

1 Introduction

1.1 Background to the project

Located on Sydney's Northern Beaches, Narrabeen Lagoon is a popular location for local residents and tourists alike, due to its natural wildlife and environment, bushwalks, water sports and other recreational activities. The lagoon and its surrounding environment are also home to many important aquatic ecosystems. The area is highly urbanised with many residential properties surrounding the lagoon's foreshore.

Narrabeen Lagoon is one of NSW's approximately 70 Intermittently Closed and Open Lakes and Lagoons (ICOLLs), the largest of the four coastal lagoons within the Northern Beaches Local Government Area and it is also the largest in the Greater Sydney Metropolitan Area (SMEC 2011). Storms and ocean tides cause sand to infill the narrow channel entrance at North Narrabeen (refer **Figure 1-1**), which leads to intermittent closing of the lagoon to the ocean.

In the past, flooding of the Narrabeen Lagoon catchment has caused property damage, restricted property access or otherwise has been a general inconvenience to the community. Flooding occurs after heavy rain in the catchment, or from elevated ocean water levels (which can be due to storm surge and/or king tides), or a combination of both (Cardno, 2019). Ocean levels have on occasion been observed to be so high that some incoming waves have splashed over the Ocean Street Bridge, requiring closure of the road (e.g. on 5 June 2012). The photos below were taken with elevated ocean levels on 6 June 2012.



Figure 1-1: Elevated ocean levels on 6 June 2012

Over the last forty years Council has actively managed the entrance of Narrabeen Lagoon so that it is mostly open, reducing the flood risk of homes and businesses. During periods of entrance closure or constriction, Council will intervene and undertake a mechanical opening of the lagoon entrance once the lagoon level rises and pre-determined "trigger" conditions are met.

Every few years Council undertakes a larger scale removal of sand, known as an entrance clearance. This management practice involves the removal of between 30,000 and 50,000 cubic metres of sand from the greater entrance area (west and east of the Ocean Street Bridge) with heavy machinery, with the objective of keeping the entrance in open condition for a number of years (depending again on ocean and rainfall conditions). Each entrance clearance operation requires significant planning and funding and takes many months to complete.

The Narrabeen Lagoon Floodplain Risk Management Plan (Cardno, 2019) identified entrance clearance works as the highest ranked option for flood mitigation within the catchment. It also called for, as a matter of high priority, the preparation of an Entrance Management Strategy to undertake a technical investigation into whether (and if so, how) the current entrance management practices for Narrabeen Lagoon could be improved.

Council has prepared this draft Strategy to review the current practices and establish the most effective way to continue to manage the Narrabeen Lagoon entrance. This report reviews all aspects of entrance management, including short term emergency response arrangements, medium term clearance works and for the long term, investigates some alternative options to the current medium term practices.

1.2 Community engagement and key stakeholders

Community and key stakeholder engagement was undertaken in two stages during the development of this draft Strategy. Stage 1 sought feedback on the identified management options proposed to be investigated further. Stage 2 will seek feedback on the draft Narrabeen Lagoon Entrance Management Strategy, including the prioritised recommendations for implementation.

1.2.1 Stage 1

Stage 1 community and key stakeholder engagement for this draft Strategy was conducted over a six-week period, from 10 February 2021 to 28 March 2021, and consisted of a series of activities that provided opportunities and platforms for community and stakeholders to contribute. Consultation included the preparation of an interactive options report (RHDHV, 2021). The web-based report tool, or iReport, included an educational video on management of the Narrabeen Lagoon entrance. The community and stakeholder engagement report is provided in **Appendix F**, and summarised below.

This engagement sought community feedback on the way Council currently manage the entrance and the alternate and long term options being considered. A total of 96 submissions were received through the project page on Council's website. The consultation and responses highlighted the diversity of opinion in the local community about the key issues and management objectives for Narrabeen Lagoon. Community feedback also revealed a high level of local and historic knowledge and sense of public ownership of Narrabeen Lagoon.

A variety of themes were identified within the submissions. While no individual theme was represented in the majority of submissions, the two most common themes were:

- Support for further investigation and potential implementation of a sand pumping scheme; and,
- Options that maximise the duration of lagoon entrance open conditions should be prioritised.

1.2.2 Stage 2

Council will undertake a second stage of community and key stakeholder engagement to seek feedback on this draft Strategy. Engagement will include:

- Public exhibition of the draft Strategy document;
- Presentation/s of supporting information to assist the community understand the draft Strategy; and,
- Opportunities to hear directly from Council staff and technical consultants, which may include public presentations, one-on-one meetings, attending relevant committee meetings etc.

A summary of the outcomes of the engagement will be included in the final Strategy.

