



MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

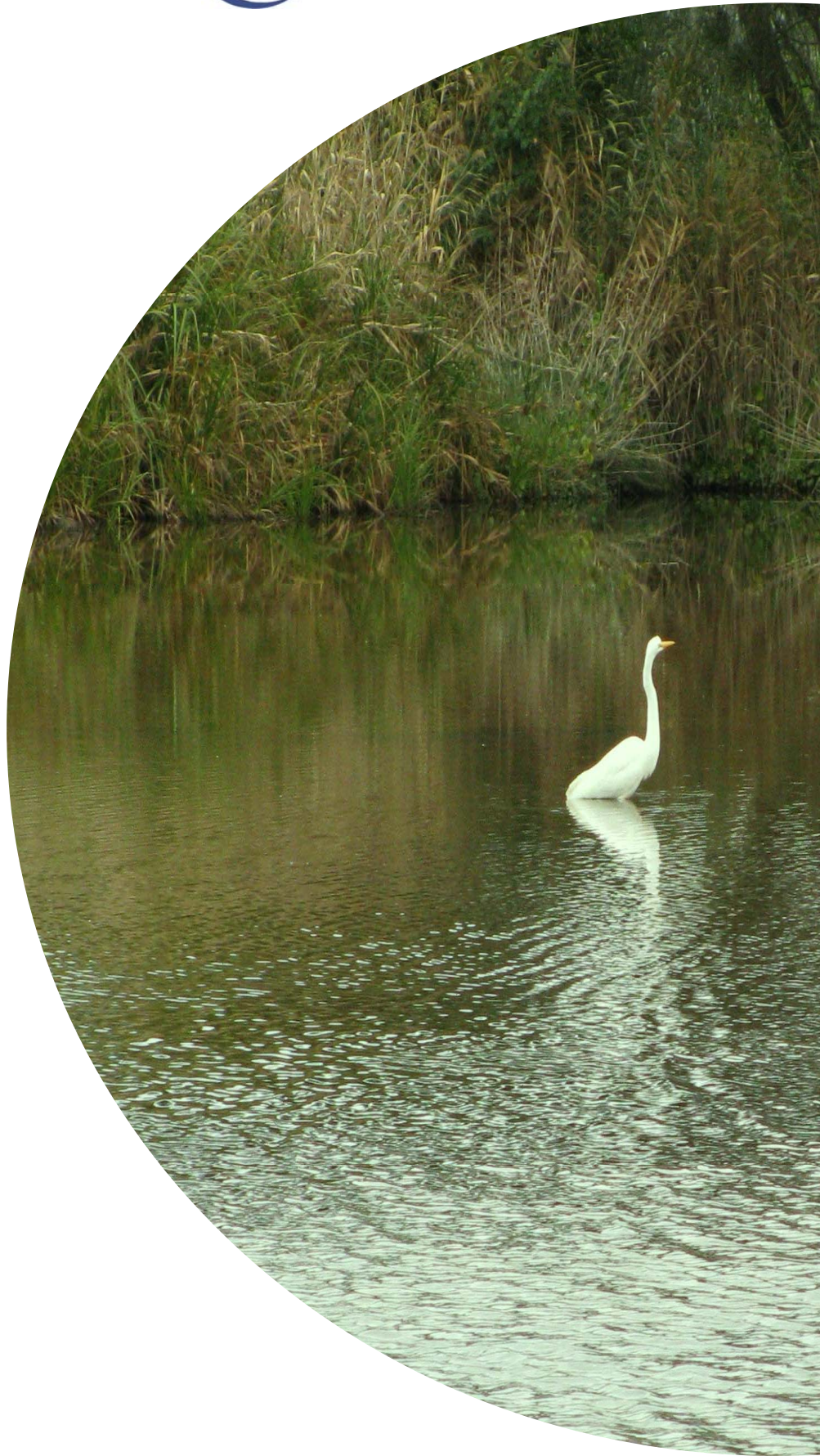


Sutherland Shire
COUNCIL



Marton Park Wetland Management Plan

Final Report





Marton Park Wetland Management Plan

FINAL REPORT

for

Sutherland Shire Council

by

Molino Stewart Pty Ltd

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EXECUTIVE SUMMARY

Marton Park Wetland is located on the Kurnell peninsula on the southern shores of Botany Bay. Botany Bay has iconic heritage status. It is the site of Captain Cook's landing and effectively the starting point of European settlement in Australia and the huge changes that were to follow for indigenous Australians. Marton Park Wetland forms an integral part of the cultural landscape of southern Botany Bay and the Aboriginal significance of the study area cannot, be separated from the significance and cultural values of the wider region and Botany Bay.

The wetland is an example of a Sydney Freshwater Wetland, an endangered ecological community (EEC) listed on the NSW Threatened Species Conservation (TSC) Act 1995 and known habitat for the Green and Golden Bell Frog (GGBF) which is listed as endangered in NSW and vulnerable at the national level. Marton Park Wetland also contains Swamp Oak Floodplain Forest, another EEC listed on the NSW TSC Act. The wetland also provides important habitat for a variety of native species and migratory birds.

Marton Park Wetland is adjacent to, and within the catchment of, the internationally significant Towra Point Nature Reserve and RAMSAR listed wetland. The wetland is also recognised as part of an east-west wildlife corridor linking Botany Bay National Park to Towra Point Nature Reserve (DECC 2009).

This Management Plan recognises the important role played by the wetland in the maintenance of ecological processes on the Kurnell Peninsula. It facilitates hydrological processes and provides biophysical habitat. The wetland is a receptor for stormwater from the residential and light industrial areas of Kurnell. Marton Park Wetland filters and purifies this water prior to it reaching Quibray Bay and the Towra Point Aquatic reserve. Marton Park Wetland is a potential sink for pollutants and sediment entrained in the runoff from the surrounding catchment. In the longer term the Management Plan recognises the wetland will be vulnerable to sea level rise due to climate change.

The Management Plan has revealed the value of the wetland to the community in terms of specific environmental and social values is extremely high due to the wetland providing green bushland areas and biodiversity. The existing wetland walk is the result of a community project, it is well utilised and has made the wetland a feature of recreation in Kurnell. Caltex also identified the valuable environmental contribution that Marton Park Wetland makes in setting an example of the environmental sensitivity of the area and the need for staff to operate in an environmentally sensitive manner.

This Management Plan provides for the future management of Marton Park Wetland, recognising the importance of the interests of the many stakeholders including: the local community, Sutherland Shire Council (SSC), the Sydney Metropolitan Catchment Management Authority (SMCMA), the NSW Department of Planning, the NSW Department of Environment Climate Change and Water (DECCW), Caltex Refineries Pty Ltd; and La Perouse Local Aboriginal Land Council (LALC).

The threats and opportunities to Marton Park Wetland documented for this Management Plan have driven the development of management strategies. The threats to Marton Park Wetland are significant and will require a coordinated approach to address, they include:

- Catchment practices;
- Weeds;
- Decreased water quality;
- Potential modification for flood mitigation;
- Climate change;

- Feral pests; and
- Rubbish dumping.

There are opportunities to build on existing initiatives and activities to address the results and causes of these threats. A number of management strategies and actions can be used to build the capacity of owners, managers and neighbours to the wetland to assist in improving the condition of the wetland now and in the future. Key among these:

- A coordinated approach to wetland management;

The Kurnell Peninsula is the focus of a variety of environmental initiatives that are directly linked to Marton Park Wetland. These include the Kurnell 2020 project which focuses on the creation of wildlife corridors across the peninsula, the SMCMA and SSC feral pest eradication programs and the SSC Bushcare and Greenweb initiatives. DECCW is also responsible for implementing management plans for the GGBF and the Towra Point RAMSAR listed wetland. The La Perouse LALC has a role in promoting and protecting Aboriginal heritage values. Other initiatives include Shorebirds 2020, a reinvigorated monitoring program that is a collaborative enterprise between Birds Australia, the Australasian Wader Studies Group (AWSG), WWF-Australia and the Australian Government's Natural Heritage Trust.

These initiatives all have some bearing on Marton Park Wetland and the implementation of management strategies and actions presented in the Management Plan. A coordinated approach to management on the Kurnell Peninsula will lead to significant cost savings and better environmental outcomes for Marton Park Wetland and the broader Kurnell Peninsula. As a result the Management Plan proposes a management forum made up of all stakeholders and the Kurnell community to ensure a coordinated approach to management, monitoring and research.

- Environmental education for sustainability;

Environmental education for sustainability goes beyond informing the community about the values of the wetland and provides them with skills to take action to address threats to the wetland. Initiatives in this area suitable for Marton Park Wetland include a review of existing signage. Installation of additional signage at various points along a wetland boardwalk that presents the features and functions of that area of the wetland and opportunities for residents to participate in recognising birds, plants and other fauna that may use the wetland. Other environmental education for sustainability initiatives would include a series of workshops providing residents with skills to contribute to improved condition of the wetland, this could include but not be limited to: the management of properties with stock and gardens to minimise polluted runoff into the wetland; management of chemicals and fertilisers in Kurnell to safeguard the wetland; management of light industry activities to safeguard the wetland; local gardens contributing to the Kurnell Village wildlife corridor.

- Building community participation and capacity;

Caltex Refineries NSW Pty Ltd currently undertakes two environmental initiatives that focus on Marton Park Wetland: celebration of World Environment Day and Clean Up Australia Day. The Management Plan supports wider community participation in these environmental initiatives through publicising the events, providing incentives for local residents to participate in these events (for example native plant tube stock for their gardens) and a direct link between these activities and achieving management objectives set out in this Management Plan for example cleanup activities in areas earmarked for walkway extension and weed eradication.

- Extending community access.

The Marton Park Heritage and Wetland walk is a community initiative that has been realised and proves to be a focus for recreation in the township of Kurnell. The community consultation for the Management Plan revealed a desire by the community

for access around the wetland to be extended. Extension of the walkway (in the form of a boardwalk) in sections from Captain Cook Drive to Cook Street, then from Cook Street along the rear of the Kurnell Industrial Estate and then along the edges of the Caltex Refinery (wetland side of the fenceline) to the Caltex car park and then down Solander Street to Captain Cook Drive would provide extensive opportunities for recreation and environmental education through signage and exposure to the different aspects of the wetland.

The management strategies for Marton Park Wetland have been developed to take into account the threats and opportunities presented in the Management Plan and to provide a basis for clear specific management objectives. The management strategies identified for Marton Park Wetland include:

- To develop a management forum;
- To maintain or improve the quality of water flowing through the wetland;
- To reduce weed infestation in the wetland;
- To safeguard the hydrological function of the wetland and plan for climate change;
- To conserve and maintain existing native vegetation,
- To conserve and enhance habitat values;
- To enhance appropriate public access to the wetland
- To conserve Aboriginal and European heritage values;
- To provide environmental education, and promote awareness and action to support the management of the wetland; and
- To encourage appropriate scientific research.

The management strategies and actions have been prioritised and costed and are presented in Appendix F to the Management Plan.

1 INTRODUCTION

1.1 The Management Plan

The Marton Park Wetland Management Plan has been prepared to ensure the values of the wetland are recognised and to support land owners and managers in conserving and enhancing those values. The Management Plan also aims to reflect the Kurnell community's concerns and aspirations for the wetland.

The Management Plan contains a description of the wetland and an examination of its hydrology, environmental values, heritage values, and social values. Relevant policies, acts and strategies are also considered. Threats to the wetland are identified along with management strategies to address them and to enhance values. Management objectives and actions are prioritised and costed and potential funding sources identified. A monitoring plan for wetland management is also presented.

1.2 Scope of the Plan

As indicated above the plan aims to identify values and threats to the wetland. Management strategies and actions have been developed to address threats and promote identified values. The Marton Park Wetland Management Plan will be integrated with the Kurnell Floodplain Risk Management Study and Plan.

The Management Plan should be reviewed every five years to enable the effectiveness of the recommended management actions to be considered and updated with new information or technology and community concerns. Wetland management actions should be reviewed annually and reported within the framework of Sutherland Shire Council's (SSC) Quadruple Bottom Line Management Plan reporting commitments.

2 SIGNIFICANCE AND MANAGEMENT OBJECTIVES

2.1 Significance of Marton Park Wetland

Marton Park Wetland is located on the Kurnell peninsula on the southern shores of Botany Bay. Botany Bay has iconic heritage status. It is the site of Captain Cook's landing and effectively the starting point of European settlement in Australia and the huge changes that were to follow for indigenous Australians. Botany Bay, Kurnell and La Perouse are to many the most historic localities in Australia. Marton Park Wetland provides important social and heritage values to the local and broader Australian community and is considered important to the local Aboriginal community.

The wetland is an example of a Sydney Freshwater Wetland, an endangered ecological community (EEC) listed on the NSW Threatened Species Conservation (TSC) Act 1995 and known habitat for the Green and Golden Bell Frog (GGBF) which is listed as endangered in NSW and vulnerable at the national level. Marton Park Wetland also contains Swamp Oak Floodplain Forest, another EEC listed on the NSW TSC Act. The wetland provides important habitat for a variety of native species and migratory birds.

The wetland is adjacent to, and within the catchment of, the internationally significant Towra Point Nature Reserve and RAMSAR listed wetland. Marton Park Wetland is also recognised as part of an east-west wildlife corridor linking Botany Bay National Park to Towra Point Nature Reserve (DECC 2009).

Marton Park Wetland plays an important role in the maintenance of ecological processes on the Kurnell Peninsula. It facilitates hydrological processes and provides biophysical habitat. The wetland is a receptor for stormwater from the residential and light industrial areas of Kurnell. Marton Park Wetland filters and purifies this water prior to it reaching Quibray Bay and the Towra Point Aquatic reserve RAMSAR listed wetland.

2.2 Goals for Wetland Management

The Kurnell Peninsula and Marton Park Wetland are covered by the Sydney Regional Environmental Plan No.17 Kurnell Peninsula. This document refers to the National Conservation Strategy for Australia (1984) which has been superseded by the National Strategy for the Conservation of Australia's Biodiversity (1996). The overarching goal of that current policy is:

“to protect biological diversity and maintain ecological processes and systems”

The goal of the NSW Government's Wetland Management Policy Department of Land and Water Conservation (1996) is:

“the ecologically sustainable use, management and conservation of wetlands in NSW for the benefit of present and future generations.”

Sutherland Shire Council (2006) provides the following objectives for wetlands and waterways in their Development Control Plan (DCP).

- to protect, restore and maintain ecological processes, natural systems and biodiversity within wetlands and waterways;
- to minimise sedimentation and pollution of wetlands and waterways;
- to restore degraded wetlands, wetland buffer areas, waterways and riparian zones;
- to ensure appropriate fire management regimes and hazard reduction techniques for wetlands, wetland buffer areas, waterways and riparian zones.
- to encourage best practice environmental design measures so that the sustainability of wetlands and waterways is maintained or improved.

Although Marton Park is not included in the SSC DCP (2006) these objectives are useful in informing management goals for the Wetland.

3 SITE SETTING AND CONTEXT

3.1 Location and Setting

Marton Park Wetland is located approximately 17 kilometres south east of Sydney on the Kurnell Peninsula in the Sutherland Shire local government area. The wetland is an extensive freshwater wetland that covers approximately 10 hectares. Figure 1 shows the location of the wetland.

Marton Park Wetland drains to Quibray Bay and the internationally significant Towra Point Aquatic Reserve and RAMSAR listed wetland. The catchment of Marton Park Wetland is described in detail in section 5. It is a mixture of residential, commercial and industrial land uses and National Park.



Figure 1A Wetland Location



Figure 1B Wetland Boundary

3.2 Land Tenure and Zoning

Marton Park Wetland is made up of land parcels owned by Sutherland Shire Council; NSW Department of Planning and Caltex Refineries NSW Pty Ltd. The legal ownership descriptions are presented below in Table 1 and shown in Figure 2.

Table 1: Land Ownership Marton Park Wetland

Description	Owner
Lots 56,59,60,61,62,65, 66,67,68,69 DP 8135 Lot 34 DP 908	NSW Department of Planning
Lot 36 DP 908 Lots 57,58, 64 DP 8135 Part Lot 4 DP 535532	Sutherland Shire Council
Part Lot 146,147,148,151,152 DP 455883. Part Lot 1-6 DP 1087718. Lot 1&2 DP 1087807	Caltex Refineries NSW Pty Ltd

The Sydney Regional Environmental Plan, Kurnell Peninsula (REP 17), is the planning instrument covering the wetland. The site is a mixture of 9(a) Regional Open Space and 6(a) Public Recreation. The objectives of these zones set out in Section 4.



Figure 2 Legal Ownership of Wetland

3.3 Climate

The climate of the Kurnell Peninsula is characterised by warm to hot summers, with an average maximum temperature of 25° C (Bureau of Meteorology 2009). Winter months are typically cool to mild with an average maximum temperature of 20° C (Bureau of Meteorology 2009). February and December are usually the warmest months, with most rain expected in January.

3.4 Physical Geography

The Kurnell Peninsula is an elevated plateau of Hawkesbury Sandstone around 18 kilometres long. The topography is characterised by gently undulating to rolling coastal dunefields and relic dunes (Hazelton *et al* 1990), highly modified in areas by sand mining and industrial development.

The topography of Marton Park Wetland is relatively flat with a maximum elevation of five metres AHD. The wetland contains a large depression of around one metre deep that varies from filled with water to completely dry. The north western edge of Marton Park Wetland between Captain Cook Drive and Solander Street was filled in the 1940s to create a park and now supports a playing field, community hall and childcare centre.

Soils on the peninsula include non cohesive, highly permeable podzols with very low fertility (Hazelton *et al* 1990). The wetland is characterised by soils with accumulated organic debris which form organic acid peat soils which are permanently waterlogged (Hazelton *et al* 1990).

Marton Park Wetland is mapped as “high probability” for acid sulphate soils by the Department of Land and Water Conservation (DLWC) Acid Sulphate Soil Risk Map for Port Hacking (1995).

3.5 Wetland Type or Category

Marton Park Wetland is classified as a freshwater wetland; it includes fringing Swamp Oak Floodplain Forest. Marton Park Wetland does not fit neatly into broad wetland types or categories used for NSW (Kingsford *et al* 2003). Historical aerial photos of the wetland indicate that up until the construction of the Caltex Refinery in the late 1940s the wetland was connected to Quibray Bay and would have been considered part of that estuarine wetland system. Since that time it appears that restriction of tidal exchange has resulted in the alteration of the wetland into a freshwater system.

3.6 Adjacent Land Use

The adjoining landuse to the south and east is the Caltex oil refinery owned and operated by Caltex Refineries NSW Pty Ltd. It is the largest refinery in Australia. It was opened in 1955 and is a major employer for the area (SSC 2007). The refinery covers an area of around 2.4 square kilometres.

To the north of Marton Park Wetland lies the Kurnell residential village which contains 773 dwellings which house approximately 2110 residents (ABS 2006). On the north eastern boundary of the wetland a variety of light industry is present within the Kurnell Industrial Estate.

The Kurnell residential village contains a number of rural residences and small paddocks containing horses and stables are common.

Further to the east on the Kurnell Peninsula, Botany Bay National Park covers 5.0 square kilometres and to the west Towra Point Nature Reserve covers 6.3 square kilometres. Towra Point Aquatic Reserve and Boat Harbour Aquatic Reserve cover a total area of approximately 15 square kilometres (DECC 2009).

3.7 Wetland Infrastructure

Marton Park Wetland is located adjacent to the public recreation facilities of Marton Park. These facilities include Marton Park Hall, Preschool, Guide Hall, toilet facilities, playing field and concrete walking track around the park (and edge of wetland).

Infrastructure within the wetland is limited to:

- the drainage infrastructure (pits and pipes) shown in Figure 3;
- two open drains (from the corner of Torrens Street and Captain Cook Drive through the park to the wetlands; from the wetland under Captain Cook Drive to Quibray Bay ; as shown on Figure 3) ; and
- a ramp and pollutant trap at the southern end of Cook St.

Marton Park Wetland is connected to Quibray Bay via a box culvert (1.5m x 0.9m) under Captain Cook Drive which flows into a trapezoidal open channel before reaching Quibray Bay. The culvert upstream invert is approximately 0.65m AHD which restricts the amount of saline water that can enter the wetland. The open channel is approximately 270m long. Previously swampy areas to the north of the Marton Park Wetland provide flow to the wetland via a 375mm diameter pipe.



Figure 3 Drainage Infrastructure

4 PLANNING CONTEXT

A number of state and local government strategies, policies and Acts are influential in the management of Marton Park Wetland and the habitats and species it supports. These are outlined below.

4.1 Sydney Regional Environmental Plan No.17 Kurnell Peninsula

The Kurnell Peninsula is situated within the Sutherland Shire Local Government Area. However, the relevant planning instrument for the Peninsula is the Sydney Regional Environmental Plan No.17 Kurnell Peninsula (REP No.17). The reasons for the excision of the Peninsula from the LEP are not specified, however they may well relate to the historic and environmental significance of the area. Sutherland Shire Council is the consent authority under REP No.17.

The Marton Park Wetland is covered by zone 9(a) Regional Open Space and zone 6(a) Public Recreation. The objectives of these zones are set out below.

Zone No 9 (a) (Regional Open Space (Reservation) Zone) objectives:

“(a) to identify land to be acquired for the provision of regional open space and to protect environmentally sensitive lands,

(b) to identify and bring into public ownership those lands of strategic importance to the management of the Towra Point Nature Reserve or the Towra Point Aquatic Reserve, and

(c) to provide opportunities to enhance the total environmental quality of the Kurnell Peninsula.”

Zone No 6 (a) (Public Recreation (Existing) Zone) objectives:

“(a) to identify land which is vested in the Council and which is set aside principally for the purposes of public recreation,

(b) to identify land which is owned by the Crown and which is under the care, control and management of the Council as public recreation space, and

(c) to provide a range of recreation opportunities to meet the needs of the community.”

4.2 The NSW Wetlands Management Policy

The *NSW Wetlands Management Policy* (DLWC, 1996) is a component policy of the *NSW State Rivers and Estuaries Policy* (Water Resources Council, 1993). This policy established the framework for the management of rivers and estuaries and related systems based on the Total Catchment Management (TCM) philosophy and ecologically sustainable development principles. The Policy provides guidance on the wise use and rehabilitation of wetlands and associated best management practices.

4.3 A Wetland Prioritisation Technique for the Sydney Metro Catchment Management Area (SMCMA)

The above report was prepared as part of the Sydney Metropolitan Catchment Management Authority (SMCMA) Wetland Management Strategy (Stage 1) (Schaeper *et al* 2007). The report:

- compiled existing mapping data to identify the extent of wetlands in the SMCMA region;
- remapped wetlands that are listed in the Directory of Important Wetlands in Australia (DIWA);
- developed a wetland rehabilitation prioritisation technique, and;
- assessed the condition of the eight DIWA wetlands that occur in the SMCMA region.

A desktop wetland prioritisation technique was developed to prioritise wetlands for rehabilitation. The report presents the results of the condition assessment trial on the eight DIWA wetlands in the SMCMA region and a wetland which is of a known poor value. Each wetland was ranked according to the natural values, and the threats to those natural values. The nine wetland rankings were spread across the three condition categories of high, medium and low based on a variety of criteria. The wetland rehabilitation prioritisation technique and wetland condition assessment method were considered suitable for use in the SMCMA region.

4.4 Kurnell 2020 Project

The Kurnell 2020 Project is an initiative of the SMCMA. The year 2020 marks the 250 year anniversary of Captain Cook's arrival in Botany Bay on the *Endeavour* voyage. The Kurnell 2020 project aims to create a living memorial of the landscape by restoring the natural components of the peninsula to as close as possible to those present in 1770 (DECC 2009). The vision of the project is that by 2020 the condition of the natural ecosystems on public and private lands on the Kurnell Peninsula will be improved (SMCMA 2009).

The project aims to do this through the creation of bushland corridors across the Kurnell Peninsula to link Botany Bay National Park and the RAMSAR wetland at Towra Point. Coordinated onground works will include bush regeneration, weed and pest species control, seed collection and revegetation. These onground works will be undertaken in collaboration with Botany Bay National Park, Sutherland Shire Council, Local Aboriginal Land Councils, local businesses, local communities and the broader Australian public (SMCMA 2009). As part of this project wildlife corridors across the peninsula have been identified and mapped in the Kurnell 2020 Corridor Delineation report.

