

“Where will our knowledge take you?”

Pearl Beach Lagoon Coastal Zone Management Plan

Final Report **February 2014**



DOCUMENT CONTROL SHEET

BMT WBM Pty Ltd BMT WBM Pty Ltd 126 Belford Street BROADMEADOW NSW 2292 Australia PO Box 266 Broadmeadow NSW 2292 Tel: +61 2 4940 8882 Fax: +61 2 4940 8887 ABN 54 010 830 421 www.bmtwbm.com.au	Document : R.N2286.002.00.Draft Plan Project Manager : Michelle Fletcher
	Client : Gosford City council Client Contact: Tim Macdonald Client Reference

Title :	Pearl Beach Lagoon Coastal Zone Management Plan
Author :	Michelle Fletcher
Synopsis :	The Pearl Beach Lagoon Coastal Zone Management Plan provides a strategic framework and action plan for the future management of the Pearl Beach Lagoon. It aims to redress current issues, and conserve existing values, using a range of implementation mechanisms, including on ground works, community engagement programs and planning instruments. The Plan includes an indicative costing, potential funding sources and identifies responsibilities for implementation and future monitoring.

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EXECUTIVE SUMMARY

<i>Goal</i>	The primary goal of the Pearl Beach Lagoon Coastal Zone Management Plan (CZMP) is to improve lagoon health into the future
<i>Purpose</i>	The Coastal Zone Management Plan provides an Action Plan for undertaking works and other initiatives aimed at improving the overall health and condition of Pearl Beach Lagoon
<i>Audience</i>	<p>The primary audience of the Coastal Zone Management Plan is Gosford City Council. Other stakeholders, including the Pearl Beach Lagoon Progress Association and the general public, are also likely to take a keen interest in future management of the lagoon.</p> <p>The contribution of the local residents that live within the catchment of the lagoon cannot be discounted. The very success of the plan relies on the close involvement, good will and engagement of the local community; particularly the residents whose properties are adjacent to the lagoon.</p>
<i>Management Aims</i>	<p>The overarching objective is to improve the health of Pearl Beach Lagoon, particularly in the following areas:</p> <ul style="list-style-type: none">• Water quality to support ecological function• Improved condition of fringing vegetation, including the Melaleuca wetland (listed as an Endangered Ecological Community (EEC) of Coastal Sand Swamp Forest (37ei) under the <i>Threatened Species Conservation Act 1995</i>) and fringing sedgeland, which provide habitat for local species• Improved diversity and abundance of native wetland fauna (including waterbirds)• Protection and enhancement of aesthetic beauty <p>Maintain a level of public access</p>

Management Objectives

The management objectives for the Pearl Beach Lagoon CZMP are to:

- Link Councils coastal zone management planning with other planning processes in the coastal zone to facilitate integrated coastal zone management.
- Involve the community in the preparation and implementation of the CZMP, including making information relating to the plan publically available.
- Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems.
- To protect and restore the natural lagoon's aquatic and terrestrial ecosystems.
- Address the current and future potential risks to lagoon health. The CZMP addresses the top ten identified threats to lagoon health including:
 - 1) Stormwater pollution
 - 2) Weed invasion
 - 3) The weir
 - 4) Infilling of lagoon foreshores
 - 5) Foreshore management (including mowing)
 - 6) Lagoon shallowing / sedimentation
 - 7) Pollution inputs / incidents other than stormwater
 - 8) Introduced fauna
 - 9) Climate change (including sea level rise)
 - 10) Algal blooms
- Protect and preserve lagoon amenity, maintain and improve public access arrangements to foreshores, support appropriate recreational uses and protect the cultural and heritage environment.
- The effects of climate change, including sea level rise, on coastal hazards, ecosystem health and community uses in determining management actions.
- Base decisions for managing risks on the best available information and reasonable practice, including adopting an adaptive management approach.

Context

This Coastal Zone Management Plan has been developed under the NSW Government's Estuary Management Program. It complies with the requirements of the NSW Estuary Policy 1992 and the NSW Coastal Policy 1997. It is consistent with the NSW Government's Guidelines for Preparation of Coastal Zone Management Plans.

Status

This Plan will be adopted by Gosford City Council following extensive review by relevant stakeholders and government agencies, and following a public exhibition. This Plan should be consulted during all future reviews of Environmental Planning Instruments and place-based Plans across the catchment area.

<i>Relationship to other plans</i>	<p>The area covered by this CZMP is also subject to the requirements of the Local Environment Plan, a Flood Management Plan and the Regional Biodiversity Strategy.</p> <p>Parallel to the implementation of this Plan, GCC will also be implementing CZMPs for Wamberal, Terrigal, Avoca and Cockrone Lagoons and significant economies of scale may be achieved in implementing similar management actions across multiple localities.</p>
<i>Management Actions</i>	<p>Nine Management Actions have been shortlisted from a long list of options and included in this plan. They have been selected as the options that are best able to meet the aims and objectives, the most likely to have community support, can be implemented in a timely manner, are cost effective and are practical given the current planning framework.</p> <p>The nine Management Actions are:</p> <ol style="list-style-type: none"> 1. Provide information to the community 2. Prepare a vegetation and access master plan 3. Training program for Council and contractor works staff 4. Retrofit stormwater quality improvement measures 5. Rehabilitate habitats within creek lines of catchments 6. Improved compliance of construction activities 7. Include Pearl Beach Lagoon in Council's Lagoon Opening Policy and Procedure 8. Investigate options to modify the weir 9. Investigate options for removing material from the bed of the lagoon <p>More details on each of these actions is included in Chapter 4</p>
<i>Implementation responsibilities</i>	<p>For the majority of Management Actions, the responsibility for implementation rests with the relevant departments within Gosford City Council (GCC). In addition to GCC, the NSW Office of Environment and Heritage (Department of Premier & Cabinet), (NSW Office of Water), relevant catchment management bodies and the local community will continue to assist with the management and co-ordination of implementation of the Plan.</p>
<i>Program of works</i>	<p>Specific tasks have been identified to help GCC and others with implementation. Implementation is recommended to commence immediately, with highest priority actions targeted first (subject to funding availabilities)</p>
<i>Costs and funding</i>	<p>There are a small number of Management Actions that will require significant new sources of funding. These include retrofitting new Water Sensitive Urban Design (hereafter WSUD) devices and rehabilitations works. Many of the remaining Management Actions only require in-kind involvement from existing staff and the community.</p> <p>Once gazetted, this Plan can be used as a lever for obtaining environmental funds through the Federal and/or State Governments (e.g. Estuary Management Program).</p>
<i>Indicators for success</i>	<p>The ultimate success of the Pearl Beach Lagoon CZMP will be gauged by how well the Aims of the Plan have been met. Given that the Aims are broad and measurable over a longer timescale, a series of Performance Measures have been incorporated into the Action Plan for each Management Action. Their purpose is to identify progress and short term successes in Plan implementation. These are also summarised in the Monitoring and Evaluation Chapter (Chapter 5).</p>

<i>Consultation</i>	The community at Pearl Beach have a strong interest in the sustainability of the Lagoon and have been actively involved throughout Plan preparation. Consultation with the relevant Council departments, other stakeholders, and the community has underpinned the development of this Plan. The community will also have the opportunity to review the Plan during a public exhibition period. Within the Action Plan (refer to Chapter 4), community links have been identified for each of the actions.
<i>Review and amendment provisions</i>	This Plan has an indicative 10 year timeframe. Progress with implementation should be formally reviewed annually. Contingency measures should be activated if progress is slow. A complete review and amendment of the Plan should occur after 10 years, and should redress outstanding issues, new environmental management practices, new scientific data, and any emerging changed governance and administrative arrangements.

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1 INTRODUCTION

1.1 Preamble

This document is the second and final component of the Pearl Beach Lagoon Coastal Zone Management Plan (CZMP). It provides a suite of actions and related implementation details to be undertaken by Gosford City Council (GCC), other public authorities and the community to address priority management issues affecting Pearl Beach Lagoon over the next 5-10 years.

As the CZMP will guide the investment of resources in the estuary, it needs to be based on the best possible information. The first stage of preparing the CZMP is documented in the Pearl Beach Lagoon Condition Study and Community Uses Report (BMT WBM, 2012). It reviews the available information on the present condition of Pearl Beach Lagoon and describes the results from a program of community and stakeholder consultation regarding the lagoon.

For completeness, this document should be read in conjunction with the Pearl Beach Lagoon Condition Study and Community Uses Report.

The process for developing CZMPs, as prescribed by the NSW Government, is discussed in Section 1.3.

1.2 Purpose of this Plan

The primary purpose of the Pearl Beach Lagoon Coastal Zone Management Plan is to provide direction and guidance on future actions within and around the lagoon and its catchment, which will help to achieve long term improvements in lagoon health. The process of reviewing the available information and consulting with interested stakeholders that underpins this plan means that it can guide the best use of the limited resources available.

The plan will also be a useful way of attracting resources from agencies including the NSW and Federal Governments. Under the Coastal Zone Management Program, the NSW Government provides estuary management grants to support local government to improve the health of NSW estuaries. To be eligible for funding, actions generally need to be recommended in a site specific Coastal Zone Management Plan, prepared according to the guidelines (refer Section 1.4 for details).

1.3 How to Read this Document

This document presents a series of 'Implementation Schedules' for 14 recommended management strategies. These schedules include specific details on what actions need to be undertaken and a timeframe for commencement. The schedules also include relative prioritisation, estimated costs and responsibilities for the various actions.

1.4 The NSW Government Coastal Zone Management Process

For the past 20 years, the Estuary Management Process in NSW has been guided by the Estuary Management Policy (1992) and Estuary Management Manual (1992). Recently, the NSW

Government released new *Guidelines for Preparing Coastal Zone Management Plans* (the CZMP Guidelines), which replace the Estuary Management Manual and combines the former coastal and estuary management processes. Under the new CZMP Guidelines, estuary management is required to focus on addressing risks to the health of estuaries through practical management actions. Focus is guided towards estuary health, because this aspect is not explicitly investigated or managed through any other council or state planning process.

Fundamentally, the steps required to prepare a Coastal Zone Management Plan, in accordance with the CZMP guidelines, are:

1. Identify and discuss the planning framework relevant to management of the estuary;
2. Prioritise management objectives based on a combination of issues that need attention, and conservation of natural and social values;
3. Assess and select potential management options to achieve the objectives;
4. Detail a schedule of activities for the implementation of the best management options; and
5. Indicate responsibilities and sources of funding for implementing the best options.

A key platform of the new CZMP Guidelines is the adoption of a risk-based approach to the management of estuary health. Risk-based management of estuaries has several key advantages, including:

- all risks are assessed and compared equally, ensuring that management efforts are directed towards those areas or issues that post the greatest risk to estuary health and sustainability;
- better streamlining of the Plan with existing Council's operational plans, as the risk approach inherently requires that existing management efforts are included in the assessment of risk, rather than a duplication of actions;
- the risk approach identifies the highest priority risks, which are not currently being managed (sufficiently) through any other process, targeting management resources towards the highest priority issues;
- management options can be designed to reduce the likelihood of the risk (e.g. planning setbacks) and the consequence of the risk (e.g. emergency management works);
- and where there is a high level of community concern regarding an issue that presents a low risk, monitoring and trigger levels can be set without absorbing funding resources unnecessarily.

Under Section 733 of the NSW *Local Government Act 1993*, councils are taken to have acted in 'good faith' and receive an exemption from liability where their actions were done substantially in accordance with the "coastal management principles" given in the CZMP Guidelines (DECCW, 2010a). Further, intended changes to Section 117 of the Environmental Planning and Assessment Act 1979 will require the CZMP Guidelines be taken into consideration when councils prepare their local environment plans (LEPs).

