



KINNAIRDS WETLAND ENVIRONMENTAL MANAGEMENT PLAN 2014

Vision:

"To maintain Kinnairds Wetland as a biologically diverse, functioning wetland system dominated by indigenous flora and fauna, enhancing successful breeding opportunities and encouraging the utilisation of rare and threatened species, whilst providing suitable retardation and water purifying attributes for the Muckatah Surface Water Management Scheme and valued by the community for passive recreation, ecotourism and ecological benefits".



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SUMMARY

Kinnairds Wetland is a 93.15 hectare terminal wetland complex near the township of Numurkah in Northern Victoria which is part owned by Goulburn Murray Water and Moira Shire Council and part-privately owned. The wetland is a shallow freshwater marsh in a prior stream depression (Muckatah Depression), characterised by a vegetation community of sparse mature River Red Gum over Common Spike-sedge, Water-milfoil and Moira Grass. The site is notable as having the largest recorded population of the EPBC (1999) listed species Rigid Water Milfoil and is a breeding ground for Royal Spoonbills, Australasian Shovelers and Whistling Kites, and as a feeding ground for migratory species.

The wetland has been modified and enhanced by earthworks associated with the Muckatah Surface Water Management Scheme. This scheme provides major regional drainage benefits for a considerable area of irrigated agriculture within the Muckatah catchment. The surface water management works have been designed to utilise the wetland as a retardation basin and filtering system whilst enhancing the wetland values. It also provides for the first time a means for water management control within the wetland basin. Prior to the works, agricultural development in the district had impacted on the wetland from inappropriate flooding regimes associated with poor drainage and unseasonal inflows.

This is the second edition of this management plan with the first edition having been completed in 2003. This management plan will be updated every ten years and presents the necessary geo-morphological, biological, utilisation history, management history and current stakeholders' requirements to support the management recommendations as detailed. Wetland values, especially as a Royal Spoonbill breeding site and Brolga and Latham's Snipe feeding site, public amenity and the flow retarding and nutrient assimilating attributes of the wetland, form the basis of this plan.

ACKNOWLEDGMENTS

Acknowledgement of Country

Kinnairds Wetland Advisory Committee acknowledges the Yorta Yorta Nation as the traditional owners of the Kinnairds Wetland area. Wetlands such as Kinnairds Wetland, creeks and other tributaries have very high importance to the families and clans of the Yorta Yorta Nation as the floodplain environment provided sustainable sustenance to their people. It is valued presently for the purpose of continuing their symbiotic relationship with the natural environment. An example of the value of Kinnairds Wetland to the Yorta Yorta is expressed through being home to totemic fauna species and other valuable resources. Evidence of their longstanding inhabitancy in and around Kinnairds Wetland is reflected through significant cultural sites such as scar trees.

More current information on the Yorta Yorta existing aspirations in natural resource management can be found in the YYNAC 2012-2017 Whole of Country Plan.

General Acknowledgements

This environmental management plan represents the collective efforts of a range of people, whose assistance in the provision of background information, strategy formulation and review of draft documents have culminated in the development of a 'workable' supported strategy. This plan was written by Jo Wood of Goulburn Broken Catchment Management Authority on behalf of Moira Shire Council. A special thanks to Gary Deayton of Moira Shire Council and Sam Green Goulburn-Murray Water for their assistance with this plan.

ABBREVIATIONS

AHD	Australian Height Datum
BB CMN	Broken Boosey Conservation Management Network
CAMBA	China-Australia Migratory Bird Agreement
DEPI	Department of Environment and Primary Industries
EPBC	<i>Environment Protection Biodiversity Conservation Act (1999)</i>
EVC	Ecological Vegetation Classes
FFG	<i>Flora and Fauna Guarantee Act (1988)</i>
GB CMA	Goulburn-Broken Catchment Management Authority
GMW	Goulburn-Murray Water
ha	Hectare
IWC	Index of Wetland Condition
JAMBA	Japan-Australia Migratory Bird Agreement
km	Kilometre
KWAC	Kinnairds Wetland Advisory Committee
MDBA	Murray-Darling Basin Authority
ML	Megalitre (one million litres)
ML/d	Megalitre per day (measure of flow)
ROKAMBA	Republic of Korea Australia Migratory Bird Agreement
VEWH	Victorian Environmental Water Holder

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1. INTRODUCTION

1.1 LOCATION

Kinnaids Wetland is a 93.15 hectare wetland complex part owned by Goulburn Murray Water and Moira Shire Council and part-privately owned situated in the Moira Shire and approximately 2 kilometres north-east of the Numurkah township in northern Victoria (Figure 1).