4.5 Kurnell 2020 Corridor Delineation

This project forms part of the Kurnell 2020 Project. Collection and collation of current flora and fauna information for the Kurnell Peninsula was undertaken to provide a baseline for wildlife corridor delineation, and as a measure of success for future rehabilitation projects. A total of 40 species of flora and fauna found during the project are listed as threatened in NSW, 11 of which are threatened in Australia. Eight endangered ecological communities were identified from the 24 vegetation communities that occur on the Peninsula (DECC 2009).

The report proposes a number of biodiversity corridors for the Kurnell Peninsula (including Marton Park Wetland) which link Botany Bay National Park and Towra Point Nature Reserve with isolated patches of vegetation and connect the environment from the marine and intertidal zones to the terrestrial zones (DECC 2009).

The report acknowledges long term success of the corridors will depend on cooperation between landowners in establishing and maintaining an integrated management plan over the entire Kurnell Peninsula. The social values of the Kurnell Peninsula are considered likely to benefit from improving its biodiversity and aesthetic amenity. The report indicates this change is likely to attract tourism and help change the perception of Kurnell as a place for heavy industry to a view that reflects its ecological and historical significance (DECC 2009).

4.6 Green Web Sydney - A Vegetation Management Plan for the Sydney Region

Green Web Sydney is an initiative of the combined Sydney Regional Organisations of Councils (SROCs) that promotes the establishment of a green web of native vegetation to protect, conserve and enhance remnant bushland in the Sydney region (SROCs 2009).

Sutherland Shire Council is implementing a Greenweb program which aims to protect and enhance the Shire's native plant and animal populations by identifying key areas of bushland habitat and establishing corridors to connect them (SSC 2008).

SSC's Greenweb incorporates both public and private lands. Its main target is private property owners within the Shire's Greenweb network. Council funds various initiatives to support Greenweb. This has included a program where owners of private property in Sutherland Shire's Greenweb network were able to apply for financial assistance to support ecological restoration work on bushland in their property (SSC 2008). SSC's Bushcare program is a complimentary program that undertakes bushland regeneration activities on public land in Sutherland Shire.

4.7 NSW Invasive Species Plan 2008-2015

The NSW Invasive Species Plan was developed through extensive consultation with a wide range of stakeholders. The NSW Invasive Species Plan aims to prevent new incursions, contain existing populations and adaptively manage widespread species. The plan aims to foster a cooperative culture where all relevant parties contribute with the aim of minimising the impacts of invasive species in NSW (Department of Primary Industries DPI 2008).

The NSW Invasive Species Plan identifies four goals:

- Exclude – prevent the establishment of new invasive species;
- Eradicate or contain – eliminate, or prevent the spread of new invasive species;
- Effectively manage – reduce the impacts of widespread invasive species; and
- Capacity building – ensure NSW has the ability and commitment to manage invasive species.

These goals aim to deliver specific measurable outcomes and actions that complement the NSW targets for natural resource management as identified in the NSW State Plan. The Plan's principles address current planning processes, efficacy and ethical issues, and is based on current commitments by the NSW Government and investment by a wide range of other stakeholders (DPI 2008).

4.8 Weed Management Strategy for the Sydney Metropolitan CMA Region 2007-2011

The Weed Management Strategy for the SMCMA aims to enhance and build on what is already being done by providing guidelines and recommending actions to improve allocation of resources, education and coordination of on ground work between 2007 and 2011. Many of the recommended actions have been identified by Council staff, state agency staff, volunteers and professional bush regenerators who were involved in the consultation and development phases of this strategy (SMCMA 2007).

The Strategy acknowledges that effective and long-term weed management by Councils, agencies and landholders does not consist only of removing weeds. The Strategy recommends:

- a review the weed management priorities across the SMCMA region;
- directing funding and resource allocation toward the higher priorities; and
- coordinating on ground work across land management boundaries and according to the available resources and priorities.

4.9 Threatened Species Priority Action Statement

The NSW Threatened Species Priorities Action Statement (PAS) is a strategic approach to threatened species recovery which can be used by all members of the community (DECC 2007). A key driver for the production of the PAS was the recognition by the NSW government of the requirement for a new approach to managing threats to native plants and animals (DECC 2007). As the number of species listed under the TSC Act 1995 grew, an alternative to individual species recovery plans was necessary.

The PAS is based on 34 unique recovery and threat abatement strategies. Under each strategy, several actions may be listed. Detailed actions provide further information on what is required to secure recovery of threatened species. These are further categorised into high, medium and low priority actions according to their relative importance for recovery or threat abatement for each species and key threatening process. Then where feasible actions are assigned to the broad geographic area where they are best placed to occur, that is, catchment management area or local government area (DECC 2007).

A long term goal of the PAS is to identify key locations for each threatened species. Actions can then be tailored to each location to manage and abate the specific threat operating at a particular site (DECC 2007).

4.10 Threatened Species Recovery Plans

There are no recovery plans for the EECs present in the wetland, the Sydney Freshwater Wetland or the Swamp Oak Floodplain Forest. However there are a variety of priority actions identified by DECCW to assist in the recovery of these EECs. These actions are contained within the PAS and are linked to the profiles of the EECs contained on the DECCW website (DECC 2005a).

Marton Park Wetland supports known habitat for the Green and Golden Bell Frog (GGBF) *Litoria aurea* listed as endangered in NSW and vulnerable at the national level. A recovery plan has been prepared for this species (DEC 2005)

The draft Commonwealth and New South Wales State Recovery Plan for the Green and Golden Bell Frog *Litoria aurea* (DEC 2005), considers the conservation requirements of the species across its known range. It identifies the future actions to be taken to ensure

the long-term viability of the Green and Golden Bell Frog in nature and the parties who will carry out these actions.

The actions within the Recovery Plan are also listed as Actions within the DECC Priorities Action Statement. The draft Recovery Plan defines Key Populations as conservation management units and gives recognition and focus for conservation to 43 such populations across the former extent of the species almost state-wide distribution. The plan acknowledges the key population of the Green and Golden Bell Frog on the Kurnell Peninsula is a large and robust population and that it was here the species was first recorded by Captain Cook's party in 1770 (DEC 2005).

4.11 Management Plan for the Key Population of Green and Golden Bell Frogs at Kurnell

The Management Plan for the Key Population of Green and Golden Bell Frogs at Kurnell (DECC 2007a) has been prepared to ensure that the Kurnell population is successfully managed and monitored such that the species continues to persist in the locality and measures of the population's viability are maintained or improved over time. The two aims of the Management Plan:

- to identify and, where possible, address the threats and other issues/factors affecting or likely to affect the conservation of the species at Kurnell.
- to manage the species in accordance with the strategies outlined within the draft GGBF Recovery Plan.

The plan acknowledges that Sutherland Shire Council manages Marton Park Wetlands in conjunction with Caltex Refineries NSW Pty Ltd. Although the plan indicates there are no recent reports of GGBF records for the wetland, the site has high probability of being occupied from time to time by GGBF (DECC 2007a). The implications of this Plan for the Management of Marton Park Wetland are discussed further in Section 6.

5 HYDROLOGY AND CLIMATE CHANGE

5.1 Catchment Analysis

Marton Park Wetland is currently a freshwater wetland with limited tidal influence. The catchment area draining to the Marton Park Wetland is approximately 0.96 km². The wetland (Figure 1) plays an important role in the drainage of the surrounding area, including the eastern portion of Kurnell, part of the Caltex Oil Refinery and the Botany Bay National Park (refer to Figure 4). The car park and administration area of the Caltex Oil Refinery also drain to the wetland. The remaining industrial areas of the refinery are bunded off, with runoff treated onsite, and then discharged to Botany Bay directly. Due to the flat nature of the terrain, historically there were few defined drainage paths within the catchment. Some of these have been filled by residential and industrial development.

The Caltex Oil Refinery site also captures runoff from part of the Botany Bay National Park. The Refinery's drainage system is designed to provide a level of treatment for runoff entering or generated within the site, prior to discharge into downstream areas. Runoff is treated onsite then discharged via:

- a 1050 mm diameter pipe which runs along a drainage easement and discharges into Botany Bay near the Caltex Wharf
- a 1050mm diameter pipe under Captain Cook Drive and into Quibray Bay

Runoff from the Australian Lubricating Oil Refinery (ALOR) site drains to the west, into an open channel, which runs along Sir Joseph Banks Drive and into Quibray Bay (Gutteridge Haskins & Davey Pty Ltd, 1992).

Marton Park Wetland is connected to the remnant wetland area near Reserve Rd via a pipe under Cook Street (refer to Figure 3). The wetland outflows to Quibray Bay via a box culvert under Captain Cook Drive (1.5m x 0.9m), which then flows into a trapezoidal open channel before reaching Quibray Bay.

Historically Marton Park Wetland and the remnant wetland area near Reserve Road were part of a much larger wetland system directly connected to Quibray Bay (as seen in the 1943 aerial photo (Refer to Figure 5). Freshwater lakes were located in the upper reaches of the catchment. The north western corner of the refinery was constructed on reclaimed wetland, reducing the wetland area and connectivity. In order to improve the drainage system in Kurnell a number of pipes were constructed in Marton Park Wetland after the 1980's.

The catchment is a mixture of residential, industrial land uses and open space/National park (Table 2 and Figure 4). The majority of the catchment area is open space/National Park. Marton Park wetland represents 12.5% of the catchment area.

Table 2: Percentage Land use within Marton Park Wetland Catchment

	Residential	Commercial	Industrial	National Park/Open Space/Wetland
Percentage of Catchment (%)	24.96	0.36	12.80	61.88

The upper reaches of the catchment are predominantly steep, particularly within Botany Bay National Park where slopes of up to 25% can be found. However, the lower reaches of the catchment, including the Kurnell Township itself, are typically flat and low lying. Elevations are generally below 3 m Australian Height Datum (AHD).



Figure 4 Wetland Catchment



Figure 5 1943 Aerial Photograph

5.2 Inflow and Outflows

A number of inflows to Marton Park Wetland exist. As indicated much of the oil refinery is bunded and surface runoff treated onsite before discharging directly to Botany Bay. Runoff from the non industrial components (eg. Administration and car park areas) does however flow into the wetland.

Several point source inflows to the wetland exist including:

- Three 0.45m diameter drainage pipes on Solander Street which drain the non-industrial components of the refinery (Refer to Figure 3);
- Pipe network draining residential and light industrial areas to the north east which enters the wetland at Cook Street;
- Flow from an open drain from the corner of Torrens Street and Captain Cook Drive through the park to the wetlands, draining residential areas; and
- Flow from a drain under Captain Cook Drive near Shepherd Street draining residential areas.

Several overland flow paths also flow into the wetland:

- Overland flow or runoff from surrounding residential and light industrial areas, to the North and north east not captured by drains;
- Rainfall directly on the wetland, and
- Runoff from the non bunded areas of the oil refinery.

However, the majority of the inflow to the wetland enters via the pipe network at Cook Street. The main outflow from the wetland occurs at the corner of Captain Cook Drive and Solander Street where an open drain and box culvert connect the wetland to Quibray Bay.

The area has a fairly high groundwater table which is often located close to the surface. This is due to the proximity of the ocean and Botany Bay. The interaction between the groundwater and surface water is likely to be high given the sandy nature of the soil. This also means that contaminants can move through the groundwater relatively quickly. Threats to the groundwater include the large number of horses in the area, the area not being sewered for a long time (historical threat), potential infiltration from industrial sites (including the oil refinery). Some of the local residents access this groundwater for outdoor/ garden use. Locals report that the groundwater is of poor water quality.

5.3 Wetland Capacity

Marton Park Wetland has an area of approximately 120,000 m². This represents approximately 12.5% of the catchment area. A water level of 0.8 m AHD the wetland has an inundated area of approximately 6600m². The approximate bank full capacity of the wetland is 45, 000 m³. At a water level of 0.8 m AHD the wetland has a volume of approximately 710m³.

5.4 Flow Regime

Marton Park Wetland is an ephemeral wetland, experiencing a wetting and drying cycle. Water levels within the wetland fluctuate depending on rainfall. Kurnell has an average annual rainfall of 1083mm (Sydney Airport AMO, (BOM, 2009)), with a mean number of rain days of 128. The

site is exposed to only a minor amount of seasonal variability in rainfall (Refer to Table 3). Kurnell is located in the coastal zone and therefore in most years rainfall will exceed evaporation. The wetland experiences good variability of flow which is important for the wetland environment.

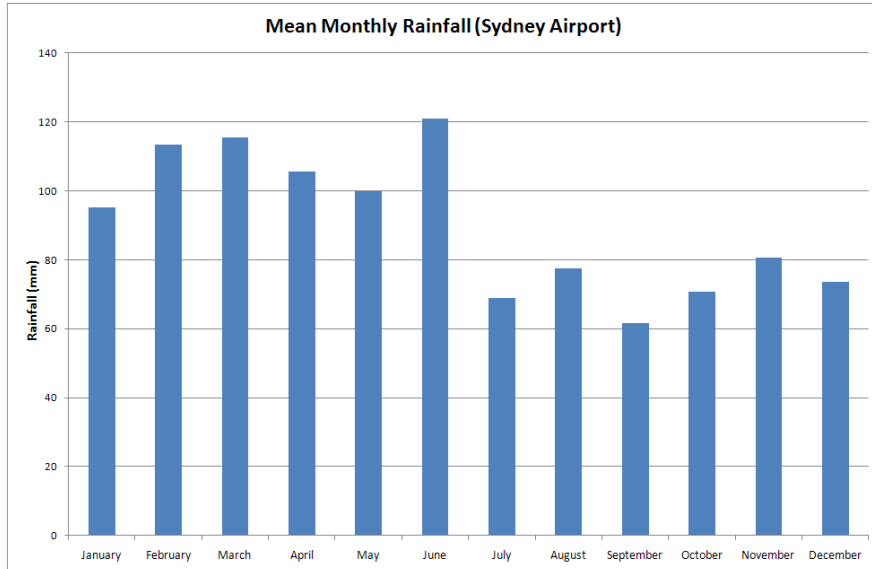


Table 3: Mean Monthly Rainfall (Sydney Airport)

The wetland experiences extended dry periods where the water level drops below the Captain Cook Drive culvert inlet level (0.65m AHD), with the remaining water being evaporated or infiltrated into the sandy bed. The wetland may occasionally become completely dry with the sandy bottom exposed and only a few remnant puddles remaining (This can be seen in the aerial photo from January 2007). During dry periods the wetland is recharged by groundwater seepage through the sandy bed.

In contrast, during wet periods the wetland may fill to capacity and the water level may remain elevated due to the low capacity of the culvert under Captain Cook Drive. This may be exacerbated by the culvert being partially blocked by debris.

These situations are however extremes, the more general range of levels is what drives ecosystem response. The water level within the wetland would typically be between 0.65 and 0.9 m AHD. At times there can be an open body of shallow water generally less than one metre deep located close to the outlet.

5.5 Tidal Influence

Historical aerial photography flown in 1943 shows the extended wetland as directly connected to Quibray Bay and therefore tidal (Figure 5). It is not possible to quantify what part of the tidal range penetrated to the current wetland location. The connection of Captain Cook Drive through to Torres St (and the reclaiming of land for the oil refinery) significantly limited the extent of the tidal range. The wetland would then have experienced a transition from tidal to salt marsh through to its current fresh water state.

The mean high water level for Kurnell (Botany Bay) is approximately 0.6 m AHD. The recommended storm tide levels for Botany Bay are tabulated below (Table 4). The highest tide ever recorded in Sydney Harbour was 1.5 m AHD.

Table 4: Recommended Storm tide levels in Botany Bay

Type of Tide	Peak Water Level (mAHD)
Mean High Water Spring	0.6
Mean Higher High Water Spring Solstice	1.1
5% AEP Design Tide	1.5
1% AEP Design Tide	1.7
Extreme Design Tide	2.0

*AEP = Annual Exceedance Probability

(Source: Bewsher, 2004)

A simple one-dimensional hydrodynamic (MIKE 11) model of the wetland was developed to determine the extent of tidal influence on the wetland (therefore the volume of water that passes in and out of the wetland). The wetland was modelled using a storage-area relationship derived from a digital elevation model. A one dimensional channel was used to represent the open channel drain and the Captain Cook Drive culvert connecting Marton Park Wetland with Quibray Bay. A sinusoidal tide was applied as the downstream boundary (based on Sydney tide levels). The model was run for a Mean High Water Spring (MHWS, which occurs once a month) and a Mean Higher High Water Spring Solstice (MHHWSS level above which the tide seldom rises) tide. Table 5 below summarises the MIKE 11 model results. The model confirms that very little saline water enters the wetland with 1.5 m³ of saline water entering the wetland during a MHWS tide. During a MHHWSS approximately 1700 m³ of saline water enters the wetland.

Table 5: MIKE11 Model Results (Existing 2009 Conditions)

Case Name	MHWS	MHHWSS
Peak Tide Level (m AHD)	0.68	1.04
Low Tide Level (m AHD)	-0.60	-0.60
Peak Wetland Water Level (m)	0.66	0.93
Low Wetland Water Level (m)	0.66	0.74
Change in Water Level (m)	0	0.19
Change in Volume (m ³)	1.5	1667.1

Under the current conditions tidal flow only extends into the wetland when the tidal level exceeds 0.65m above mean sea level, this being the same level as the invert of the culvert under Captain Cook Drive/Solander Street, which connects the wetland with an open drain and Quibray Bay. This is, however, assuming that the culvert is not blocked by debris and other constraints to flow. The amount of saline water which enters the wetland would therefore be small. Accumulation of debris or sediment will restrict drainage of the wetland. The wetland water level is therefore likely to remain elevated for extended periods of time following a rainfall event.

5.6 Impacts of Climate Change

5.6.1 General

Research conducted by the United Nations Intergovernmental Panel on Climate Change (IPCC) (Solomon *et al.*, 2007), has shown that there has been an observable change in global climatic conditions over the last 100 years. Observed changes include an increase in global surface temperature of 0.74°C between 1906 and 2005, and a global sea level rise of 1.8 mm/yr on average (a total of 0.08m) between 1961 and 2003. Solomon *et al.* (2007) also found long term changes in precipitation for a number of continents. Based on IPCC research, ignoring ice flow melt, global sea levels are predicted to rise between 0.18 and 0.59m by 2100.

The NSW Government Department of Environment of Climate Change and Water (DECCW) has produced a *Draft Sea Level Policy* document which outlines state government policy in relation to sea level rise. When the influence of ice melt and the predicted higher than global average sea level rise on the east coast of Australia are included, the predicted sea level rise on the NSW coast is up to 0.40m by 2050 and 0.90m by 2100 (NSW DECC, 2009). It should be noted that there are still a number of uncertainties in these predictions. World greenhouse gas emissions are currently tracking above the high level scenario.

The effects of climate change are also predicted to result in a change in average and seasonal rainfall patterns, including flood producing rainfall events. These changes have the potential to increase the frequency and severity of flooding. However, there is still much uncertainty about the specific nature of such changes on a regional basis and research continues.

5.6.2 Marton Park Wetland

The Kurnell Township Flood Study (WMAwater, 2009) assessed the impacts of climate change (in the form of increased rainfall and elevated ocean levels) on the Kurnell Township including Marton Park Wetland. While rainfall is likely to increase with climate change, of more concern for Kurnell is risk of increase in ocean level.

Raising ocean levels will increase the ocean's interaction with the wetland. This was investigated by rerunning the MIKE11 one-dimensional hydrodynamic model described in Section 5.5 with increased ocean levels representing the 2050 and 2100 climate change scenarios.

As the culvert connecting the wetland and Quibray Bay is of limited capacity, the impact of ocean level rise will be reduced. However at some point in the future there will be a real risk to the wetland and the wetland may eventually revert to its previous saline state.

By 2100 under the current projections the tidal exchange with the wetland will be more likely and will result in storm surge flowing over Captain Cook Drive into the wetland with increasing frequency. By 2100 a 1% design tide level would be flow over the road. Any wave effects etc would push more saline water into the wetland.

Table 6: MIKE 11 Model Results (Climate Change)

Case Name	MHWS			MHHWSS		
	Existing 2009 Conditions	2050 Scenario (+0.4m)	2100 Scenario (+0.9m)	Existing 2009 Conditions	2050 Scenario (+0.4m)	2100 Scenario (+0.9m)
Peak Tide Level (m AHD)	0.68	1.08	1.58	1.04	1.44	1.94

Case Name	MHWS			MHHWSS		
Low Tide Level (m AHD)	-0.60	-0.20	0.30	-0.60	-0.20	0.30
Peak Wetland Water Level (m)	0.66	0.98	1.5	0.93	1.3	1.7
Low Wetland Water Level (m)	0.66	0.76	0.92	0.74	0.85	1.03
Change in Water Level (m)	0	0.22	0.58	0.19	0.45	0.67
Change in Volume (m ³)	1.5	2381.1	13674	1667.1	9164.7	24223.3

5.7 Water Quality

Water Quality is often seen as a good measure of catchment health, and as such water quality represents the catchment area and its contributors. Marton Park Wetland is a potential sink for pollutants entrained in the runoff from the surrounding catchment. There are a number of significant threats to water quality located within the Marton Park Wetland catchment. These can be considered in terms of point source and diffuse pollution sources.

5.7.1 Diffuse Pollution

Diffuse pollution results from broad-scale land-use practices such as land clearing for development. Diffuse pollution is recognised as a significant threat to wetlands and can result in the eutrophication of water bodies. The effects of diffuse pollution can be long term and are less easily and less quickly reversed than those of point source pollution.

The primary threat to the wetland water quality is from diffuse pollution from surface water, as it will reach the wetland quickly. Surface runoff from the surrounding residential areas has to enter a drain before getting to the wetland and therefore any pollutants are likely to be reduced due to this non direct path between the source and the wetland. This includes nutrient rich run off from properties in Kurnell stocked with horses, utilising domestic garden fertilisers and even run off from local roads. Suspended sediments in any overland flow from residential areas are likely to fall out on the grass prior to reaching the wetland.

5.7.2 Point Source Pollution

Point source pollution occurs when pollutants are emitted more directly into an environmental system. The key point sources of pollution for Marton Park Wetland are the Kurnell Industrial Estate and Caltex Oil Refinery. The Kurnell Industrial Estate has a direct hard surface link with the wetland and therefore any pollutants are unlikely to be intercepted before reaching the wetland.

The Caltex Oil Refinery adjacent to the wetland is bunded off with all runoff from industrial areas treated and discharged to Botany Bay. There is a minimal chance of runoff from the bunded area reaching the wetland. Runoff from the non industrial/administration/car park area does enter the wetland.

The refinery produces a variety of products including petrol; diesel; jet fuel; fuel oils; LPG/Butane/Propane gases; bitumen; and a mix of lubricating oil base stocks, waxes and other products such as process oils and sulphur (Caltex 2009). These materials, although unlikely to reach the wetland via surface runoff, pose a potential point source pollution risk if they were to enter the groundwater system.

Any contaminants in the wetland may enter the groundwater system. When the water level is high contaminants from the surface water may enter the groundwater. The reverse may happen when the water level is low. Pollutant transfer via groundwater is orders of magnitude slower than from surface water and it is possible that groundwater contamination caused decades ago could be leaching out now.

5.7.3 Water Quality Monitoring

No historical water quality monitoring records could be obtained for the site. However, water quality monitoring was undertaken as part of this study by Sutherland Shire Council at four locations (refer to Table 7 and Figure 6):

- Cook St
- Marton Park Rugby south corner
- Solander St
- Near Shepherd St

Water quality testing of the wetland was undertaken on the 3rd and 17th of July 2009. No rainfall was recorded in the five days preceding the testing on the 3rd of July. Testing on the 17th July was conducted following 18mm of rainfall in the previous two days. This may have washed some chemicals/pollutants into the wetland and partially explain any high concentrations. During the water quality testing hydrocarbon sheen was observed on the water.

