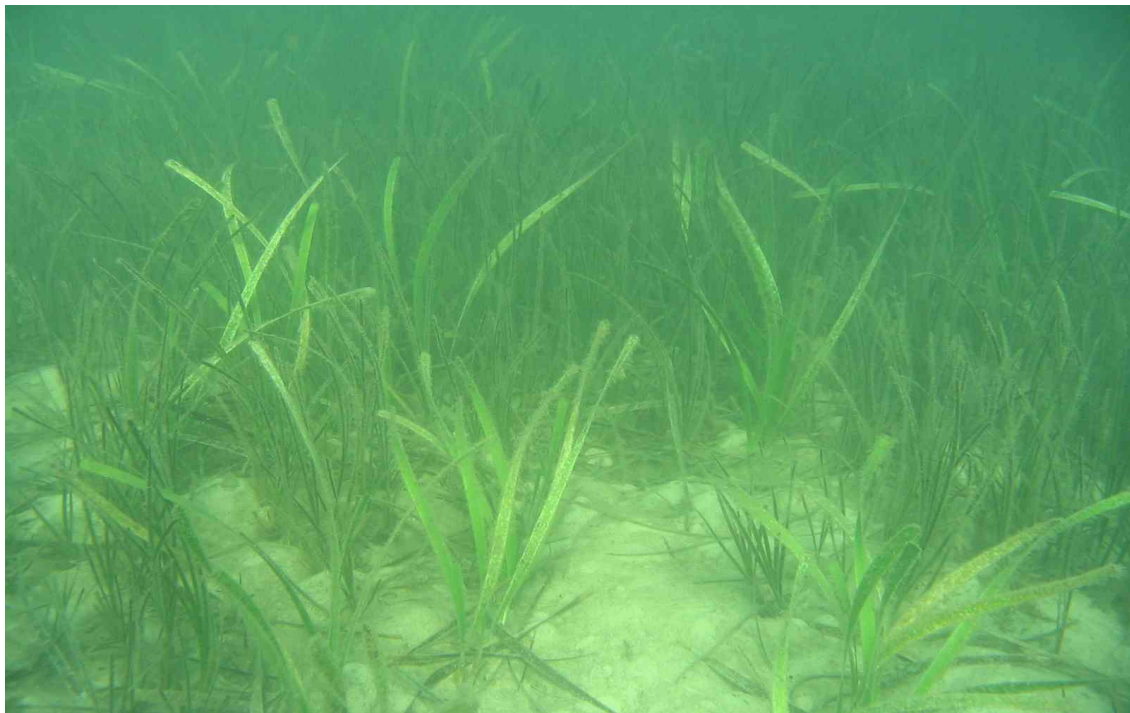
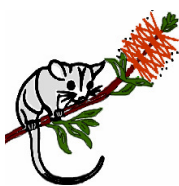


SEAGRASS MANAGEMENT PLAN

**FOR THE PROPOSED REDEVELOPMENT OF THE
LAKE MACQUARIE YACHT CLUB AND MARINA ON
LAKE MACQUARIE**



Prepared for
EJE Architecture, de Witt Consulting and Lake Macquarie Yacht Club



ECOTONE ECOLOGICAL CONSULTANTS Pty Ltd

39 Platt Street, Waratah NSW 2298

phone: (02) 4968 4901 fax: (02) 4968 4960

web: www.ecotoneconsultants.com.au

EEC PROJECT No. 0749LMYb

22 January 2010

1.0 Introduction

The following Seagrass Management Plan (SMP) has been prepared in response to the agency comments from the NSW Department of Primary Industries – Fisheries section attached to the Department of Planning Director-General’s Environmental Assessment Requirements. It has been prepared by Ecotone Ecological Consultants Pty Ltd expanding on earlier seagrass management strategies and reports developed by Bio-Analysis Pty Ltd in consultation with DPI-Fisheries.

All seagrass areas in NSW are protected under the NSW Fisheries Management Act via the NSW Fisheries’ Fish Habitat Protection Plan No. 2. The NSW Fisheries Scientific Committee has also made a Proposed Determination to list the seagrass *Posidonia australis* as Endangered Populations in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie in Part 2, Schedule 4 of the Act.

The purpose of this management plan is to:

- Provide guidelines for works that could potentially impact on seagrass habitat.
- Provide methods to be used for minimising impacts on both *Zostera capricorni* and *Posidonia australis*.
- Provide management guidelines to ensure the long term survival and viability of the seagrass beds around the site.
- Ensure that there is no net loss of seagrasses in the area as a result of these activities.