1.5 Consultation During Preparation of the CZMP

Community engagement is always an important component of developing CZMP's as significant information about natural waterways rests within the local community and the most successful plans

are those implemented with community support and enthusiasm. The preparation of the current plan has been characterised by an outstanding show of community interest and each of the stages, from field visits through to the compilation and review of background information, workshopping of ideas and report review have involved significant input from the community.

The formal opportunities for community involvement have been:

- Community survey distributed during project start up;
- On-site meetings at the time of field inspection;
- Open community meeting (with more than 60 attendees) to identify values and issues;
- Consultation via Councils online “Have Your Say” engagement hub which received 1123 site visits and 179 document downloads;
- Invited community representatives participated in the project threat assessment workshop.
- Public Exhibition of the Draft CZMP (6 September – 13 October 2013)
- Public Meeting during the Public Exhibition of the Draft CZMP (6 September 2013)
- 156 visits to the project website during the public exhibition of the Draft CZMP
- 39 individual downloads of the Draft CZMP document
- Eight (8) written submissions were received during public exhibition which focussed on 16 issues. The contents of the draft CZMP have been amended to reflect community comments where appropriate. A breakdown of the issues raised is provided in Table 1-1

Table 1-1 Issues Raised During the Public Exhibition

Issue	No. of Comments
The weir	6
Siltation	3
Funding	2
Difficult to read	2
Level of detail	2
Change to priority order	2
Hydrology & Groundwater	2
Factual inaccuracies	2
Education	1
Endangered Ecological Community	1
Acid sulphate soils	1
Myrtle Rust	1

Issue	No. of Comments
Water quality	1
Improved mapping	1
Sea Level Rise	1
Development impacts	1

1.6 How does the Plan support the Community strategic Plan: Gosford 2025?

The management actions contained within this plan will, once implemented, directly contribute to meeting objectives and strategies identified within the Community Strategic Plan: Gosford 2025 (CSP).

The successful implementation of this CZMP will also assist in fostering community wellbeing, social connection, feeling included and valued sense of community and cultural vitality. More specifically, the CZMP will contribute to the following objectives and strategies identified in the Society and Culture theme:

- A1 - Our community is a safe place
- A1.3 Build connections and relationships in the community
- A2 - Our local history, culture and diversity is valued and celebrated
- A2.3 Promote opportunities for a range of local cultural and recreational activities
- A4 - Our built environment is a desirable place to be
- A4.2 Provide opportunities for enjoyment of community spaces and places
- A5 - Our health and wellbeing provide for a satisfying and productive life
- A5.4 Promote the benefits of a range of learning opportunities.

Pearl Beach Lagoon is one example of Gosford's unique environmental assets and is appealing to both residents and visitors. As awareness and appreciation of the benefits of the environment grow, greater emphasis is being placed on the sustainability and preservation of the environment.

The successful implementation of this CZMP will assist in valuing and appreciating the natural environment, environmental protection and the use of resources. More specifically, the CZMP will contribute to the following objectives and strategies identified in the Environment theme:

- B1 Diversity of the natural environment is protected and supported
- B1.1 Identify and manage threats to native flora and fauna
- B1.2 Identify and preserve areas of conservation value
- B1.3 Support the healthy function of our ecosystems
- B2 Opportunities exist to access and experience natural areas

- B2.1 Improve and promote public access to natural areas
- B2.2 Increase participation in community based environmental activities
- B2.3 Protect natural areas whilst encouraging access by the community
- B4 We live in an environment where pollution is minimised
- B4.1 Prevent and reduce pollution from human activities
- B4.2 Manage the impacts to humans and the environment from pollution (including Climate Change impacts)
- B4.3 Protect the natural environment from further pollution
- B5 Benefits of the natural environment are understood and valued
- B5.1 Increase awareness and understanding of the natural environment
- B5.3 Increase involvement in actively protecting the natural environment
- B6 Land use and development protects the value and benefits provided by the natural environment

Importantly the coastal management planning process also encourages good governance, empowering the community to act, work partnership and contributes to:

- D1 Decision making processes are open and transparent
- D2 We collaborate to achieve outcomes
- D3 We are engaged and well informed

It is important to note that, while Council has the lead responsibility for the implementation of the Plan, there are a range of government agencies, community groups and individuals also identified as having responsibility for implementation of the actions identified in the Plan. (i.e. contingent on the availability of funding or resources for project delivery). The very success of the plan relies on the close involvement, good will and engagement of all partners.

1.7 Legislative and Strategic Planning Context of the CZMP

1.7.1 NSW Estuary Management Process

Up until recently, the Estuary Management Process in NSW was guided by the Estuary Management Policy (1992) and accompanying Estuary Management Manual (1992). This was replaced in 2011 by the NSW Government's *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010) ('the CZMP Guidelines').

Under the new CZMP Guidelines, estuary management is required to focus on addressing risks to the health of estuaries through practical management actions. Estuary health has become a focus because this is not explicitly investigated or managed through other council or state planning processes.

As outlined in the CZMP Guidelines, a CZMP that addresses coastal ecosystem health management should include the following, which may be commenced in stages:

- A description of the health status of the estuary, the pressures affecting the estuary health status and their relative magnitude, and projected climate change impacts upon estuary health including consideration of the NSW Sea Level Rise Policy Statement benchmarks, which may be documented in an Estuary Processes Study;
- Identify the management objectives based on conservation of environmental and community values, and prioritise the issues or threats to those values that require treatment;
- Preparation of management options to respond to the identified pressures or threats to estuary health and values, which should include an understanding of the existing planning and legislative framework for the CZMP;
- Assessment of the costs and benefits of the management options, including community acceptability, to select preferred management actions;
- Prepare an implementation schedule for the preferred management actions, which indicates the timeframe (or trigger), responsibilities and performance measures for implementation as well as potential sources of funding;
- Present the plan to Council for adoption, then to the Minister for Certification,; and
- Monitor and review the plan on a regular basis (5-10 years).

Step 1 to 4 have been completed for Pearl Beach Lagoon (refer BMT WBM, 2012). The Implementation Schedule (Step 5) is addressed in the present Pearl Beach Lagoon CZMP.

A key doctrine of the CZMP Guidelines is the adoption of a risk-based approach to the management of estuary health. The Risk Management Principles and Guidelines (Australian Standard ISO 31000:2009) have therefore been applied to the development of this document, fulfilling this requirement. A risk-based approach has several key advantages for the management of estuaries, including:

- all risks or threats are assessed and compared equally, ensuring that management efforts are directed towards those areas or issues that post the greatest risk to estuary health and sustainability;
- the process enables better streamlining of the Plan with existing Council operational and strategic plans, as the risk approach inherently requires existing management efforts to be included in the assessment of risk, avoiding the duplication of actions in the CZMP;
- the risk approach identifies the highest priority risks that are not currently being adequately managed through any other process, targeting management resources towards the highest priority issues;
- management options can be designed to reduce the likelihood or frequency of occurrence of the risk (e.g. an adaptation action to raise floor levels to reduce the likelihood of flooding) and / or the consequence of the risk (e.g. an intervention action for the regular cleaning of stormwater treatment devices); and
- where there is a high level of community concern regarding an issue that presents a low risk, monitoring and trigger levels can be set for the risk without absorbing substantial funding resources unnecessarily.

1.7.2 Meeting the Coastal Management Principles

The CZMP Guidelines outline a number of 'Coastal Management Principles' that should be achieved in the preparation of CZMPs. Under Section 733 of the *Local Government Act 1993*, councils are taken to have acted in 'good faith' and receive an exemption from liability of coastal hazards and risks where their actions were done substantially in accordance with the CZMP Guidelines, including the Coastal Management Principles.

The Coastal Management Principles and the manner in which these are addressed through this Pearl Beach Lagoon Coastal Zone Management Plan, are described in Table 1-.

Table 1- Coastal Management Principles Addressed by the Pearl Beach Lagoon CZMP

	Coastal Management Principles (DECCW, 2010)	Addressed by Pearl Beach Lagoon CZMP	Report Section
Principle 1	Consider the objectives of the <i>Coastal Protection Act 1979</i> and the goals, objectives and principles of the NSW Coastal Policy 1997	The preparation of this CZMP has followed the <i>Guidelines for Preparing Coastal Zone Management Plans</i> that is the manual for implementation of the objectives of the Act for CZMPs. In determining the goals aims and objectives of the Pearl Beach Lagoon CZMP, the NSW Coastal Policy has been considered. Climate change implications including sea level rise have been considered.	Exec summary Climate change as a threat is considered in 2-2
Principle 2	Optimise links between plans relating to the management of the coastal zone	By using a risk-based approach, existing controls within existing plans are reviewed and incorporated into the analysis of risk, and also used as starting point for developing risk treatments (i.e. management options).	Chapters 1 and 2
Principle 3	Involve the community in decision-making and make coastal information publicly available.	Comprehensive community consultation has been undertaken throughout the development of this plan.	Section 1-5
Principle 4	Base decisions on the best available information and reasonable practice; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach.	An investigation of the scientific aspects of Pearl Beach Lagoon was conducted. This was combined with community consultation and further investigations to identify the community values and human pressures upon the lagoon. The values and threats to the lagoon are based upon these studies and information. The multi criteria assessment used to prioritise the options included consideration of the impacts upon these values and threats. The monitoring and evaluation has been designed to facilitate continuous improvement	Chapter 3 and Appendix A
Principle 5	The priority for public expenditure is public benefit; public expenditure should cost effectively achieve the best practical long-term outcomes	The cost benefit analysis for management options has recognised the public benefit as priority for management options	Chapter 3 and Appendix A

	Coastal Management Principles (DECCW, 2010)	Addressed by Pearl Beach Lagoon CZMP	Report Section
Principle 6	Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risk where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented	This plan has been prepared using the ISO 31000:2009 International Standard Risk Management Principles and Guidelines. The risk based approach is an internationally recognised framework for management because it incorporates the best available information and its uncertainty. The adopted Risk Management Framework intrinsically requires ongoing monitoring of risks and review and tailoring of risk treatments (management options).	Chapter 3
Principle 7	Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions	The Risk Management approach is an internationally accepted standard that intrinsically incorporates both the known and possible frequency and consequence of a threat, thereby incorporating the uncertainty in the occurrence of risks / threats. This Coastal Zone Management Plan includes an ongoing monitoring and evaluation component, linked to an estuary health monitoring program.	Chapter 3
Principle 8	Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems	Ability of a management option to provide environmental protection or benefit has formed part of cost benefit analysis of options.	Chapter 3 and Appendix A
Principle 9	Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy	The open coast and rocky headlands are not included in the study area. Public access to lagoon areas has been included.	N/A to Study area
Principle 10	Support recreational activities consistent with the goals of the NSW Coastal Policy	Recreational usage is an important component in determining the values of the lagoon	Chapter 2

1.7.3 State and Commonwealth Legislation and Policies

There are a number of State Parliamentary Acts, Policies and guideline documents that are relevant to the management of the Gosford Coastal Lagoons. The relevant legislative documents are listed below, with detailed review given in Appendix A:

- *Environmental Planning and Assessment Act 1979;*
- *State Environmental Planning Policy (SEPP) No. 71 – Coastal Protection;*
- *SEPP No. 14 – Coastal Wetlands;*
- *SEPP (Infrastructure) 2007;*
- *Coastal Protection Act 1979;*

- *Threatened Species Conservation Act 1995;*
- *National Parks and Wildlife Act 1974;*
- *Fisheries Management Act 1994;*
- *Local Government Act 1993;*
- *Crown Lands Act 1989;*
- *Water Management Act 2000*
- *Protection of the Environment Operations Act 1997;*
- *Catchment Management Act, 2003;*
- *Natural Resource Management Act, 2003*
- *Environment Protection and Biodiversity Conservation Act 1999;*
- *NSW Wetlands Policy;*
- *The NSW Coastal Policy 1997; and*
- *The former Estuary Management Manual 1992.*

1.7.4 Regional and Local Environmental Planning Instruments

The Central Coast Regional Strategy (CCRS) was developed by the NSW Department of Planning (DP) as a long-term land use plan for the region. The Strategy covers the Gosford and Wyong Shire LGAs. It contains policies and actions designed to cater for the region's projected housing and employment growth over the period to 2031 and outlines how and where future development should occur. Significant growth is not expected to occur in the study area.