Table 7: Water Quality Monitoring Results

Date	3 July 09	17 July 09					
Location	Cook St	Cook St	Marton Park Rugby south corner	Solander St	Near Shepherd St	ANZECC 2000 Protection of Aquatic Ecosystems (95% species + Lowland rivers of SE Australia)	Australian Runoff Quality Guidelines (2006)
Conductivity	1500	675	730	2070	139	NE	NE
pH	7.01	6.91	7.37	7.54	6.58	6.5-8.0	NE
Dissolved oxygen mg/L	-	6.53	5.9	8.82	8.48	NE	NE
Dissolved oxygen %	-	64	57	84	80	>85	NE
Temperature	-	14.5	13.6	13	12.8	NE	NE
Ammonia	1.25	0.33	0.51	0.21	0.04	0.90	0.20
BOD	2	3	<2	<2	<2	NE	2

Date	3 July 09	17 July 09					
Arsenic	0.001	<0.001	<0.001	<0.001	<0.001	0.013	
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	
Chromium	0.002	0.001	0.002	0.001	<0.001	0.001	
Copper	0.002	0.003	0.005	<0.001	0.003	0.0014	0.01
Lead	<0.001	0.002	0.003	0.001	0.002	0.0034	0.025
Nickel	<0.001	0.001	0.001	<0.001	<0.001	0.011	
Zinc	0.03	0.046	0.048	0.01	0.025	0.008	0.05
Oil and grease	<5	<10	<10	<10	<10		
Enterococci	36	1200	1700	180	1600	NE	1000
Total N	2.1	1	1	0.8	0.2	0.5	0.5
Total P	0.04	0.05	0.04	<0.01	0.01	0.05	0.05
TSS	1500	4	40	14	2	NE	25



Figure 6 Water Quality Monitoring Locations

The Cook St location in particular was found to have slightly elevated ammonia and Total Nitrogen levels. Potential sources of nitrogen in the catchment are industrial cleaning operations, and animal droppings. These are plant nutrients and can result in increased photosynthesis. Elevated levels of chromium, copper, lead and zinc were found during testing. These levels indicate a source other than natural. However rainfall that fell in the days prior to the testing may have flushed the contaminants into the wetland. The Enterococci level at Cook St was found to increase following the rainfall event. High levels of Enterococci are likely to have come from animal faeces (eg dogs and horses) or sewer overflows washed into the wetland during the rainfall event.

Elevated suspended solids levels were recorded at the southern corner of Marton Park Rugby grounds. Anecdotal evidence suggests that there has been significant sediment accumulation in the wetland. The natural process of sediment accumulation has been accelerated by humans (by residential development and grazing). The upper reaches of the Marton Park Wetland catchment are National Park which would produce a fair amount of coarse sediment. The surrounding sand dunes and the filling of the refinery site probably contributed to sediment loads entering the wetland. With the poor hydraulic connection very little of the sediment will transfer out to Quibray Bay, however it would result in increased blocking of this connection. Historically the freshwater lakes upstream which are now filled would have captured much of the sediment contained in the runoff.

Marton Park Wetland has an important role in filtering the nutrient rich urban and industrial runoff from the residential and industrial areas of Kurnell before it reaches Botany Bay and the internationally significant Towra Point Aquatic Reserve. Regular water quality monitoring will assist in the recognition of accidental spills if and when they occur and allow for rapid action to address the source of pollution to the wetland. The improvement and maintenance of water quality in Marton Park Wetland has implications for the sensitive downstream environment.

5.1 Conclusions

Marton Park Wetland plays an important role in the drainage of the surrounding area. The Wetland has a small catchment area characterised mainly by open space and parkland. The wetland plays an important role in filtering runoff from the area prior to it reaching Quibray and Botany Bays. Marton Park Wetland is a potential sink for pollutants and sediment entrained in the runoff from the surrounding catchment. There are a number of significant threats to water quality located within the Marton Park Wetland catchment including runoff from residential and industrial areas as well as groundwater. In the longer term the wetland will be vulnerable to sea level rise due to climate change.

6 ENVIRONMENTAL VALUES

6.1 Literature Review

In order to provide background information and environmental context to this Management Plan a number of previous studies undertaken on the Kurnell Peninsula have been reviewed for relevant information. A summary of these reports is presented below.

6.1.1 Cogeneration Plant Environmental Impact Statement

Woodward Clyde (1997) prepared the Kurnell Cogeneration Plant Environmental Impact Statement (EIS) on behalf of Sithe Energies Australia Pty Ltd. The EIS included a chapter on terrestrial flora and fauna which included an inspection of Marton Park Wetland which lies immediately to the north of the Cogeneration Plant site. The report identified and described the vegetation communities and fauna habitats and their condition in Marton Park Wetland. The study targeted rare or threatened species and considered the impacts of the proposed cogeneration plant.

The report identified three vegetation communities in the wetland:

- shrubland on the terrestrial edge of the wetland, dominated by *Lantana camara* with emergent *Casuarina glauca*;
- Reedland, rushland and open woodland on the wetland edge, with *Phragmites australis* and *C. glauca*, *Juncus krausii* and *Cotula coronopifolia*;
- Marsh within the wetland comprising large stands of *Cladium procerum* and *Juncus krausii*.

Fauna habitats identified in the wetland included:

- Open drains and creek lines; and
- Freshwater wetlands.

The open drains and creek lines were considered suitable habitat for nectivorous and insectivorous birds, some arboreal mammals and feral pests; a variety of reptiles and amphibians, and some bats that forage over water. The wetland was considered suitable habitat for waterfowl, amphibians including the Threatened Green and Golden Bell Frog (GGBF) and the Wallum Froglet and reptiles. Three flora species of conservation significance were considered potentially present:

- Wrinkled Kerrawang *Rulingia hermanniifolia* (small prostrate shrub);
- Nodding Raspwort *Gonocarpus salsoides* (many branched herb);
- Botany Bay Bearded Greenhood Orchid (*Pterostylis* sp 15)

A total of 10 species listed at the time on the TSC Act 1995 were considered to potentially occur with the Marton Park Wetland. These included eight birds and two amphibians, the GGBF and the Wallum Froglet.

6.1.2 Flora and Fauna Assessment Cogeneration Plant Commission of Inquiry

Lesryk (1997) prepared the above report for the area of land that covers the southern edge of the wetland adjoining Caltex Refineries NSW Pty Ltd. The report included a literature review and site assessment of the area proposed for the cogeneration plant.

The report recognised two vegetation communities:

- *Phragmites australis* Reedland; and
- *Casuarina glauca* Woodland.

Seven plant species of conservation significance were considered as having potential to occur including those listed in section 6.1.1 above and:

- Magenta Lily *Syngium paniculatum*;
- *Tethratheca juncea*;
- Thick Lipped Spider Orchid *Caladenia tessellata*; and
- Buttercup Doubletail *Diuris aequalis*;

Thirteen plant species of regional conservation significance were also considered as having potential to occur.

Fauna assessment included spotlighting, ultrasonic bat call detector and playback of threatened amphibian species calls. A total of 24 native birds were recorded along with 2 reptiles and 3 frogs. Fauna habitats identified in Marton Park Wetland included:

- Reedlands;
- *Casuarina* Woodlands; and
- Aquatic Environments.

The reedland was considered suitable foraging and sheltering habitat for native animals. The *Casuarina* woodland was recognised as providing a range of foraging and sheltering habitats for a number of native species and some threatened animals on occasion. The aquatic environments in Marton Park Wetland were considered an important resource for a range of wetland and migratory birds, and as foraging and roosting habitat for threatened bird species. The GGBF was considered a potential visitor to the wetland on occasion; however the presence of exotic fish was expected to reduce the value as a breeding site.

A total of 13 species listed on the TSC Act 1995 had been previously recorded in the area and an additional seven species had been recognised by the Co-generation plant EIS (Woodward Clyde 1997). Based on the presence of suitable habitat, of the species listed, the following were considered as having a high or moderate likelihood of occurrence

-
- Common Bentwing Bat *Miniopterus schreibersii*;
 - Eastern Freetail Bat *Mormopterus norfolkensis*;
 - Large-footed Myotis *Myotis adversus*;
 - Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*;
 - Green and Golden Bell Frog *Litoria aurea*;
 - Powerful Owl *Ninox strenua*.

The report recognised Marton Park Wetland, its associated reedlands and riparian vegetation as the main wildlife corridor in the vicinity. The corridor was expected to be a north east, south west corridor linking Botany Bay National Park with Quibray Bay and Towra Point Nature Reserve.

6.1.3 Kurnell 2020 Corridor Delineation

This report has been considered in more detail in Section 4. Marton Park Wetland is recognised in this report as provincial corridor No. 10. DECC (2009) recognised provincial corridors lie partly or wholly within privately owned land and will require cooperation from landowners to be successful. They currently support vegetated areas which are important linkages across the peninsula. Corridor 10 aims to create an east-west link from Botany Bay National Park to Towra Point Nature Reserve also connecting Marton Park (DECC 2009).

6.1.4 UBM Kurnell Peninsula Fauna Survey

As part of the Kurnell 2020 Corridor Delineation study (DECC 2009) fauna surveys were undertaken across the Kurnell peninsula at 14 different sites, including Marton Park Wetland by UBM Ecological Consultants (UBM 2009). A range of methods and techniques were used to record fauna species from all vertebrate groups. Each of the following techniques was used at all 14 survey sites:

- A formal diurnal bird census;
- Searches for active herpetofauna (reptiles and amphibians);
- Nocturnal census (spotlighting, owl call playback and frog searches);
- Ultrasonic call detection for microchiropteran bats;
- Tree hollow investigations;
- Recording of indirect evidence of fauna presence (tracks, scats, nests, diggings, bones and other traces); and
- All opportunistic or incidental fauna sightings were recorded.

Survey results for Marton Park Wetland reveal it supports a variety of native and introduced fauna species. UBM (2009) indicate the wetland supports a diverse range of wetland habitat important for a large number of birds and amphibians (UBM 2009). The results of the UBM (2009) fauna survey have been incorporated into Appendix A.

The report reveals that fauna species inhabiting the Kurnell Peninsula are either highly mobile, can survive in small and fragmented habitats or can adapt readily to the urban environment (UBM 2009). These results indicate the formation of official wildlife corridors and increased protection across the Kurnell Peninsula will enhance existing fauna population survival.

6.1.5 The Green and Golden Bell Frog Key Population at Kurnell Management Plan

DECC (2007) prepared a the plan to satisfy Action 11.3.4 of the draft Green and Golden Bell Frog (GGBF) Recovery Plan that was developed in accordance with the Threatened Species Conservation Act 1995.

The GGBF population on the Kurnell Peninsula is considered to currently exist as two sub-populations that include: Kurnell West and Kurnell East. The management plan recognises the Kurnell Peninsula has been highly modified and that GGBFs often occupy habitats that have been significantly altered and are made by humans. The plan recognises that while no recent reports of GGBF exist for Marton Park Wetland the site has a high probability of being occupied from time to time by GGBF.

Threats to the GGBF population identified in the plan include:

- Loss of habitat;
- Introduced predators;
- Disease - Frog Chytrid fungus;
- Habitat degradation - Weed invasion of foraging and breeding areas;
- Water quality – groundwater dependent water bodies at risk from groundwater contamination;
- Herbicide Spraying – herbicides are potentially toxic to the GGBF;
- Predation of GGBF from native predators;
- Inappropriate recreational use.

Of these threats the most relevant to the management of Marton Park Wetland include habitat degradation by weeds, herbicide use in bush regeneration and weed control, introduced predators and degradation of water quality.

The Kurnell GGBF Management Plan has three objectives:

1. to maintain the two existing GGBF sub-populations;
2. where possible enhance existing GGBF habitat and thus measures of population viability; and
3. to increase connectivity within and between sub-populations.

Six strategies were developed to achieve these objectives:

1. Further development, where appropriate, of GGBF breeding and other habitat components on public and private lands;
2. Improvement of habitat within the GGBF key populations;
3. Education and communications to build awareness of the GGBFs and encourage further on-ground actions;
4. Reduction of external threats to GGBFs;

-
5. Monitoring and research to better understand the extent and dynamics of the Kurnell GGBF population; and
 6. Coordination and communication between the various stakeholders, land managers and the community.

The plan was scheduled to run for three years from mid 2007 to mid 2010. Recommendations of the GGBF Management Plan have been taken into account in the formulation of management strategies and actions for Marton Park Wetland.

6.2 Ecological Assessment

In order to document the vegetation communities and fauna habitats present at Marton Park Wetland a literature review, desktop assessment and field assessment were undertaken. The desktop assessment is described below. The wetland was visited by an ecologist on Wednesday the 12th of August, the weather was warm and sunny with light high cloud and the temperature reached 20.5 degrees Celsius. There had been some light showers on the previous evening.

The field assessment involved a traverse of the wetland including the boundaries of the wetland and boundaries of the vegetation communities in the central area of the wetland adjacent to the Caltex Refinery.

Vegetation communities were identified on the basis of structure and dominant plant species. Plant species present were identified, recorded and assessed as indicators for Endangered Ecological Communities and for possible threatened plant species occurrence. The density of weeds in various vegetation communities and areas of the wetland were also noted.

Fauna habitats in the wetland were identified on the basis of vegetation structure and available habitat attributes. Threatened fauna species indicated as potentially present in the study area on the basis of wildlife database analysis were considered when searching the wetland and the existence of specific habitat for these species was assessed. A diurnal search of the wetland was undertaken on the above occasion.

6.2.1 Desktop Assessment

A desktop assessment was undertaken to review the existing information available on the vegetation communities and fauna habitats in the wetland. This included the studies summarised above and species and endangered ecological communities listed on the NSW TSC Act 1995 and the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. A variety of studies have been undertaken in the Kurnell area that identified native fauna species in the vicinity of the wetland including: Lesryk (1997); Gunninah (1996) Lesryk (1996); Urban Bushland Management Consultants (1995); Lesryk (1995); and Antcliff (1995). These studies contained in Lesryk (1997), the recent UBM (2009) fauna survey and review of the DECCW Wildlife Atlas have enabled the development of a fauna species list for Marton Park Wetland (which includes species within a three kilometre radius) that is contained in Appendix A.

a) Threatened Species Conservation Act 1995

A spatial analysis was undertaken utilising the Department of Environment and Climate Change and Water (DECCW) Wildlife Atlas of threatened species records in a ten kilometre radius of the site (the locality).

The search revealed a total of 27 fauna species and four flora species listed on the TSC Act 1995. The species recorded during the database search and potentially occurring in Marton Park Wetland are listed in Appendix B.

Desktop Assessment and liaison with SSC revealed that Marton Park Wetland supports two Endangered Ecological Communities (EECs) listed on the TSC Act 1995:

- Sydney Freshwater Wetland in the Sydney Basin Bioregion; and
- Swamp Oak Floodplain Forest

Detailed descriptions of these EECs are provided by DECC Threatened species profiles (DECC 2009a). These profiles also provide advice on priority actions to help recover these EECs and references on information regarding identification and management. The advice provided by DECC (2009a) was taken into account in the formulation of management strategies and actions for Marton Park Wetland (see chapter 10).

b) Locally and Regionally Significant Species

Lesryk (1997) revealed 13 plant species of local or regional significance are considered as potentially occurring in the Marton Park Wetland, three of these have also been noted as locally significant in the Sutherland Shire Biodiversity Strategy (SSC 2000). These are listed below in Table 8

Table 8: Locally and Regionally Significant Plant Species

Common Name	Scientific Name
Maidens Wattle	<i>Acacia maidenii</i>
	<i>Banksia aemula</i>
Swamp Water Fern	<i>Blechnum indicum</i> *
Tuckeroo	<i>Cupaniopsis anarcardioides</i> *
	<i>Darwinia leptantha</i>
Soft Corkwood	<i>Duboisia myoporoides</i>
Swamp Mahogany	<i>Eucalyptus robusta</i>
Hairy Cheese Tree	<i>Glochidion ferdinandi</i> var. <i>pubens</i>
Guinea Flower	<i>Hibbertia virgata</i>
Cockspur Vine	<i>Maclura cochinchinensis</i> *
Milk Vine	<i>Marsdenia rostrata</i>
Water Milfoil	<i>Myriophyllum</i>
Bush Pea	<i>Pultanea dentata</i>

Source: Lesryk (1997), SSC (2000) *

c) Environment Protection and Biodiversity Conservation Act 1999

An online search of matters of National Environmental Significance or other matters protected by the EPBC Act was undertaken for a ten kilometre radius of the site.

The online search revealed a number of matters relevant to this Management Plan:

- Towra Point Aquatic Reserve - the area is of international significance under the Convention on Wetlands of International Importance (RAMSAR) as it is a

feeding site of more than 1% of the known Australian population of several waders. The area also supports numerous migratory birds listed in the China Australia Migratory Birds Agreement (CAMBA) and the Japan Australia Migratory Birds Agreement (JAMBA). The area supports three nationally uncommon birds, the Pied Oystercatcher, Lewin's Rail and the Little Tern.

- Kurnell Peninsula Headland is listed on the National Heritage List (see section 7.4).

Suitable habitat is present for species listed at the State and National level including the:

- Swift Parrot listed as Endangered at the national level on the EPBC Act 1999 and Endangered at the State level on the TSC Act 1995;
- Wandering Albatross listed as Vulnerable at the National level on the EPBC Act 1999 and Endangered at the State level on the TSC Act 1995;
- Green and Golden Bell Frog listed as Vulnerable at the national level on the EPBC Act 1999 and Endangered at the State Level on the TSC Act 1995;
- Grey-headed Flying-fox listed as Vulnerable at the National level on the EPBC Act 1999 and Vulnerable at the State level on the TSC Act 1995;
- Sunshine Wattle listed as Endangered at the National and State level;
- Botany Bay Bearded Greenhood Orchid listed as Endangered at the National and State level;
- Magenta Lilly Pilly listed as Vulnerable at the National level and Endangered at the State level.

Suitable habitat is also present for a number of migratory bird species listed on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (BONN), Chinese Australia Migratory Bird Agreement (CAMBA), Japanese Australia Migratory Bird Agreement (JAMBA) Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) (See Appendix B) including:

- Greater Sand Plover (coastal);
- Lesser Sand Plover (shores marshes rarely inland) ;
- Wandering Albatross (marine pelagic aerial);
- Sanderling (beaches);
- Great Knot (tidal mudflats);
- Broad-billed Sandpiper (coastal mudflats occasionally inland); and
- Terek Sandpiper (coastal mudflats occasionally inland).

6.2.2 Field Assessment

a) Vegetation Communities

The results of the desktop analysis and field assessments revealed the presence of seven vegetation communities in Marton Park Wetland. The vegetation communities are listed and described below and shown in Figure 7. A plant species list is provided in Appendix C.

1. Landscape Plantings;
2. Phragmites Reedland;

3. Cladium Sedgeland;
4. Casuarina Woodland;
5. Grassland;
6. Open Water; and
7. Weed Plumes in Casuarina Woodland.

Table 9 places these vegetation communities in the context of the NSW Vegetation Types Database and provides a summary of dominant species and fauna habitat values. The vegetation communities are described in detail below.

Table 9: Summary of Vegetation Communities and Fauna Habitat Values

Vegetation Community	EEC	Biometric Vegetation Type (DEC 2005)	Dominant Species	Condition	Habitat Values
Landscape Plantings	No	n/a	<i>C.glauca</i> , <i>M.quinquenervia</i>	Moderate	Moderate- foraging resources for birds and arboreal mammals, high levels of human use adjacent to this habitat type
<i>Phragmites</i> Reedland	Freshwater Wetlands in the Sydney Basin Bioregion	Freshwater Wetlands	<i>Phragmites australis</i>	Moderate to good, condition increases toward the interior of wetland	Moderate to high- foraging, shelter and breeding habitat for water fowl and foraging and shelter resources for migratory birds and reptiles and amphibians
<i>Cladium</i> Sedgeland	Freshwater Wetlands in the Sydney Basin Bioregion	Freshwater Wetlands	<i>Cladium procerum</i>	Moderate to good, minor weed invasion on terrestrial edge	Moderate to high- foraging, shelter and breeding habitat for water fowl and foraging and shelter resources for migratory birds and reptiles and amphibians
<i>Casuarina</i> Woodland	Swamp Oak Floodplain Forest	Forested Wetlands	<i>Casuarina glauca</i> <i>Melaleuca armillaris</i>	Moderate, some areas of intense weed infestation on terrestrial edge of wetland	High -seasonal foraging and shelter resources for nectivorous birds, insectivorous birds and arboreal mammals. Foraging and shelter resources for mega and micro chiropteran bat species including the Grey headed Flying Fox and the large-footed Myotis, owls and raptors and feral pests, foxes cats and rabbits
Grassland	No		Blady Grass <i>Imperata</i>	Highly modified	Low to moderate- some foraging and shelter

Vegetation Community	EEC	Biometric Vegetation Type (DEC 2005)	Dominant Species	Condition	Habitat Values
			<i>cylindrica</i>		resources for reptiles and foraging habitat for birds and small mammals.
Open water	Freshwater Wetlands in the Sydney Basin Bioregion	Freshwater Wetlands	<i>Juncus kraussii</i>	good	High water source for a variety of native and introduced species, foraging resources for migratory birds and some bats, breeding habitat for amphibians, habitat for aquatic species and invertebrates.
Weed Plumes in Casuarina Woodland	Swamp Oak Floodplain Forest	Forested Wetlands	<i>Casuarina glauca</i> , <i>Lantana camara</i> , Coral Trees <i>Erythrina x sykesii</i>	Low, high levels of weed infestation in all vegetation layers	Moderate –foraging and shelter resources for birds and arboreal mammals, reptiles and amphibians, shelter resources for some migratory birds

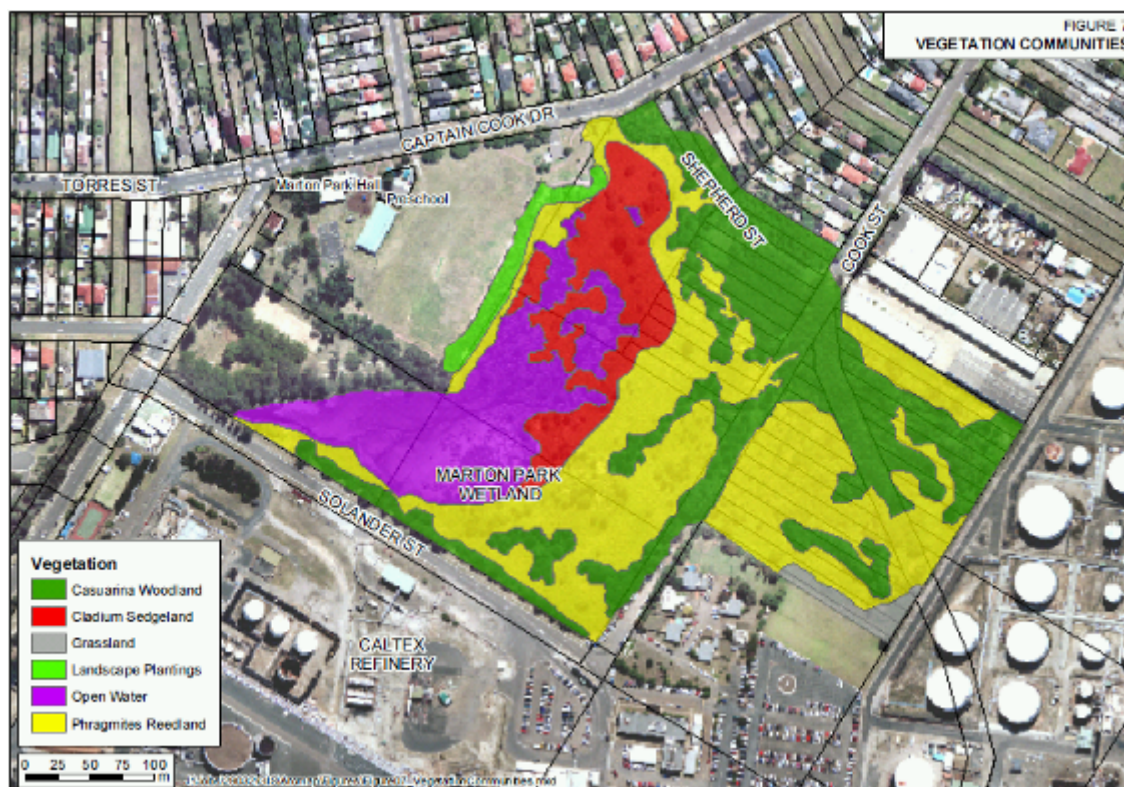


Figure 7 Vegetation Communities

i) *Landscape Plantings*

This community is located on the north west and south west boundaries of the wetland between the wetland and the walking track adjoining Marton Park. The community closest to Marton Park is divided topographically, with the edge closest to Marton Park supporting a woodland with emergent Swamp Oaks *Casuarina glauca* Broadleaved Paperbark *Melaleuca quinquenervia*, and Eucalypts *Eucalyptus robusta* reaching ten metres with a relatively cleared understorey and ground cover of leaves and organic matter. Closer to the wetland the soil has been mounded to form a berm and this area supports woodland dominated by emergent *Casuarina glauca* with a tall shrub layer occurring in clumps including: Lantern Banksia *Banksia ericifolia*, Coastal Banksia *Banksia integrifolia* and Sweet Pittosporum *Pittosporum undulatum*.