1.3 Managing a complex environment

Balancing the management of this popular recreation location, with the protection of important aquatic ecosystems, whilst mitigating flooding to reduce risks to the many residential properties and infrastructure assets surrounding the lagoon's foreshore is a complex task. It is important that the evaluation and analysis undertaken in this draft Strategy carefully considers the environmental, economic and social impacts, both positive and negative, for each option. Some key considerations include:

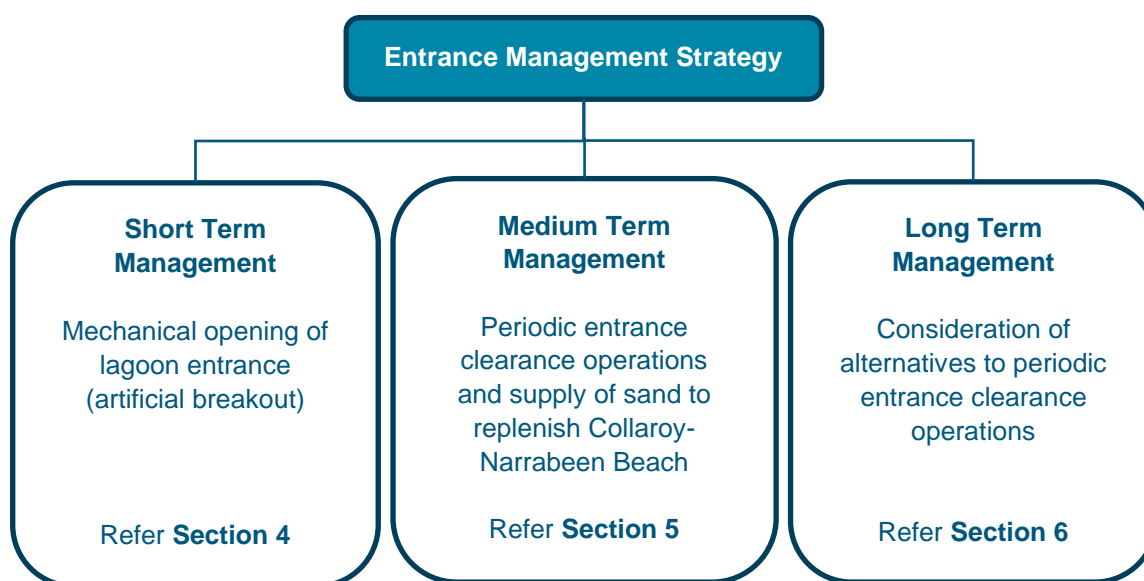
- The lagoon itself comprises a fragile and diverse aquatic and terrestrial ecosystem. The impacts of any proposed options on flora, fauna, ecological communities and other natural lagoon characteristics needs to be thoroughly considered.
- The lagoon is a highly valued recreational resource, with the entrance forming part of a national surfing reserve.
- Catchment conditions vary over time and can influence runoff, and therefore flooding.
- Effective emergency response is required to reduce the risk of flooding, especially of low-lying properties surrounding the lagoon.

It is important to note that from BMT WBM's (2013) flood study of Narrabeen Lagoon it was concluded that regardless of the implementation of Council's policy to mechanically open the entrance during flood events, significant flood inundation is expected during major catchment floods. Therefore, during large rainfall events, short-term strategies alone will not be able to completely mitigate flood inundation.

It should also be noted that when catchment flooding occurs in combination with elevated ocean levels or when elevated ocean levels alone present a flood risk (as is the case in the photos of Narrabeen Lagoon in **Figure 1-1** above), mechanical opening of the lagoon entrance would not reduce the severity of foreshore flooding. In fact, if during a flood event the ocean level is higher than the lagoon water level (which can occur due to the combination of astronomical tide, storm surge, and wave setup), then having the ICOLL entrance closed may in fact lessen the flood impact. A permanently open estuary would likely have greater flood impacts in the long term due to sea level rise as a result of climate change (Coffs Harbour City Council, 2018).

1.4 Overview of this report

The draft Entrance Management Strategy (EMS) for Narrabeen Lagoon is structured based on the three main elements as shown below. Short, medium and long term entrance management procedures are investigated in detail in **Sections 4, 5 and 6** respectively of this report:



This report considers the available data and literature to investigate the current short and medium term strategies in place for managing the Narrabeen Lagoon entrance, including the reasoning behind them. It also reviews best practice for ICOLL entrance management, to aid in the discussion of opportunities for improvements and innovation, weighing both the costs and benefits of environmental, social and economic factors before outlining recommendations for future management.

For long term entrance management, this report documents the development of concept proposals for each of the potential long term entrance management options under consideration and the assessment of the feasibility and economic, social and environmental impacts and risks of the options against the 'base case' or current entrance management practices undertaken by Council. This assessment is informed by review of existing literature, morphodynamic modelling of selected options and cost estimation by a quantity surveyor. The final section, **Section 7** presents prioritised recommendations for implementation.

Refer to the **Glossary** for the definition of technical terms used in this report.