Until recently the Gosford Planning Scheme Ordinance (GPSO) was the principal planning instrument for Gosford urban areas and Interim Development Order No 122 (IDO 122) was the principal planning instrument for the non-urban areas. However on 11 February 2014 the Minister for Infrastructure and Planning made the Gosford Local Environmental Plan (LEP) 2014 which for large areas of the LGA, replaces the GPSO, the IDO 122 and the Gosford City Centre LEP 2007 (outside of the study area) as the principal planning instrument for Gosford. It was prepared under the direction of the State Government to all local councils, as per the Standard Instrument (Local Environmental Plans) Order 2006 ('the Standard Instrument'). The Standard Instrument Order provides for set land use zonings and definitions of permissible uses that must be used by all NSW councils in preparing their revised LEPs. In general, the new zonings given to the land parcels in the Gosford LEP 2014 aim to be as closely aligned as possible with the previous land use zonings and definitions. The LEP also sets out provisions such as building height, FSR and lot size, heritage significance etc

The Coastal Open Space System (COSS) does not fit within any of the zonings available for use from the Standard Instrument, but is recognised by both Council and DPI as important for the preservation of environmentally sensitive lands, with substantial positive benefits to the community. As such, until

such time as an appropriate land use zoning is available in the standard template, all Council owned and managed Coastal Open Space System (COSS) lands and all privately owned lands zoned Conservation 7(a) and Scenic Protection 7 (c2) located east of the M1 Motorway have been deferred from the LEP. The provisions of the Gosford Planning Scheme Ordinance (GPSO) and Interim Development Order No 122 (IDO No 122) remain in place as they relate to this land.

Gosford Development Control Plan (DCP) 2013 came into effect with the Gosford LEP gazettal. It provides a document that is better streamlined with the new LEP format, and includes additional provisions. For Gosford, this has involved the compilation of many individual DCPs into a single document. In general, the new DCP format provides development controls for land use types (e.g. low density residential), specific areas (e.g. Gosford City Centre) and environmental or risk aspects (e.g. floodplain management). There are aspects of lagoon management that have been incorporated. The DCP has retained the provisions of DCP 89 Scenic Quality which rank different landscapes in terms of their state, regional or local significance, together with describing their scenic conservation issues, development absorption capacities, visual sensitivities and statements of significance. (Gosford Draft DCP Part 2, Chapter 2.2).

2 PRIORITISED VALUES AND THREATS TO PEARL BEACH LAGOON

The characteristics of the lagoon and the processes taking place are described in some detail in the Pearl Beach Lagoon Condition Study and Community Uses Report (BMT WBM, 2012). A brief overview of the values and threats identified for the lagoon and its catchment are provided in the following section.

2.1 Values

The five key values this CZMP aims to protect are:

- **Natural bushland and riparian vegetation**

Fringing vegetation, including the Melaleuca wetland (listed as Endangered under the TSC Act) and sedgeland, which provide habitat for local species were identified as a key ecological value of the study site through the ecological assessment (refer to Appendix B). The Melaleuca trees were also identified as a key value at the stakeholder workshop. The role of wetland vegetation in reducing the likelihood of bank erosion and in filtering catchment runoff was also acknowledged.

- **Wetland fauna**

The lagoon is an important habitat for water birds, with the open water and fringing sedgeland habitats providing locally important habitat for several local bird species, particularly dusky moorhen (*Gallinulka tenebrosa*).

- **Water quality for ecological function**

This is considered an essential foundation for lagoon health. The Lagoon Condition Study showed that there is insufficient data to confidently describe the water quality of the lagoon. The confirmation of avian botulism at the site in 2010 and also observed water quality issues, provide sufficient justification for improving water quality in the future.

Maintenance of water quality and habitats within the lagoon will assist in supporting wetland fauna.

- **Aesthetic beauty**

The environmental and social benefits of the lagoon is valued by residents living by the lagoon, holiday makers, walkers and birdwatchers.

It should be noted that humans are prone to regard a wetland that looks good as one that *should* be a desirable residence for the species it has been managed or created for. Water is an important part of the wetland aesthetic, so dry wetlands are regarded as less desirable, even though many wetland species are not only well adapted to regular, seasonal drying out, but may depend upon it.

- **Public access around the lagoon**

In regards to lagoon health, public access can sometimes be detrimental. The aim for Pearl Beach Lagoon is not to increase visitation but to maintain current levels of access in and around the lagoon and to reduce impacts to the surrounding wetland.

For further descriptions on these values, please refer to the Lagoon Condition Study and Community Uses Report (BMT WBM 2012).

2.2 Risk Based Threat Assessment

The use of a risk-based approach for managing threats to estuary health is a requirement of the new CZMP Guidelines, and accords with current international best practice for natural resource management.

The standard risk management approach defines the magnitude of risk as a combination of 1) the likelihood of a risk event occurring, and 2) the consequence if such an event does occur. For this project, a variation on the standard risk approach has been adopted to address management of existing threats that already have a 'frequency' of occurrence, as opposed to future / unrealised risks that have a 'likelihood' of occurrence.

The methodology used here is consistent with the approach applied to Wamberal, Terrigal, Avoca and Cockrone Lagoons, also located within the Gosford LGA (refer BMT WBM, 2013).

The 'Threat Assessment' process is adapted from the Australian Standard Risk Management Principles and Guidelines (AS/NZS ISO 31000:2009), and is described below and presented schematically in Figure 2-1.

- **Establish the Context** – the requirements and scope of a coastal zone management plan for estuaries set by NSW Legislation and Guidelines provides the context for the threat assessment and intended outcomes. The purpose and context for the Pearl Beach Lagoon CZMP is outlined in the Lagoon Condition Study and Community Uses Report;
- **Identify the Threats** – the threats arise from the pressures upon lagoon processes that subsequently modify the lagoon's values. Pressures may be historical, they may be occurring at present, or they may arise in the future such as due to sea level rise. A combination of scientific assessment and community inputs assisted to identify the external pressures upon the lagoon and therefore direct threats to Pearl Beach Lagoon;
- **Analyse the Threats** – the threats to lagoon values need to be qualified in terms of the **frequency** with which they occur and the **consequence** of their occurrence, so that an appropriate management response to intervene or adapt to the threat can be identified. That is, the level or degree of threat (extreme, high, medium or low) is the product of *frequency X consequence*;
- The *frequency* of occurrence for the threats aims to qualify the existing threats that are already occurring as well as the potential future threats such as the impacts of sea level rise;
- The *consequence* relates to the impact of the threats upon the values of the lagoon, particularly the environmental values;
- The frequency and consequence are then combined to determine the level or *degree of the threats* to the lagoon. The product of frequency and consequence are specified within a Threat Matrix. The level of threat is listed for each identified threat, which is then used to assist in the identification and prioritisation of management actions, with management options that treat the greatest threats given priority. This threat analysis was undertaken at a workshop attended by representatives of Council, state agencies and selected members of the local community. A

register of the threats listed in priority order from greatest to least threat for Pearl Beach Lagoon was prepared;

- **Evaluate the Threats** – in consultation with Council and other stakeholders (from, state agencies and others including the Pearl Beach Progress Association), the threat assessment and threat criteria were checked to ensure a reasonable and consistent outcome. The existing controls that may manage any of the identified threats was investigated and included in the development of management options where appropriate ;
- **Manage the Threats** – the process of developing coastal management options is directly related to managing the threats to lagoon values. Management options may be designed as:
 - intervention actions (targeting frequency of threats) to improve or protect lagoon values and therefore eliminate extreme or high threats; or
 - adaptation actions (targeting consequence of threats) to maintain, protect or improve lagoon values and therefore reduce extreme or high threats and incidentally eliminate medium or low threats where possible;
- The management options were considered based upon the technical viability of implementation in the study area. A cost benefit analysis for the options was conducted to consider a range of factors. A key component of this analysis was to score the options based upon the level of threat treated by the option, i.e. options that treated extreme threats are weighted more highly than those treating low threats. In this manner, the prioritisation of management options is tied directly to the threat assessment; and
- **Implement Management Strategies (Risk Treatments)** – Chapter 4 of this Coastal Zone Management Plan details how the recommended management options (risk treatments) shall be implemented (costs, timeframes etc.) and funded. Ongoing monitoring and review of both the threats and management options is also detailed.

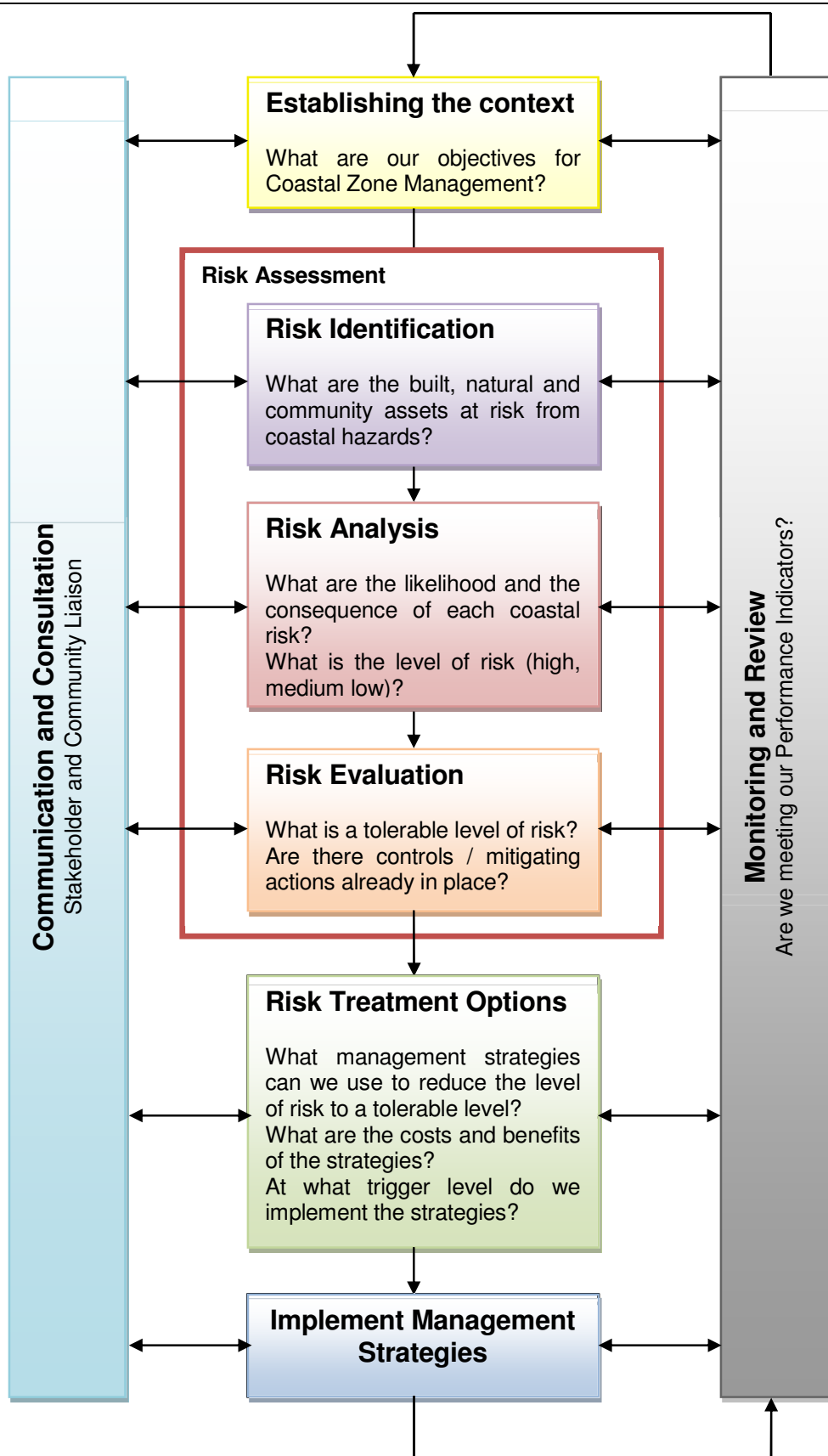


Figure 2-1 Risk Management Framework (ISO 31000:2009) adapted to Coastal Zone Management

2.2.1 Assessing Frequency of Occurrence for Threats

For each of the threats a frequency was allocated by each participant at the threat assessment workshop using the scale shown in Table 2-1. The participants included representatives of different departments of Council, state government and members of the local community.