Occasionally clumps of Lantana *Lantana Camara* occur between this community and the wetland primarily on the northern edge closest to Captain Cook Drive. On the higher ground adjacent to the pathway the shrub layer is sporadic and includes *Lomandra longifolia*, *Dianella caerulea* saplings of *Ficus rubignosa* and Illawarra Flame Tree *Brachychiton acerifolius*.

This vegetation community supports a dense leaf litter with a small number of weeds including Asparagus Fern, Kikyu Grass, thistles and occasionally Moth Vine *Araujia hortorum*. Closer to the edge of the wetland and open water, Kurnell Curse *Hydrocotyle bonariensis* is common along with Lomandra. In one area the vegetation between the wetland and the terrestrial edge has been removed to establish what appears to be a bike jump. There is some evidence of concentrated human use with some litter.

On the north western edge of the wetland this community opens up to the drainage line and a variety of weeds occur on the wetland edge adjacent to the Marton Park Wetland sign including Kurnell Curse *Hydrocotyle bonariensis* and Pellitory *Parietaria judaica* (Class 4 noxious weed in SSC LGA), Milk Thistle *Silybum marianum* and Kikyu Grass *Pennisetum clandestinum*.

ii) *Phragmites Reedland*

This community dominates the western portion of the wetland that can be viewed from the Marton Park walking path through to eastern boundary with Caltex Refineries NSW Pty Ltd. The community often forms pure stands of the Common Reed *Phragmites australis*, occasionally emergent Swamp Oak *Casuarina glauca* occur forming small clumps on higher ground. The reedland is wet underfoot often with around 1 metre of water. There are patches of Lantana in this community, generally on the terrestrial edges of the wetland, a large patch occurs near the north eastern boundary close to the Caltex Refinery. Occasionally in this community patches of sedges occur, forming pure stands often of Pale Rush *Juncus pallidus*. This community is part of the Sydney Freshwater Wetlands in the Sydney Bioregion EEC.

iii) *Cladium Sedgeland*

This community dominates the wetland between the open water on the western edge and the *Phragmites* Reedland to the east. It forms almost pure stands of Leafy twig Rush *Cladium procerum* reaching 1.5 metres. The boundary to the *Phragmites* Reedland can be identified by the abrupt change from the glossy green of the *Cladium* to the taller wheat coloured stems of the *Phragmites*. In areas adjoining open water the edge of this community is dominated by clumps of *Juncus kraussii*. Kurnell Curse *Hydrocotyle bonariensis* is common amongst the base of the rushes. This community is part of the Sydney Freshwater Wetlands in the Sydney Bioregion EEC.

iv) *Casuarina Woodland*

This community consists of emergent Swamp Oaks *Casuarina glauca* reaching over 10 metres. It occurs on the terrestrial edges of the wetland where it is often subject to extensive weed invasion (see weed plumes description) by Lantana, Blackberry and Coral Trees. It also occurs within the wetland often in small or linear clumps. The understorey is highly variable. In some areas the climber Common Silkpod *Parsonsia straminea* var. *straminea* has invaded the canopy and the stems of mature plants have become thick and woody. This climber is particularly prevalent behind the Kurnell Industrial estate but does occur sporadically throughout the *Casuarina* canopy across the wetland. The locally significant Swamp Water Fern *Blechnum indicum* was also recorded in the area behind the industrial estate during the field assessment. Although searched for the other locally significant climber Cockspur Vine *Maclura cochinchinensis* was only recorded from an adjoining garden on Captain Cook Drive.

In the central areas of the wetland the *Casuarina* Woodland understorey consists of pure stands of *Phragmites australis*, patches of Pale Rush *Juncus pallidus* occur and Sword Edge *Ghania sieberana* also occurs in clumps. On the terrestrial edges of the wetland including between Captain Cook Drive and Cook Street the understorey can be dominated by weeds and behind the Kurnell Industrial Estate stands of Pale Rush *Juncus pallidus* occur with a variety of weeds.

In the area of the wetland adjoining the Caltex site the ground level is highly variable possibly due to past filling. On the landward side of the wetland some patches of emergent Swamp Oak *Casuarina glauca* occur with a shrub layer consisting of Bracelet Honeymyrtle *Melaleuca armillaris*.

Along Solander Street between the wetland and the road, this community contains Swamp Oak *Casuarina glauca*, Sydney Golden Wattle *Acacia longifolia* var. *sophorae* and locally significant Tuckeroo *Cupaniopsis anacardioides*. *Pittosporum undulatum* occurs sporadically in this community and the ground cover is dominated by Kikyu Grass. A steep slope occurs down to the wetland from this roadside community and *Phragmites* reedland occurs. At the end of Cook Street this community occurs in conjunction with a weed plume.

This community is part of the Swamp Oak Flood Plain Forest EEC.

v) *Grassland*

This community occupies a small area adjoining the Caltex Refinery in the south east corner of the wetland. The ground level varies sloping off sharply to the south east. Blady Grass *Imperata cylindrica* dominates this area reaching around 0.5 metres in height. A variety of introduced species including grasses also occurs.

vi) *Open Water*

Open water occupies the central area of the wetland. The expanse of open water varies over time and with rainfall. It ranges from dry to around 0.5 metres deep. The edges of open water on the northern tip of the wetland contain small areas of Duck Weed. *Juncus kraussii* forms emergent, island like clumps sporadically across the open water.

At the end of Cook Street a small area of open water is present there was no obvious floating, submerged or emergent vegetation in the open water. Although none was observed at the time of survey the noxious weed Water Hyacinth has been recorded from this area in the past (Lesryk 1997). At the Captain Cook Drive inlet Duck Weed was present in the northern margins of the open water reflecting nutrient rich water.

This community is part of the Freshwater Wetlands in the Sydney Bioregion EEC.

vii) *Weed Plumes*

Weed plumes occur in a number of areas including:

- around the drainage line adjacent to the fire station at Captain Cook Drive on the northern edge of the wetland;
- between captain Cook Drive and Cook Street (Shepherd Street) behind adjoining houses;
- at the end of Cook Street;
- behind the Kurnell Industrial Estate;
- between the Marton Park pathway and the wetland; and
- along the terrestrial bund between the wetland and the Caltex Refinery.

The location and density of weeds are shown on Figure 8. These weed plumes have been mapped to demonstrate weed density and guide weed removal stages. Weed plumes generally occur on the edges of the wetland and are often associated with stormwater inlets.

The primary weed present is Lantana *Lantana camara* but Coral Trees *Erythrika x sykesii* also occur and both can form large dense clumps. A small number of the noxious Pellitory *Parietaria judaica* individuals were located on the edge of the wetland near Marton Park adjacent to the wetland sign.

At the Captain Cook Drive fire station a dense weed plume associated with the drainage line occurs. This area includes a small number of natives: *Phragmites australis*, Bracken Fern *Pteridium esculentum*, Bleeding Heart *Omalanthus populifolius* and Sydney Golden Wattle *Acacia longifolia* var. *sophorae*. A variety of weeds also occur including Kurnell Curse *Hydrocotyle bonariensis*, Monstereo *Monstera deliciosa*, Crofton Weed *Ageratina adenophora*, Lantana *Lantana camara*, Dandelion and Cobblers Pegs *Bidens pilosa*.

Weeds, in particular Lantana dominate the understorey of the *Casuarina* Woodland behind the houses between Captain Cook Drive and Cook Street (Shepherd Street). A variety of other weeds occur including Blackberry *Rubus fruticosus*, Asparagus Fern *Asparagus aethiopicus*, Kurnell Curse *Hydrocotyle bonariensis* and Monstereo *Monstera deliciosa*. This weed plume includes a large clump of Lantana over three metres high and extending many metres in toward the centre of the wetland. The high levels of Lantana infestation continue to dominate the understorey around the terrestrial edge of the wetland at the end of Cook Street.

At the end of Cook Street Lantana is again the dominant weed with Wandering Jew *Tradescantia fluminensis*, Hydrocotyle, Asparagus Fern, Kikyu Grass, Blackberry *Rubus fruticosus*, *Bidens pilosa* and isolated individuals of *Senna pendula*. A large garden escape from the hibiscus family *Abuliton x hybridum* occurs adjacent to the Marton Park Wetland sign at the end of Cook Street. The natives Bracken Fern and Bleeding Heart also occur in this area.

Behind the Kurnell Industrial Estate between the buildings and the wetland another less intense weed plume occurs. In this area Lantana again dominates part of the understorey. On the terrestrial edge of the *Casuarina* Woodland closest to the buildings the ground level drops down, the overstorey is open and the shrub layer is dominated by Pale Rush *Juncus palladus* interspersed with Lantana. Under the *Casuarina* canopy the understorey is dominated by dense patches of Lantana increasing in density to the east. A number of Coral Trees also occur in this weed plume including a circular grove toward the eastern boundary, the understorey in this area is dominated by Lantana. Closer to the wetland the understorey condition improves and includes Pale Rush, *Melaleuca armillaris* and ferns.

A weed plume is also associated with the disturbed wetland edge bordering the Caltex refinery on the southern boundary of the wetland. This area supports a variety of weed species on the steep berm leading out of the wetland and up to the refinery fence. There is one large patch of Lantana present in the wetland in this area.



Figure 8 Location and Density of Weeds

These weed plumes occur within the Sydney Freshwater Wetland and Swamp Oak Flood Plain Forest EECs of Marton Park Wetland.

A number of weeds present in Marton Park Wetland are classified as noxious weeds and recognised at a national level these are listed below in Table 10.

Table 10: Noxious Weeds in Marton Park Wetland

Common Name	Species Name	SSC Weed Management Plan	NSW Noxious Weed Category Sutherland Shire	Regional Weed Management Plan	Weed of National Significance	Key Threatening process (TSC Act)
Pellitory/ Asthma Weed	<i>Parietaria judaica</i>	Yes	4	Yes (Central Sydney)		
Lantana	<i>Lantana Camara</i>	Yes	4		Yes	Yes
Blackberry	<i>Rubus fruticosus</i>	Yes	4		Yes	
Asparagus Fern	<i>Asparagus aethiopicus</i>	No	(Not noxious in Sutherland Shire Council but			

Common Name	Species Name	SSC Weed Management Plan	NSW Noxious Weed Category Sutherland Shire	Regional Weed Management Plan	Weed of National Significance	Key Threatening process (TSC Act)
			noxious elsewhere in Sydney Region)			
Water Hyacinth (recorded previously Lesryk 1997)	<i>Eichhornia crassipes</i>	No	2			

Control Classes of Noxious Weeds (NSW Department of Primary Industries 2005)

- 1 The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist
- 2 The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist
- 3 The plant must be fully and continuously suppressed and destroyed.
- 4 The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.*
- 5 There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists

b) Fauna Habitats

i) Reed and Sedgeland

This fauna habitat consists of a dense cover of reeds sedges and rushes with sporadic emergent *Casuarina glauca*. This habitat was wet under foot although no water ponds or pools were observed. A series of 3 large ground nests made of reeds were observed and are likely those of the Purple Swamphen *Porphyrio porphyrio* recorded in the wetland. This fauna habitat is likely to provide shelter, foraging and breeding grounds for a variety of water fowl and shelter and foraging habitat for a variety of migratory wetland birds known to visit the Kurnell peninsula.

The Common Eastern Froglet *Crinia signifera* and the Striped Marsh Frog *Limnodynastes peronii* were heard calling in this habitat type. It is likely to provide shelter and breeding habitat resources for a variety of amphibians. The wetland also has a high probability of being occupied by the GGBF at times (DECC 2007). A variety of reptiles would also be expected to utilise this habitat for foraging, shelter and breeding, the Red-bellied Black Snake and Long-necked Tortoise have been recorded in the wetland in the past (Lesryk 1997).

ii) Casuarina Woodland

This fauna habitat provides a variety of resources for native fauna. The canopy provides seasonal foraging resources for nectivorous and insectivorous birds and arboreal mammals. A Brush-tailed Possum scat was observed during the field assessment in this community adjacent to the Kurnell Industrial Estate. The habitat also provides a variety of shelter resources for arboreal species and birds while areas of dense lantana infestation in the shrub layer provide cover for small birds. This habitat would also provide shelter and foraging resources for mega and micro chiropteran bat species including the Grey-headed Flying-fox and the large-footed Myotis (both recorded in the past (Lesryk 1997). The Myotis may forage over the open water areas

of the wetland. This community would also provide foraging resources on occasion for owls and raptors. This habitat also provides foraging habitat for a variety of introduced species including foxes, cats, domestic dogs, rats and rabbits.

iii) Open Water

This habitat provides water resources for a variety of native species. It provides breeding habitat for a range of amphibians and important foraging resources for some wetland and migratory bird species. This habitat is also important for a number of aquatic species and invertebrates. The species composition and diversity of fringing vegetation of the open water may provide a predictor of the use of this habitat by the GGBF.

Hamer *et al* (2001) found in their study of GGBF habitat on Kooragang Island in the Hunter River that water bodies were more likely to be occupied by the GGBF if they had:

- a high abundance of *Juncus kraussii*, *Schoenoplectus littoralis* and *Sporobolus virginicus*;
- a high diversity of vegetation on the banks of waterbodies; and
- neighbouring waterbodies within 50 metres were also occupied by the GGBF.

The study indicates that the emergents *Juncus kraussii* and *Schoenoplectus littoralis* may provide a suitable micro-habitat for basking and foraging for the GGBF (Hamer *et al* 2002). The relationship between the GGBF and these plants is unclear, however the presence or absence of these plants is considered a possible indicator of a particular stage of wetland succession (Hamer *et al* 2002). The study indicated the presence of the eastern mosquito fish did not influence waterbody occupation on Kooragang Island and tadpoles were found coexisting with the introduced fish (Hamer *et al* 2002). The study concluded that habitat creation projects for the GGBF were more likely to succeed if wetland habitat is created in proximity to an existing population (Hamer *et al* 2002).

c) Fish Passage

Currently fish passage between Marton Park Wetland and Quibray Bay is significantly restricted as connection is via a box culvert (1.5m x 0.9m) under Captain Cook Drive which flows into a trapezoidal open channel before reaching Quibray Bay. The culvert upstream invert is approximately 0.65m AHD which restricts the amount of saline water that can enter the wetland and essentially blocks fish passage between the wetland and Quibray Bay.

d) Buffer Zones and Connectivity

Marton Park Wetland is recognised as a significant part of an east - west wildlife corridor between Botany Bay National Park and Towra Point Nature Reserve (DECC 2009). The Kurnell village corridor recognised by DECC (2009) as Corridor 10, includes a variety of vegetation types and road side vegetation and local resident's gardens. The wetland is recognised as supporting a diverse range of wetland habitats that are important for a large number of birds and amphibians and a refuge for fauna (DECC 2009). The corridor does contain disturbed areas and will depend on community cooperation including appropriate dog and cat management and creating a continuous link of vegetation in gardens suitable for use by a range of native animals such as small birds and mammals (DECC 2009).

Marton Park Wetland does contain buffer vegetation in the form of landscape plantings, Casuarina woodland and weed plumes on the terrestrial edges. The buffers vary in width and they vary significantly in condition. Along Solander Street the buffer is formed by a single row of trees on a roadside verge before a steep berm drops over 1 metre to

the wetland. A similar situation occurs adjacent to the Caltex car park where a single row of small trees or shrubs occur between the wetland and parking space.

On the edge of the wetland adjoining Marton Park a buffer zone over 10 metres wide supports landscape plantings and in some areas weeds, including lantana. Along Shepherd Street between Captain Cook Drive and Cook Street a wider terrestrial buffer is formed however it is subject to significant weed invasion. A weed infested terrestrial edge also occurs between the wetland and the Kurnell Industrial Estate. A narrow grass strip is present on the eastern boundary between the wetland and the Caltex Refinery. The southern boundary to the refinery does not contain a buffer; rather a steep berm is present between the refinery and the wetland that supports a number of weed species.

6.3 Conservation Significance of Marton Park Wetland

The overall conservation significance of Marton Park Wetland is considered high. The wetland forms habitat for a variety of threatened species listed at the state and national level. Of particular concern is the likely use of the wetland by the Green and Golden Bell Frog, considered endangered at the State level and Vulnerable at the national level. A key population of this species occurs on the Kurnell Peninsula and the area is the subject of a GGBF management plan.

The wetland contains two endangered ecological communities listed on the NSW TSC Act 1995:

1. Sydney Freshwater Wetland in the Sydney Basin Bioregion; and
2. Swamp Oak Floodplain Forest

Marton Park Wetland also provides important foraging habitat for a variety of migratory birds including seven species listed on the Convention on the Conservation of Migratory Species of Wild Animals (BONN), Chinese Australia Migratory Bird Agreement (CAMBA), Japanese Australia Migratory Bird Agreement (JAMBA) and Republic of Korea Australia Migratory Bird Agreement (ROKAMBA). Vegetation communities also provide foraging, shelter and breeding resources for a range of native species.

The wetland forms a recognised wildlife corridor between Botany National Park in the east and Towra Point Nature Reserve in the west (DECC 2009).

Marton Park Wetland also provides an important buffer for runoff and pollution between the residential and light industry of Kurnell and the internationally significant Towra Point Aquatic Reserve RAMSAR listed Wetland to the west.

Preliminary consideration of A Wetland Prioritisation Technique for the Sydney Metro Catchment Management Area (SMCMA) (Schaeper *et al* 2007) indicates Marton Park Wetland scores moderately on the wetland values assessment 18 out of a possible 24 or around 75%. The wetland however also scores moderately on the threat assessment a total of 15 out of 24 or around 62%. This would give Marton Park Wetland a medium condition and priority for rehabilitation.

7 HERITAGE VALUES

7.1 Literature and Database Review

A range of archaeological and historical data was reviewed for Marton Park Wetland and its surrounds. This literature and data review was used to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context. The review of documentary sources included heritage registers and schedules and archaeological reports.

Aboriginal literature sources included the Aboriginal Heritage Information Management System (AHIMS) maintained by the NSW Department of Environment and Climate Change (DECC) and associated files and catalogue of archaeological reports. Sources of historical information included regional and local histories, heritage studies and theses; parish maps; and where available, other maps, such as portion plans.

Searches were undertaken of the following statutory and non-statutory heritage registers and schedules:

Statutory sources:

- Aboriginal Heritage Information Management System (AHIMS) (NSW DECC);
- World Heritage List;
- The National Heritage List (Australian Heritage Council);
- The Commonwealth Heritage List (Australian Heritage Council);
- The Register of the National Estate (Australian Heritage Council);
- The State Heritage Register (NSW Heritage Office); and
- Heritage Schedule(s) from the Sutherland Shire Council Local Environmental Plan 2006.

Non-statutory sources:

- The State Heritage Inventory (NSW Heritage Office); and
- Register of the National Trust of Australia (NSW).

7.2 Field Assessment

At the time of field survey most of the Marton Park Wetland was inundated in approximately half a metre of water. Consequently a general survey in areas that were not inundated was conducted by archaeologists Deirdre Lewis-Cook and Bec Parkes in August 2009.

The study area was inspected from its outer boundaries for features such as dune systems and areas of archaeological sensitivity and potential archaeological deposit.

7.3 Aboriginal Context

7.3.1 Ethnohistory

The information available about the occupation and use of Botany Bay by Aboriginal people comes from a variety of sources. References to the Aborigines of the Sydney region are found in the journals, diaries and general writings of the early colonists, explorers and settlers. 'Natives' were one of the main subjects of interest to those who arrived in the First Fleet and 'all the journals contain frequent references to them' (Fitzhardinge 1961). Other information sources include reports, published documents and histories, oral information retained by the local Aboriginal community, and the traces of past generations left in the landscape of Botany Bay that have been identified and interpreted by archaeologists to provide a context for Aboriginal occupation of the area.

The exact boundaries between Aboriginal groups that existed in 1788 are impossible to reconstruct because of the lack of reliable data available from that time. There have been numerous attempts at mapping the pre-contact and contact territories of Aboriginal people in the Sydney region (Capell 1970, Eades 1976, Kohen 1986, 1988, Mathews 1901a, 1901b, Ross 1988, Tindale 1974). The primary data are limited, as the early observers (members of the First Fleet and settlers) did not document how Aboriginal people perceived of their own groups or how they differentiated themselves from one another.

The linguistic and tribal boundaries and size of areas attributed to the various Sydney region Aboriginal groups vary between different interpreters. Kurnell falls within Dharawal linguistic and/or tribal boundaries (Kohen 1986, Eades 1976, Ross 1988) and Gwiagal linguistic boundaries (Capell 1970). Meanwhile, Tindale has an Eora tribe, which was closely linked to the Tharawal (Dharawal) tribe, extending from the northern shores of Port Jackson to the edge of the plateau overlooking the Hawkesbury River and south to Botany Bay and the Georges River.

Contemporary reviews now place the Kurnell peninsula in the territory of the Gweagal band of the Eora people. The Eora spoke Dharawal and are known from early historical descriptions of encounters with Europeans along the Georges River and southern shores of Botany Bay (for example, Turbet 1989, Salt in Sutherland Shire Environment Centre web site www.ssec.org.au).

Today, Local Aboriginal Land Council boundaries are situated so that Marton Park Wetland is located entirely within the boundaries of La Perouse Local Aboriginal Land Council. That Land Council area extends south from Port Jackson to around Waterfall, and west around the shores of Botany Bay. Much of the Land Council's south-western boundary is delineated by the Illawarra Railway Line.

7.3.2 Kurnell Peninsula

Professional archaeological investigation began in the late 1980s when Byrne assessed shell middens adjacent to Lindum Road prior to a sand mining proposal (Byrne 1986; 1987a; 1987b).

Many of the Aboriginal sites recorded on the Kurnell Peninsula were identified in the course of surveys conducted by Smith and Rich in 1989 in the context of the *Aboriginal Sites on Kurnell Peninsula Management Study* (Smith et al 1990).

Recent studies conducted on the Kurnell peninsula include an indigenous heritage assessment for a proposed desalination pilot plant (Navin Officer Heritage Consultants 2005), a cultural heritage assessment for a proposed 132kV electricity cable (Navin

Officer Heritage Consultants 2006a) and an Aboriginal heritage assessment for the proposed desalination plant (Navin Officer Heritage Consultants 2006b).

Heritage assessments were conducted for the proposed Kurnell Desalination Plant site in 2006. The site was composed of two parcels of land, Lot 101 DP 1027438, and Lot 102 DP 1027438 (Navin Officer Heritage Consultants 2006b).

No Aboriginal sites or objects were recorded in the course of the 2006 field survey of Lot 101. Site #52-3-1232 was not re-located and it was presumed to have been destroyed.

Three Aboriginal sites had been previously recorded as occurring in Lot 102. Two shell middens containing stone artefacts and associated stone artefact scatters (sites 52-3-214 and 52-3-217) were recorded sometime in the 1980s, and an open artefact scatter (site 52-3-370) was recorded in 1987. Lot 102 was the subject of systematic archaeological survey in 2004 (Jo McDonald CHM 2004) and archaeological subsurface testing in 2005 (Jo McDonald CHM 2005). Neither of the two previously recorded sites was re-located in the context of the 2004 field survey. No Aboriginal archaeological or cultural deposits were identified in the course of the excavations. No Aboriginal sites or objects were recorded in the course of the 2006 field survey of Lot 102.

