - Marginal recession trend at northern end
  - Marginal accretion trend at southern end

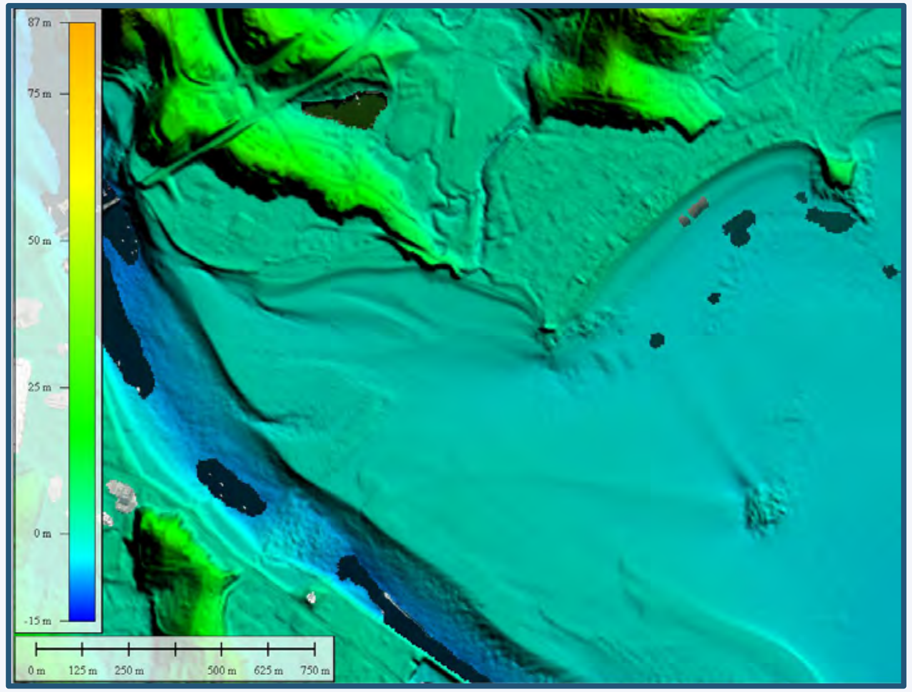


Surfside West / Wharf Road

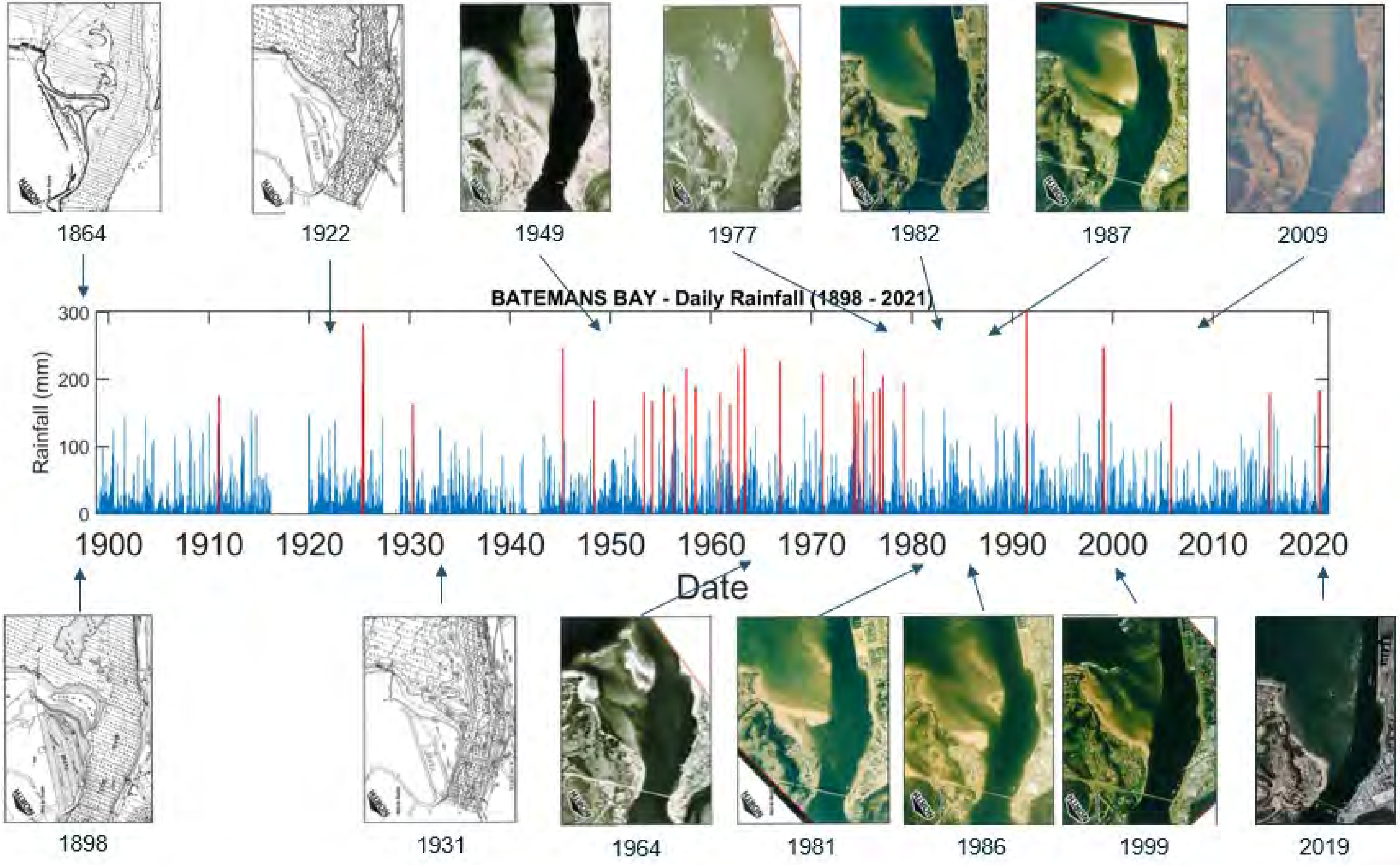
- Surfside West History
  - Natural creek line channelized with culvert at western end (circa 1950s)
  - Dynamic fluctuating shoreline

- Wharf Road History
  - Located along a 400 m stretch of active coastline with considerable instability.
  - Residential allotments created in the 1800s during an accreted phase has meant that many allotments are now below the high water mark.
  - A seawall was constructed in the 1960s/1970s at the North West end.