Table 2-1 Frequency Scale for Threat Assessment

Scale	Frequency Descriptor
1	Almost Never
2	Rare
3	Infrequent
4	Occasionally
5	Frequently / Continuous

2.2.2 Assessing Severity of Consequences for Threats

As with the frequency, the workshop participants also nominated a severity rating for each of the threats. The scale used for this component is shown in Table 2-2.

Table 2-2 Consequence Scale for Threat assessment

Scale	Consequence
1	No or negligible impact to the environmental value
2	Small but measurable impact to environmental value but impact is temporary and value is maintained at current level over time
3	Moderate impact to environmental value; impact is still temporary and recovery is likely over time
4	Major impact to environmental value; impact will occur for period of months/years. Recovery is possible in the long term
5	Permanent loss of value; recovery unlikely or irreversible

2.2.3 Categorising the Threat

A threat matrix was developed to provide the overall threat level from the combination of consequence and frequency, as given in Table 2-3.

The matrix has been designed to ensure that the combination of frequency and consequence was a reasonable reflection of the level of threat or risk that may already be occurring.

Table 2-3 Threat Assessment Matrix

		Consequence				
		Negligible (1)	Small but measurable (2)	Moderate (3)	Major (4)	Permanent (5)
Frequency	Often / Continuous (5)	low	medium	high	extreme	extreme
	Occasionally (4)	low	medium	high	high	extreme
	Infrequent (3)	low	medium	high	high	high
	Rare (2)	low	low	medium	medium	high
	Almost never (1)	low	low	medium	medium	medium

The degree or level of threat from the combination of the frequency and consequences ascribed for each threat is listed in Table 2-4. Further descriptions of the Threats are available in the Pearl Beach Lagoon Condition Study and Community Uses Report (BMT WBM 2012).

The results demonstrate how the approach can work well to bring together multiple sources of information (data, experience, knowledge, academic research) in a transparent way to help guide management decisions for complex ecosystems that are not fully understood. The risk based threat assessment technique helps to take the subjectivity out of deciding where limited resources should be spent to improve lagoon condition. The 2010 avian botulism outbreak was a key driver for the community and council to rehabilitate the lagoon and protect its ecological values into the future. While this outbreak was devastating to witness and received local press coverage, such events occur rarely and recovery is possible. For this reason, avian botulism has been categorised as a low level threat to Pearl Beach Lagoon. Ongoing stormwater pollution, which occurs almost continuously with major impacts to the environmental values of the lagoon, may go unnoticed to many in the wider community, and thus has been categorised as an extreme level threat. Therefore limited resources would be better invested in improving the quality of stormwater before researching avian botulism

further. Notwithstanding, many threats overlap, as in this example, with both related to declining water quality (including reduced dissolved oxygen, increased nutrients and higher temperatures).

Table 2-4 Threats and Threat Levels as determined by the Stakeholder Workshop

Threat	Threat Level
Stormwater pollution	Extreme
Weed invasion	Extreme
The weir	Extreme
Infilled lagoon foreshores / modified profile	Extreme
Foreshore management (including mowing)	Extreme
Lagoon shallowing / sedimentation	Extreme
Pollution inputs / incidents other than regular stormwater	High
Introduced fauna	High
Climate change (including sea level rise)	High
Algal blooms	High
Groundwater extraction (via 10 private bores)	Medium
Conflicts between lagoon users	Medium
Myrtle rust	Medium
Water extraction (including fire management)	Low
Bushfire	Low
Avian botulism	Low
Safety to humans	Low
Safety - flooding	Low

3 ASSESSMENT OF MANAGEMENT OPTIONS

3.1 Long List of Management Options

An initial 'long-list' of possible Management Options was developed, to protect the identified values and to manage the identified threats. The source of these options include recommendations from the Lagoon Condition Study, which incorporated specialist hydrology and ecology assessments, community input through the workshop process, suggestions from agency representatives and other stakeholders from the threat assessment workshop, best practice approaches used elsewhere and tailored strategies developed by the Study Team. The long list contained over around 40 potential management options.

The possible Management Options identified utilise a variety of implementation mechanisms that can act at different levels, or can target different aspects of the problem. Types of Management Options considered include:

- planning controls and policies;
- economic incentives and cost sharing arrangements;
- regulation and compliance;
- on-ground works and rehabilitation;
- investigation;
- monitoring;
- research; and
- education and public relations.

It is not practical nor affordable for Council to implement all of these options, and therefore a methodology for prioritising options was developed. The result is a list of recommended options to achieve the management objectives within an affordable and realistic timeframe.

3.2 Evaluation of Management Options

A two stage approach was applied to the initial long list of options. Firstly, options passed through a coarse filter wherein management options that were clearly "no regrets" actions were 'fast-tracked' to a short-list of options. 'No regrets' refers to options that are clearly beneficial to the lagoon, the broader community, and involve little or no trade-offs. These options should be pursued irrespective of the specific aims and objectives of this CZMP.

In general, implementation of all 'no regrets' options should be pursued as part of normal day-to-day duties by Council and other relevant management authorities.

For all remaining options, a further fine filter was used to evaluate the benefits and costs of the options. Options that score well in the fine filter were also included in the final short-list. Options that did not get short-listed may still potentially have merit at some point in the future and therefore have been included in Appendix A of this document for future reference.

3.2.1 The Fine Filter Traffic Light Assessment

A multi-criteria assessment tool was developed to evaluate the positive and negative costs and benefits of the various options. These costs and benefits consider more than the technical merits of the options, by including aspects such as the degree of the threats addressed, implementation cost (capital and on-going), timeframe, community acceptance, ease of implementation and effectiveness (in terms of the management intent of the value that the option addresses).

The fine filter assessment tool is based on a “traffic light” colour system for a range of variables, to clearly display if an aspect of an option should be cause to “stop” and reconsider, “slow” to proceed with caution or “go” with few trade-offs expected. The assessment has been conducted for each possible Management Option. It is aimed at presenting quickly and clearly the benefits and trade-offs of a particular option, to assist in the selection of a short-list of management options.

Each of the options has a final score based on this traffic light assessment. The criteria that were adopted in the assessment are given in Table 3-1. In the scoring system used, green coloured traffic lights were given 3 points, orange 2 points and red 1 point. This gave each option an overall score out of 18.

If an option scored 17 or more it was included as a Best Management Option (BMO) and given a priority to be undertaken within the next 2 years. These included the ‘no regrets’ options.

If an option had a score between 15 and 17 it was categorised as a “Second Pass Option” and included in the implementation table to be actioned within the next 5 years.

The scores for each option are included in Appendix A, along with further information on all options considered..

Shortlisted options and their implementation timeframes are listed in Table 3-2.

Table 3-1 Fine Filter (Traffic Light Assessment) Criteria -Refer to Appendix A for Application

	Does it address high level threat?	Effectiveness / Risk Reduction Potential (RRP)	Time frame	Cost	Practicality / Legal	Community Support
STOP & reassess	No – addresses low level threat only	Option does not provide an effective and long term solution. Risk reduction potential is relatively low	LONG Term (> 5-10yrs before tasks can commence). Requires prior commitment of funds, resources or other tasks to be completed first	High (\$300K to millions)	LOW: Will require approval to implement and significant community engagement. There is a residual risk that approval will not be able to be obtained for the proposed works/strategy. Works may also require significant resources that are presently unavailable	LOW: Unlikely to be acceptable to community and politically unpalatable. Extensive community education, endorsement by Minister(s) and Council required.
SLOW	No- addresses medium level threat	Option is considered worthwhile, but does not necessarily help with long term sustainability and lagoon health.	MEDIUM Term (> 2 – 5yrs before tasks can commence). Requires prior commitment of funds, resources or other tasks to be completed first	Medium (e.g. \$30,000 - \$300,000)	MEDIUM: May require approvals to be implemented, but works are generally supported. Generally these approvals would likely to be granted assuming requirements are met. May require some resources that would require redistribution of existing tasks and duties by officers.	MEDIUM: Would be palatable to some, not to others (50/50 response). Briefing by Councillors, GM and community education required
GO	Yes – addresses extreme or high level threat	Option provides an effective long term solution	SHORT Term (tasks can commence within approximately 2 years). Generally can be completed without too many barriers	Low (< \$30,000)	HIGH: No or minimal approvals or other impediments required to implement. No significant additional resources required (can be done as part of normal duties)	HIGH: Is very politically palatable, acceptable to community. Minimal education required

Table 3-2 Shortlisted Management Actions

Action	Category / Timeframe	Reference (refer to Chapter 4)
Provide information to the community	No Regrets / Immediate - ongoing	1
Prepare a vegetation and access master plan	No Regrets / Immediate - ongoing	2
Encourage a reduction in catchment pollution through stormwater runoff	No Regrets / Immediate-ongoing	3
Works staff training program	BMO / within 2 years	4
Retrofit Stormwater Quality Improvement Measures	BMO / within 2 years	5
Rehabilitate habitats within creek lines of catchments	BMO / 2-5 years ongoing	6
Improved compliance of residential construction activities	BMO / 2-5 years ongoing	7
Improved planting around fringes of the lagoon	BMO / 2-5 years ongoing	8
Improve foreshore structure and habitat	BMO / within 2 years	9
Include Pearl Beach Lagoon in Council's Lagoon Opening Policy and Procedure	BMO / 2-5 years	10
Investigate options to modify the weir	2 nd Pass Option / 2-5 years	11
Investigate options for removing material from the bed of the lagoon	2 nd Pass Option / within 5 years	13

3.3 Consistency and Efficiency of Parallel Implementation with Other CZMPs

In addition to Pearl Beach Lagoon, CZMPs will also be implemented by GCC for Wamberal, Terrigal, Avoca and Cockrone Lagoons, and for Brisbane Water. Benefit to each of these projects would be gained by economies of scale by drawing on similar actions and sharing the costs across the waterways. For example, each of the lagoons has recommendations regarding:

- Increased inspections and compliance of residential constructions;
- Development and implementation of updated Entrance Management Policies; and
- Updated Lagoon fact sheets.

3.4 Community Links

The community at Pearl Beach has shown overwhelming interest in the long term management of the lagoon. In an attempt to make the most of this valuable resource for the lagoon's improved estuary health into the future, opportunities for community involvement have been identified for each of the management actions. These include both opportunities for assistance in implementation and also for future monitoring and performance review. Please refer to the individual action tables in Chapter 4 for further details.

3.5 Potential Funding Sources

An important reason for preparing a Coastal Zone Management Plan is the ability to attract sources of Government funding. By demonstrating that a considered and informed approach has been taken to designing actions, funding organisations can be confident that resources provided will be a good investment. This is particularly true for the NSW Government Estuary Management Grant Program, which is likely to be a key avenue for future funding. The Action Plan given in Chapter 4 includes a range of grants and funding sources for each action. Some further information on potential grants is given in Table 3-3. This list of funding sources is not exhaustive and it will be important to track and identify emerging grants opportunistically during implementation.