In April 2007 Navin Officer Heritage Consultants conducted an archaeological assessment of the Kurnell section of the Desalinated Water Delivery Infrastructure Project. The assessment included surface survey and a review of environmental, historical and archaeological information. No Aboriginal archaeological sites or objects were located on the Kurnell Peninsula; however one area of potential archaeological deposit, *Kurnell Pipeline PAD*, was identified in the area.

In August 2007 a cultural heritage assessment was conducted for the Kurnell STS by Navin Officer Heritage Consultants to determine the nature of site 52-3-0212 and the implications of potential Aboriginal heritage within the development area.

7.3.3 The Study Area

No Aboriginal sites have previously been recorded within Marton Park Wetland.

7.4 Historical Context

7.4.1 Historical Overview

The European history of Botany Bay has been well documented in numerous books, reports and articles. A summary history only is provided here, with particular reference to information relevant to Marton Park Wetland.

a) The Explorers

Kurnell is, to many, one of the most historic localities in Australia. When Captain Cook first entered Botany Bay in April 1770, he landed on its southern shore at Kurnell. However, it was his reports of the northern shore that steered future events. Cook mapped the whole of the Bay and much of the hinterland, including the La Perouse peninsula. His shore party discovered a fresh water stream flowing into the Bay on its northern shore, west of Bare Island, (Randwick and District Historical Society 1989:3).

On bringing the First Fleet into Botany Bay 18 years later, Captain Arthur Phillip sought the stream from Cook's report. Less impressed with the Bay than Cook, on 26 January 1788, Phillip sailed for Sydney Cove, which offered a more sheltered anchorage. As he was preparing to depart, the French navigator, Jean-François de Galaup La Pérouse

(Comte de La Pérouse), sailed his ships *Astrolabe* and *Boussole* into Botany Bay, assisted by an officer of the First Fleet.

While Phillip founded the British Colony of NSW on the southern shore of Port Jackson, La Pérouse and his party erected a stockaded camp, including an observatory and garden on the peninsula near the present Frenchmans Bay, so named by Phillip to signify the landing place of the La Pérouse expedition. They stayed for about six weeks and were the first European residents of the area (Randwick and District Historical Society 1989:3-6).

Few visits were made to the shores of Botany Bay during the first years of the colony. Casual visitors included convicts, hunters, timber-getters and shepherds. Members of Phillip's staff and naturalists made periodic visits (Larcombe n.d.). Peron, a French voyager, visited the area in 1802.

b) Permanent European Settlement in Kurnell

From 1815 until 1899, the southern shore passed through the hands of a series of leaseholders and landowners, including John Connell, James Birnie, the Laycock family, and Thomas Holt. They successfully used it for various enterprises, such as dairying, market gardening, and running cattle, although none were especially successful.

James Birnie was the first to receive land on the southern shore of Botany Bay 27 years after the First Fleet departed, when in 1815 Governor Macquarie granted him 700 acres along with 160 acres of saltwater marshes. Early parish maps indicate that the study area, a low lying wetland basin, has always been swamp land, its use, defined as part of Birnie's 160 acres of salt water marshes, changing little since being owned by James Birnie (Figure 9).

Birnie set up a farm, market garden, and dairy and built a homestead, which he named Curnell toward the east of the Captain Cook Landing place memorial. There he installed his caretaker/manager while he perused whaling and other shipping interests from his Sydney home. In 1828, Birnie was declared insane and his estate was sold to John Connell. By 1838 almost the entire Kurnell Peninsula was owned by John Connell. Much of the area was heavily cleared, the timber being sold in Sydney.

Upon John Connell's death in 1849, the estate was handed down to his grandsons; however, in 1861 after financial hardship John Connell Laycock sold his land to Thomas Holt.

Figure 9 shows the approximate location of Marton Park Wetland (blue area) from 1913 (?) on the Land & Property Information (L&PI) Map no. 14039602.

This parish map and some earlier maps show that the general area surrounding the current study area has been salt water marshes and wetlands for a long time. The majority of these wetland areas have since disappeared owing to the development of Kurnell and changes in landuse patterns. The current study area, apart from vegetation clearing, has remained a wetland since Birnie's initial use of the land and has remained somewhat undisturbed.



7.4.2 Historical Investigations

Several investigations have been made into the historical heritage of Kurnell. Prominent among them are:

- A heritage study of the Shire of Sutherland in 1993 (Perumal Murphy Wu 1993);
- A Draft Conservation Management and Cultural Tourism Plan for the Cape Baily Lighthouse in 1999 for the NPWS (Graham Brooks & Associates Pty Ltd 1999); and
- A Heritage Issues Statement on the Cronulla Sewage Treatment Plant (Goddon Mackay Pty Ltd 1997).

Ten European heritage items have been recorded at Kurnell. These items include one nationally listed heritage item - the Kurnell Peninsula Headland. On 25 February 2005, the Minister for the Environment and Heritage, Senator Ian Campbell, announced the listing of the Kurnell Peninsula Headland on the National Heritage List maintained under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The place occupies an area of approximately 325 ha on the southern headland at the entrance to Botany Bay. It includes the Meeting Place Precinct, including Captain Cook's Landing Place, the coastal, landmark, sandstone, areas of Kurnell Headland between Sutherland Point in the north and Doughboy Head in the south, Endeavour Heights and sand dunes, including Botany Cove, in the southwest. The boundaries are defined by Botany Bay National Park and a small parcel of Sydney Water land at Potter Point (Figure 9).

The site was selected for recording on the National Heritage List due to its significance as the site of Captain Cook's first landing in Australia, and the site of the first recorded contact between indigenous inhabitants and British settlers. It was also the first site in Australia to be explored by British scientists, such as Joseph Banks. It is therefore considered to be of 'outstanding heritage value'.

None of these sites or areas falls within the current study area.

7.4.3 The Study Area

No historic relics have previously been recorded within Marton Park Wetland.

7.5 Aboriginal Participation

Marton Park Wetland falls within the boundaries of the La Perouse Local Aboriginal Land Council (LPLALC). This group was contacted by telephone and an invitation was extended to the Council to provide a representative to participate in the archaeological field survey of the study area.

Shane Ingre (LPLALC) subsequently participated in the field survey.

A Record of Aboriginal Field Participation is provided in Appendix E.

A copy of the archaeological report will be forwarded to the La Perouse Local Aboriginal Land Council for their information.

7.6 Results

7.6.1 Aboriginal Sites

No Aboriginal objects have previously been recorded within Marton Park Wetland.

No Aboriginal objects or areas of archaeological potential were identified within Marton Park Wetland in the course of the present investigation.

7.6.2 Aboriginal Cultural Values

Marton Park Wetland, together with Kurnell Peninsula is considered important by, and to, the local Aboriginal community.

7.6.3 Historical Sites

No historical sites have previously been recorded as occurring within Marton Park Wetland.

No historical sites, items, or areas of archaeological potential were identified within Marton Park Wetland in the course of the present investigation.

7.7 Heritage Values of Marton Park Wetland

Marton Park Wetland forms an integral part of the cultural landscape of southern Botany Bay, which saw some of the earliest observations of the continent by Europeans and some of the earliest contacts between Europeans and Aborigines on the east coast of Australia. The Aboriginal significance of the study area cannot, therefore, be separated from the significance and cultural values of the wider region and Botany Bay.

The Kurnell Peninsula has strong and special cultural significance to the Aboriginal community, both locally and amongst associated communities throughout NSW and particularly the NSW South Coast.

Although no cultural heritage sites have been identified within Marton Park Wetland, the area is considered important to the local Aboriginal community. Therefore, it is appropriate to consider the management of these cultural values in the context of the Marton Park Wetland Management Plan.

The anticipated future use of Marton Park Wetland is expected to be similar to current landuse patterns.

The retention and promotion of natural vegetation on landforms which are similar to the original forms, such as Marton Park Wetland, contributes to an appreciation of the landscape context of early Aboriginal settlement and the natural resources relied upon by its members

The retention of Marton Park Wetland also provides a resource for cultural education.

8 SOCIAL VALUES

The eastern part of Sutherland Shire including the Kurnell Peninsula where Marton Park Wetland is located is an established area of Sydney with a mixture of urban uses and activities, a wide range of which is focused on the natural features of the area (Woodward-Clyde, 1997). The area also has historical significance, contains a National Park and wetlands and a variety of manufacturing and processing industries (Woodward-Clyde, 1997). Kurnell also supports a population of approximately 2,110 residents (ABS, 2006).

It is important to gain the views, cooperation, commitment and participation of the community when preparing management plans. It can be seen from previous reports in the Kurnell area, such as the Cogeneration Plant Environmental Impact Assessment (EIA), that the community is concerned about a number of issues affecting their local area including environmental, economical, social health and safety and design as well as expressing a desire to remain informed throughout the process.

8.1 Existing and Potential User groups

Marton Park Wetland, despite being well known within community groups, is currently rarely used. Several community groups and other associated organisations were interviewed in regards to their use of the wetlands including:

- Sutherland Shire Council (SSC);
- Kurnell Progress Association;
- National Parks and Wildlife Service (DECC&W);
- Caltex Refineries NSW Pty Ltd; and
- Department of Planning (DoP).

At the time of plan preparation, contact was unable to be made with La Perouse Local Aboriginal Land Council and responses from Sutherland Shire Environment Centre have not yet been received.

The Department of Planning acquired 4.7ha of land within Marton Park for the purposes of Regional Open Space, however approximately 75% of this is managed by Sutherland Shire Council.

SSC has several bushcare groups that care for the Kurnell Peninsula, which includes Marton Park Wetland. One such group is the “Bushwackers” who invite the community to join in with weeding, planting and exploring bushland areas.

SSC has on occasion used the wetland as an educational resource for primary school students. A Council representative from their Environmental Science and Policy unit attended the latest “Water Tight Day” at the local school, Kurnell Primary, which used the wetland as a field trip destination. The students were involved in a day of activities relating to water conservation and the environment.

SSC also stated that the outcomes of this report would determine the extent of their use in the future based on environmental opportunities for education or other environmental programs within Council such as species and natural area protection.

Local schools are one future potential user of Marton Park Wetland for educational purposes as it provides an ideal environment to learn about water conservation, water quality and their importance to the local environment.

A large number of the groups surveyed about their use of Marton Park Wetland acknowledged that there were likely to be some local residents who use the area as a recreational walk.

The Caltex refinery which has been operating for more than 50 years owns part of Marton Park Wetland and staff members drive past the Marton Park Wetland to access the refinery site. Caltex also has refinery offices which overlook the wetland and a number of staff use the wetland recreationally for walking during breaks.

Currently, Caltex is involved in routine litter clearing and maintenance along the Solander Street side of the wetland and they also hold two environmental events each year. Clean Up Australia Day sees refinery staff removing litter and rubbish from outside the refinery including Marton Park Wetland and on World Environment Day staff participate in tree planting and weed removal within Marton Park Wetland. This activity has been coordinated with Sutherland Shire Council and is expected to continue.

The Caltex refinery also has future plans to relocate more offices to the grassed area on the southern side of the wetland so the future use of the area is expected to increase as the wetland becomes a backdrop to the working environment.

The number of users could be expected to increase as the area's profile is raised by the launch of the Kurnell 2020 project. The project, funded by the Australian Government's Caring for Our Country Community Coastcare program with in-kind support from SSC and the Sydney Metropolitan Catchment Management Authority, will aim to re-establish the vibrant bushland of the Kurnell Peninsula, including Marton Park Wetland.

Its aim is to improve existing vegetation and create biodiversity corridors. This project will include strategic planning and corporate engagement strategies, determining corridor locations and local consultation, on-ground work for weed management and plant nursery enhancements. It is timed to be completed for the 250th anniversary of Captain Cook's landing in 2020. The community is currently being urged to participate in the process.

Many of the groups surveyed stated that they would increase their use of Marton Park Wetland in the future if recreational facilities such as a boardwalk and lookout were installed there.

8.2 Value of Marton Park Wetland to the Community

From the literature and studies reviewed and responses received from the community groups, the value of Marton Park Wetland is varied, however there is potential for its value to grow in the future.

Many of the groups interviewed stated that they believed the overall social value to the surrounding community was fairly low because of a lack of environmental education in the area and misconceptions surrounding the wetland as a "*smelly, mosquito infested swamp*." The people who used Marton Park Wetland for walking and recreational purposes were the exception to this.

All groups interviewed stated that the value to the community in terms of specific environmental social values was extremely high. Its importance to the community is due to it having green bushland areas and biodiversity, and, as noted by DECCW, the presence of threatened species populations such as the Green and Golden Bell Frog. Caltex in particular also identified the valuable environmental contribution that Marton Park Wetland makes in setting an example of the environmental sensitivity of the area and the need for staff to operate in an environmentally sensitive manner.

In 2007 SSC carried out a Neighbourhood Interaction and Participation Survey which gives some insight into the use of parklands by residents in the Sutherland Shire.

13% of residents stated that they use parks as a place to socialise with friends or family. This is the same percentage that uses arts venues such as the cinema, theatres and galleries. This number has increased from 2.4% in 1997. Parks were identified by the 25 to 39 year age group as a being relatively more significant in terms of socialising for them than for other groups, probably as a result of this group's connection with the young family lifecycle stage (NIPS, 2007). The population profile for Kurnell indicates that age groups between 5 and 14 years and 25-54 years make up the two largest age group percentages (ABS, 2006). This appears to indicate that a large proportion of the Kurnell Peninsula is comprised of young families and therefore, there is opportunity to promote the value of the wetlands to these families in the future.

The proportion of Sutherland Shire respondents who walked daily has increased by almost 20% since 1997. At the same time the combined percentage of respondents who indicated they didn't or couldn't walk dropped by just over 13% from the 1997 figures (NIPS, 2007). This indicates that the percentage of residents who are walking daily is on the increase and areas such as Marton Park Wetland will be necessary in the future to accommodate these recreational users.

The survey also uncovered that 13% of Sutherland Shire respondents participated in bushcare or environment groups, a percentage which is up from 2.5% in 1997 (NIPS, 2007). A growing interest in environmental matters will also help to boost Marton Park Wetland's social value and use in the future.

8.2.1 Marton Park Heritage and Wetland Walk

In 2001 a proposal was developed by the Kurnell Residents Association to establish a Marton Park Heritage and Wetland Walk to be centred on Marton Park Wetland. The walk aimed to promote physical fitness, recognise and preserve heritage, advance reconciliation through acknowledgement of Kurnell as the first meeting place of Aboriginal and European cultures and to promote and raise awareness of the wetland and the need for conservation.

The need for the project was identified by surveys of the local community, consultation with youth groups and local committees and observations from community members. Two surveys were undertaken, the first aimed to evaluate needs of youth in Kurnell, while the second aimed to evaluate support for the walkway project.

The surveys revealed the top four needs for youth were a skate ramp, play ground equipment, basketball court and bike track. The Kurnell Youth Development Committee recognised the legal implications of a skate ramp and chose the heritage and wetland walk suitable for use as a bike track as an alternative. The second survey recognised almost 90% of the community surveyed supported the walkway.

The detailed proposal for the heritage and wetland walk was submitted to SSC with a request for funding, this was granted and the walkway was constructed. The existing walkway between Marton Park and the wetland is a component of this project and a direct result of this community and council initiative.

8.2.2 Community Wetland Display

As this Management Plan has been in preparation the Kurnell community has responded with a display of information and visual materials about Marton Park Wetland at the art gallery located in Captain Cook Drive, Kurnell. This is a further indication of the local community's interest in and desire to promote Marton Park Wetland to the residents of Kurnell and visitors to the area.

8.3 Community Consultation

8.3.1 Approach

A community consultation program was undertaken as part of this Management Plan (Management Plan). The objectives of the program were to:

- identify values of the wetland to the community
- gain an understanding of community attitudes towards the wetland; their likes and dislikes; and
- provide an opportunity for community members to offer suggestions on how the wetland could be improved.

Involving the community in the preparation of the Management Plan ensures the plan reflects the needs and concerns of those who have an interest in the future of Marton Park Wetland.

A number of techniques were used to facilitate communication between the community and the study team during the preparation of the Management Plan. These included:

- phone interviews with known user groups;
- distribution of a newsletter to the residents of Kurnell and making it available for download from the Molino Stewart website;
- day to day contact through the provision of a contact name, phone number and email address; and
- two community workshops at the Marton Park Community Hall.

The first workshop was held during the preparation of the draft Management Plan so the community could directly indicate their likes and dislikes to the study team and provide input into the management strategies by identifying how they thought the wetland could be improved.

The second workshop was held after the preparation of the draft Management Plan to provide the community with an opportunity to comment on the draft document.

8.3.2 Results

A total of fifteen people attended the first workshop, held at Marton Park Community Hall. They included members of the local community, a representative of Caltex Refineries Pty Ltd, Council staff and members of the study team. A short presentation on the Management Plan process and studies being undertaken was provided by Molino Stewart and WMAwater. A series of historical aerial photos of Marton Park was also presented, dating as far back as 1943. The community members then broke into two groups to address the following questions:

- what they liked most about the wetland;
- what they liked least about the wetland;
- how they thought the wetland could be improved.

Participants were asked to list these things and, where possible, rank them in order of priority. While listing responses came relatively easy to the group, ranking proved difficult and it was considered a matter of personal preference.

Specific features which attract people to the wetland included birds, the area of open water, the She Oaks and reeds and sedges, frogs, educational opportunities including the new signs, the pleasant view, the presence of bird and wildlife habitat, and the recreational value of being able to walk around the wetland. These factors were largely common to both groups.

There was general agreement among and between groups on things they did not like about the wetland, a clear response being a sense of neglect of the wetland over many years and the presence of weeds. Other things people disliked about the wetland included the presence of fill material and blocked drainage paths that impede the natural flow of water through the wetland. Litter, vandalism and a lack of bins and toilet facilities were also things people disliked.

In response to the final questions on improving the wetland it was sometimes difficult to separate the wetland from the adjoining Marton Park area. However a number of the issues raised have a direct bearing on the wetland and so are included here. Suggestions to improve the wetland included:

- Extending the existing walkway all around the wetland (there was a belief this would lead to greater community appreciation of the area);
- Involve more young people in the wetland (for example through school based programs);
- Increased rubbish and litter removal;
- Provision of a viewing platform (although one resident indicated this would be a waste of money);
- Remove the blockages to water flow through the wetland;
- Provision of better facilities in the park including high visibility toilets;
- Clearing of rubbish and weeds from around the edge and let the wetland maintain itself;
- Restrict vehicular access to Marton Park;
- Police alcohol free zones;
- Commitment from Council to implement the plan and maintain the wetland.

The final workshop session involved participants coming back together as one large group to present and discuss their responses to workshop questions. The participants then made some further recommendations regarding the Management Plan.

- Marton Park Wetland should be promoted in the local press and the SSC website;
- The adopted Management Plan for Marton Park should be promoted across the Sutherland Shire;
- That broader community participation/land management projects should be championed at Kurnell and promoted for Marton Park Wetland.
- The example for this last point was Clean Up Australia and the groups recognised the need for a local champion to promote the initiative for the whole wetland.

The second community workshop saw 16 people come along to the Marton Park Community Hall including representatives from the Kurnell Progress Association, the Kurnell Artists Cooperative, the broader local Kurnell community, Council staff and members of the study team. A short presentation summarising the management strategies was provided and the meeting then broke into groups to discuss the strategies they were concerned with in more detail.

Discussions focussed on the strategies related to the management forum, the extension of the access track, weed eradication and bush regeneration.

The workshop participants embraced the idea of a management forum and who would be appropriate members and how a working model could be established taking into account established community groups including the existing road management committee. The merits of the Kurnell Peninsula wide approach to environmental management were also discussed.

Participants also identified the need for Council to secure appropriate funding to initiate the weed eradication and bush regeneration activities outlined in the plan. Use of the stormwater levy to fund these management activities was raised. Also engagement with Scott Morrison Federal MP for Cook was discussed as a source of funding for the implementation of the plan. Discussion also focussed on the route of the proposed walkway extension and the appropriate signage.

Consideration to the engagement of Kurnell Primary School students and local High School students in Bushcare programs was also put forward during discussions. Overall the community were very enthusiastic about the Marton Park Wetland Management Plan and much discussion focussed on the practical measures required implementing the management strategies. The evening concluded with a visual presentation of photographs of Marton Park Wetland and surrounds taken by the local photographer and member of the Kurnell Artists Cooperative.

9 OPPORTUNITIES AND THREATS TO MARTON PARK WETLAND

9.1 Opportunities

The information presented so far in this Management Plan reveals that the threats to Marton Park Wetland are significant; however there are also opportunities to build on existing initiatives and activities to address not just the results but the causes of these threats. A number of management strategies and actions can be used to build the capacity of owners, managers and neighbours to the wetland to assist in improving the condition of the wetland now and in the longer term. Key among these are:

- A coordinated approach to wetland management;
- Environmental education for sustainability;
- Building community participation and capacity; and
- Extending community access.

9.1.1 Coordinated Wetland Management

The Kurnell Peninsula is the focus of a variety of environmental initiatives that are directly linked to Marton Park Wetland. These include the Kurnell 2020 project which focuses on the creation of wildlife corridors across the peninsula, the SMCMA and SSC feral pest eradication programs and the SSC Bushcare and Greenweb initiatives. DECCW is also responsible for implementing management plans for the GGBF and the Towra Point RAMSAR listed wetland. The La Perouse LALC has a role in promoting and protecting Aboriginal heritage values. Other initiatives include Shorebirds 2020, a reinvigorated monitoring program that is a collaborative enterprise between Birds Australia, The Australasian Wader Studies Group (AWSG), WWF-Australia and the Australian Government's Natural Heritage Trust. These initiatives all have some bearing on Marton Park Wetland and the implementation of management strategies and actions presented in this plan. A coordinated approach to management on the Kurnell Peninsula will lead to significant cost savings and better environmental outcomes for Marton Park Wetland and the broader Kurnell Peninsula. As a result this Management Plan proposes a management forum made up of all these stakeholders and the Kurnell community to ensure a coordinated approach to management, monitoring and research.

9.1.2 Education for Sustainability

Environmental education for sustainability goes beyond informing the community about the values of the wetland and provides them with skills to take action to address threats to the wetland. Initiatives in this area suitable for Marton Park Wetland include a review of existing signage. Installation of additional signage at various points along a wetland boardwalk that presents the features and functions of that area of the wetland and opportunities for residents to participate in recognising birds, plants and other fauna that may use the wetland. Other suitable environmental education for sustainability initiatives would include a series of workshops providing residents with skills to contribute to improved condition of the wetland, this could include but not be limited to: the management of properties with stock and gardens to minimise polluted runoff into the wetland; management of chemicals and fertilisers in Kurnell to safeguard the wetland; management of light industry activities to safeguard the wetland; local gardens contributing to the Kurnell Village wildlife corridor.

9.1.3 Building Community Participation

Caltex Refineries NSW Pty Ltd currently undertakes two environmental initiatives that focus on Marton Park Wetland: celebration of World Environment Day and Clean Up Australia Day. The Management Plan supports wider community participation in these environmental initiatives through publicising the events, providing incentives for local residents to participate in these events (for example native plant tube stock for their gardens) and a direct link between these activities and achieving management objectives set out in this Management Plan for example clean up activities in areas earmarked for walkway extension and weed eradication.

9.1.4 Extended Community Access

The Marton Park Heritage and Wetland walk is a community initiative that has been realised and proves to be a focus for recreation in the township of Kurnell. The community consultation for this plan revealed a desire by the community for access around the wetland to be extended. Extension of the walkway (in the form of a boardwalk) in sections from Captain Cook Drive to Cook Street, then from Cook Street along the rear of the Kurnell Industrial Estate and then along the edges of the Caltex Refinery (wetland side of the fenceline) to the Caltex car park and then back down Solander Street to Captain Cook Drive would provide extensive opportunities for recreation and environmental education through signage and exposure to the different aspects of the wetland.

9.2 Threats

9.2.1 Catchment Practices

Marton Park Wetland has a role in filtering the nutrient rich urban and industrial runoff from the residential and industrial areas of Kurnell before it reaches Quibray Bay and the Towra Point Aquatic Reserve RAMSAR wetland. A variety of land management practices in the catchment can contribute to diffuse pollution of the wetland by nutrient / pollutant enriched run off including use of domestic garden fertilisers, use of household chemicals, stocking of properties with horses and domestic pets. A number of contaminants associated with vehicles and run off from local roads can also contribute to nutrient rich run off. Point source pollution can occur due to unregulated or accidental releases of waste water or stockpiled materials including petrochemicals in the wetland catchment. Increased nutrients can contribute to weed invasion of the wetland and reduced water quality.