This SMP should be read in conjunction with the overall Environmental Assessment report and with particular reference to the Flora and Fauna Assessment report including appendices providing previous Seagrass Assessment reports by Bio-Analysis Pty Ltd prepared in 2005 and 2008.

2.0 The importance of seagrass habitat

Seagrasses are protected under the *Fisheries Management Act 1994*. The construction works proposed as part of the LMYC redevelopment proposal have the potential to directly and/or indirectly disturb the seagrasses *Zostera capricorni* and *Posidonia australis* and the protected fish family (Syngnathidae) at the project location. Seagrasses are aquatic angiosperms (flowering plants) that are important biological components of coastal estuaries. They provide nursery grounds and food for commercially important prawns, fish and wading birds and generally act as a structural habitat for a variety of estuarine animals and plants. Seagrasses provide a role in stabilising bottoms and shorelines and act as a natural water filter for suspended solids. There are three common species of seagrass found within Lake Macquarie; *Halophila ovalis*, *Zostera capricorni* and *Posidonia australis* (West et al., 1985, Roberts et al., 2000). Large-scale declines (up to 85%) in seagrass meadows have been recorded within NSW estuaries (West et al., 1990). Management of seagrasses currently falls under the jurisdiction of the Department of Primary Industries (Fisheries) and is contained within the *Fisheries Management Act, 1994* and their policy and guidelines for aquatic habitat management and fish conservation (Smith and Pollard, 1998). This policy also includes the protection of other estuarine habitats such as un-vegetated shallow mud and sand flats as well as deeper soft sediment habitats.

Syngnathids are a unique family of fish, which includes seahorses, pipefish, pipehorses and seadragons. Syngnathids can be highly variable in colour and shape and some have the ability to change colour quickly to mimic seagrasses and seaweeds they inhabit. This characteristic is a major defence and feeding strategy. Their small fins restrict them to slow movement giving them little opportunity to escape from predators, or to actively chase their prey. Most species live on shallow

reefs or within seagrass beds in estuaries. Their reproductive strategy is unique in that the female deposits eggs on or in the male's body for incubation and the male then gives birth. Syngnathids are highly vulnerable to human impacts due to their low reproductive and dispersal rates and their sedentary nature. While not listed as threatened species, all seahorses, pipefish, pipehorses and seadragons are protected from collection under the NSW Fisheries Management Act.

3.0 Description of the seagrass at the site

The previous seagrass reports document the extent and composition of seagrass beds within the existing LMYC marina area; within the proposed marina extension area; within the area immediately adjacent to the marina; and within other parts of Belmont Bay to the north and south of the LMYC site.

Seagrass beds are present within and adjacent to the existing LMYC marina and extend from the shoreline out approximately 400 metres into Lake Macquarie in the Belmont Bay area. At 400 metres from the shoreline, the seagrass beds are patchy and this is considered due to insufficient light penetration for seagrass growth (Bio-Analysis, 2005).

While the seagrass meadows within the existing marina bays were in reasonably good condition, the seagrass cover was more patchy and the plants were considered not as healthy, at the existing LMYC marina as at reference sites off nearby Lions Park and Andersons Point.

Both the seagrass species *Zostera capricorni* and *Posidonia australis* are present in the seagrass beds in this part of Belmont Bay, but the cover and density of *Posidonia australis* was much lower within the seagrass meadows at the existing marina than at the reference locations. It appears that *Zostera capricorni* is colonising disturbed areas of substratum at the existing marina more effectively than *Posidonia australis*.

The existing marina bays appear to be providing protection from wave action and disturbance of bottom sediments which resulted in better water clarity within the marina than outside it.

There are many swing moorings in the Belmont Bay area and from inspection of aerial photographs and the observations of Bio-Analysis Pty Ltd (2008), the swing moorings are having a considerable impact on seagrasses with circles up to 10 metres in diameter (approx. 80 square metres) being denuded of all marine vegetation. The seagrass meadows in the vicinity of these swing moorings have a relatively high density of *Posidonia australis*.

These swing moorings were considered by Bio-Analysis to be having a far greater impact on seagrass meadows in the Belmont Bay area than the operation of the existing LMYC and its associated structures.

4.0 Description of the potential risks to the seagrass beds as a result of the proposed LMYC redevelopment and potential mitigation measures.

Marina extension

There is potential for direct impacts on the seagrass beds by the construction of the marina extension, as a result of installation of piles. These will be 330 mm in diameter and there will be 350 new piles. This totals a 30 square metre area of lost substrate, however in the proposed marina

extension area there is just 20% cover of seagrass, so approximately 6 square metres of seagrass could potentially be directly impacted.

