



Case Study

Management & monitoring of an ICOLL entrance clearance



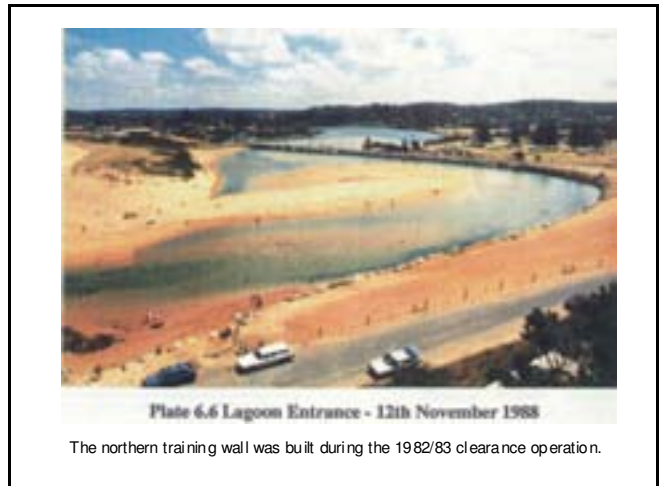
Narrabeen Peninsula 1886



Ocean Street Bridge and causeway. Built in 1928.
Upgraded to concrete in the 1960s.



Narrabeen Terminus Shops, Pittwater Road – 1942 Flood



Entrance Management Study (MHL, 1989)

- Warringah Council commissioned MHL to develop a management plan for the maintenance of the entrance.
- Sixteen (16) management strategies were identified and four (4) were selected for further investigation.
- The strategy chosen was: Formalised Mechanical Breakout and Entrance Clearance Operations.

Why does the entrance close?

- movement of sand into the entrance resulting from wave, current and wind processes.
- when the volume of sand moved into the entrance by the incoming tide exceeds the amount of sand carried out of the entrance by the outgoing tide.
- over time the entrance becomes in-filled to the point where it closes.

Why is sand cleared from the lagoon entrance?

- Flooding is the key issue.
- Significant number of flood-affected properties within the floodplain.
- The periodic clearance of sand from the entrance is primarily to assist in the successful breakout of the Lagoon when water levels rise to the pre-determined level.
- Water quality is also a consideration.

Where is the sand placed?

- Sand is placed on Collaroy/Narrabeen Beach, which has a long history of coastal erosion.



Collaroy beachfront following the great storm of 1933. The surf club is visible in the background – River Collective



Collaroy Beach, April 1995.



How often do entrance clearance operations occur?

Year	Sediment Removed (m ³)	Location with respect to Ocean Street Bridge	Approximate Cost (\$)*	Approximate Duration
1975	150,000	?	48,000	5 months
1979	37,500	?	?	1 month
1982/83	60,000	?	?	
1987	40,000	East	140,000	3 months
1990	30,000	East and West	60,000	4 months
1992/93	56,000	East and West	176,000	5 months
1995	27,500	East and West	39,000	4 months
1999	70,000	East and West	330,000	3 months
2002	40,000	East and West	600,000	4 months
2005	45,000	East and West	800,000	2 months

* Dollar estimates are likely to relate to the year in which the expenditure occurred and cannot be directly compared due to variables such as inflation, whether Council 'outsourced' the work (i.e. used external contractors/consultants), or undertook the work 'in-house'.

Who pays for the entrance clearance operations?

- Financial assistance is provided by the NSW Government for up to two thirds of the cost of the project.
- In accordance with the 2:1 cost sharing arrangements of the NSW Floodplain Management Program.

The 2006 entrance clearance operation

- Due to project's size and complexity, a decision was made in the early planning stages of the project to commission a specialist coastal engineering company to assist Council in managing the project.
- Council invited quotations and Cardno Lawson Treloar (CLT) was the successful tenderer.

Design details

- Pre-clearance bathymetry of entrance area defined from survey.
- Considerations included: seagrass beds, proximity of training wall and Ocean Street Bridge, depth to the rock weir, and the maximum depths of excavation.
- Beach replenishment details were based on the need to create a profile which improved beach amenity and provide some short-term stability and protection for beach-front properties.