Table 3-3 Examples of Potential Funding Sources

Grant Name / Further Information / key dates	Details
The Gosford Protection of the Environment Trust	<p>The Gosford 'Protection of the Environment Trust' was set up by Council to promote the protection and enhancement of the natural environment, in particular, the conservation of flora and fauna indigenous to the Local Government Area of Gosford City.</p> <p>The Gosford 'Foundation Trust' was set up by Gosford City Council to encourage and facilitate benevolent acts by public spirited citizens and to manage and acknowledge donations received. Gifts to the Gosford Foundation Trust may be applied to items such as, but not limited to, public libraries, the arts, enhancement to public places including benches, gardens, trees, decoration of pavements, shelters, public sporting facilities as well as preservation of historic buildings.</p> <p>Contributions and gifts to the Trust can be used for the acquisition, maintenance, preservation, enhancement or embellishment of land. If a developer is required to transfer land to an Environmental Organisation as a condition of development, it may be transferred to The Gosford Protection of the Environment Trust. In return for their generosity, citizens making donations to Council's Trusts are eligible to claim tax deductions in accordance with the provisions of the federal Income Tax Assessment Act 1997.</p>
BiodiversityFUND	The Biodiversity Fund will fund projects which best target the three themes:

Grant Name / Further Information / key dates	Details
Ongoing	<ul style="list-style-type: none"> • biodiverse plantings • protecting and enhancing existing native vegetation • managing invasive species in a connected landscape
Caring for Our Country / Ongoing	<p>Target Area Grants will fund activities that will contribute to the achievement of the three strategic objectives of the Sustainable Environment stream of Caring for our Country:</p> <ul style="list-style-type: none"> • maintenance of ecosystems services, including ecological and cultural values, now and into the future • protection of our conservation estate • enhanced capacity of Indigenous communities to conserve and protect natural resources
Community Action Grants	<p>Community Action Grants are a small grants component of the Australian Government's Caring for Our Country initiative that aims to help local community groups take action to conserve and protect their natural environment. The grants are targeted towards established local community-based organisations that are successfully delivering projects to support sustainable farming and/or protect and enhance the natural environment.</p> <p>Each year, investment proposals are sought from environmental, Indigenous, Landcare, Coastcare and sustainable agriculture community groups for grants of between \$5000 and \$20 000 (GST exclusive) to take action to help protect and conserve Australia's natural resources and environment.</p>
Estuary Management Grants Program / Annual	<p>The primary objective of the NSW Government's Estuary Management Program is to provide support to councils to improve the health of NSW estuaries and understand the potential risks from climate change.</p>
Environmental restoration and rehabilitation Ongoing	<p>The aim of the Restoration and Rehabilitation (R&R) program is to facilitate projects to prevent or reduce pollution, the waste stream or environmental degradation of any kind, run by community organisations and State and Local government organisations.</p> <p>Through these projects, we also aim to improve the capacity of communities and organisations to protect, restore and enhance the environment.</p>
Ian Potter Foundation / always open	<p>The Ian Potter Foundation is a private Australian philanthropic foundation which makes grants for charitable purposes in Australia in areas including the environment</p>

Grant Name / Further Information / key dates	Details
Coles Junior Landcare Grants Program / Ongoing	Through the Junior Landcare Grants Program, any school or organisation that would like to involve their students in landcare projects, in conjunction with local landcare groups, can apply for grants to assist them with the cost of their projects
Open Gardens Australia Ongoing	Open Gardens Australia is a self-funding, not for profit organisation that promotes the knowledge and pleasure of gardens and gardening to all Australians. A demonstration site showing appropriate species and management approach (e.g. mowing) could be set up on private land beside Pearl Beach Lagoon. This could be used to educate other land owners and visitors about the lagoon, its significance and appropriate practices.

3.6 Further consideration of Weir Removal / Modification Action

Following the Public Exhibition and community meeting, more information was required regarding the option to modify or remove the weir. In particular there was a sentiment amongst some that the option should receive a higher prioritisation. Within the present document the recommendation to further investigate this as a 2nd pass option remains. On balance, on the information available, there would be little to gain from either modifying or removing the weir, under the current scenario. The lagoon essentially acts as a sediment basin for catchment inputs. This would also be the case naturally; however catchment development, increased hard stand areas and ongoing catchment activities have significantly accelerated this process. The inclusion of the weir modification action therefore remains as a lower priority.

Key Considerations

For	Against
Removal of the weir would allow (very occasional) flushing out of sediments and pollutants during large flood events (lagoon would remain closed for the vast majority of the time)	If the weir was removed or modified, bottom sediments including black ooze would be exposed with associated visual and odour impacts
More closely mimics natural system	Predominantly closed nature of the lagoon and height above sea level will result in extremely low potential for fish passage
Periodic exposure of mudflats will provide foraging habitat for shorebirds.	Fisheries habitat potential considered marginal (Scott Carter DPI Fisheries pers. Comm.)

	Change to present valued waterbird visitors
	If the wetland fully dries out during spring or summer aquatic life may be lost

3.7 NSW Weir Management Policy

The NSW Government State Weirs Policy aims to halt and where possible, reduce and remediate the environmental impacts of weirs.

The policy document presents a range of principles to be considered regarding weirs. These are addressed in Table

Table 3-4Principals of the NSW Weir Policy with response for Pearl Beach Lagoon

Principle	Response
The construction of new weirs or enlargement of existing weirs shall be discouraged	Enlargement of the Pearl Beach Lagoon Weir is not being considered.
Weirs that are no longer providing significant benefits to the owner or user shall be removed, taking into consideration the environmental impact of removal.	The Pearl Beach Lagoon Weir still provides some benefit to local residents through its role in odour reduction and waterbird habitat.
Where retained, owners shall be encouraged to undertake structural changes to weirs to reduce their environmental impact on the environment.	Reducing the height of the weir to allow more frequent overtopping by seawater, or replacing the structure with a weir incorporating stop boards offer negligible environmental improvements.

4 ACTIONS

1	Provide information to the community	Category	No Regrets			
		Priority	Immediate			
Detailed description						
<p>Develop a range of educational materials which assist in enhancing understanding and appreciation of the Lagoon and its catchment. Education should focus upon identified values (Inc. information on habitat values, the importance to the lagoon in the local landscape and ways residents can contribute to its protection and management) and also threats such as current mowing extents, appropriate species selection for gardening, mindful domestic pet ownership and promoting provision of woody debris and other suitable materials which provide habitat. Particular emphasis should be given to providing information to private landholders directly adjacent to the lagoon.</p> <p>The information should be disseminated as part of an ongoing communications plan with the following considerations:</p> <ul style="list-style-type: none">• The two target audience groups for communication will be landholders adjoining the lagoon and other visitors,• There should be a focus on building community understanding and appreciation of Pearl Beach Lagoon values• A focus on identifying ways that the community can contribute to catchment health improvements <p>Educational resources may include factsheets, web information, smartphone applications, improved interpretive signage and information sessions.</p> <p>A key resource would be the development of fact sheets aimed at residents. This option could also be strengthened through the Open Gardens Initiative. This could involve setting up a demonstration garden on private land showcasing appropriate species and management techniques, funding may be available through future rounds of the Open Gardens Program</p>						
Threats addressed by this option		Weed Invasion	Foreshore Management			
		Extreme	Extreme			

1	Provide information to the community				Category	No Regrets
					Priority	Immediate
Values enhanced by this option	Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function		
Focus area	Education	Community links	Build on the Pearl Beach Environmental Guide Performance Indicators could be measured by interested community members An interested landowner could prepare a demonstration garden / participate in the open garden initiative			
Responsibility	GCC Environmental Division					
Supporting groups	Pearl Beach Progress Association, Bush care, Catchment Management Body/Local Land Services					
Links to other actions	2. Planting Guide 8.Improved planting around the fringes of the lagoon Reduce stormwater runoff Work staff training program	Links to existing works	Develop factsheet and educational material as part of large coast and estuary education program under development			

1	Provide information to the community	Category	No Regrets
		Priority	Immediate
Costs and resources		Funding opportunities	Monitoring and performance indicators
<p>Capital:</p> <p>This is a relatively low cost option that should be implemented using existing Council staff through the current coastal and marine education program.</p> <p>Ongoing (per annum):\$1000 for printing & distribution</p> <p>Staff time in updating material</p>		<p>Community Action Grants</p> <p>Open Gardens Initiative</p> <p>Hunter Central Rivers CMA (or proposed successor institution for the CMA)</p>	<ul style="list-style-type: none">• Changes in behaviour, e.g. portion of mowed areas around the lagoons edge• Proportion of appropriate native species utilised in new plantings

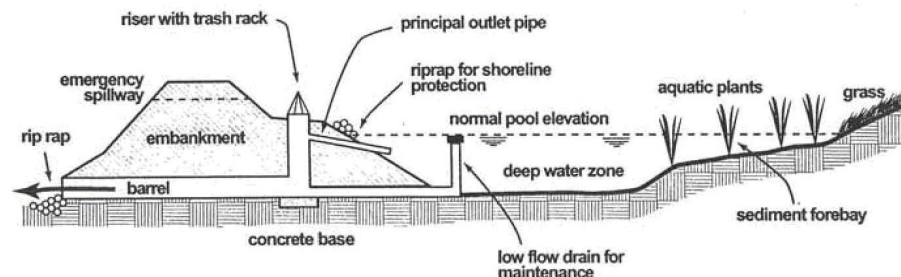
2	Prepare a vegetation and access master plan	Category	No Regrets
		Priority	Within 2 yrs
Detailed description			
<p>Prepare a planting and access schematic to guide rehabilitation of key habitats and encourage appropriate recreational access within the catchment. The master plan will focus upon:</p> <p>Access – promote key entry points; propose appropriate path networks (i.e. low key crush sandstone) and viewing points which are non-obtrusive, avoid private property and protect valuable habitat. Key entry points should be limited to the easements between houses on Diamond Road. These could be formalised in a low key manner (for example, using crushed sandstone) and signage should be limited to one sign with a Quick Response (QR) code for further details. QR codes are square 2 dimensional barcodes that can be scanned by smart phones so the user can be redirected to web based information. The advantages of using QR codes is that they allow discrete signage and that information can be updated electronically. The access point could possibly include a viewing platform or sitting area on public land near the southern easement off Diamond Road. These would need to be integrated with stormwater measures . Entry from the southern side of the entrance channel should be discouraged as there is not the available space for access on public land without impacting on wetland plants. An updated sign describing values should replace the existing sign on the northern side of the entrance channel..</p> <p><u>Amenity</u> – positioning of appropriate interpretive/compliance signage at entry points, and trails, seating etc which enhance appreciation and learning of the surrounding environment whilst not detracting from the visual appeal of the lagoon foreshore.</p> <p><u>Vegetation Enhancement Plan</u> – developed from EEC mapping and vegetation communities, applying weed eradication, succession plantings, zonation etc. in a staged process across site and could also include other EEC parcels within the catchment. This will also link to information/education for residents.</p> <p><u>Landscape Master Plan</u> -identify opportunities to provide appropriate interpretive information while also increasing planting around the fringes of the Lagoon with a focus on endemic plantings appropriate for identified vegetation communities. This will support Councils vegetation management activities as well as local residents in contributing to habitat restoration. The first priority should be enhancement of the existing Coastal Sand Swamp Forest Endangered Ecological (37ei) Community adjacent to Pearl Beach Lagoon through weed removal and the establishment of endemic ground cover and canopy species to enable long term succession.</p>			