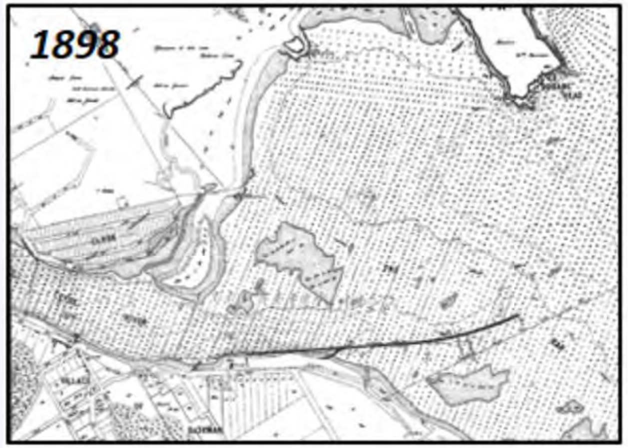


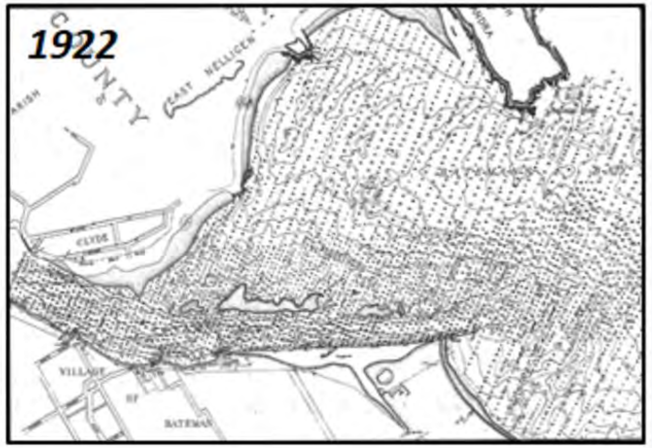


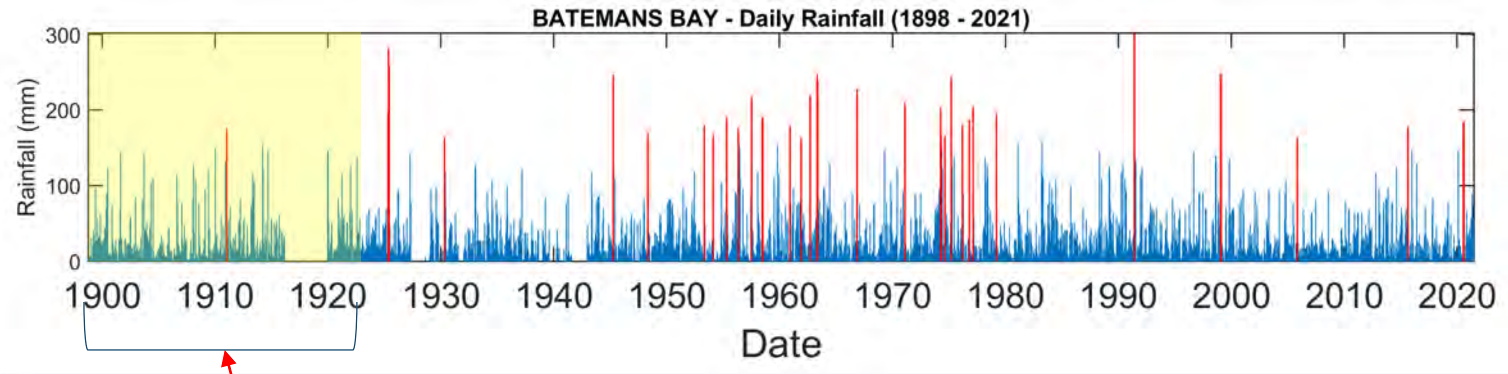
Rainfall and Flooding



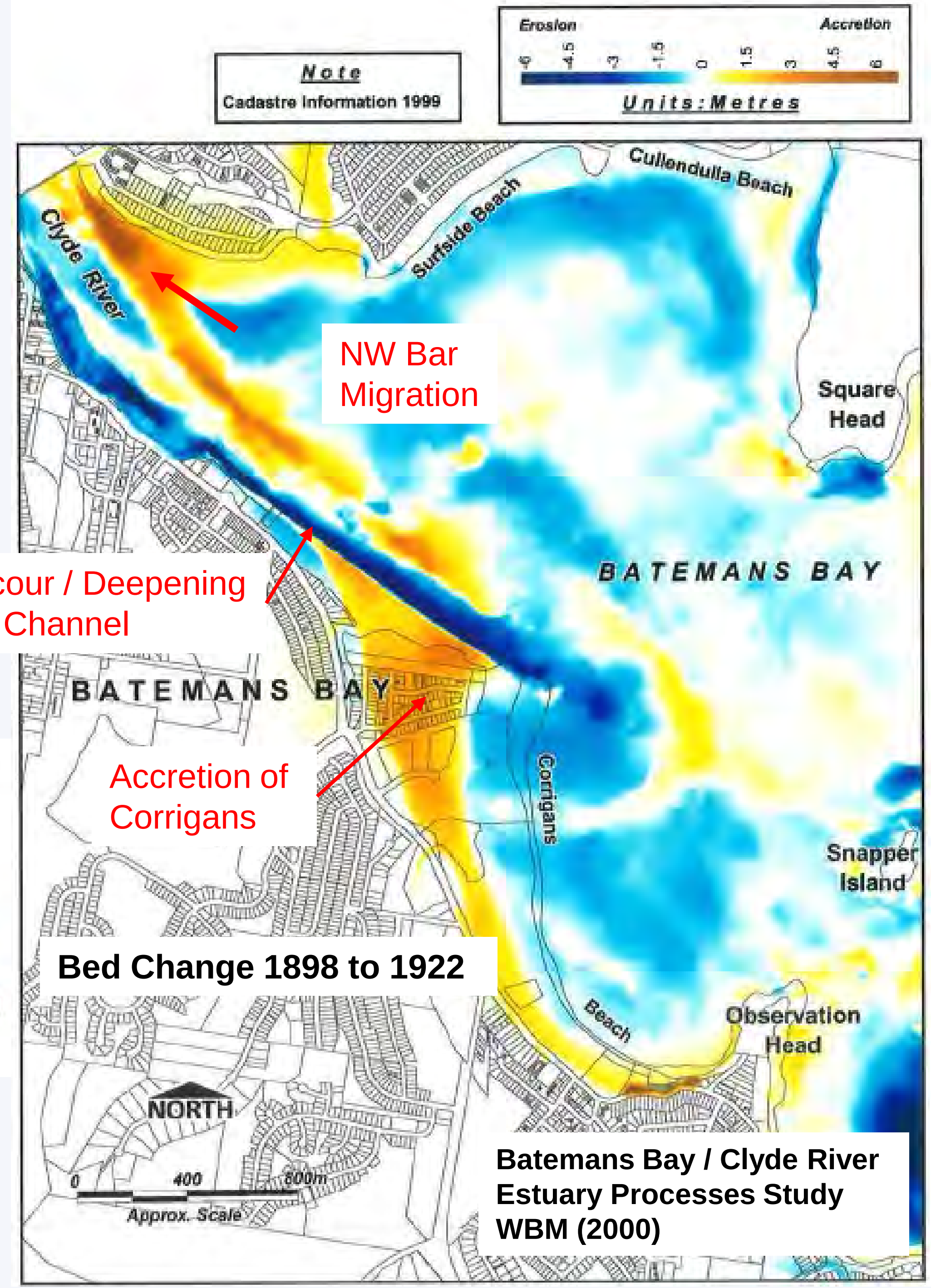
Low Rainfall Period





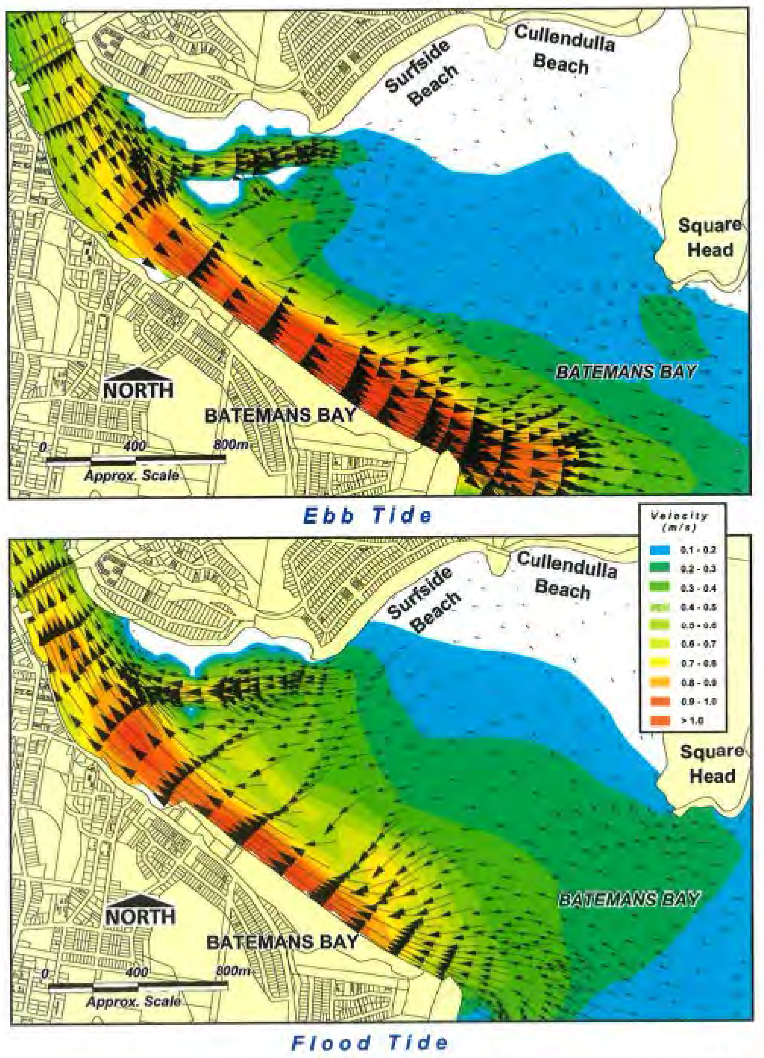


Low Rainfall period