9.2.2 Weeds

Weed invasion is a major threat to Marton Park Wetland. Extensive and dense infestations of lantana occur on the edge and within the wetland. The terrestrial edges of the wetland around Cook Street support a variety of weeds a number of which are declared noxious weeds in the Sutherland Shire including lantana and Blackberry. Aquatic weeds did not appear extensive at the time of winter survey however the noxious Water Hyacinth has been recorded from the wetland in the past. Weed infestation reduces the long term viability of the vegetation communities and the endangered ecological communities of the wetland and compromises fauna habitat values.

9.2.3 Decreased Water Quality

Unregulated or accidental releases of contaminants from the adjoining Kurnell Industrial Estate and oil refinery are a potential threat to the health of the Marton Park Wetland System. The direct hard surface link between the Kurnell Industrial Estate and the wetland means that any release of contaminants from the industrial estate will flow directly into the wetland. The runoff from industrial areas within the Caltex Oil Refinery adjacent to the wetland is bunded, with all runoff treated and discharged to Botany Bay. Run off from the car park and administration areas flows directly into the wetland. The wetland is also vulnerable to groundwater contamination. When the water level is high contaminants from the surface water may enter the groundwater. The reverse may happen when the water level is low. The primary threat to the wetland water quality however is from surface water, as it will reach the wetland quickly. Pollutant transfer via groundwater is orders of magnitude slower than from surface water. It is possible that groundwater contamination caused decades ago could be leaching out now.

The various types of substances pose different threats to the wetland and take different times to break down in the natural environment. The most serious threat is posed by the release of heavy metals into the wetland system that take an extended time to breakdown and pose a threat to wetland and human health. The value of wetland plants in phytoremediation, or the removal of pollutants, including heavy metals from the natural environment is well recognised (Kumar Rai 2008). However there are limits to the capacity of wetlands to remove pollutants and care must be taken to avoid repeated and long term exposure of Marton Park Wetland to toxic pollutants.

9.2.4 Potential Modification for Flood Mitigation

Although not recommended in the current Kurnell Township Flood Study (WMAwater 2009) modification of Marton Park Wetland for flood mitigation presents a number of potential threats. Disturbance of the wetland substrate may result in exposure of acid sulphate soils with associated negative environmental impacts. Alteration of the hydrological regime can alter the floristics and structure of vegetation communities and fauna habitats. Any increase in the size of outlet pipes would provide increased tidal exchange as sea level rises due to anthropogenic climate change. This would in effect salinise the wetland risking the health of endangered ecological communities and threatened species such as the GGBF.

9.2.5 Anthropogenic (human induced) Climate Change

The impacts of human induced climate change on the Kurnell Township and Marton Park Wetland have been assessed (WMAwater, 2009). The impacts may include increased rainfall and elevated ocean levels. The specific impacts on Marton Park Wetland may only become clear as new research emerges and climate change occurs over time, however alteration to salinity levels in the wetland may alter vegetation and fauna assemblages and result in the demise of the existing endangered ecological communities.

9.2.6 Feral Pests

The presence of feral pest including feral cats, foxes, rats and rabbits can negatively impact on the native fauna species that utilise the wetland through predation. Rabbits can also negatively impact on regeneration and revegetation activities.

European Carp have also been introduced to the Sutherland Shire and pose a potential threat to the aquatic environment of Marton Park Wetland. The bottom feeding habit of

Carp increases water turbidity, making it unsuitable for many native species and Carp can compete with native fish species. Mosquito Fish also pose a threat to native species in Marton Park Wetland; they prey on young native fish and tadpole species and are a recognised threat to the nationally vulnerable Green and Golden Bell Frog.

Feral Rusa Deer are also known from the Kurnell Peninsula, originally from the Royal National Park this species have spread into many suburbs of the Sutherland Shire and have the potential to establish a small herd on the Kurnell Peninsula. This species grazes on young shoots and seedlings disrupting revegetation after fire. Deer can also ringbark trees when scraping juvenile skin from antlers and pose a significant potential threat to the vegetation communities and fauna habitats of Marton Park Wetland.

Unregulated use of the wetland by domestic dogs and cats also poses a threat to native fauna. Due to the use of the wetland by water fowl species as a breeding habitat the risk posed by feral pests is high.

9.2.7 Rubbish Dumping

There is some evidence of rubbish dumping and littering in Marton Park Wetland. This issue is not severe at the current time but continued rubbish dumping and particularly dumping of garden waste into the wetland has the potential to exacerbate the threats presented to vegetation communities and fauna habitats by weeds and to further degrade the terrestrial edge of the wetland.

10 MANAGEMENT STRATEGIES

10.1 Management Strategies

The management strategies below have been developed to take into account the threats and opportunities presented in the previous sections and to provide a basis for clear specific management objectives.

- To develop a management forum;
- To maintain or improve the quality of water flowing through the wetland;
- To reduce weed infestation in the wetland;
- To safeguard the hydrological function of the wetland and plan for climate change;
- To conserve and maintain existing native vegetation,
- To conserve and enhance habitat values;
- To enhance appropriate public access to the wetland
- To conserve Aboriginal and European heritage values;
- To provide environmental education, and promote awareness and action to support the management of the wetland;
- To encourage appropriate scientific research.

These are now elaborated upon.

10.2 Management Forum

10.2.1 Objectives

- Develop a management forum to review the results of monitoring and revise management objectives and actions and ensure a coordinated approach to management, monitoring and research of Marton Park Wetland and across the Kurnell Peninsula.

10.2.2 Actions

- Identify and fund a lead authority to manage the forum;
- Formally invite key stakeholder groups to be part of the forum (these would include but not be limited to: Sutherland Shire Council; Kurnell Progress Association; la Perouse Local Aboriginal Land Council; National Parks and Wildlife Service (DECCW); Caltex Refineries NSW Pty Ltd; Sydney Metro Catchment Management Management Authority; and Department of Planning (DoP)) Birds Australia;
- Devise how the forum will operate, possibly as an email group or internet forum with meetings as required;
- Agree on terms of reference for the forum – for example: review monitoring data for Marton Park Wetland as it becomes available; provide comments on

appropriate revisions to management strategies and actions; share research results gathered on the Kurnell Peninsula to inform management of Marton Park Wetland and achieve broader aims such as consolidation of Marton Park Wetland as a wildlife corridor and as a filter for Towra Point Aquatic Reserve RAMSAR Wetland; and respond to and support community concerns and initiatives.

10.2.3 Performance Targets

- Lead authority identified and suitably resourced;
- Formal invitations issued to join the management forum;
- Forum meeting held within first year of management plan operation;
- Forum input into review and updating of management strategies and actions.

10.2.4 Funding Sources

- Sydney Metro CMA Kurnell 2020 project;
- NSW Environmental Trust Environmental Research grants;
- NSW Environmental Trust Environmental Education grants;
- Australian Government's Natural Heritage Trust.

10.3 Water Quality

10.3.1 Objectives

- Reduce diffuse and point source pollution of Marton Park Wetland;
- Manage and construct access trails to control erosion and sediments.

10.3.2 Actions

- Establish a water quality monitoring program for Marton Park Wetland. This program should be based on SSC's Strategic Water Quality Monitoring Program and include the basic parameters recorded for this study;
- Monitoring should also be undertaken and a record kept of the amount of litter, organics and suspended solids removed from the pollutant trap at the stormwater entry point at the end of Cook Street;
- Monitoring should be undertaken every six months;
- Water quality monitoring results should be made available directly to the local community and industry neighbours;
- Engage the community in a communication, education, public awareness and action program focussing on the their roles and actions that can reduce diffuse and point source pollution into the wetland for example use and storage of chemicals and fertilisers only as directed, collection and reuse of horse manure and appropriate disposal of dog droppings in and around the wetland;

- When monitoring results indicate recommended water quality parameters have been exceeded, engage with local residents, industry neighbours and refer to the management forum to discuss actions that can be undertaken in response with a focus on education and action to increase water quality;
- Incorporate stormwater pollution prevention messages into interpretative signage and/or brochures developed for Marton Park Wetland;
- Ensure any track extension minimises erosion and incorporates appropriate sediment and erosion control measures during and post construction;
- Install filter strip plantings at the inlet locations of the wetland (using locally endemic native wetland species -not Typha);
- Construct gross pollutant and sediment traps or stormwater treatment devices at inflow points to the wetland (Cook Street inlet should be updated as a priority and a continued maintenance program be implemented).

10.3.3 Performance Targets

- Water quality monitoring program established;
- Reduction in the level of contaminants in Marton Park Wetland's surface water to achieve compliance with SSC's Strategic Water Quality Monitoring Program;
- Communication of water quality monitoring program results to wetland owners and neighbours;
- Reduction over time in the amount of litter, organics and suspended solids removed from the pollutant trap at the stormwater entry point at the end of Cook Street;
- Installation of filter strip planting at stormwater inlet locations.

10.3.4 Funding Sources

- NSW Environmental Trust Environmental Research grants;
- Sutherland Shire Council's Stormwater levy fund.

10.4 Hydrology and Climate Change

10.4.1 Objectives

- Protect Marton Park Wetland's flood mitigation role for the Kurnell township;
- As a short term objective, protect Marton Park Wetland from the impacts of climate change and therefore maintain its current fresh water state;
- As a longer term objective: assess how to manage Marton Park Wetland from climate change and a greater tidal range.

10.4.2 Actions

- Promote drainage management strategies that do not increase tidal exchange with Marton Park wetland;
- Monitor the impacts of changes in hydrology on flora and fauna;

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- In the short term the current hydrological regime and tidal range should be maintained;
 - Council should assess the risk to the wetland from climate change when there is more certainty in the predictions. Council should assess in five years time, based on the most up to date climate change science;
 - Identify similar wetlands along the NSW coast which are subject to greater risk from climate change and will be affected by elevated ocean levels before Marton Park Wetland. Council should monitor their response to elevated ocean levels and management strategies implemented for these wetlands;
 - Evaluate installation of a height adjustable weir at the outlet of the wetland to Quibray Bay, as a means of wetland management in the future climate;
 - In the longer term a management plan for the wetland will be needed which deals with rising sea levels and increased tidal influence.

10.4.3 Performance Targets

- Maintain the current hydrological regime (ie. the wetland should remain freshwater and a minimal tidal regime). Water quality monitoring should include Electrical Conductivity (EC) to develop good baseline EC data so any changes in the tidal influence can be noted.
- Impacts of changes in hydrology on flora and fauna quantified;
- The risk to Marton Park wetland from climate change and climate change science/literature to be assessed in five years.

10.4.4 Funding Sources

- Department of Environment, Climate Change and Water;
- Sydney Metropolitan Catchment Management Authority;
- Sutherland Shire Council.

10.5 Vegetation Communities

10.5.1 Objectives

- Conserve native vegetation communities including Sydney Freshwater Wetland and Swamp Oak Flood Plain Forest endangered ecological communities listed on the TSC Act 1995;
- Reduce weed infestations in the wetland.

10.5.2 Actions

- Conduct a thorough floristic survey of the wetland and reconcile/verify existing plant species lists;
- Implement vegetation management strategies as appropriate that are consistent with the priority actions identified for the EECs (Appendix D);

- Take into account the presence of significant species and communities and their ecological requirements in all management activities (including flood mitigation and weed management);
- Develop, consolidate and maintain links among SSC, the SMCMA and Botany Bay National Park (management forum) to share strategies and scientific research results to improve vegetation management strategies (particularly of endangered ecological communities and threatened or regionally significant plant species) in the wetland and on the Kurnell Peninsula;
- Undertake appropriate weed control and bush regeneration activities to safeguard native vegetation communities (see section 10.7).

10.5.3 Performance Targets

- Completion of floristic survey of Marton Park Wetland using plot based survey methodology;
- Revision and updating of existing plant species list for the wetland;
- Interaction among SSC, the SMCMA and Botany Bay National Park to share knowledge and experiences on management of vegetation communities on Kurnell Peninsula (attendance at management forum);
- Reduction in weed infestation density in wetland vegetation communities;

10.5.4 Funding Sources

- Sydney Metro CMA Kurnell 2020 project;
- NSW Environmental Trust Environmental Research grants.

10.6 Weeds

10.6.1 Basic principles

A number of fundamental principles apply when considering the removal of weeds from Marton Park Wetland. These are listed below.

- No herbicide spraying – herbicides are potentially toxic to the Green and Golden Bell Frog (GGBF);
- Begin weeding activities in areas of high biodiversity value and move toward vegetation of lower condition;
- Work from isolated weed infestations toward core infestations;
- Protect the healthier native vegetation and habitats of rare fauna and flora first;
- Work down the slope so that seeds are not being washed down onto previously weeded areas;
- Work in stages. The size of the area targeted at each stage should be manageable enough to follow up thoroughly;
- Select the most suitable control method in each area, to avoid damage to native vegetation and waterways, plan appropriate disposal of weed material;

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- Utilise existing noxious weed management plans available for weeds in the SSC local government area, but with special consideration of the danger of spraying herbicides to the GGBF;
 - Prepare a weed management calendar to maximise the effectiveness of control activities and protect native species.

The location and density of weed plumes are shown on Figure 8. These weed plume zones have been developed to demonstrate weed density and guide weed removal stages. In the practical implementation of weed management activities it is envisioned these zones would be broken into sub zones to enable effective management.

Weed removal includes primary (first time), secondary (follow up) and maintenance (long term) weeding. Vegetative waste including native tree branches should be retained and mulched and utilised onsite. Vegetative waste containing weed propagules should be removed from site and disposed of at an appropriate waste disposal facility.

Weed removal and bush regeneration techniques are likely to change over the life of this plan. The most up to date weed removal and bush regeneration and revegetation techniques should be used and these should be considered carefully in light of the potential use of the wetland by the GGBF.

10.6.2 Objectives

- To reduce weed infestations in Marton Park Wetland
- To promote regeneration of and revegetation with native species

10.6.3 Actions

- Identify the appropriate person within Council to oversee weed removal and bush regeneration in the reserve;
- Secure funding for preparation and implementation of weed management plan;
- Commission a qualified bush regeneration contractor to prepare and implement a weed management plan for Marton Park Wetland;
- Use the management forum to communicate and coordinate among all stakeholders to implement a wetland wide weed eradication and bush regeneration strategy;
- Promote Marton Park Wetland into SSC's Bushcare program to provide opportunities for local residents to join existing programs on the Kurnell Peninsula (Bushwackers) in weeding and bush regeneration activities;
- Consider the inclusion of Kurnell Primary School into SSC's Schools in Greenweb program to facilitate school student's involvement in wetland management;
- Review and update weed removal and regeneration/ replanting efforts based on the results of initial weeding activities.

10.6.4 Specific Actions for Weed Control in Marton Park Wetland

- Select weed plume/plumes for initial primary weeding activities based on weed density mapping provided in the Management Plan;

- Priority should be given to the densest weed plume containing lantana (see Figure 8) between the inlet at Captain Cook Drive and Cook Street;
- Second priority should be given to the eradication of Coral Trees and lantana infestation between the inlet at Cook Street and the Caltex Refinery behind the Kurnell Industrial Estate;
- Third priority to weed maintenance along the landscaped edge between the wetland and Marton Park
- Fourth priority to sparse weed density zones on the Marton Park edge of the wetland and the Caltex Refinery border;
- Final priority should be given to other terrestrial edges of the wetland for weed control and monitoring;
- Divide weed plume zones into sub zones to enable effective weed removal and ongoing management.
- Undertake primary, secondary and follow up weeding of lantana and coral tree infestations in Marton Park Wetland using appropriate weed removal techniques over the life of this plan.
- Primary, secondary and follow up weeding of weed plumes associated with inlets into the wetland should be carried out;
- Install filter strip plantings (grown from seed collected from local native species) at the inlet locations of the wetland;
- Collect seed for revegetation from vegetation communities on site and have a local nursery or suitably qualified contractor raise seed to tube stock. Undertake revegetation of filter strips with local species and *Casuarina* woodland areas with endemic trees and shrubs to create a multi layered forest;
- Bush regenerators maintain a watching brief for infestations of aquatic weeds in the wetland including but not limited to Water Hyacinth and take appropriate action as required;
- Bush regenerators should develop a protocol for weeding in the wetland habitats and have an understanding of the hygiene protocol for the control of disease in frogs (NSW NPWS 2001).

10.6.5 Performance Targets

- Commissioning of a qualified bush regenerator/ bushland manager to develop and implement weed management plan and bushland management in Marton Park Wetland;
- Reduced weed densities in Marton Park Wetland vegetation communities;
- Bushcare program initiated at Marton Park Wetland and with a reasonable number of participants;
- Kurnell Primary School participating in SSC's Schools in Greenweb program at Marton Park Wetland
- Primary weeding undertaken in weed infested areas;
- Locally endemic native species raised from seed for planting in endangered ecological communities and as filter strips at stormwater inlets;
- Secondary and follow up weeding of weed infested areas;
- Revegetation of *Casuarina* Woodland.

10.6.6 Funding Sources

- Sydney Metro CMA Kurnell 2020 project;
- Weed Management Strategy for the SMCMA 2007 – 2011
- SSC Green Web program;
- SSC Bushcare program;
- NSW Environmental Trust Environmental Research grants.

10.7 Habitat Values

10.7.1 Objectives

- To protect native fauna and enhance fauna habitats in Marton Park Wetland by maintaining natural processes, mitigating human impacts and reducing weeds;
- To protect and enhance fauna habitat values for native species and significant species listed at the state and national level;
- To promote habitat values for the Green and Golden Bell Frog (GGBF).

10.7.2 Actions

- Undertake weed removal and bush regeneration within fauna habitats of Marton Park Wetland as outlined in the section 10.7;
- Consider fauna habitat values at each stage of weed eradication and bush regeneration activities. Consider a staged approach to weed eradication so that some fauna habitat attributes are replaced prior to complete removal of weed habitat;
- Ensure bush regenerators have a protocol for the removal of weeds and rubbish with fauna habitat attributes e.g. shaking of lantana stalks prior to manual removal, searching under ground cover weeds for reptiles and amphibians prior to removal;
- Ensure bush regenerators are familiar with the hygiene protocol for the control of disease in frogs (NSW NPWS 2001) and that this is applied when dealing with amphibians;
- Ensure any revegetation is undertaken to maximise fauna habitat values for example planting in groups;
- Include private properties adjoining Marton Park Wetland into SSC's Greenweb program to contribute to achievement of east west wildlife corridor between Botany Bay National Park and Towra Point Nature Reserve;
- Undertake comprehensive fauna survey of Marton Park Wetland over several seasons to update existing fauna species list;
- Develop a long term fauna survey/monitoring program linked to refine existing species lists and monitor changes in populations;
- Develop partnerships with existing bodies implementing fauna management on the Kurnell Peninsula (eg DECCW GGBF Management Plan for the Key population at Kurnell; and Sydney Metro CMA Kurnell Corridors initiative);
- Monitor the presence of feral pest in Marton Park Wetland (see section 11.6);

- Incorporate Marton Park Wetland into SSC's Feral Animal Policy control initiative;
- Incorporate Marton Park Wetland into SMCMA feral pest eradication on the Kurnell Peninsula program.

10.7.3 Performance Targets

- Implementation of weed eradication and bush regeneration activities in Marton Park Wetland;
- Implementation of relevant protocols for the protection of fauna e.g. the hygiene protocol for the control of disease in frogs (NSW NPWS 2001);
- Fauna survey of Marton Park Wetland;
- All adjoining properties recruited into SSC's Greenweb program;
- Development and implementation of long term fauna monitoring program;
- Development of partnerships with State Government and their contractors implementing fauna management plans on the Kurnell Peninsula;
- Inclusion of Marton Park Wetland in feral pest eradication programs being undertaken by the SSC and SMCMA;

10.7.4 Funding Sources

- Sutherland Shire Council's Feral Animal Policy;
- Sydney Metro CMA Kurnell 2020 project;
- Weed Management Strategy for the SMCMA 2007 – 2011;
- NSW Department of primary Industries NSW Invasive Species Plan 2008-2015;
- NSW Environmental Trust Environmental Research grants.

10.8 Public Access and Signage

10.8.1 Objectives

- To enhance appropriate public access to Marton Park Wetland;
- To enhance environmental education through the provision of appropriate signage;

10.8.2 Actions

- Continue the walking track (raised boardwalk to safeguard wetland) in stages around Marton Park Wetland:
 - Captain Cook Drive and Cook Street;
 - Cook Street along the rear of the Kurnell Industrial Estate;
 - Edges of the Caltex refinery (wetland side of the fenceline) to the Caltex car park;
 - Link to Solander Street to captain Cook Drive (existing pathway.)

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- Consider installation of a bird hide or look out adjacent to the open water area of the wetland. The benefit of a lookout would need to be balanced against the potential negative impacts on disturbance of water fowl and migratory birds.
 - Install additional educative signage regarding the significance of Marton Park Wetland and simple measures residents and visitors can take to safeguard the values of the wetland specifically
 - retain the aerial photo, provide a short explanation of why Marton Park Wetland is important and how people can care for it and provide a council phone number for more information and to report any damage and provide separate regulatory signage;
 - installation of additional signage at various points along a wetland boardwalk that present the features and functions of that area of the wetland and opportunities for residents to participate in recognising birds, plants and other flora and fauna of the wetland.
 - Provide opportunities for the local community to have direct input into the style and route of the walkway;
 - Reduce weed density on the terrestrial edges of Marton Park Wetland to enhance recreational and education experience.

a) Signage Guidelines

- Consider revising existing signage the Sutherland Shire Environment Centre (2004) provides some principles for the use of signs, these include: the number of signs be kept to an absolute minimum; avoid clutter and visual vandalism; wording on signs should be brief, clear and complete; no unnecessary words should be used; signs may be used to inform, advise, direct, limit, restrict, warn, forbid and threaten;
- Information content on signage recommended by Sutherland Shire Environment Centre (2004) includes:
 - Advisory - for example, take all litter home, stay on the track, and do not remove flora and fauna.
 - Descriptive - Large map depicting routes in sub section on one side panel; smaller catchment map on the other panel; type of route and grading, features of interest.
 - Interpretive - e.g. indigenous, biodiversity, heritage related to the track as a whole and sub section in particular.
 - Regulatory - eg walking only or it is offence to light fires, dogs on leads etc.
 - Warning signs - eg Use track at your own risk and statements of the danger; for example risk of drowning from open water.
- The Sutherland Shire Environment Centre (2004) also provides detailed information on the design and layout of signs. Detailed suggestions on wetland signage and design are also provided by Wetland Link (2009).
- Sutherland Shire Council guidelines on signage should also be considered.

b) Walkway Guidelines

- A standard be adopted for construction of track works, consistent with the appropriate Australian Standards;
- treated pine is not recommended as a construction material:

- the design of raised walking tracks and all track structures should be carried out with regard to foundation bearing, live loadings and stability. Design should be in accordance with the applicable Australian Standards.

10.8.3 Performance Targets

- Approval for and construction of a walkway between Captain Cook Drive and Cook Street (Shepherd Street);
- Approval for and construction of a walkway between Cook Street along the rear of the Kurnell Industrial Estate;
- Approval for and construction of a walkway between edges of the Caltex refinery (wetland side of the fenceline) to the Caltex car park;
- Approval for and construction of a walkway link between Caltex car park and Solander Street;
- Installation of revised educative signage;
- Detailed consideration of installation of a bird hide adjacent to open water area of wetland.

10.8.4 Funding Sources

- NSW Environmental Trust Environmental Education Grants;
- SMCMA Kurnell 2020 project;
- Corporate sponsorship.

10.9 Heritage Values

10.9.1 Objectives

- Retain and promote the natural vegetation of Marton Park Wetland to contribute to appreciation of the landscape context of early Aboriginal settlement and the natural resources relied upon by its members.