2	Prepare a vegetation and access master plan	Category	No Regrets			
		Priority	Within 2 yrs			
<p>In stream planting could be trialled once improvements in the lagoon become apparent (possibly within 2-5years of stormwater interventions). It is important to acknowledge that ‘natural conditions’ can’t be fully restored.</p> <div><p>Natural lagoon profile with large WL range and gentle foreshore slopes</p><p>Image shows a simplified natural and modified lagoon profile for Pearl Beach Lagoon. The green line and arrow indicate the typical area of land privately owned</p><p>Modified lagoon profile with restricted WL range (due to the weir and artificial entrance opening) and steep foreshore slopes (due to progressive filling of backyards)</p></div> <p>The schematic should also consider landward migration of wetland vegetation in response to sea level rise, opportunities for bank regrading and appropriate public access. This needs to build on the existing replanting work and adapting as new lessons are learnt. Adjusting the slope will be complicated by the boundaries between public and private ownership so priority should be given to public lands. Acknowledgement that returning to a natural state is not entirely achievable and clear goals on restoration is required.</p>						
Threats addressed by this option		Weed Invasion	Foreshore Management	Conflicts between users		
		Extreme	Extreme	Medium		
Values enhanced by this option		Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function	Public access around the lagoon
Focus area		Planning	Community links	Provide a key resource for existing and future		

2	Prepare a vegetation and access master plan		Category	No Regrets
			Priority	Within 2 yrs
Responsibility	GCC		Bushcare groups	
Supporting Groups	OEH, Catchment Management Authority / Local Land Services			
Links to other actions	1. Information for residents 8. Improved planting around the fringes 9. Improve foreshore structure and habitat	Links to existing works	Rehabilitation works undertaken by GCC and others	
Costs and Resources		Funding Opportunities		Monitoring and Performance Indicators
Capital: Landscape master planning ~\$5,000 Implementation will be approximately ~\$20,000 and the subject of a specific report to Council prior to implementation. Ongoing (per annum): ~ \$5,000 for bush regeneration/ weed control and access maintenance		Masterplanning may be funded through Councils internal budget and potentially community contributions through Council Trust operations.		<ul style="list-style-type: none"> Schematic drafted, exhibited and finalised. Implementation of Landscape master plan

3	Works staff and contractor training program	Category		BMO	
		Priority		Within two years	
Detailed description					
<p>Undertake an intensive engagement program for Council works staff involved in sediment and erosion control within the catchments to raise the profile of best practice erosion and sediment control, vegetation management and assist staff with new policies and procedures. The first steps would be to assess staff awareness levels around sediment and erosion control policies and opportunities to improve practices and legal responsibilities.</p> <p>The target for the program would be operational staff with responsibility in:</p> <ul style="list-style-type: none">erosion and sediment controlvegetation and managementsite assessment <p>The aim of the training would be to raise the profile of best practice erosion and sediment control assist staff with new policies and procedures and track improvements in performance</p>					
Threats addressed by this option	Stormwater Pollution	Lagoon shallowing (sedimentation)	Pollution inputs	Avian Botulism	
	Extreme	Extreme	High	Low	
Values enhanced by this option	Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function	
Focus area	Education	Community links	Nil		

3	Works staff and contractor training program		Category	BMO
			Priority	Within two years
Responsibility		GCC		
Supporting groups		GCC contractors		
Links to other options		3. Liaise with landholders to reduce sediment and nutrient inputs 7. Improved compliance of residential construction activities	Links to existing works	This strategy is also being considered LGA wide to support Council Erosion and Sediment Control Policy
Costs and resources		Funding opportunities		Monitoring and performance indicators
To enable a genuine transfer of information that translates into targeted and informed outcomes an allowance of \$10,000 should be made to research and design implement appropriate content.		Estuary Management Grants Program		<ul style="list-style-type: none"> Audit work sites before and after training administered. Monitor immediately following training and 6 months down the track.

4	Retrofit stormwater quality improvement measures	Category	BMO			
		Priority	Within two years			
Detailed description						
<p>Hydrological modelling undertaken for the Condition Study Report indicated the introduction of sediment traps has the potential to reduce sediment loads by up to 54%. The recommended approach is for a treatment train which includes vegetated filtration measures in road reserves adjacent to stormwater inlets and retrofitting sediment traps adjacent to main stormwater outlets. The main stormwater outlets are located in the vicinity of 80 Diamond Road, 88 Diamond Road and 106 Diamond Road. The priorities for these should be determined by the MUSIC modelling results included in the Condition Study (BMT WBM). The results show potential reductions in Total Suspended Sediments per catchment. These results are included in summary in Appendix B.</p> <p>The schematic here is indicative only and sediment traps would be custom designed for the site. For example a variable inflow pipe may be more appropriate</p>						
						
Threats addressed by this option	Stormwater Pollution	Lagoon shallowing (sedimentation)	Avian botulism			
	Extreme	Extreme	Low			
Values enhanced by this option	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function			
Focus area	Works	Community links	Nil			

4	Retrofit stormwater quality improvement measures		Category	BMO
			Priority	Within two years
Responsibility	GCC			
Support Groups	NSW Office of Water			
Links to other options	3 Encourage a reduction in catchment pollution through stormwater runoff	Links to existing works	Nil	
Costs and resources		Funding opportunities		Monitoring and performance indicators
<p>Capital: Highly variable, allow \$10,000 for design, \$20,000 construct per unit</p> <p>Ongoing (per annum): ~\$10,000 (dependant on design and function)</p>		<p>Estuary Management Grants Program</p> <p>Environmental Restoration and rehabilitation grants</p>		<p>Installation of sediment traps</p> <p>Volume of sediment trapped and removed per annum.</p> <p>Occurrence of events where sediment trap is effectively bypassed due to inadequate maintenance.</p>

5	Rehabilitate habitats within creek lines of the catchment	Category	BMO
		Priority	2-5 years ongoing
Detailed description			
<p>The catchment draining to Pearl Beach Lagoon is 42.5ha. Bushland areas cover the steeply grading upper catchment areas. Runoff from bushland to the west of the lagoon is intercepted by Pearl Beach Drive and conveyed along this road prior to discharge through culverts as concentrated runoff onto the eastern side of Pearl Beach Drive. Concentrated discharge of runoff may elevate the erosion of soils along the downstream drainage corridors. Runoff from bushland north of Beryl Boulevard drains through residential properties to this street prior to entering a piped drainage system through concrete drainage pits located on the high side of the street. The piped drainage systems discharge into the northern side of the lagoon.</p> <p>Opportunities should be taken within the urbanised catchment to rehabilitate and naturalise creek lines, particularly considering the absence of kerb and guttering. Larger scale erosion sites may require bed control structures and other larger scale interventions as well as revegetation to rehabilitate them and thus reduce sediment loads to the lagoon.</p> <p>Rehabilitation should focus on protection of undisturbed vegetation and prioritise bush regeneration using a catchment management approach.</p> <p>Sub catchments have been mapped and are shown in the Condition Study. A detailed mapping exercise should be undertaken to show the length, condition and priority for rehabilitation. Important components of this mapping will be to :</p> <ul style="list-style-type: none">• Document current condition of creek lines• Identify problems at their source• Conserve ecologically significant areas of the creek lines• Protect the creek lines from further degradation• Engage appropriate weed management techniques• Assist the natural regeneration of the native vegetation• Increase community awareness of the issues and values• Engage the community in active involvement to protect and rehabilitate creek lines <p>It is essential that all involved personnel are aware that a licence from OEH is required for all work undertaken in an EEC under the Threatened Species</p>			

5	Rehabilitate habitats within creek lines of the catchment				Category	BMO
					Priority	2-5 years ongoing
Conservation act 1995.						
Threats addressed by this option	Stormwater Pollution	Weed Invasion				
	Extreme	Extreme				
Values enhanced by this option	Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function		
Focus Area	Works	Community links	Potential for involvement of interested residents, bush care, dune care and other volunteer based organisations			
Responsibility	GCC					
Support responsibility	NSW Office of Water					
Links to other options	2. Prepare a vegetation and access master plan	Links to existing works	Rehabilitation works undertaken by GCC, Bushcare, dune care			
Costs and resources		Funding opportunities		Monitoring and performance indicators		
Capital: ~\$10,000 Ongoing (per annum): ~\$5,000		NSW Estuary Management Grant Program BiodiversityFUND Caring for Our Country		Works undertaken Survival rates of plants		

6	Improved compliance for construction activities	Category	BMO
		Priority	Within two years (ongoing)
Detailed description			
<p>Residents, Council and other agencies can influence the quality of stormwater. Increasing awareness through education and training programmes will be the primary method in changing behaviour and attitudes.</p> <p>However, we all need to actively and responsibly take the necessary steps to minimise the pollution of stormwater and compliance is an important tool in minimising degradation of our environment.</p> <p>Compliance must target the following areas:</p> <ul style="list-style-type: none">• Control of pollution from the community;• Control of pollution from construction, maintenance and operations activities of Council, utilities and other agencies; and• Control of pollution from the building and construction industry <p>Guiding principles include:</p> <p>Eliminate non-stormwater discharges</p> <p>Stormwater drains must only carry stormwater runoff, and not wastewater or washdown water, rubbish, litter or any other contaminant that can be reasonably prevented from entering the system.</p> <p>Control stormwater pollution at its source</p> <p>It is far preferable to reduce and, where possible, eliminate the causes or sources of stormwater pollution rather than treat the effects somewhere downstream. Source controls place responsibility directly on the polluter and this should lead to long term permanent solutions resulting from simple changes in practice.</p>			

6	Improved compliance for construction activities	Category	BMO			
		Priority	Within two years (ongoing)			
Stormwater runoff is a resource <ul style="list-style-type: none">Stormwater runoff should be managed as a valuable water resource. Better quality runoff increases the value of the resource and also the potential number of uses from recreational waterbodies to alternative sources of water supply.						
Maximum extent practicable <p>Reducing pollutants in stormwater is difficult and costly to quantify or prescribe, so the aim is to reduce pollution to the maximum practicable extent by promoting best management practices. Increase resourcing to conduct site inspections to determine if residential construction projects are complying with requirements under the <i>Protection of the Environment Operations Act 1997</i></p>						
Threats addressed by this option		Stormwater Pollution	Lagoon shallowing / sedimentation			
		Extreme	Extreme			
Values enhanced by this option		Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function	
Focus area		Compliance		Community links	Encourage the local community to identify and report non-compliant construction sites	
Responsibility		GCC				
Support groups		Nil				

6	Improved compliance for construction activities		Category	BMO
			Priority	Within two years (ongoing)
Links to other options		3. Encourage a reduction in catchment pollution through stormwater runoff	Links to existing works	Council resources are currently at capacity in regard to managing compliance activities through its operations program. Additional resources would provide benefits across the LGA.
Costs and resources		Funding opportunities		Monitoring and performance indicators
Capital: ~\$10,000 generally absorbed within staff time, however it is likely that existing compliance staff are unable to inspect all sites, and therefore would benefit from funding to support targeted personnel for this and other waterways in GCC. This could be achieved for around \$80,000 per year (with the Pearl Beach Lagoon Portion only covering a small percentage of this.)		Estuary Management Grant Program		Percent of reported incidents inspected by Council Number of inspections undertaken.

