Extract Tuggerah Lakes Floodplain Risk Management Study and Plan

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6.3.1. Management of the Entrance

DESCRIPTION

If the entrance to Tuggerah Lakes becomes blocked by sand build up (formation of a berm) then floodwaters will pond to the height of the berm before any outflow occurs. Thus potentially, a long duration but low intensity rainfall event could cause significant flooding. This situation is typical of all Intermittently Open and Closed Lake and Lagoons (ICOLL) along the NSW coast. Councils adopt different management approaches depending on the nature of the ICOLL and the local constraints. For example, Gosford City Council has different approaches for each of its four lagoons (Wamberal, Terrigal, Avoca and Cochrane Lagoons). The management approach needs to be developed taking into account the hydraulic, social, economic and environmental factors. Generally, the approaches adopted today involve less human interference and a more "natural" opening regime. Ad hoc or informal opening or clearing of the entrance is not recommended.

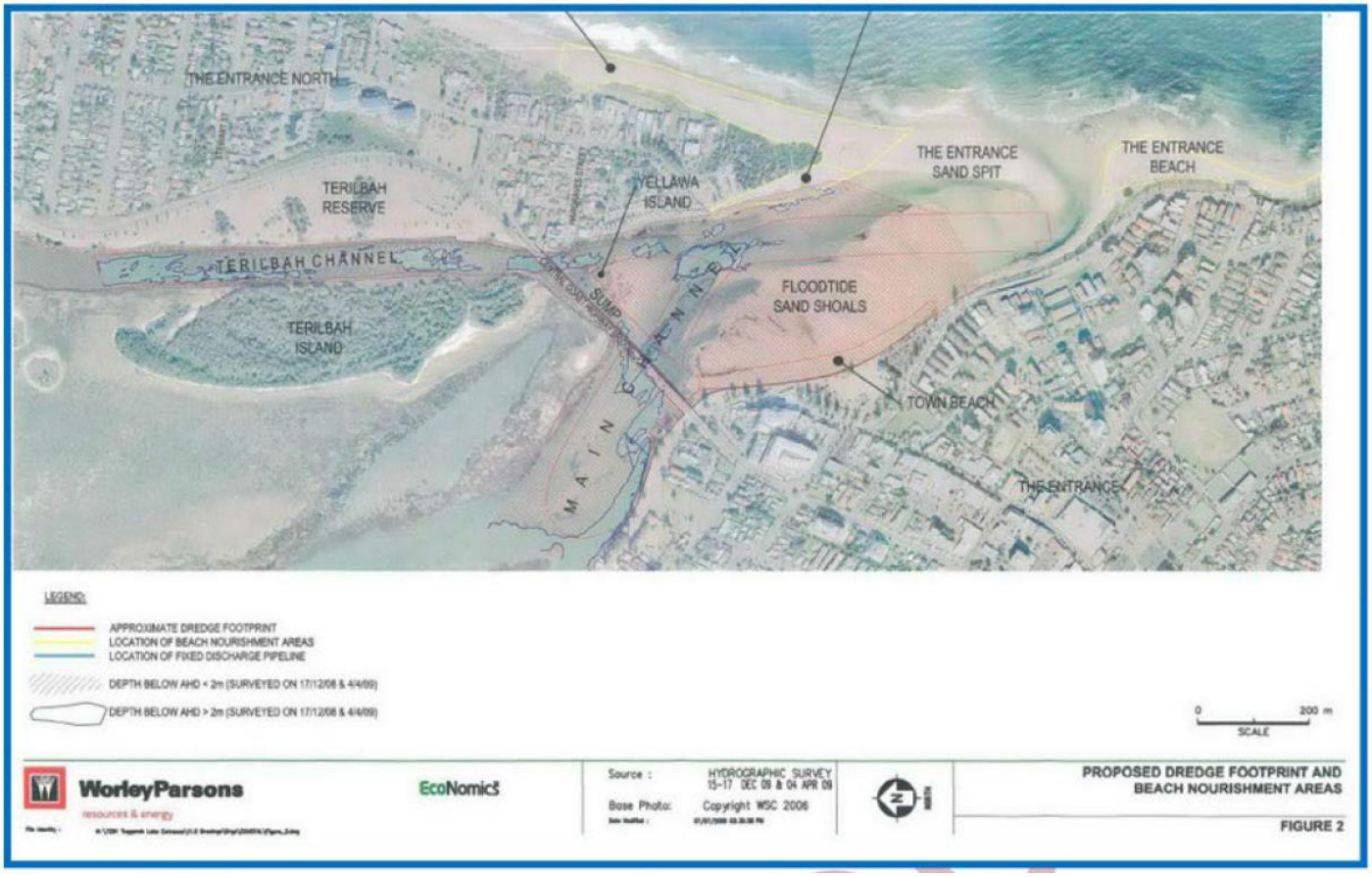
DISCUSSION

From a flooding perspective, an entrance that is as wide and as deep as possible ensures flood levels are as low as possible for a rainfall-induced event (i.e flooding from rainfall is the dominant mechanism). The opposite is true for an ocean/estuary-induced event (flooding due to high ocean/estuary levels rather than due to high rainfalls). At some of the smaller ICOLLs (Terrigal, Wamberal, Smiths Lake) Councils "control" the height of the entrance (by opening the entrance by mechanical means) to minimise flooding. However, this can only be achieved through regular maintenance and a quick response to the weather conditions. This procedure is an additional expense for Council, but more importantly, alters the natural lakes ecosystem. The current best-practice for managing ICOLLs is for the opening/closing regime to be self-maintaining, as far as possible, with human intervention only when there is likely to be a significant adverse social impact.

Dredging of the entrance has been undertaken intermittently since 1993. Reference 5 provides a review of environmental factors to support the continued dredging and indicates that maintenance dredging is required to "maintain tidal flows and reduce flood risks to life and property in low lying areas of the estuary". The proposal involves dredging up to 1 00 ,000 m3 per annum (though may be only 30,000 m3) with the dredged sands deposited on the depleted ocean beaches to the north of the entrance mouth. Whilst the report mentions a reduction in flood risk several times there is no quantitative assessment of the benefit and it does state that "it is not likely to significantly impact peak flood levels in the lake". The report also justifies dredging as it would prevent more frequent closure of the mouth. The annual cost to Wyong Shire Council for dredging at the entrance to Tuggerah Lakes is in the order of $0.5 million.