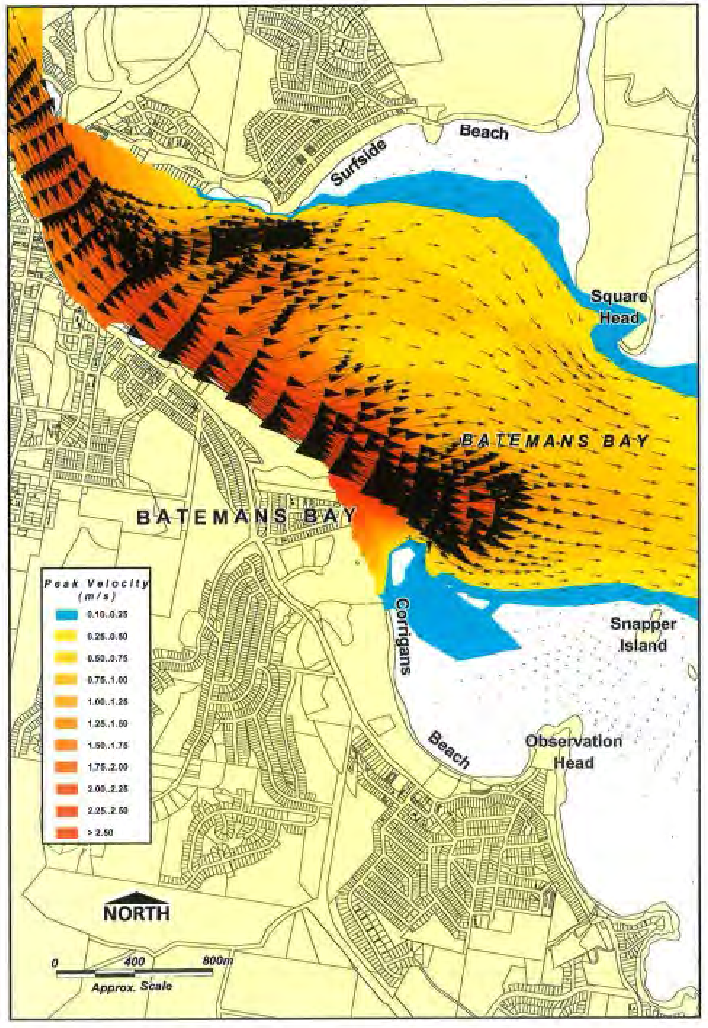
Surfside West / Wharf Road

- Tide
  - Tidal flows generate currents across Wharf Road/Surfside in excess of 0.5m/s (dependent on shoal configuration)
  - Would hinder onshore transport of sediment from nearshore shoals when present
- Flood
  - Flood flows generate currents across Wharf Road/Surfside in excess of 2m/s
  - Will drive significant sediment transport through area
  - Flow structure dependent on shoal configuration prior to flood and flood magnitude



Tidal Current Pattern, Mean Spring Tide Figure 4.37

WBM (2000)