7	Include Pearl Beach Lagoon in council overall Lagoon Opening Policy and Procedure	Category	BMO			
		Priority	2-5 years			
Detailed description						
<p>Pearl Beach Lagoon entrance is occasionally artificially opened by Council to reduce the flood threat along Coral Crescent and adjacent properties. The trigger for opening the lagoon is marked by a white line at approximately 2.75 metres AHD on the concrete block retaining wall on the northern side of the entrance channel. Council does not routinely monitor the level of water in the entrance channel</p> <p>Entrance openings are therefore triggered by staff inspections or notification by local residents. The decision by Council to open the lagoon is made based on a combination of the trigger level being reached and the beach berm being high and predicted rainfall. It is understood that mechanical openings of this nature occur once or twice a year. Manual openings are carried out by excavator or backhoe depending on the beach / erosion conditions.</p> <p>The existing opening practice has not been formalised. This action involves consideration of site specific factors (flood risk, ecological benefits and community uses) to be incorporated into the Council opening procedure. The policy and Procedure will include details such as triggers for opening, safety considerations and actions and documentation requirements.</p> <p>The existing opening practice has not been formalised. This action involves consideration of site specific factors (flood mitigation, encouragement of biodiversity, water quality improvements, reduction of sedimentation and consideration of community uses) to be incorporated into the Council opening procedure. The policy and procedure will include details such as triggers for opening, safety considerations and actions and documentation requirements.</p>						
Threats addressed by this option		Stormwater pollution	Conflicts between lagoon users	Safety - flooding		
		Extreme	Medium	Low		

7	Include Pearl Beach Lagoon in council overall Lagoon Opening Policy and Procedure				Category	BMO
					Priority	2-5 years
Values enhanced by this option	Natural Bushland / riparian Vegetation	Wetland Fauna	WQ to support ecological function			
Focus area	Works	Community links	Nil			
Responsibility	GCC					
Support groups	Nil					
Links to other options	11. Investigate options for weir modification	Links to existing works	Linked to the weir and future management of it.			
Costs and resources		Funding opportunities			Monitoring and performance indicators	
Capital : ~\$15,000 for review and integration of Pearl Beach into formal procedure/ policy Ongoing (per annum): No cost		Estuary Management Grants Program			Procedure prepared and implemented	

8	Investigate options to modify the weir	Category	SPO
		Priority	Within 2-5 years
Detailed Description			
<p>Section 3.6 of this CZMP provides a general overview of the considerations relating to potewntil alteration to the current weir structure. This information could form the basis to investigate opportunities to replace the weir with a modified structure that allows variable heights (through stopboards or something similar).</p> <p>The first step in implementing this option will be setting clear objectives to inform design and operation of the structure. Given the history of involvement of the local community, this could be achieved through a workshop which involves Councils Coast and Estuary Team, NSW Fishries and external expertise as required. The questions that need to be resolved include:</p> <ul style="list-style-type: none">• Are high odour conditions tolerable, if so, how frequently?• Should frog breeding efforts be prioritised over potential water quality benefits?• What species of in stream plants are desirable?• What bird species are desirable / have the potential to visit if suitable habitat is available?• What are the impacts of changes to the hydraulics of the lagoon?. A water level recording instrument should continue to be deployed upstream of the new structure to ensure that changes to the hydraulic regime, are monitored and are as intended. The time between manipulation of the floodgates and an observable ecological response will be significant (seasons to years). It is therefore important that the structure only be used in a controlled manner, which takes this lag time into consideration. <p>Once a clear set of objectives have been agreed upon, a bathymetric survey should be undertaken to assist in design of the structure. An REF will be required before any works occur.</p> <p>It is essential that all involved personnel are aware that a licence from OEH is required for all work undertaken in an EEC under the Threatened Species Conservation act 1995.</p> <p>Ongoing management and monitoring of such a structure would be an ongoing cost to Council.</p>			

8	Investigate options to modify the weir				Category	SPO
					Priority	Within 2-5 years
Threats addressed by this option	The Weir	Lagoon shallowing and infilling	Algal blooms	Introduced fauna		
	Extreme	Extreme	High	High		
Values enhanced by this option	Wetland Fauna	WQ to support ecological function				
Focus area	Planning and Research	Community links	Nil			
Responsibility	GCC					
Support responsibility	Nil					
Links to other options	10 Include Pearl Beach Lagoon in Council overall Lagoon Opening Policy and Procedure	Links to existing works	Will need to be consistent with Flood Plan			
Costs and resources		Funding opportunities		Monitoring and performance indicators		
Capital: ~ \$15, 000 for investigation		Estuary Management Grants Program		Modified weir structure designed and approved		
Weir modification or removal is estimated to cost around \$20,000		Possibly Habitat Action Grants		Modified weir structure in place.		
Ongoing (per annum): Ongoing monitoring and						

8	Investigate options to modify the weir		Category	SPO
			Priority	Within 2-5 years
manipulation of the structure would be at a cost of around \$\$2,000 per year made up primarily of staff time				

9	Investigate options for removing material from lagoon bed	Category	SPO			
		Priority	Within five years			
Detailed Description						
<p>Infilling of the lagoon, particularly with finer sediments was identified as a community concern during consultation.This management action will involve an investigation into the various methods available to increase lagoon depth (and remove organics) without detrimental impacts. Implementation of this option will require environmental impact assessment to determine the nature of the material to be removed and the disposal of this material.</p> <p>An indication of the steps required is given below.</p> <p>Step 1: Prepare a sampling and analysis plan outlining the number and location of samples, and data analysis and reporting procedures</p> <p>Step 2: Undertake core sampling with testing for Acid Sulphate Soils, sediment grading analysis and heavy metal testing</p> <p>Step 3: Confirmation of dredging design and dredging quantities – this will require survey to ensure operations remove only catchment derived non ASS sediment</p> <p>Step 4: Undertake an assessment of environmental constraints</p> <p>Step 5: Undertake an assessment of dredging design and disposal methods. The outcome of this will be a feasibility study that outlines the results and considerations of each of the steps above.</p>						
Threats Addressed by this option	Lagoon infilling and sedimentation	Stormwater Pollution				
	Extreme	Extreme				
Values Enhanced by this option	Natural Bushland / riparian Vegetation	Wetland Fauna	Aesthetic Beauty	WQ to support ecological function		
Focus area	Research and Monitoring		Community Links	Nil		
Responsibility	GCC					

9	Investigate options for removing material from lagoon bed		Category	SPO
			Priority	Within five years
Support groups	Nil			
Links to other options	Nil	Links to existing works	Nil	
Costs and Resources		Funding Opportunities		Monitoring and Performance Indicators
Capital: Investigation \$10,000 (internal staff time) Ongoing (per annum): No cost		Estuary Management Program Grant		Foreshore condition in terms of vegetation cover and bank erosion

Table 4-1 Costing for implementation of Pearl Beach Lagoon CZMP Management Actions

Action	Comment	Timeframe	Initial Cost Estimate	Ongoing costs p.a.
1. Provide information to the community	Option implemented using existing Council staff and programs. Linked with other management options. Grant funding opportunities.	Immediate	Existing resources	\$1000 for printing & distribution Staff time in updating material
2. Prepare a vegetation and access master plan	Option implemented using existing Council staff and programs. Linked with other management options. Grant funding opportunities. Subject to specific report to Council prior to implementation.	Within 2 yrs	Landscape master planning ~\$5,000 Implementation ~\$20,000	~\$5,000 for weed control and access maintenance
3. Works and contractor staff training program	To enable a genuine transfer of information that translates into targeted and informed outcomes an allowance of \$10,000 should be made to research and design implement appropriate content. Will form part of staff/contractor induction.	Within 2 yrs then ongoing	~\$10,000	Staff time
4. Retrofit stormwater quality improvement measures	Highly variable, allow \$10,000 to \$20,000 per unit plus ongoing maintenance costs (2 cleans per year). Cost estimate include the installation of two units. Grant funding opportunities.	Within 2 yrs	~\$40,000	~\$14,000
5. Rehabilitate habitats within creek lines of the catchment	Grant funding opportunities.	2-5 years	~\$10,000	~\$5,000
6. Improved compliance of residential construction activities	Generally absorbed within staff time, however it is likely that existing compliance staff are unable to inspect all sites, and therefore would benefit from funding to support targeted personnel for this and other waterways in GCC. This could be achieved for around \$80,000 per year (with the Pearl Beach Lagoon Portion only covering a small percentage of this.)	Within 2 yrs	~\$10,000	Staff time
7. Include Pearl Beach Lagoon in council overall Lagoon Opening Policy and Procedure	Pearl Beach Lagoon would be considered as part of wider review of Lagoon Opening Policy and Procedure. Grant funding opportunities.	2-5 years	~\$15,000	Nil

Action	Comment	Timeframe	Initial Cost Estimate	Ongoing costs p.a.
8. Investigate options to modify the weir	Grant funding opportunities.	2-5 years	~\$15,000	~\$2,000
9. Investigate options for removing material from lagoon bed	Internal staff time. Grant funding opportunities.	Within 5 yrs	~\$10,000	Nil
		TOTAL	~\$135,000	~\$27,000

5 MONITORING AND EVALUATION

The uniqueness of Pearl Beach Lagoon means there is some difficulty in identifying appropriate comparison and trigger values for water quality parameters. The community uses of the report will also influence parameters measured as the lagoon is not used for recreational contact or water supply. The key focus of monitoring and evaluation should be on the implementation of this CZMP and any broad scale changes in response to these management actions.

5.1 Collection of Baseline Data to Inform Performance Review

A key focus for the monitoring program is to collect data now that can be used along the implementation time line to assess the performance of the plan in the future. Most environmental processes involve intra seasonal variability and require long term data on natural processes and patterns before the effects of individual management actions could begin to be assessed. There are, however some indicators that could be collected now to build baseline knowledge. The collection of this information now provides the opportunity for community involvement, and will assist in informing an adaptive management approach. These include:

- Proportion of foreshore that is mowed to within 1 metre, 2 metres and 3 metres of the bank.
- Quadrant based present or absent assessment of understorey recruitment in melaleuca wetland
- Survival rate of sedgeland plantings
- Proportion of foreshore that is vegetated by natural species
- Documentation of all lagoon entrance opening events
- Foreshore condition in terms of vegetation cover and bank erosion
- Snapshot audit of construction sites within the catchment
- Does the lagoon open naturally? If so, how often?

Care will be needed to make sure data collection and categorisation techniques are clearly outlined to allow sampling to be repeated in the future.

5.2 Indicators for Monitoring

The adopted estuary health monitoring program should be based on key indicators that are monitored at the State level under the MER Program. This includes monitoring of:

- Turbidity;
- Other supporting physico-chemical indicators such as salinity, dissolved oxygen, pH, and temperature;
- Estuarine Macrophytes (seagrasses, saltmarsh, mangroves) distribution change; and
- Riparian vegetation distribution and condition.

5.3 Sampling Period and Effort

Sampling period and effort will in part be limited by available resources, however it is recommended that at a minimum the following occur:

- One off assessments of estuarine macrophyte distribution and condition every 5 to 10 years to identify change in extent and condition over time.
- One off assessments of riparian vegetation distribution and condition every 5 to 10 years to identify change in extent and condition over time.
- Sampling sites should be as for the waterwatch data. Regular and event based sampling of physio chemical parameters. In particular event based sampling should be undertaken to help understand the biological and biogeochemical response that occurs immediately following rainfall.
- The methodology for assessing change in macrophyte distribution over time will follow the State of the Catchment Reports methodology.

5.4 Evaluation and Reporting

Evaluation of the data is important for determining whether any priorities of the plan need to be amended or specific actions need to be taken. Evaluation should be an ongoing process.

Reporting of the data is important for highlighting to key stakeholders and the community in general how the health of Pearl Beach Lagoon is changing over time and compares to other estuaries. Reporting should be in the form of yearly report cards on estuary health / water quality.

An annual newsletter to the community reporting on the achievements and challenges of plan implementation should be prepared and disseminated.

5.5 Plan Review

It is recommended that this Implementation Action Plan be reviewed annually, to determine progress with individual actions and strategies, while a broader audit and update be conducted every 5 years. The annual review should focus on funding, resources and barriers to implementation of the individual actions and strategies, whereas the 5 year audit should target re-evaluation of values, processes and threats to determine progress with overall aims and objectives. From the 5 year audit, changes can be made to the Plan to ensure the document remains current, and relevant to the community uses and understanding of lagoon processes.

6 REFERENCES

BMT WBM 2012 Pearl Beach Lagoon – Lagoon Condition study and Community Uses Report




















BMT WBM 2013 (in draft) Coastal Zone Management Plan for four Gosford Lagoons























































DECCW 2010 Guidelines for Preparing Coastal Zone Management Plans

APPENDIX A: OPTION ASSESSMENT

The outcome of the option assessment is presented in the following table. For a description of the categories used, please refer to section 1.2 of the main report. Following the traffic light options assessment is a table giving additional information on options excluded through this process.