The following comments are made regarding the flooding issues referred to in Reference 5.

- Neither Reference 5 nor the quoted references provide any quantitative assessment of the benefits to flooding of dredging and to the best of our knowledge no hydraulic study has been undertaken which quantifies the benefits to flooding of dredging the entrance to Tuggerah Lakes.
- Reference 5 is unclear on how dredging will benefit flooding. Is the benefit of dredging only to reduce the duration of flooding and there will be no reduction in peak flood levels and/or will dredging prevent closure of the entrance and so reduce flood levels?
- It is unclear how dredging will reduce the duration of flooding. Whilst in theory any removal of sand from upstream of the berm at the beach will provide some reduction as it will "facilitate scour", the link between dredging and reduction in duration is not defined. Whilst any reduction in the duration of flooding is of benefit this needs to be quantified in terms of a reduction in tangible and intangible damages (is a 1 hour reduction in duration when your property is inundated for 2 days of significance?).
- Reference 5 proposes a large extent of dredging (see plan below). Whilst dredging near the beach berm may have a benefit in "facilitating scour" it is unclear how dredging upstream of the bridge or adjacent to the Town Beach will provide much benefit.



- Generally a "closed" entrance will increase flood levels compared to an "open" entrance as the floodwaters must overtop the "closed" entrance before floodwaters can escape. Reference 5 indicates that dredging will prevent more frequent closure of the entrance but it does not describe the link between dredging and prevention of closure of the entrance. It is agreed that dredging near the beach berm or actually within the beach berm will assist (by how much is not known) but how will dredging upstream of the bridge assist? Also the dredge only operates for 3 months a year. Thus outside this period what certainty is there that the entrance will not close when the dredge is elsewhere?

OUTCOMES

Dredging will not adversely affect flooding. The only exception to this is possibly in an elevated ocean event with large waves which may "enter" the entrance more than in a non- dredged scenario causing "pumping up" of the lake or wave damage downstream of the bridge. However the benefit to the community in terms of reduced tangible or intangible flood damages due to dredging has never been quantified.

It is difficult to obtain a quantitative estimate of the benefits of dredging, namely: a reduction in flood level, a reduced duration of inundation or a reduced likelihood of entrance closure and presumably this is why this has not been undertaken. Unfortunately even today's sophisticated Two Dimensional hydraulic models cannot accurately simulate the scouring of an entrance during a flood.