10.9.2 .Actions

- The Marton Park Wetland be retained and managed to promote a healthy wetland ecosystem;
- Where necessary, a program of weed removal and promotion of native vegetation species should be conducted, ensuring that the local Aboriginal community are involved in the formulation and execution of the program;
- The Aboriginal history and cultural heritage of the area should be promoted, in consultation with the local Aboriginal community, and in such a way that the heritage values of the area are not degraded;
- The potential impact on cultural heritage values of proposed developments near to the study area should be adequately assessed prior to their approval;
- In the event that Aboriginal objects or historic relics are uncovered by maintenance or other works, such as weeding or vegetation clearing, then work

should cease in the vicinity of the find/s and advice sought (in the first instance) from the project archaeologist and then the NSW DECCW.

10.9.3 Performance Targets

- Implementation of weed eradication and bush regeneration program;
- Consultation by SSC with the local Aboriginal community on how to promote Aboriginal history and cultural heritage of the area;
- Adequate assessment of impacts of proposed adjacent developments on cultural heritage values of Marton Park Wetland;
- Cessation of work if Aboriginal objects or historic relics are uncovered in the wetland and advice sought (in the first instance) from the project archaeologist and then the NSW DECCW.

10.9.4 Funding Sources

- Department of Planning - Heritage Branch, Heritage Works Projects;
- Department of Planning - Heritage Branch, on ground interpretation works.

10.10 Community Environmental Education, Awareness and Participation in Wetland Management

10.10.1 Objectives

- To develop community awareness and sense of stewardship to reduce threats and encourage appropriate recreational uses of the wetland;
- To educate the community on the values of the wetland and provide them with skills and knowledge to contribute to wetland management;
- To provide opportunities for the community to be actively involved in wetland management.

10.10.2 Actions

- Invite local residents to be part of the management forum;
- Review signage at Marton Park Wetland,
- Develop a web page for Marton Park Wetland and update it with the results of monitoring programs, initiatives that are occurring on the Kurnell Peninsula, general information about the wetland, opportunities to be involved in Clean Up Australia Day activities and World Wetland Day Activities and with opportunities for residents and the public to record fauna and plant records;
- Engage the local community in the design and location of, and extension of, the current walking track
- Promote local community participation in bush regeneration activities within Marton Park Wetland under the supervision of a qualified bush regenerator;
- Promote Marton Park Wetland as a focus of education for sustainable development through engaging the local community in a series of

environmental education for sustainable development workshops covering but not limited to:

- land management to increase the quality of runoff from properties in Kurnell;
- management of chemicals and fertilisers in Kurnell to safeguard the wetland;
- management of light industry activities to safeguard the wetland;
- local gardens contributing to the Kurnell village/Marton Park Wetland Wildlife Corridor.

- Further environmental education could cover the community, primary school students and the broader public in initiatives that promote actions that care for the wetland (for example rubbish removal, appropriate access, bird census data collection, participation in monitoring, photographic competitions in association with the Kurnell Artists Cooperative and the Kurnell Art Gallery);
- Community suggestions include a Bushcare Officer from Council to work with the students at Kurnell Primary School to identify native plants and grow seedlings in a small greenhouse at the school which is not being used and engage local high school students in programs to care for the wetland;
- Promote and support broader local community participation in activities lead by Caltex Refineries NSW Pty Ltd including Clean Up Australia Day and World Environment Day;
- Promote and support community awareness and participation in World Wetlands Day on the 2nd February each year;
- Promote Marton Park Wetland to be the place of the Kurnell 2020 project with major initiatives for the project being launched from Marton Park Wetland precinct.

10.10.3 Performance Targets

- Revised signage installed at Marton Park Wetland;
- Community members join (Marton Park Wetland) management forum;
- Marton Park Wetland web page developed and launched;
- Community involvement in the design and location of the wetland walkway extension;
- Community involvement in bush regeneration program at Marton Park Wetland;
- Kurnell Primary student participation in identifying plants and growing seedlings;
- Local high school students involved in wetland care;
- Community participation with Caltex, SMCMA and SSC in Clean Up Australia Day and World Environment Day;
- Celebration of World Wetlands day at Marton Park Wetland;
- Utilisation of Marton Park Wetland as a focus for Kurnell 2020 project initiative launches.

10.10.4 Funding Sources

- Sydney Metro CMA Kurnell 2020 project;

-
- SSC Green Web program;
 - NSW Environmental Trust Environmental Education grants;
 - Corporate sponsorship.

10.11 Scientific Research

10.11.1 Objectives

- To encourage appropriate scientific research into Marton Park Wetland including climate change adaptation.

10.11.2 Actions

- Encourage the use of Marton Park Wetland for appropriate research which assists in managing the wetland's endangered ecological communities and threatened species and migratory species;
- Encourage climate change adaptation research into Marton Park Wetland and the broader Kurnell Peninsula and the opportunities to protect the internationally recognised Towra Point RAMSAR wetland;
- Encourage sea level rise risk assessment and adaptation studies for the township of Kurnell and Marton park Wetland
- Develop and consolidate links with other agencies that are implementing management plans on the Kurnell Peninsula (for example DECCW Management Plan for the Green and Golden Bell Frog; Sydney Metro CMA Kurnell Corridors project and pest management initiatives; SSC Green Web initiatives on the Kurnell Peninsula through the management forum;
- Utilise the management forum as a body to receive and distribute the results of scientific research relevant to the management of the wetland.

10.11.3 Performance Targets

- Research projects undertaken in Marton Park Wetland;
- Review of management of Marton Park Wetland based on the results of relevant scientific research.

10.11.4 Funding Sources

- Department of Environment, Climate Change and Water Climate Action Grants Program;
- NSW Environmental Trust Environmental Research grants.

11 MARTON PARK WETLAND MONITORING PLAN

11.1 Introduction

Monitoring of Marton Park Wetland will enable wetland managers to:

- Collect long term information on the success of management actions introduced as part of this Management Plan;
- Collect information on the quality of surface water in the wetland and trends in water quality;
- Collect information on the occurrence of threatened species and health of endangered ecological communities within the wetland;
- Collect information to assist in estimating the level of use of the wetland by migratory birds;
- Collect information on the occurrence of feral pests in the wetland;
- Provide an evaluation of management actions;
- Provide recommendations for future management actions.

11.2 Water Quality Monitoring

11.2.1 Question

- How does water quality in Marton Park Wetland change over time with management and climate change?

11.2.2 Objectives

- Identify the current surface water quality conditions;
- Monitor diffuse and point source pollution;
- Assess the state of the wetland as defined by SSC's Strategic Water Quality Monitoring Program;
- Identify trends in surface water quality;
- Identify current rates of tidal exchange and record changes over time;
- Identify a measurable reduction in level of contaminants in surface water quality in the wetland.

11.2.3 Monitoring

- Long term water quality sampling should be performed at the identified water quality monitoring locations used for this Management Plan;
- The addition of surface water quality sampling sites should be added to accommodate variability, consider issues such as spatial variation, safety and access, accurate identification and location of sites (ANZECC 2000);

- Sampling and reporting methods should follow SSC's Strategic Water Quality Monitoring Program;
- Sampling should be undertaken every six months, preferably late summer and late winter;
- Monitoring should include those variables listed in Table 7, with an estimated cost of \$5000 per annum (including laboratory analysis);
- The monitoring results should be made accessible to all stakeholders and the broader public;
- After two years monitoring results should be reviewed to identify trends and consider requirements for ongoing monitoring.

11.3 Monitor Occurrence and Persistence of Threatened Species

11.3.1 Question

- Is the GGBF using habitats in Marton Park Wetland?
- How is Marton Park Wetland being used by the GGBF?

11.3.2 Objectives

- Include Marton Park Wetland in monitoring programs for the Green and Golden Bell Frog on the Kurnell Peninsula.

11.3.3 Monitoring

- Ensure DECCW include Marton Park Wetland in monitoring efforts of the GGBF key population on the Kurnell Peninsula.

11.4 Monitor Endangered Ecological Communities and Native Vegetation

11.4.1 Question

- How do vegetation communities and endangered ecological communities in Marton Park Wetland respond over time with management and climate change?

11.4.2 Objectives

- Monitor the health and status of the Sydney Freshwater Wetland and Swamp Oak Floodplain Forest endangered ecological communities in Marton Park Wetland

11.4.3 Monitoring

- Vegetation monitoring should utilise quantitative surveys using quadrats and transects (following the methodology detailed in the Biobanking Operation Manual (DECC 2009b));
- Sampling should be based on the vegetation mapping undertaken for the Management Plan (it is recognised the wetland is a dynamic system and boundaries of vegetation communities may change over time);
- A minimum of two plots and transects per vegetation type should be undertaken;
- Plots should be located away from the edges of vegetation communities;
- Plots should be a nested 20 x 50 metre and 20 x 20 metre quadrat as shown below.

Data collection should include:

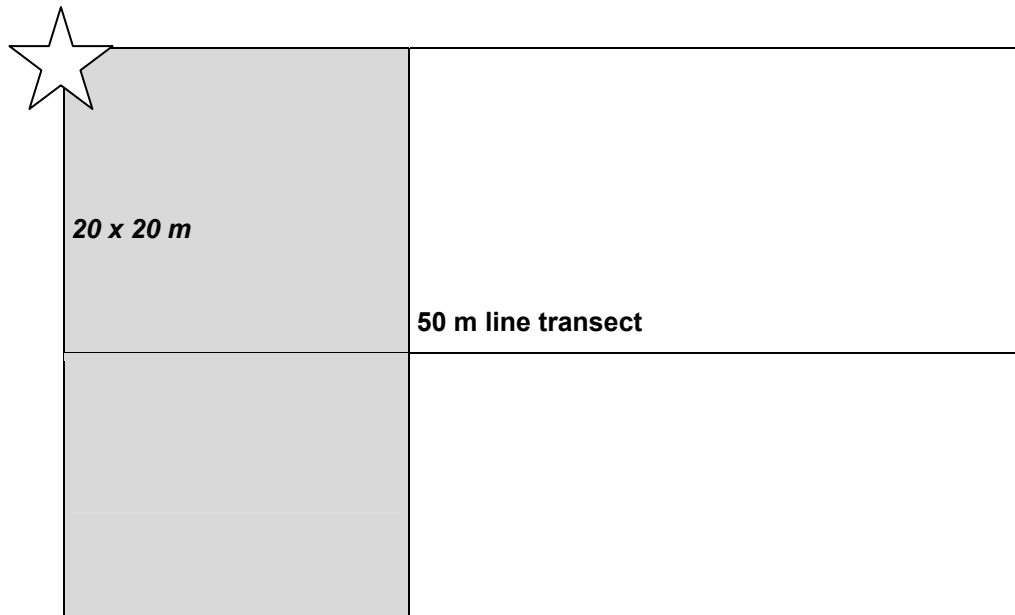
Indigenous Plant Species Richness

- In each 20m x 20 m plot systematically walk the plot and count the number of indigenous plant species for all vascular plants (no need to identify the species);
- At 10 points along a 50 metre transect an estimate should be made of the percentage cover of the native overstorey and native mid storey. For each stratum divide the total by the number of points measured along the transect to obtain % foliage cover (e.g. 50%, 0%, 0%, 40%, 0%, 45%, 50%, 55%, 0%, 0% = $240/10 = 24\%$ foliage cover)
 - Native overstorey– tallest woody stratum (> 1 metre including emergents);
 - Native mid-storey– all vegetation between the overstorey stratum and a height of 1 metre.
- At 50 points along a 50 metre transect an estimate should be made of the percentage cover of native ground covers. For each ground cover type divide the total hits by the number of points measured along the transect to obtain % foliage cover.
 - Native ground cover (shrubs) – all woody vegetation below 1 metre in height and native to NSW
 - Native ground cover (grasses)– native grasses (*Poaceae* family native to NSW)
 - Native ground cover (other)– non woody vegetation (vascular plants-ferns and herbs) below 1 metre in height and native to NSW
- *Exotic plant cover – vascular plants not native to Australia*
- At 50 points along a 50 metre transect an estimate should be made of the percentage cover of exotic plant cover. To obtain % cover divide the total hits by the number of points measured along the transect.
- The presence of other habitat attributes along the transect should also be recorded eg open water, bare ground, leaf litter, track or disturbed area;
- The nature of any disturbance should also be recorded;
- An assessment of the level of disturbance should also be made.

Tucker (2004) provides examples of survey and data collection forms and guidelines on the design and implementation of vegetation monitoring.

Layout of nested 20 x 50m and 20 x 20 m plots used for the assessment of vegetation condition attributes:

GPS Reference Point



Source DECC (2009b)

11.4.4 Objectives

- Utilise photo points to monitor long term changes in vegetation

11.4.5 Monitoring

- Establish a series of photographs to cover large areas of the wetland;
- Establish permanent photopoints within the area covered by the photograph;
- Photos should be taken at higher than ground level utilising a step ladder to enable greater coverage of the wetland;
- Photo points should be established where variation in vegetation communities extent, distribution and condition is likely to occur (in Marton park Wetland this would include communities adjacent to open water and areas subject to weed eradication and areas of stormwater inlet);
- Suggested photo points are the Marton Park Wetland sign on the heritage pathway, the Cook Street inlet, the north east corner of the wetland adjacent to the internal Caltex access road, the corner of Solander Street and the Caltex car park; at a point within weed plume along Shepherd Street;
- The date, time and weather conditions at the time of the photograph should be recorded;
- Photographs should be taken during spring.

11.5 Monitor Native Fauna

11.5.1 Questions

- What fauna species and what level of use of fauna habitats are occurring in Marton Park Wetland Do they change with management?

11.5.2 Objectives

- Monitor the diversity of fauna species and the level of use of fauna habitats within Marton Park Wetland.

11.5.3 Monitoring

- Establish transects in the wetland that can be used for spotlighting;
- Establish transects that can be used for small mammal trapping;
- Establish areas that can be used for collecting bird census data include recognised vegetation communities, areas where regeneration is expected and areas of open water. At each survey area birds are to be recorded while haphazardly traversing the area with all birds recorded either through direct observation or calls. Birds should be recorded in five minute intervals and recording continue until no new species are recorded for three consecutive five minute periods. Opportunistic recordings of bird species can also be made throughout the course of monitoring;
- Consideration should be given to including Marton Park Wetland into the Shorebird 2020 Program supported by Birds Australia and the Commonwealth Government see <http://www.shorebirds.org.au/> for more information;
- Establish sites to be used for frog call and owl call playback;
- Establish areas that are suitable for anabat recording;
- Undertake all the above survey methods twice annually for five years, carrying out five sessions per monitoring period

11.6 Monitor Feral Pests

11.6.1 Question

- What feral pests are using Marton Park Wetland and at what levels?
- What changes in feral pest use are occurring with management?

11.6.2 Objectives

- Understand which feral pests are utilising Marton Park Wetland;
- Understand most effective eradication techniques.

11.6.3 Monitoring

- During fauna survey monitoring sessions record opportunistic evidence of feral pests;
- Collect fox scat and forward them to Barbara Triggs for analysis to determine what foxes are preying on in the Wetland;
- Utilise Marton Park Wetland as a site for feral pest eradication and monitoring on the Kurnell Peninsula.

11.7 Environmental Education

11.7.1 Question

- Does environmental education contribute to improved wetland management and condition?

11.7.2 Objectives

- Provide information to the community and visitors about the values of Marton Park Wetland;
- Provide the local Kurnell Community with skills and knowledge to take action on their own properties to improve the condition of the wetland;
- Provide tenants/owners of the Kurnell Industrial Estate with skills and knowledge to take action on their own properties to improve the condition of the wetland.

11.7.3 Monitoring

- Number of wetland workshops;
- Number of participants at workshops;
- Requests for further information from residents/neighbours about the wetland or land management activities.

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APPENDICES

Appendix A Fauna Species of Marton Park Wetland

Common Name	Species Name
BIRDS	
Family: Phasiandae	
Stubble Quail	<i>Coturnix pectoralis</i>
Brown Quail	<i>Coturnix australis</i>
Family: Turnicidae	
Painted Button Quail	<i>Turnix varia</i>
Family: Pelecanidae	
Australian Pelican	<i>Pelecanus conspicillatus</i>
Family: Anhingidae	
Darter	<i>Anhinga melanogaster</i>
Family: Phalacrocoracidae	
Pied Cormorant	<i>Phalacrocorax varius</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Family: Podicipedidae	
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>
Family: Anatidae	
Black Swan	<i>Cygnus atratus</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Grey Teal	<i>Anas gibberifrons</i>
Chestnut Teal	<i>Anas castanea</i>
Hard Head	<i>Aythya australis</i>

Australian Shelduck	<i>Tadorna tadornoides</i>
Australian Shoveller	<i>Anas rhynchotis</i>
#Blue Billed Duck	<i>Oxyura australis</i>
Musk Duck	<i>Biziura lobata</i>
Family: Rallidae	
Buff-banded Rail	<i>Gallirallus philippensis</i>
Lewin's Rail	<i>Dryolimnas pectoralis</i>
Baillon's Crake	<i>Porzana pusilla</i>
Australian Spotted Crake	<i>Porzana fluminae</i>
Spottless Crake	<i>Porzana tabuensis</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>
Purple Swampphen	<i>Porphyrio porphyrio</i>
Eurasian Coot	<i>Fulcara atra</i>
Family: Ardeidae	
White-faced Heron	<i>Ardea novaehollandiae</i>
Cattle Egret	<i>Ardea ibis</i>
Great Egret	<i>Ardea alba</i>
Little Egret	<i>Ardea garzetta</i>
Eastern Reef Egret	<i>Ardea sacra</i>
Rufos Night Heron	<i>Nycticorax caledonicus</i>
Striated Heron	<i>Butorides striatus</i>
# Australasian Bittern	<i>Botarus poiciloptilus</i>
Family: Plataleidae	
Australian White Ibis	<i>Threskiornis aethiopica</i>
Royal Spoonbill	<i>Platalea regia</i>
Family: Charadriidae	
Masked lapwing	<i>Vanellus miles</i>
Black-winged Stilt	<i>Himantopus himantopus</i>
Silver Gull	<i>Larus novaehollandiae</i>
Family: Accipitridae	
Black-shouldered Kite	<i>Elanus notatus</i>
#Osprey	<i>Pandion haliaetus</i>

Whistling Kite	<i>Milvus sphenurus</i>
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>
Brown Goshawk	<i>Accipiter fasciatus</i>
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>
Swamp Harrier	<i>Circus approximans</i>
Family: Falconidae	
Black Falcon	<i>Falco subniger</i>
Peregrine falcon	<i>Falco peregrines</i>
Australian Hobby	<i>Falco longipennis</i>
Brown Falcon	<i>Falco berigora</i>
Naken Kestrel	<i>Falco cenchroides</i>
Family: Columbidae	
White-headed pigeon	<i>Columba leucomela</i>
*Rock Dove	<i>Columba livia</i>
*Spotted Turtle Dove	<i>Streptopeliachinensis</i>
Bar-shouldered Dove	<i>Geopelia humeralis</i>
Common Bronzewing	<i>Phaps chalcoptera</i>
Crested Pigeon	<i>Geophaps lophotes</i>
Family: Cacatuidae	
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>
Parrot Family: Psittacidae	
Galah	<i>Eolophus roseicapillus</i>
Little Corella	<i>Cacatua pastinator</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Subfamily: Loriinae	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>
Musk Lorikeet	<i>Glossopsitta concinna</i>
Subfamily: Polytelitinae	
Australian King Parrot	<i>Alisterus scapularis</i>
#Superb Parrot	<i>Polytelis swainsonii</i>

Subfamily: Playtrocinae	
Cockatiel	<i>Leptolophus hollandicus</i>
#Swift Parrot	<i>Lathamus discolor</i>
Crimson Rosella	<i>Platycercus elegans</i>
Eastern Rosella	<i>Platycercus eximius</i>
Red-rumped Parrot	<i>Psephotus haematonotus</i>
Family: Cuculidae	
Brush Cuckoo	<i>Cuculus variolosus</i>
Fan-tailed Cuckoo	<i>Cuculus flabelliformis</i>
Horsefield's Bronze Cuckoo	<i>Chrysococcyx basalis</i>
Shining Bronze Cuckoo	<i>Chrysococcyx lucidus</i>
Common Koel	<i>Eudynamys scolopacea</i>
Pheasant Coucal	<i>Centropus phasianinus</i>
Family: Strigidae	
#Powerful Owl	<i>Ninox strenua</i>
Southern Boobook	<i>Ninox novaeseelandiae</i>
Family: Tytonidae	
Barn Owl	<i>Tyto alba</i>
Family: Podargidae	
Tawny Frogmouth	<i>Podargus stigidus</i>
White-throated Night Jar	<i>Eurostopodus mysticallis</i>
Family: Alcedinidae	
Laughing kookaburra	<i>Dacelo novaeguineae</i>
Sacred Kingfisher	<i>Halcyon sancta</i>
Dollarbird	<i>Eurystomus orientalis</i>
Family: Neosittidae	
White Throated Treecreeper	<i>Cormobates leucophaea</i>
Family: Maluridae	
Superb Fairy-wren	<i>Malurus cyaneus</i>
Variegated Fairy-wren	<i>Malurus lamberti</i>

Southern Emu-wren	<i>Stipiturus malachurus</i>
Family: Pardalotidae	
Spotted Pardalote	<i>Pardalotus punctatus</i>
Striated Pardalote	<i>Pardalotus striatus</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
Chestnut-rumped Heathwren	<i>Hylacola pyrrhopyia</i>
Brown Gerygone	<i>Gerygone mouki</i>
Mangrove gerygone	<i>Gerygone levigaster</i>
Brown Thornbill	<i>Acanthiza pusilla</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Yellow Thornbill	<i>Acanthiza nana</i>
Striated Thornbill	<i>Acanthiza lineata</i>
Family: Meliphagidae	
Red Wattlebird	<i>Anthochaera carunculata</i>
Brush Wattlebird	<i>Anthochaera chrysoptera</i>
Noisy Friarbird	<i>Philemon corniculatus</i>
#Regent Honeyeater	<i>Xanthomyza Phrygia</i>
Noisy Minor	<i>Manorina melanocephala</i>
Lewin's Honeyeater	<i>Meliphaga lewinii</i>
Brown Honeyeater	<i>Lichmera indistinct</i>
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>
White-eared Honeyeater	<i>Lichenostomus leucotis</i>
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>
White-naped Honeyeater	<i>Melithreptus lunatus</i>
Tawny-crowned Honeyeater	<i>Phylidonyris melanops</i>
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>
White-cheeked Honeyeater	<i>Phylidonyris nigra</i>
Eastern Spinebill	<i>Acanthorhynchus tenuiostris</i>
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>
White-fronted Chat	<i>Ephthianura albifrons</i>
Eastern Whipbird	<i>Psophodes olivaceus</i>
Family: Petroicidae	
Rose Robin	<i>Petroica rosea</i>
Eastern yellow Robin	<i>Eopsaltria australis</i>

Family: Pachycephalidae	
Grey Shrike Thrush	<i>Colluricincla harmonica</i>
Golden Whistler	<i>Pachycephala pectoralis</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Family: Dicuridae	
Grey Fantail	<i>Rhipidura fuliginosa</i>
Rufous Fantail	<i>Rhipidura rufifrons</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Leaden Flycatcher	<i>Myiagra rubecula</i>
Black-faced Monarch	<i>Monarcha melanopsis</i>
Magpie Lark	<i>Grallina cyanoeuca</i>
Spangled Drongo	<i>Dicurus bracteatus</i>
Family: Oriolidae	
Olive-backed Oriole	<i>Oriolus sagittatus</i>
Figbird	<i>Sphecotheres viridis</i>
Family: Ptilonorhynchidae	
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>
Family: Campephagidae	
Black-faced Cuckoo Shrike	<i>Coracina novaehollandiae</i>
White-winged Triller	<i>Lalage recolor</i>
Family: Artamidae	
Dusky Woodswallow	<i>Artamus cyanopterus</i>
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Australian Magpie	<i>Gymnorhina tibicen</i>
Pied Currawong	<i>Strepera graculina</i>
Family: Corvidae	
Australian Raven	<i>Corvus coronoides</i>
Family: Hirundinidae	