There could also be some deposition of transported sediment on seagrass beds during the installation of the piles, but this is expected to be of short duration by comparison with natural occurrences.

There is potential for damage to seagrass beds around the proposed marina extension area due to the actions of construction barges etc during the construction period and there is potential for damage to the seagrass beds within and around the marina extension area due to routine boating and mooring activities following construction.

There is potential for indirect impacts from shading since the approximately 20% coverage of seagrass within the proposed marina extension area will be shaded to some degree by the marina structure and by boats at berths. It is proposed to construct the decking of the marina from Rigidex II or similar, which is an open mesh moulded fibreglass decking that permits some sunlight through, particularly when the sun is high in the sky.

There will be 72 new berths with the potential to shade the seagrass beds to some degree. All the proposed berths are unlikely to be occupied continuously, however.

The proposed marina extension will be constructed similarly to the existing marina with a wave skirt along the northern and southern sides to a depth of 1.8m. This will comprise 200mm boards aligned vertically with 60 mm gaps. The proposed western skirt will have a depth of 2.4m and 200mm boards with 18mm gaps.

Due to the greater water depth within the proposed marina extension area (approximately 4 metres) it is not expected that the substrate would be disturbed by any boat movements or back-wash from the wave skirts. We recommend however, that the LMYC specify a policy to ensure that deeper draught boats are moored within the western part of the overall marina and shallow draught boats are moored in the eastern part. Boats should be tied alongside the marina perimeter rather than using anchors. Both these policies would contribute to a reduction in potential seagrass damage associated with the operation of the marina.

The Bio-Analysis Pty Ltd reports suggest that better water clarity exists within the existing marina bays than outside them and that this has most likely resulted from the protection from wave action and disturbance of bottom sediments, afforded by the marina wave skirt and the vessels at berths. Bio-Analysis considers that there would be a likelihood of improved seagrass growth within the marina extension area following construction, due to improved wave protection leading to improved water clarity. Within the area proposed for the marina extension it is more likely that *Posidonia australis* would become established rather than *Zostera capricorni*, due to the distance from the shoreline and water depth. *Posidonia australis* is the dominant seagrass at these depths to the north and south of the LMYC area.

Changes to the hardstand area

It is now proposed to make only minor extensions to the northern edge and southern edge of the hard stand area. In response to concerns that a vertical seawall along the northern edge or the southern edge of the hard stand area may result in back-wash leading to sediment re-suspension and reduced water clarity within the adjacent seagrass beds, the extension areas will be constructed so

that they are cantilevered out over a concrete beam. This will mean that wave energy will continue to be dissipated by the existing rocky slope and seagrass wrack.

5.0 Description of the potential benefits for the seagrass beds as a result of the proposed LMYC redevelopment

The LMYC currently has 12 swing moorings that will be reduced to 8 as part of the marina redevelopment. The 4 moorings that will be released, have an associated area of bare sand of approximately 320 sq m in total. This area will be made available for seagrass re-establishment.

While there has been limited success in transplanting this seagrass at other sites around Australia, the opportunity to carry out transplanting trials using the *Posidonia* rhizomes removed from within the area to be directly impacted by any pile should be taken. Immediate transplanting of the *Posidonia* rhizomes should be carried out within both the adjacent protected marina extension bay area and within some of the four LMYC swing mooring sites to be vacated, ensuring that one swing mooring is left with no transplanted *Posidonia* rhizomes as a control site for the experiment. However, this would require the swing moorings to be vacated prior to the construction of the marina.

As a result of their observations within the existing marina, Bio-Analysis Pty Ltd consider that with the construction of the marina extension, the seagrass habitat within the new bays will be improved as a result of attenuation of wave action and consequent improvement in water clarity. The cover of seagrass west of the existing marina bays is expected to improve from the patchy (20% cover) seagrass beds currently present. Bio-Analysis Pty Ltd have estimated that if it is assumed that a similar pattern of seagrass growth will emerge from the new bays as was found within the existing bays, then there is approximately 4,120 square metres of potential lake bed where seagrass could establish once the bays are completed. This figure takes account of the new structures and shading as a result of permanently moored boats within the bays.

If we assume that *Posidonia australis* could reach percentage covers of up to 15% under this new light regime, then there could be as much as 618 square metres of *Posidonia australis* established within the new bays over time. This equates to an order of magnitude net increase in *Posidonia australis* within the area.

