Managing shoaling of the Mooloolah River entrance

Using a shoaling prediction tool

Chris Voisey, Senior Engineer (Coastal) | Department of Transport and Main Roads
Overview

1. Background
2. Shoaling processes
3. Shoaling indicator development
4. Operational performance
5. Limitations
6. Shoaling management strategy
7. Final overview
8. Acknowledgements.
Background

- Open coast tidal inlets often present navigational challenges
- Mooloolah River entrance is one of the most reliable open coast entrances on the eastern seaboard
- Critical for Port of Brisbane pilot vessels, fishing and tourism vessels and recreational boaties
- Sand is transported across the headland and into the entrance channel
- Shoaling events are infrequent, but need to be appropriately managed.
Shoaling processes

- Conditions during a shoaling event
Shoaling processes (cont.)

- Conditions between shoaling events
Sediment budget

• Two part sediment budget process

Part 1: Sediment transport along Buddina Beach to the storage area

Part 2: Sediment transport from the storage area west to the entrance channel
Shoaling indicator development

- Previous Coastal Process Investigations provided a good understanding of the headland sand bypassing processes.
- The next step was to quantify these processes to provide an entrance shoaling warning system. The department engaged specialist consultant BMT WBM to develop this system.
1. A pilot project was instigated in 2005
2. Wave buoy installed offshore of Mooloolaba beach to collect real time wave data
3. This is the primary input to the indicator tool.
1. Sediment Transport inferred from wave data
2. Wave data is used to calculate sediment transport using the following equation:
   1. Bypassing Indicator = $H_s^2 \cdot \sin(2\theta)$
   2. Where $\theta$ is the angle of the wave to the coast (+ve upcoast) and $H_s$ is significant wave height (the mean of the top 33% of waves).
Shoaling indicator development (cont.)

1. Wave Data
2. Data emailed to the department daily via automated system.
Shoaling indicator development (cont.)

1. Coastal Bathymetry
2. BMT WBM set up a hydrodynamic wave model of the area based on detailed bathymetry data
3. Model then used to create a lookup table for different wave climates to define $H_s$ and $\theta$ values to feed into the sediment transport formula.

Image courtesy of BMT WBM
1. The final indicator tool uses the buoy wave height and direction.

2. Converts this to shoreline wave height (Hs) and direction (θ) and uses this to calculate sediment transport.

3. Critical Point Cartwright storage volume of 100,000 cu.m.
Operational performance

Mooloolah River entrance sand accumulation indicator output

Dredging events

Inferred sand transport volume (cu.m)

Year

Indicator limitations

1. The indicator is a very simplified prediction of sediment transport
2. The indicator calculates “inferred” sediment transport from wave conditions
3. Understanding of sand volume in the system required to correctly interpret output.
Shoaling management strategy

- Indicator output
- Reference photos of Buddina beach
- Hydrographic surveys
- Notice to mariners and marking the channel
- Standing Offer Arrangement with a local dredging contractor
- Beach nourishment.
Shoaling management strategy (cont.)
Shoaling management strategy (cont.)

Monitoring Buddina Beach
Shoaling management strategy (cont.)

Survey and profiles
Final overview

- Indicator effectively predicts the onset of shoaling events despite its simplicity
- Predicting the magnitude of any specific shoaling event and dispersion of the shoal is less certain
- Simple and effective warning system, hand in hand with other management elements.
Acknowledgements

- BMT WBM Pty Ltd – developer of indicator tool
- Department of Science, Information Technology and Innovation – Wave Data
- The Maritime Safety Queensland Hydrographic Services team – Surveys
- The Regional Harbour Master and his team
- Mooloolaba Harbour Controller – Buddina Beach photos
Thank you