Welcome Swallow	<i>Hirundo neoxena</i>
Fairy Martin	<i>Hirundo ariel</i>
Family; Motacillidae	
Richard's Pipit	<i>Anthus novaeseelandiae</i>
Family; Alaudidae	
Brown Songlark	<i>Cinclorhamphus</i>
Family: Sylviidae	
Clamorous Reed-warbler	<i>Acrocephalus stentoreus</i>
Golden-headed Cisticola	<i>Cisticola exilis</i>
Tawny Grassbird	<i>Megalurus timoriensis</i>
Little Grassbird	<i>Megalurus gramineus</i>
Family; Passeridae	
*house Sparrow	<i>Passer domesticus</i>
Family: Ploceidae	
Red-browed Firetail	<i>Neochima temporalis</i>
Family: Nectariniidae	
Mistletoebird	<i>Dicaeum hirundinaceum</i>
Silvereye	<i>Zosterops</i>
Family: Pycnonotidae	
*Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
*Common Blackbird	<i>Turdus merula</i>
*Common Myna	<i>Acridotheres tristis</i>
*Common Starling	<i>Sturnus vulgaris</i>
MAMMALS	
Family: Phalangeridae	
Common Brushtail Possum	<i>Trichosurus vulpecula</i>
Family: Pseudocheiridae	
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>

Family: Pteropodidae	
Grey-headed Flying Fox	<i>Pteropus poliocephalus</i>
Family: Vespertilionidae	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat	<i>Chalinolobus morio</i>
Family: Vespertilionidae	
#Common Bentwing-bat	<i>Miniopterus schreibersii</i>
Family: Molossidae	
#Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>
Eastern Freetail-bat	<i>Mormopterus ridei</i> (<i>Mormopterus "Species 2"</i>)(probable id UBM (2009)
Freetail Bat	<i>Mormopterus sp.1</i>
Family: Vespertilionidae	
#Large-footed Myotis	<i>Myotis macropus</i>
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>
Long-eared Bat	<i>Nyctophilus sp.</i>
Eastern Forest Bat	<i>Vespadelus pumilus</i>
Little Forest Bat	<i>Vespadelus vulturnus</i>
Family: Rhinolophidae	
Eastern Horse-shoe Bat	<i>Rhinolophus megaphyllus</i>
Family: Emballonuridae	
#Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>
INTRODUCED MAMMALS	
*Rabbit	<i>Oryctolagus cuniculus</i>
*House Mouse	<i>Mus musculus</i>
*Black Rat	<i>Rattus rattus</i>
*Feral Cat	<i>Felis catus</i>
*Fox	<i>Vulpes vulpes</i>
*Dog	<i>Canis familiaris</i>
*Goat	<i>Capra aegagrus hircus</i>

*Horse	<i>Equus ferus caballus</i>
AMPHIBIANS	
Family: Myobatrachidae	
Common Eastern Froglet	<i>Crinia signifera</i>
#Wallum Froglet	<i>Crinia tinnula</i>
Eastern banjo Frog	<i>Limnodynastes dumerilii</i>
Brown Striped Frog	<i>Limnodynastes peronii</i>
Smooth Toadlet	<i>Uperoleia laevigata</i>
Family: Hylidae	
Green and Golden Bell Frog	<i>Litoria aurea</i>
Bleating Tree Frog	<i>Litoria dentata</i>
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>
Lesueur's Frog	<i>Litoria lesueuri</i>
Jervis Bay Tree Frog	<i>Litoria jervisiensis</i>
Peron's Tree Frog	<i>Litoria peronii</i>
Tyler's Tree Frog	<i>Litoria tyleri</i>
Verreaux's Tree Frog	<i>Litoria verreaux</i>
REPTILES	
Family: Chelidae	
Long-necked Tortoise	<i>Chelodina longicollis</i>
Family: Agamidae	
Mountain Dragon	<i>Tympanocryptis diemensis</i>
Jacky Lizard	<i>Amphibolurus muricatus</i>
Family: Pygopodidae	
Common Scaly Foot	<i>Pygopus lepidopus</i>
Family: Elapidae	
Blind Snake	<i>Rhinoplocephalus nigrescens</i>
Yellow-faced Whip Snake	<i>Demansia psammophis</i>
Black-bellied Swamp Snake	<i>Hemiaspis signata</i>
Red-bellied Blake Snake	<i>Pseudechis porphyriacus</i>
Eastern Brown Snake	<i>Pseudechis textilis</i>
Family: Scincidae	

Copper-tailed skink	<i>Ctenotus taeniolatus</i>
Striped Skink	<i>Ctenotus robustus</i>
Oak Skink	<i>Cyclodomorphus michaeli</i>
Garden Skink	<i>Lampropholis guichenoti</i>
Grass Skink	<i>Lampropholis delicata</i>
Red-throated Skink	<i>Pseudemoia platynota</i>
Three toed Skink	<i>Saiphos equalis</i>
Eastern Water Skink	<i>Eulamprus quoyii</i>
Eastern Blue-tongued Lizard	<i>Tiliqua scincoides</i>
# Species listed on the TSC Act 1995 *Introduced Species Source: Lesryk (1997) UBM (2009)	

Appendix B Threatened Species

Threatened Species Recorded within a 10 kilometre radius of Marton Park Wetland

Family	Species Name	Common Name	NSW Status	International/ National Status	Location
Plants					
Asteraceae	<i>Senecio spathulatus</i>	Coast groundsel	E		South east of Marton Park
Fabaceae (Mimosoideae)	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sunshine Wattle	E		Blue Mountain National Park
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E		Blue Mountain National Park
Orchidaceae	<i>Pterostylis</i> sp. <i>Botany Bay</i>	Botany Bay Bearded Orchid	E		Key Population Botany Bay National Park (NP)
Animals					
Amphibia					
Hylidae	<i>Litoria aurea</i>	Green and Bell Golden Frog	E	V1	Kurnell Peninsula
Myobatrachidae	<i>Crinia tinnula</i>	Wallum Froglet	V		Kurnell Peninsula

Family	Species Name	Common Name	NSW Status	International/ National Status	Location
Birds					
Accipitridae	<i>Pandion haliaetus</i>	Osprey	V		Kurnell Peninsula
Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	V		Kurnell Peninsula
Charadriidae	<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	Migratory Bird	Charadrius
	<i>Charadrius mongolus</i>	Lesser Sand Plover	V	Migratory Bird	Charadrius
Diomedeidae	<i>Diomedea exulans</i>	Wandering Albatross	E	V1, Migratory Bird	Kurnell Botany Bay
	<i>Thalassarche melanophris</i>	Black-browed Albatross	V	V1,	Cronulla Beach
Haematopodidae	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V		Botany Bay
	<i>Haematopus longirostris</i>	Pied Oystercatcher	V		Towra Point Nature Reserve (NR)
Laridae	<i>Gygis alba</i>	White Tern	V		Botany Bay National Park

Family	Species Name	Common Name	NSW Status	International/ National Status	Location
	<i>Procelsterna cerulea</i>	Grey ternlet	V		Botany Bay
	<i>Sterna albifrons</i>	Little Tern	E		Towra Point NR /Botany Bay
Meliphagidae	<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E1	Botany Bay NP north of Marton Park Wetland
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	E1	Botany Bay NP east of Marton Park Wetland
	<i>Polytelis swainsonii</i>	Superb parrot	E	V1	Botany Bay NP eastern edge
Scolopacidae	<i>Calidris alba</i>	Sanderling	V	Migratory Bird	Cronulla Beach
	<i>Calidris tenuirostris</i>	Great Knot	V,	Migratory Bird	Towra Point NR
	<i>Limicola falcinellus</i>	Broad-billed Sandpiper	V,	Migratory Bird	Cronulla Beach
	<i>Xenus cinereus</i>	Terek Sandpiper	V,	Migratory Bird	Towra Point NR north west of Marton Park Wetland
Strigidae	<i>Ninox Strenua</i>	Powerful Owl	V		Botany Bay NP
	<i>Tyto</i>	Masked Owl	V		Towra Point NR

Family	Species Name	Common Name	NSW Status	International/ National Status	Location
	<i>novae-hollandiae</i>				
Mammals					
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail bat	V		Botany Bay NP north east tip
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying fox	V	V1	Kurnell Peninsula
Vespertilionidae	<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat	V		Kurnell Peninsula
	<i>Myotis adversus</i>	Large-footed myotis	V		Kurnell Peninsula
	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Towra Point NR

E Endangered NSW Threatened Species Conservation Act 1995

V Vulnerable NSW Threatened Species Conservation Act 1995

Migratory Bird – listed on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (BONN), Chinese Australia Migratory Bird Agreement (CAMBA), Japanese Australia Migratory Bird Agreement (JAMBA) Republic of Korea Australia Migratory Bird Agreement (ROKAMBA)

V1 Vulnerable Environment Protection and Biodiversity Act 1999

E1 Endangered Environment Protection and Biodiversity Act 1999

Appendix C Flora Species List

FLORA SPECIES LIST MARTON PARK WETLAND

Family	Scientific Name
FERNS	
FILICOPSIDA	
Blechnaceae	<i>Blechnum indicum</i>
Dennstaedtiaceae	<i>Pteridium esculentum</i>
	<i>Hypolepis muelleri</i>
Gleicheniaceae	<i>Gleichenia dicarpa</i>
MAGNOLIOPSIA - DICOTYLEONS	
Amaranthaceae	* <i>Amaranthus viridis</i>
	* <i>Amaranthus hybridus</i>
	* <i>Hydrocotyle bonariensis</i>
Apiaceae	<i>Foeniculum vulgare</i>
Apocynaceae	* <i>Nerium Oleander</i>
	<i>Parsonsia straminea</i> var. <i>straminea</i>
	* <i>Ageratina adenophora</i>
	* <i>Bidens pilosa</i>
	* <i>Chrysanthemoides molinifera</i> ssp. <i>chrysanthemoides</i>
	* <i>Conyza bonariensis</i>
	* <i>Coreopsis lanceolata</i>
	* <i>Delairea odorata</i>
	* <i>Hypochoeris radicata</i>
	* <i>Senecio madagascariensis</i>
	* <i>Sonchus oleraceus</i>
	* <i>Tagetes minuta</i>
	* <i>Taraxacum officinale</i>
Caprifoliaceae	* <i>Lonicera japonica</i>
Carophyllaceae	* <i>Cerastium glomeratum</i>
Clusiaceae	* <i>Hypericum perforatum</i>
Euphorbiaceae	* <i>Euphorbia peplus</i>
	<i>Omalanthus populifolius</i>
Epacridaceae	<i>Monotoca eliptica</i>
Fabaceae: Mimosoideae	<i>Acacia longifolia</i> var. <i>sophorae</i>

Family	Scientific Name
	<i>Acaci saligna</i>
Fabaceae: Faboideae	<i>Erythrina x sykesii</i>
	<i>Glycine microphylla</i>
	* <i>Vicia sativa</i>
Geraniaceae	* <i>Pelargonium capitatum</i>
Lobeliaceae	<i>Lobelia alata</i>
Malvaceae	* <i>Modiola caroliniana</i>
Moraceae	<i>Ficus rubignosa</i>
Myrtaceae	<i>Euclayptus robusta</i>
	<i>Lophostemon copnfertus</i>
	<i>Melaleuca armillaris</i>
	<i>Melaleuca quinquenervia</i>
Ochnaceae	* <i>Ochna serrulata</i>
Onagraceae	* <i>Oenothera stricta</i>
Oxalidaceae	* <i>Oxalis rubens</i>
Pittosporaceae	<i>Pittosporum undulatum</i>
Polygalaceae	<i>Polygala virgata</i>
Proteaceae	<i>Banksia integrifolia</i>
	<i>Banksia ericifolia</i>
Plantaginaceae	* <i>Plantago lanceolata</i>
Polygonaceae	* <i>Rumex brownie</i>
	* <i>persicaria decipiens</i>
Rosaceae	<i>Rubus ulmifolius</i>
Sapindaceae	<i>Cupaniopsis anacardioides</i>
Solanaceae	* <i>Solanum nigrum</i>
	* <i>Cestrum parqui</i>
Sterculiaceae	<i>Brachychiton acerifolius</i>
Verbenaceae	* <i>Verbena bonariensis</i>
	* <i>Lantana camara</i>
MONOCOTYLEDONS	
Araceae	* <i>Zantedeschia aethiopica</i>
Cyperaceae	<i>Baumea juncea</i>
	<i>Cyperus difformis</i>
	<i>Cladium procerum</i>
	<i>Ghania sieberana</i>
	<i>Isolepis nodosus</i>

Family	Scientific Name
	<i>* Isolepis prolifer</i>
Commelinaceae	<i>Commelina cyanea</i>
Juncaceae	<i>Juncus pallidus</i>
	<i>Juncus krausii</i>
Lemnaceae	<i>Spirodela pusilla</i>
Liliaceae	<i>* Asparagus aethiopicus</i>
Lomandraceae	<i>Lomandra longifolia</i>
Poaceae	<i>*Axonopus affinus</i>
	<i>*Brizia maxima</i>
	<i>*Bromus catharticus</i>
	<i>Cynodon dactylon</i>
	<i>*Cortadiera selloana</i>
	<i>*Chloris gayana</i>
	<i>Dichelachne crinata</i>
	<i>Imperata cylindrical</i>
	<i>Paspalum distichum</i>
	<i>*Paspalum dilatatum</i>
	<i>Phragmites australis</i>
	<i>*Pennisetum clandestinum</i>
	<i>Setaria sp.</i>
	<i>*Sporobolus indicus var. capensis</i>
	<i>*Stenotaphrum secundatum</i>
Pontederiaceae	<i>*Eichornia crassipes</i>
Typhaceae	<i>Typha oreitalis</i>

* denotes introduced species

Species listed on the TSC Act 1995

Appendix D Priority Actions

Swamp oak floodplain forest – Priority Actions

Recovery strategy: Captive Husbandry or ex-situ collection/propagation		
Collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - all known provenances (conservation collection).		Medium
Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).		Medium
Recovery strategy: Community and land-holder liaison/ awareness and/or education		
Enhance the capacity of persons involved in the assessment of impacts on this EEC to ensure the best informed decisions are made.		Medium
Liaise with landholders and undertake and promote programs that ameliorate threats such as grazing and human disturbance.		Low
Recovery strategy: Habitat management: Fire		
Implement appropriate fire management practices.		Medium
Recovery strategy: Habitat management: Ongoing EIA - Advice to consent and planning authorities		
Prepare identification and impact assessment guidelines and distribute to consent and determining authorities.		Medium
Recovery strategy: Habitat management: Site Protection (eg Fencing/Signage)		
Identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required.		Medium
Recovery strategy: Habitat management: Weed Control		
Undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan and associated PAS actions.		Medium
Recovery strategy: Habitat Protection (inc vca/ jma/ critical habitat nomination etc)		
Use mechanisms such as Voluntary Conservation Agreements to promote the protection of this EEC on private land.		Medium
Recovery strategy: Research		
Undertake research to determine minimum fire frequency.		Low
Recovery strategy: Survey/Mapping and Habitat assessment		
Collate existing information on vegetation mapping and associated data for this EEC and identify gaps in knowledge. Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants.		

SOURCE: DEC (2005a)

Sydney Freshwater Wetlands in the Sydney Basin Bioregion - Priority actions

Recovery strategy: Habitat management: Other		
Implement measures to maintain/control natural hydrology and environmental flows to wetlands and surrounding areas.		High
Recovery strategy: Habitat management: Site Protection (eg Fencing/Signage)		
Implement measures restricting access and excluding grazing from wetlands and surrounding areas.		High
Recovery strategy: Habitat management: Weed Control		
Undertake targeted bush regeneration works to restore and maintain remnants.		Medium
Recovery strategy: Habitat Protection (inc vca/ jma/ critical habitat nomination etc)		
Seek to improve protection of remnants by encouraging application, implementation and enforcement of existing planning and assessment tools, e.g. SREP 20, SEPP 14.		Medium
Recovery strategy: Other Action		
[Guidelines] Prepare profile and EIA guidelines.		

SOURCE: DEC (2005b)

Appendix E Record of Aboriginal Field Participation

Record of Aboriginal Representative Participation*

Name(s) of Aboriginal Representative: Shane Ingrey

Name of Aboriginal Organisation: La Perouse Local Aboriginal Land Council

Archaeologist(s): name & address
Deirdre Lewis-Cook.....
Navin Officer Heritage Consultants Pty Ltd.....
4/71 Leichhardt Street, Kingston, ACT 2604.....

Project Name. **Marton Park Wetland**

Client: name & address: Molino Stewart
(please send your invoice ...Attn: Carolyn Hall
to this address)PO Box 614, Paramatta, NSW 2124

Type of participation: ☐ Guided inspection of study area and sites
☐ Accompanied/participated in archaeological survey
☐ Separate inspection or survey
☒ Accompanied/participated in excavation program

Period of participation:

Date(s)	Start	Finish
4 th August 2009	10 am 12pm	1:30pm

Signed (archaeologist): D. Lewis-Cook

Signed (Aboriginal representative(s)): S. Ingrey

* please note this form is not an invoice. For payment, please send an invoice from your organisation to the client name and address provided above.

Appendix F Management Summary Priorities and Cost Estimates

Management Strategy	Action	Cost	Priority
Develop a Management Forum	Identify and fund a lead authority to manage the forum	\$2500	moderate
	Formally invite key stakeholder groups	\$500	moderate
	Devise how the forum will operate (e.g. web based)	\$500	moderate
	Agree on forum terms of reference	\$1000	moderate
	Forum to review the results of monitoring and revise management objectives and actions for Marton Park Wetland and ensure coordinated management approach across Kurnell Peninsula	\$2500p/meeting \$20000 over next 4 years	moderate
Water Quality management	Undertake water quality monitoring based on SSC Strategic Water Quality Monitoring Program	5k per annum over 5 years (\$25000)	high
	Distribute the results of water quality monitoring	use management forum	high
	Engage the community in a communication, education, public awareness and action program	\$2500 first year	moderate
	Provide education resources on opportunities for reducing diffuse water pollution sources	\$1500 in first year	moderate
	Incorporate stormwater pollution prevention messages into interpretative signage and/or brochures developed for Marton Park Wetland.	(see signage costs)	moderate
	Install filter strip plantings at the inlet locations of the wetland	(see weed management costs)	high

Hydrology and Climate Change	Promote drainage management strategies that do not increase tidal exchange with Marton Park wetland	Maintain drainage status quo, do not enlarge outlet pipes	high
	Monitor the impacts of changes in hydrology on flora and fauna (see monitoring actions below)		high
	In the short term maintain the current hydrological regime and tidal range.		high
	Reassess the risk to the wetland from climate change when there is more certainty in the predictions.	\$3000	moderate
	Identify similar wetlands along the NSW coast which are subject to greater risk from climate change and will be affected by elevated ocean levels before Marton Park Wetland. Council should monitor their response to elevated ocean levels and management strategies implemented for these wetlands.	To be advised	moderate
	Evaluate installation of a height adjustable weir at the outlet of the wetland to Quibray Bay, as a means of wetland management in the future climate	\$2000	moderate
	In the longer term a management plan for the wetland will be needed which deals with rising sea levels and increased tidal influence.	To be advised	moderate
Weed management	Identify the appropriate Council Officer to oversee weed removal	\$500	high
	Commission a qualified bush regeneration	\$60000 over 5 years	Very high

	contractor to prepare and implement a weed management plan	(including monitoring)	
	communicate the weed eradication and bush regeneration strategy to other agencies on Kurnell peninsula (management forum)	\$1500	moderate
	provide opportunities for local residents/ school students to join in weeding and bush regeneration activities(SSC's Bushcare & Schools in Greenweb programs)	\$2000	moderate
	Review and update weed removal and regeneration/ replanting efforts based on the results of initial weeding activities	\$8000	moderate
Vegetation Communities	Conduct a thorough floristic survey of the site and reconcile/verify existing plant species lists for the wetland.	\$15000	Very high
	Implement appropriate vegetation management strategies consistent with the priority actions identified for the EECs (Appendix D).	(achieved through implementation of this Management Plan and weed management)	Moderate (initiate once weed eradication in progress)
	Develop, consolidate and maintain links among key stakeholders to promote vegetation management in the wetland and on the Kurnell Peninsula (management forum)	(see forum costs)	moderate
	Undertake vegetation monitoring	\$7000 per/annum (maybe included in Kurnell 2020)	high
Fauna Habitats			
	Undertake comprehensive fauna survey reconcile	\$15000	Very high

	/verify existing fauna species list for the wetland.		
	Develop and implement a long term fauna survey/monitoring program;	\$12000 per annum cost maybe included in Kurnell Peninsula wide monitoring if established under the Kurnell 2020 Corridor Delineation	high
	Develop partnerships with existing bodies implementing fauna management on the Kurnell Peninsula (management forum)	(see forum costs)	moderate
	Ensure Marton Park Wetland is part of SSC Feral Pest Policy initiative and SMCMA feral pest eradication program on the Kurnell Peninsula	(costs included in established program)	moderate
	Undertake feral pest monitoring	(cost included in fauna monitoring) under the Kurnell 2020 Corridor Delineation or SSC Feral Pest Policy initiative and SMCMA feral pest eradication program on the Kurnell Peninsula	moderate
	Develop partnership with DECCW implementing the current management plan for Towra Point Nature and Aquatic Reserve (management forum)	(see forum costs)	moderate
Community awareness and participation in wetland management	Invite local residents to be part of the management forum	\$2500 publicity	high
	Review and update signage at Marton Park Wetland	\$10000	moderate
	Develop and maintain a web page for Marton Park	\$5000 over 5 years	moderate

	Wetland		
	Engage the local community in the design and location of an extension of the current walking track between Captain Cook Drive and Cook Street (Shepherd Street)	\$2500	high
	Promote local community participation in bush regeneration activities	\$2500	moderate
	Promote Marton Park Wetland as a focus of education for sustainability	\$2000	high
	Promote and support community participation in activities such as Clean Up Australia Day and World Wetlands Day	\$2500	High
	Promote and support community awareness and participation in World Wetlands Day on the 2nd February each year;	\$1500	high
	Promote Marton Park Wetland to be the “place” of the Kurnell 2020 project		moderate
Public Access	Continue the walking track (raised boardwalk) initially around Marton Park Wetland between Captain Cook Drive and Cook Street	Around \$700 per metre depending on material and design costs	high
	Continue the walking track (raised boardwalk) Cook Street along the rear of the Kurnell Industrial Estate	Around \$700 per metre depending on material and design costs	high
	Continue the walking track (part raised boardwalk) Edges of the Caltex refinery (wetland side of the fenceline) to the Caltex car park	Around \$700 per metre depending on material and design costs	high
	Continue the walking track (raised boardwalk) Link to Solander Street to captain Cook Drive (existing	Around \$300 per metre depending on material	high

	pathway)	and design costs	
	Provide opportunities for the local community to have direct input into the style and route of the walkway		high
	Consider installation of a bird hide or look out adjacent to the open water area of the wetland.	\$3000	low
	Install additional educative signage regarding the significance of Marton Park Wetland	(see previous signage costs)	moderate
Heritage values	Retain and promote the natural vegetation of Marton Park Wetland	(see weed management plan costs)	Very high
	Develop and implement weed management plan ensuring that the local Aboriginal community are involved in the formulation and execution of the program;	as above plus invite La Perouse LALC involvement \$2500	high
	Promote Aboriginal history and cultural heritage of the area, (signage) in partnership with Kurnell 2020		high
	adequately assess the potential impact on cultural heritage values of proposed developments near to the wetland prior to their approval;	As required	Very high as required
	Stop works and seek advice in the event that Aboriginal objects or historic relics are uncovered by maintenance (or other) works	As required	Very high as required
Scientific Research	Encourage the use of Marton Park Wetland for appropriate research	\$1500	moderate
	Encourage Climate Change research into Marton Park Wetland and the broader Kurnell Peninsula	\$1500	moderate

	Encourage sea level rise risk assessment and adaptation studies for Kurnell township and Marton Park Wetland	\$1500	moderate
	Develop and consolidate links with other agencies that are implementing management plans on the Kurnell Peninsula (management forum)	(see forum costs)	high
	Utilise the Marton Park Wetland Management Forum as a body to receive and distribute the results of scientific research relevant to the management of the wetland.	Add \$500 per year for knowledge management	high
Total implementation costs over 5 years \$275 500 or \$55 500 per year			
NB A Kurnell Peninsula wide management approach could lead to significant savings			
NB All costs are approximate			