Action Plan Number	Option	No Regrets?	Threat Level	Risk Reduction Potential	Timeframe	Cost	Practicality	Community Support	Overall Score	Category
1	Provide information to private landholders directly adjacent to the lagoon on the habitat values of their frontage, describing the habitat, its importance to the lagoon and options for its protection and management.	✓							18	No Regrets
	Prepare and distribute a fact sheet regarding Pearl Beach Lagoon (INCLUDE IN STRATEGY 1 : INFORMATION TO LANDHOLDERS)	✓							18	No Regrets
2	Prepare a detailed schematic planting plan so that everyone is working toward the same goal	✓							18	No Regrets
	Identify sites where there is the potential for landward migration of wetland vegetation as a result of climate change and prioritise these for rehabilitation works. (INCLUDE IN STRATEGY 2 : PLANTING SCHEMATIC)	✓							18	No Regrets
3	Identify potential sources of nutrients and sediments and liaise directly with land owners to reduce nutrient and sediment runoff within the catchment	✓							18	No Regrets
	Document all openings (INCLUDE IN MONITORING STRATEGY)	✓							18	No Regrets
	Council to stop mowing public land in combination with rehabilitation strategies (INCLUDE IN STRATEGY 2 : PLANTING SCHEMATIC)	✓							18	No Regrets
	Identify public land to assist in rehabilitation planning (INCLUDE IN STRATEGY 2: PLANTING SCHEMATIC)	✓							18	No Regrets

Action Plan Number	Option	No Regrets?	Threat Level	Risk Reduction Potential	Timeframe	Cost	Practicality	Community Support	Overall Score	Category
4	Undertake an Intensive engagement program for works staff involved in sediment and erosion control within the catchments to raise the profile of best practice erosion and sediment control, assist staff with new policies and procedures and track improvements in performance.								17	BMO
	Water and sediment quality monitoring under closed and open conditions (INCLUDE IN MONITORING STRATEGY)								17	BMO
	Restrict access to particular pathways and revegetate in between (INCLUDE IN STRATEGY 2: PLANTING SCHEMATIC)								17	BMO
5	Investigate the potential for retrofitting sediment traps adjacent to main stormwater outlets into Pearl Beach Lagoon								17	BMO
6	Consider providing vegetated filtration measures (e.g. raingardens) in the road reserves adjacent to stormwater inlets to provide filtration of stormwater.								17	BMO
7	Rehabilitate habitats within the creek lines of the catchment								17	BMO
8	Increase planting around the fringes of the lagoon with appropriate species for reducing nutrient concentrations								17	BMO
9	Improved regulation of residential construction activities in the catchment to reduce exposure of soils to erosion from rainfall and runoff.								17	BMO

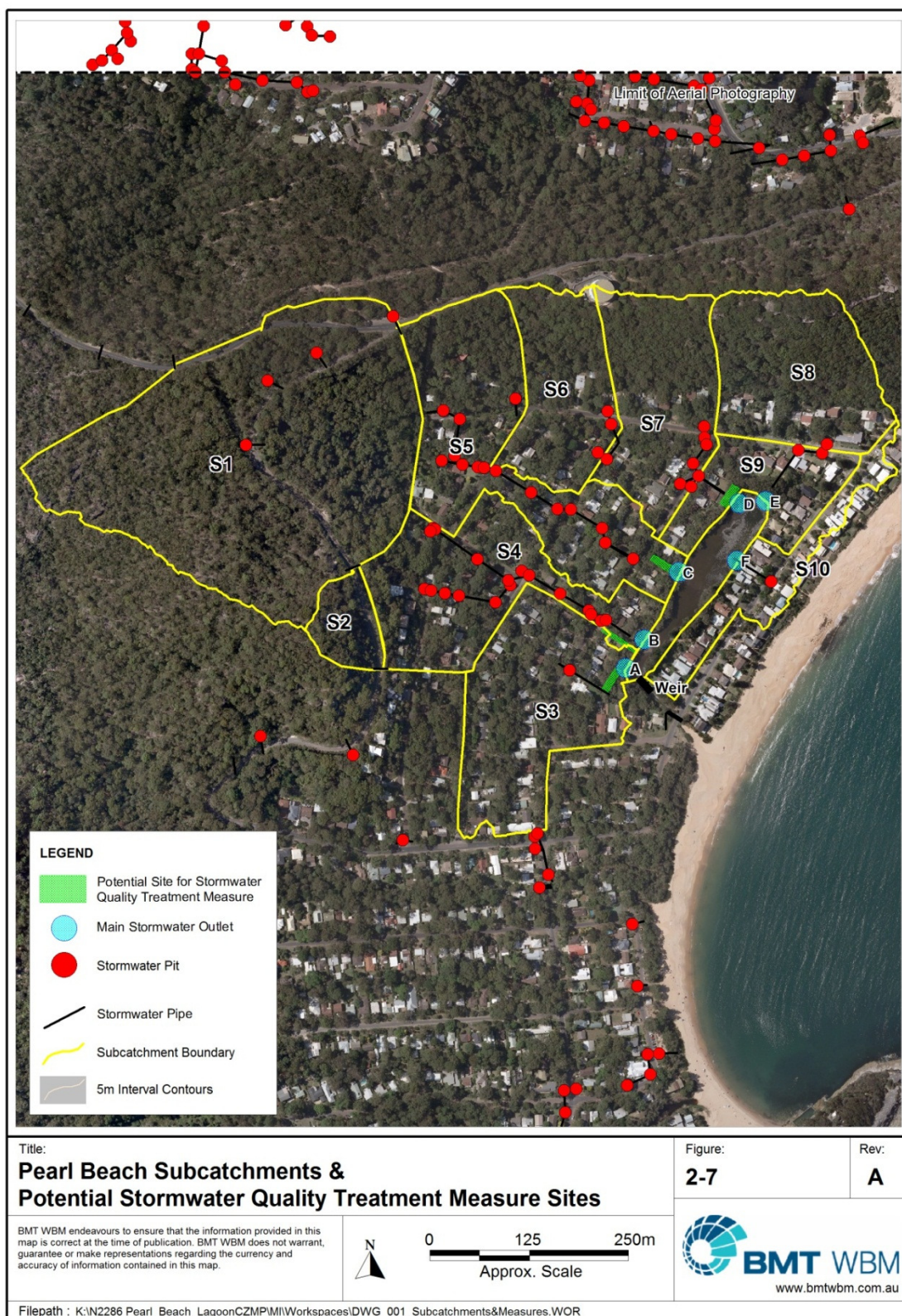
Action Plan Number	Option	No Regrets?	Threat Level	Risk Reduction Potential	Timeframe	Cost	Practicality	Community Support	Overall Score	Category
10	Improve foreshore structure and habitats. Identify specific locations for improved foreshore access and rehabilitation. Rehabilitation could include restoring a gently sloping foreshore as well as targeted planting.								17	BMO
11	Develop a specific opening policy with consideration of the objectives of the CZMP, reconsider triggers and options for entrance management with ecological benefits.								17	BMO
	Monitor macrophyte assemblages as indicators of water quality and ecological condition (INCLUDE IN MONITORING STRATEGY)								16	2nd pass option
	Event based inspections and sampling of turbid plumes / discoloration events (INCLUDE IN MONITORING STRATEGY)								16	2nd pass option
12	Undertake bank erosion works in areas currently experiencing instability. Foreshore erosion is occurring in relation to human activities, particularly foreshore maintenance. It is better to invest in revegetation works now than to react to erosion of these areas in the future.								15	2nd pass option
13	Modify the weir to provide better control of water levels and thus optimise flooding, aesthetic and ecological objectives								15	2nd pass option
14	Consider utilising amphibious machinery to remove organic material and/or remove sediment (and associated nutrients) from the lagoon								15	2nd pass option
	Remove the weir to restore a larger water level range and allow periodic flushing (emptying) of the lagoon.								14	Out
	Mechanically remove algae								14	Out

Action Plan Number	Option	No Regrets?	Threat Level	Risk Reduction Potential	Timeframe	Cost	Practicality	Community Support	Overall Score	Category
	Establish a clear link between lagoon water levels and existing assets								14	Out
	Council to undertake faecal sterol monitoring								14	Out
	Consider development controls around the lagoon to ensure adequate minimum floor heights etc								14	Out
	Acquire additional foreshore lands, bringing them into public ownership to maximise opportunities to improve foreshore ecological values and climate change adaptation (likely to be an expensive option).								11	Out
	Redirection of Pearl Beach Lagoon to the Middle Creek Entrance using channel / Pipe System								7	Out
	Dredge the lagoon to remove sediment								13	Out

Further comments on rejected options

Option	Comment
Remove the weir to restore a larger water level range and allow periodic flushing (emptying) of the lagoon.	This option requires acceptance of the odour issue that triggered the construction of the weir in the first place.
Acquire additional foreshore lands, bringing them into public ownership to maximise opportunities to improve foreshore ecological values and climate change adaptation	Prohibitively expensive, legislatively difficult and would occur over a very long time frame
Redirection of Pearl Beach Lagoon to the Middle Creek Entrance using channel / Pipe System	During high rainfall conditions, stormwater not carried through the culvert beneath Coral Crescent is discharged across the roadway and has the potential to inundate properties. It has been suggested that formalised link between the lagoon could be a flood mitigation option for Pearl Beach Lagoon. In 2008 Worley Parsons concluded that physical constraints such including topography and gradient between Pearl Beach lagoon and Middle Creek made this not feasible.
Establish a clear link between lagoon water levels and existing assets	Address through flood program
Consider development controls around the lagoon to ensure adequate minimum floor heights etc	Address through flood program
Council to undertake faecal sterol monitoring	Catchment inspection and background data review indicate that faecal contamination from human sources is unlikely to be an issue.
Dredge Lagoon	Expensive, difficult to get approval, ASS considerations.

APPENDIX B: CATCHMENT MAPPING



MUSIC Modelling Results

Sub-catchment/s Treated	Existing TSS Load (t/yr)	Treated TSS Load (t/yr)	Reduction (t/yr)	% Load Reduction
S3	3.4	1.6	1.8	54%
S1 and S5	5.1	3.8	1.3	24%
S6 and S7	3.2	1.7	1.5	47%
S2 and S4	3.1	1.4	1.7	55%
Totals	14.8	8.5	6.3	43%



BMT WBM Brisbane	Level 8, 200 Creek Street Brisbane 4000 PO Box 203 Spring Hill QLD 4004 Tel +61 7 3831 6744 Fax +61 7 3832 3627 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Denver	8200 S. Akron Street, Unit 120 Centennial Denver Colorado 80112 USA Tel +1 303 792 9814 Fax +1 303 792 9742 Email denver@bmtwbm.com Web www.bmtwbm.com.au
BMT WBM Mackay	Suite 1, 138 Wood Street Mackay 4740 PO Box 4447 Mackay QLD 4740 Tel +61 7 4953 5144 Fax +61 7 4953 5132 Email mackay@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Melbourne	Level 5, 99 King Street Melbourne 3000 PO Box 604 Collins Street West VIC 8007 Tel +61 3 8620 6100 Fax +61 3 8620 6105 Email melbourne@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Newcastle	126 Belford Street Broadmeadow 2292 PO Box 266 Broadmeadow NSW 2292 Tel +61 2 4940 8882 Fax +61 2 4940 8887 Email newcastle@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Perth	Suite 6, 29 Hood Street Subiaco 6008 Tel +61 8 9328 2029 Fax +61 8 9484 7588 Email perth@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Sydney	Level 1, 256-258 Norton Street Leichhardt 2040 PO Box 194 Leichhardt NSW 2040 Tel +61 2 9713 4836 Fax +61 2 9713 4890 Email sydney@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Vancouver	401 611 Alexander Street Vancouver British Columbia V6A 1E1 Canada Tel +1 604 683 5777 Fax +1 604 608 3232 Email vancouver@bmtwbm.com Web www.bmtwbm.com.au