Zostera capricorni also makes up around 5% of the area of the proposed outer bay footprint. This species is growing in isolated patches ranging in cover from 1-10%, with leaf lengths ranging from 100-300 mm. There will be negligible impact on *Zostera capricorni* as a result of constructing the new marina bays and as predicted for *Posidonia australis* there may be a significant net increase in this species as a result.

6.0 Summary of net effect on Seagrass

In principle, avoidance is the most successful method of ensuring seagrasses are not harmed, however there are design and mitigating mechanisms that can also be implemented to assist in managing any potential impacts.

During the preparation of the SMP, there has been direct liaison between Bio-Analysis and DPI Fisheries to ensure that the proposed construction methods will be acceptable and ensure that seagrass habitat disturbance is minimised.

Table 1 lists the potential losses and gains in seagrass habitat that could result from the LMYC redevelopment proposal and attempts to estimate the areal extent of seagrass habitat associated with them.

It would appear that overall a net increase in seagrass cover within Belmont Bay will result if all the recommended mitigation measures are adopted by LMYC

7.0 Monitoring and assessment

Since the precise extent of or severity of impact on seagrass meadows cannot be accurately estimated prior to construction, and the replanting of seagrass is somewhat experimental, the LMYC redevelopment project will require monitoring of seagrass species and cover as part of the full construction activities and ideally for a few years post-construction.

Any monitoring programme will need to be verified/approved by DPI Fisheries prior to any works taking place.

The seagrass investigations carried out by Bio-Analysis Pty Ltd leading up to the submission of the Environmental Assessment have been designed to allow future monitoring. Should such monitoring indicate any unforeseen adverse effects from the proposal, then where possible, further mitigation measures will be investigated. The monitoring results will at a minimum add to the scientific knowledge of impacts on seagrass from marina construction and will hopefully demonstrate successful seagrass transplantation and re-establishment within currently bare sand areas of the seagrass beds.

Table 1. Potential losses and gains of seagrass

Stage of Redevelopment Proposal	Component of stage	Sub-component	Potential Impacts	Mitigation Measure	Area of seagrass potentially affected	Area made available for seagrass colonisation/transplant	Timing/Duration
1. Construction	Marina extension	Construction barges etc	Damage to seagrass beds by anchors or hull impacts in shallow water	Shallow draft boats to be used and tied off to existing marina or similar, avoiding use of anchors. If anchors used, they should be located within bare sand areas only. Avoid shore landings.	Temporary small to moderate sized areas (say 40 sq. m)		Short term. Construction phase only
		Pile Driving (350 piles)	Sediment re-suspension	Expected to be minor due to sandy substrate. Localised short term impact. Sediment curtain around pile driver or drill if necessary. Drill cuttings together with water and mud used for drilling to be collected and removed from the site and disposed of at an approved waste disposal facility.	Small localised areas but no loss of seagrass		Short term. Construction phase only
			Direct loss of seagrass within the 330 mm pile diameter for 350 new piles	Remove rhizomes prior to construction of piles. Carry out experimental transplanting in consultation with DPI Fisheries	Max. 6 square metres		Life of marina.

Stage of Redevelopment Proposal	Component of stage	Sub-component	Potential Impacts	Mitigation Measure	Area of seagrass potentially affected	Area made available for seagrass colonisation/transplant	Timing/Duration
		Marina Deck Construction (900 square metres) and wave skirt installation	Shading of seagrass around perimeter of bays	Use of decking with some level of sunlight penetration (Rigidex II or similar)	Worst Case approx. 800 square metres		Life of marina
			Positive impact by protection of seagrass habitat from wave action within marina bays and improved water clarity	None required		Approx. 4,120 square metres	
	Hard Stand area	Extensions to northern and southern boundaries	Damage to seagrass beds from back-wash from sea-wall and sediment re-suspension	No sea-wall. Cantilevered construction of concrete extension over existing rocky slope	Nil		Short term. Construction phase only.
	Removal of 4 LMYC swing moorings		Positive impact by making available for transplanting & natural re-colonisation with seagrasses	None required		Approx. 300 square metres	Life of marina
2. Post-construction		Boats at berths (72 berths at average 40 sq metres)	Shading of seagrass	None possible	Worst Case approx. 2,880 square metres		Life of marina
		Boat movements within and around marina	Damage to seagrass beds by anchors or hull impacts in shallow water	Shallow draught boats to berth at existing marina, deep draught boats to berth in deeper water in western part of new marina extension. No anchors to be used within seagrass meadow area (ie. within 500 m of shore line)			Life of marina
Totals (sq. m.)					-3726 (worst case)	+4,320	
Net change (sq. m.)						+594	