Community consultation



Tender and award

- Tender process was via Open Tender advertised in the national press.
- Kingston Civil Constructions was selected as the successful tenderer based upon the evaluation of both cost, and non-cost items such as program, method statement for the works, environmental protection, previous experience, and traffic control methods.

Major items of work

- Excavation of marine sediment from the lagoon entrance as detailed on the Drawings.
- Transportation of marine sediment to Collaroy/Narrabeen Beach, placement at designated points on the beach and spreading of the sediment along the beach front.
- Mechanical opening of the Lagoon Entrance.
- Traffic Management.

Environmental Mgt. Plan

- Developed by Contractor to ensure that damage was not caused to any existing structures or the natural environment.
- Overall EMP included a Soil and Water Management Plan, Noise and Vibration Management Plan, and a Waste Management Plan.
- A specific requirement for project was the implementation of silt curtains around areas where clearance works were occurring.

Prior to 2006 Clearance



Composite photo of the Narrabeen Lagoon Entrance and photos of flooding in lagoon (September 2006).

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Entrance Clearance



Entrance clearance commenced 29 September 2006

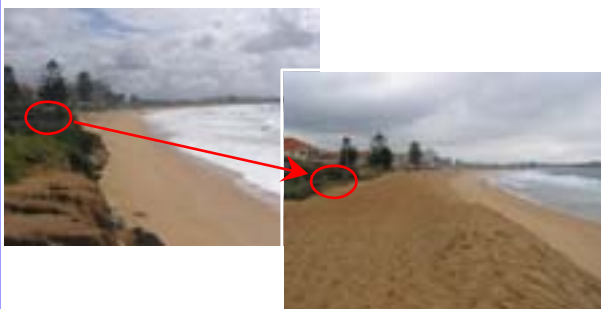
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19 Oct 2006

Beach Replenishment



Collaroy/Narrabeen Beach before (left) and after (right) replenishment.
View from Wet herill St looking North.

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Beach Replenishment



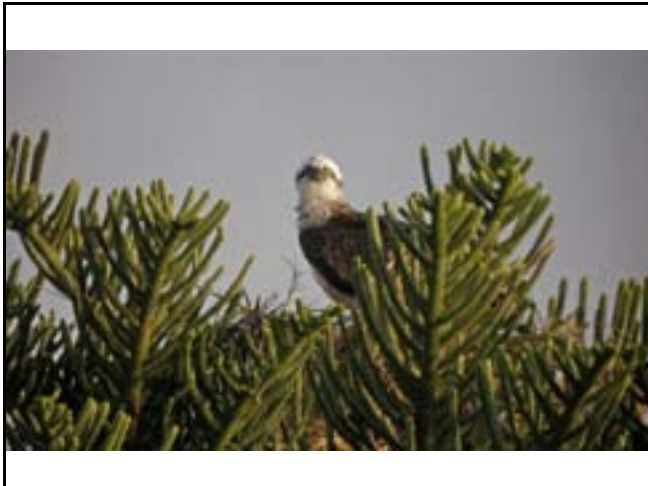
Collaroy/Narrabeen Beach before (left) and after (right) replenishment.
View from Wet herill St looking South.

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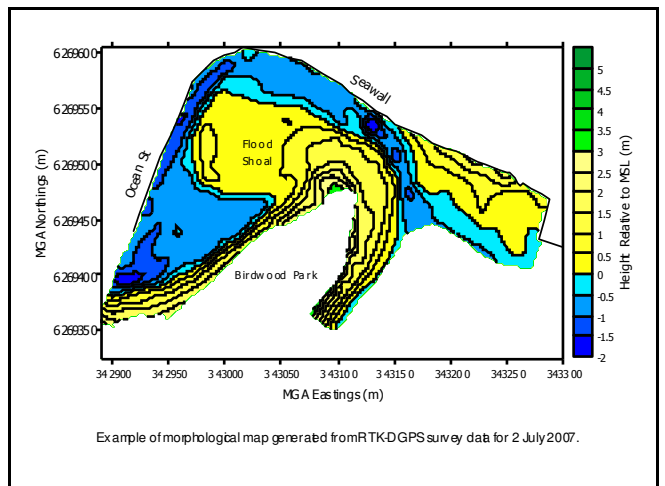
Operational environmental matters