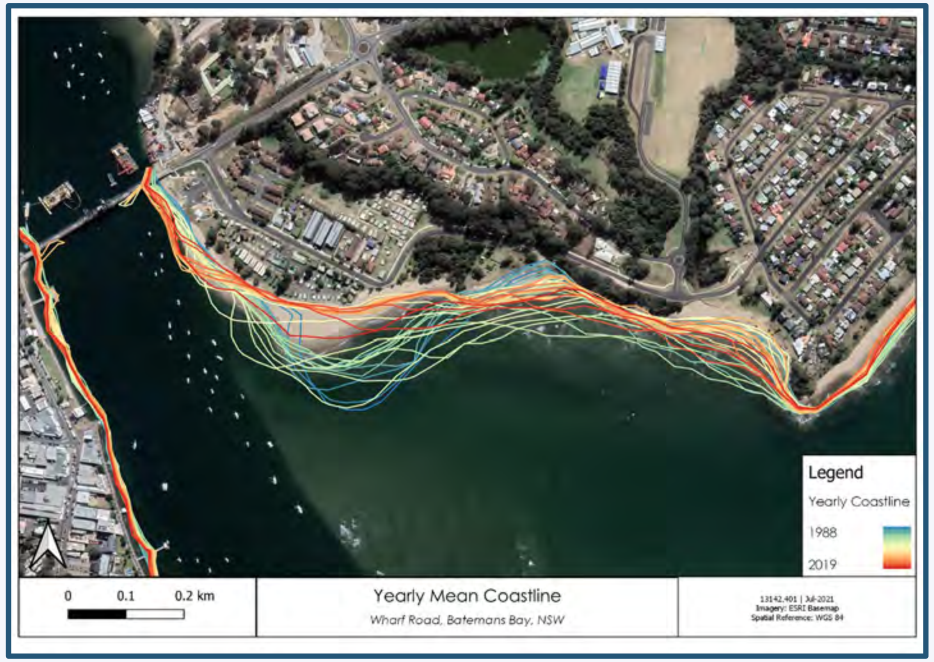


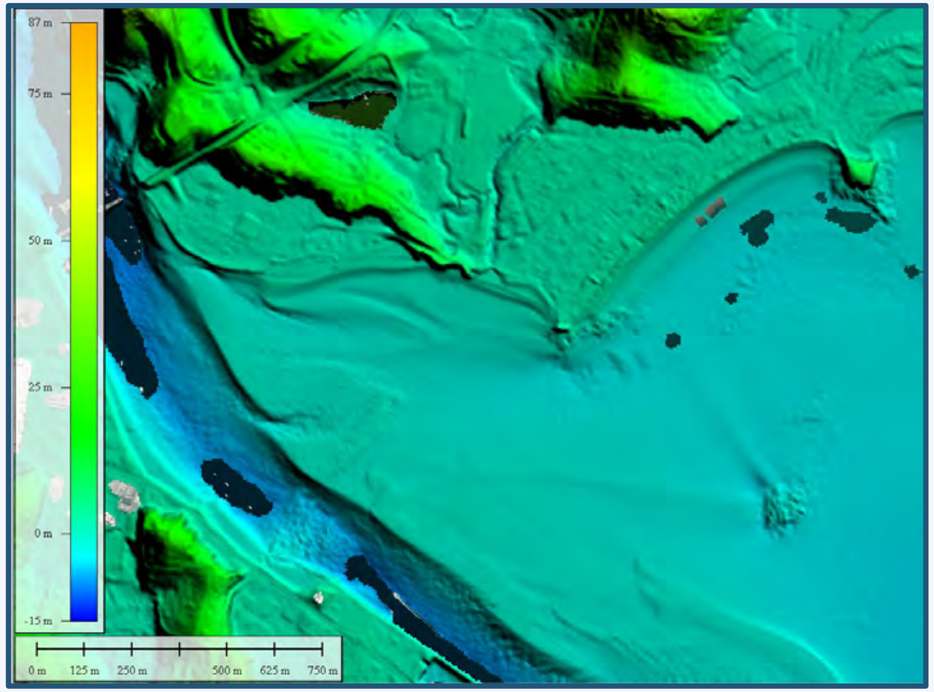
Peak Flood Velocities - 4000 m3/s Flow Figure 4.38

WBM (2000)