Even if it is shown that dredging provides a significant positive benefit in reducing flood levels this benefit will diminish in the period following dredging. Thus if a flood occurs immediately prior to the start of the next dredging period it is possible that there will be no reduction in flood level or duration of inundation as infilling has occurred (that is why further dredging is required). On this basis dredging cannot be used as a means of lowering the design flood levels adopted for flood related development control purposes.

The June 2007 event occurred with the current dredging regime in operation. It is unclear if the dredging activities prior to the event had any benefit but certainly they did not prevent the lake from reaching approximately the 10% AEP flood level (slightly higher than February 1990) resulting in considerable tangible and intangible damages to the community.

Possibly the dredging regime since 1993 has prevented minor flooding, if so this has not been documented. By comparison it is noted that Lake Macquarie (permanently open entrance) in the adjoining catchment also has only experienced two large floods since 1990 (June 2007 and February 1990) with June 2007 slightly higher than February 1990.

In the absence of any technical study it is considered that the dredging regime will have no negative impacts on flooding but only minor positive benefits (an indicative assessment is less than a 30mm reduction in peak level and maybe 6 hours reduction in duration of inundation). Whilst any reduction in flood level or duration of inundation is beneficial this must be balanced against the economic, social and environmental cost of dredging and whether the funds could achieve a greater benefit if spent on other floodplain risk management measures.

Dredging will result in a small reduction in the risk of closure of the entrance but cannot eliminate the likelihood of closure. Obviously after a period of drought and conducive ocean activity the entrance may close with or without dredging, if the dredge is present it can open the entrance but if no dredging regime is undertaken and the entrance closes then a bulldozer can be brought in to undertake the same action (as happens at Terrigal Lagoon or Shoalhaven Heads).

The minor positive benefit from dredging will only accrue to those works undertaken near the beach berm and dredging further upstream of the bridge will be of extremely limited value for flooding purposes.

An overall su')Jmary of the effects of dredging (not specifically for the dredging that is currently undertaken at the entrance by Council) is provided in Table 17.

In conclusion there is very limited justification for dredging of the entrance to Tuggerah Lakes in terms of reducing flood damages and other measures may provide a greater benefit cost ratio in reducing flood damages.

There are no quantitative records describing how the entrance berm (length, width, timeframe) is breached in a flood. A simple procedure to obtain such information would be to install a digital still or video camera at the entrance.

Table 17: Overall Summary of Effects of Dredging of the Entrance Channel

ISSUE	COMMENT
ADVANTAGES:	
Provides some reduction in flood levels. The magnitude will depend on the extent of dredging at the time of the flood.	Even a small reduction in flood level for each event equates to a significant reduction in damages: • a 0.01 m reduction decreases the AAD by 3%, • a 0.1 m reduction decreases the AAD by 30%.
Provides benefit over the full range of floods.	Many flood mitigation measures are only beneficial in a small range of events.
May provide additional non-flooding water benefits.	The improvement in water quality and / or tidal circulation will be minimal.
May increase tourist potential	It is generally acknowledged that tidal flushing and the relatively safe water environment resulting from dredging will attract tourist to the area (swimming, boating, fishing).
Dredged material may be used elsewhere.	Beach nourishment or sale of material.
DISADVANTAGES:	
High initial cost.	Over $1 million dollars to purchase a dredge. Difficult to obtain government funding for works of this magnitude.
Likely high maintenance cost.	Ongoing maintenance will be required to ensure that infilling does not subsequently occur (approximately $0.5 million per annum). The cost to maintain the dredge is over $150,000 per annum.
Disposal of material.	A suitable site is required.
Possible environmental impacts.	These would have to be rigorously examined in an Environmental Impact Statement (EIS) and include: • water quality, • flora/fauna, • erosional/sedimentation regime, • lake flushing, • impact on tidal regime, • increased ocean wave penetration.
Possible adverse social impacts.	These may include: • the noise of the dredge, • visual pollution, • increased tidal range (more frequent exposure of mud flats), • affectation on the local tourist industry, • loss of fish spawning and prawning areas, • destruction of aquatic flora and fauna.
Likely hydraulic benefit (reduction in flood level).	A significant amount of dredging would be required to achieve (say) a 0.01 m reduction in flood level. Will the community support a large expenditure to achieve such a small reduction in flood level?
Increase in ocean affectation	It is possible that a wider and deeper entrance will allow ocean waves to enter the entrance channel more freely that at present, possibly during elevated ocean events damage to foreshore structures may occur.