- Seagrass monitoring undertaken by specialist consultants The Ecology Lab found that there was little variation in the distribution and total area of seagrass beds.
- Concerns of DEC regarding Ospreys led to Avifauna Research & Services being commissioned to conduct an impact assessment of the clearance operations on the Ospreys, which concluded that the works had no detrimental impact upon these birds or their breeding success.



Monitoring of entrance infilling

- Monitoring of complex and dynamic coastal systems is logistically difficult, time-consuming and expensive.
- A monitoring program and scientific study of the evolution of the entrance system post-clearance is being undertaken by WRL using RTK-DGPS surveying, in-situ measurements and an ARGUS video image camera system.



Data analysis and interpretation

- video data showed rapid reformation and growth of the flood shoal due to sediment ingress following the re-opening of the lagoon entrance

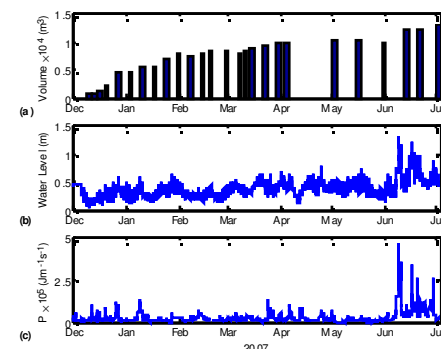


Merged oblique Argus images of the study site

- (a) At the completion of entrance clearance, one day after re-opening the entrance (7 Dec 2006).
- (b) Two months after re-opening (8 Feb 2007).
- (c) Seven months after the re-opening of the entrance (12 Jul 2007).

Data analysis and interpretation

- Using morphological maps generated from survey data, the evolution of the volume of the flood shoal was calculated.



Comparison of volumetric evolution with hydrodynamic forcing.

- (a) Cumulative volume of flood shoal.
- (b) Lagoon water levels.
- (c) Wave power.

Data analysis and interpretation

- Flood shoal started to form within the first weeks following the entrance clearance.
- Volume shows a consistent increase over time, but is somewhat episodic with changes between surveys being as much as 2,300 m³ (1-14 June 2007), but more typically of the order of 420 m³.
- Total change in volume of the flood shoal in the initial seven months was 12,900 m³, which equates to an average ingress rate of 445 m³/week.

Clearance Outcomes

- clearance operation undertaken between 29 September 2006 and 6 December 2006.
- Removed ~45,000 m³ of sand.
- Sand used for:
 - beach replenishment works along Collaroy/Narrabeen Beach
 - minor replenishment of the beach area adjacent to the Sydney Lakeside Holiday Park.

Clearance Outcomes

- Overall it was a success with only minor issues during the works phase.
- The major objectives of the operation were all fulfilled:
 - improved flood mitigation
 - restoration of tidal flushing
 - improved water quality

Cost

- Total cost (excluding Council staff time) was approximately \$800,000.
- 'Works' costs - ~ 80%
- 'Management' costs - ~ 20% (design, assessment, approvals, supervision)

Monitoring of entrance is ongoing

- Results to date have provided qualitative and quantitative information on the initial infilling of the entrance via the evolution of the flood shoal volume.
- Future work will continue to quantify the infilling mechanisms in order to provide further insight into ICOLL processes.

Concluding remarks

- Implementation of the recommendations from the Post Completion Report, together with the findings from WRL's ongoing monitoring, will lead to further improvements in the management of future entrance clearance operations.
- This combination of science and management, 'feeding' off each other and not occurring in isolation, will lead to ongoing improvements in the management of Narrabeen Lagoon entrance.

Acknowledgements