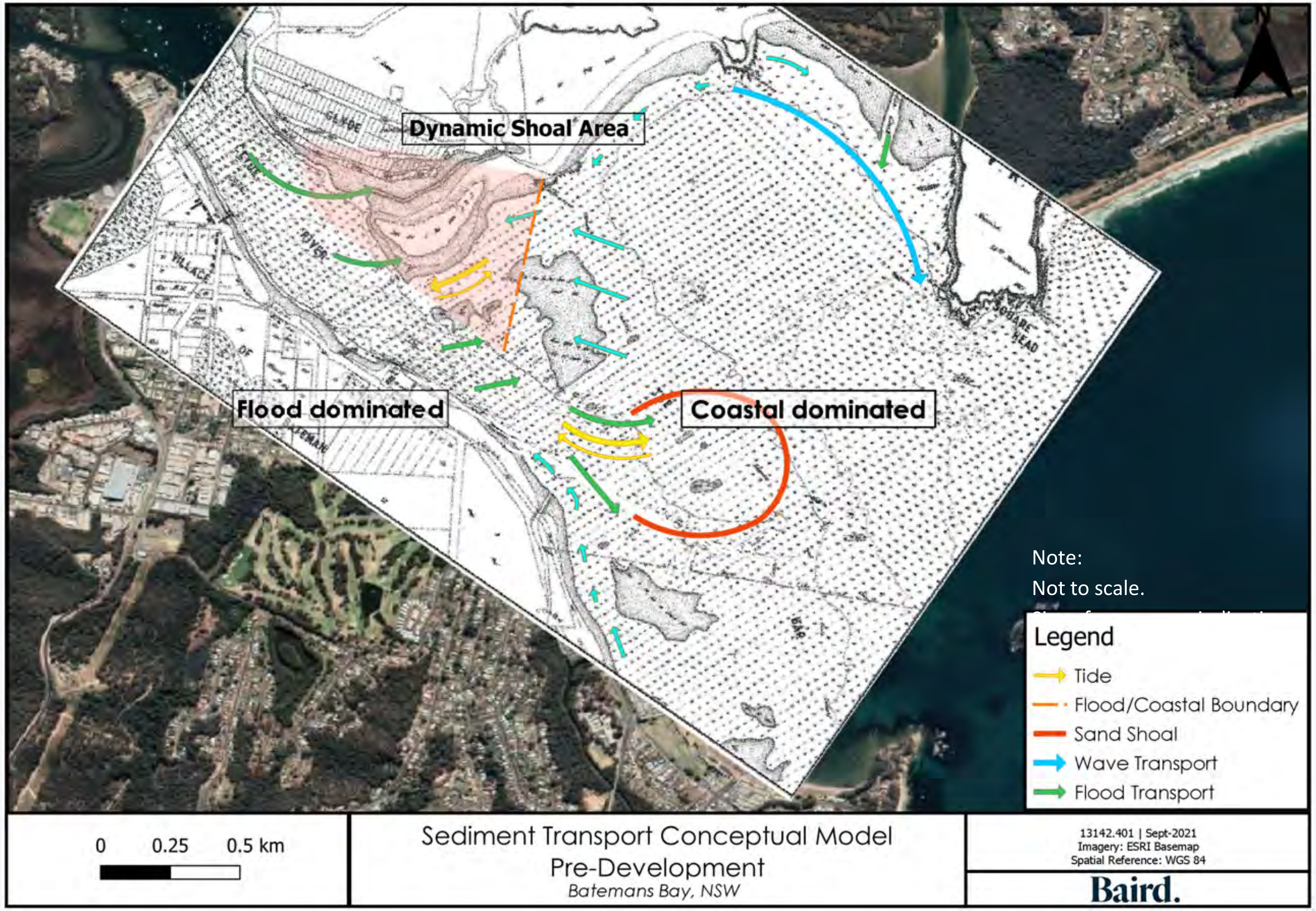
Wharf Road

- Sediment Transport
  - Clyde River flood events are the major influence on re-working the Wharf Road beach and shoal, with large flows close to the beach and across the shoals leading to scour
  - Wave induced transport during ambient and elevated offshore swell, which replenish Wharf Rd shoreline from the shoal (over time)
  - Longshore transport is to the west along the beach, predominantly from wave driven currents and a flood tide inequality (flood > ebb currents).





Sediment Transport Concept Models – Pre-Training Wall



Sediment Transport Concept Models – Present Day