The wetland is classified as a palustrine¹, freshwater marsh in a prior stream depression (Muckatah Depression) fed from a 600 square kilometres catchment beginning near Yarrawonga on the north-western slopes of the Warby Ranges (G-MW 1999). It is a naturally formed terminal wetland system at the bottom of the Muckatah Catchment. Outfall from the Muckatah Depression flows south through the wetland complex to the Broken Creek. Similarly, flows from the Broken Creek back up and flood the wetland during high flow events.

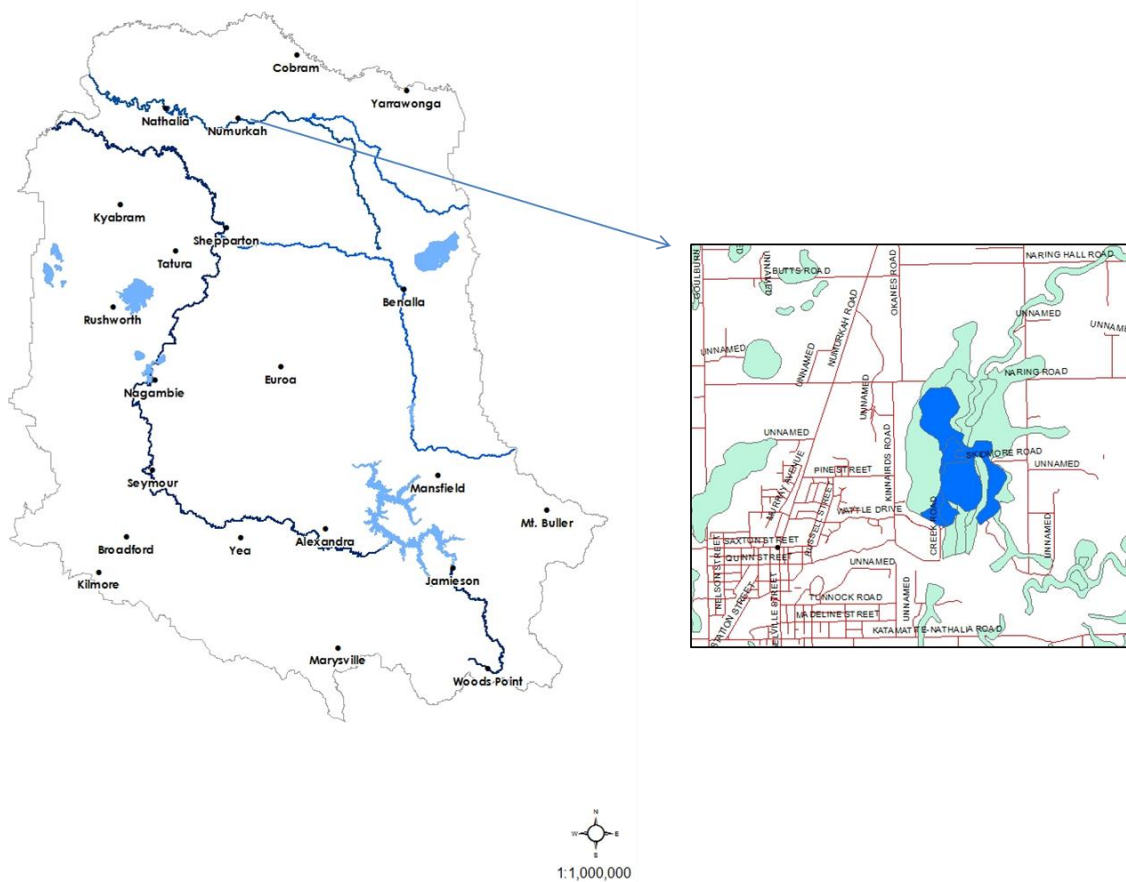


FIGURE 1: LOCATION OF KINNAIDS WETLAND IN THE GOULBURN BROKEN CATCHMENT

¹ Palustrine wetlands are freshwater systems that have a significant aerial coverage of vegetation (more than 30%).

1.2 FORMATION OF KINNAIRDS WETLAND AND LAND STATUS

Prior to European settlement, the area now identified as Kinnairds Wetland was a seasonal open River Red Gum Wetland filling on a near annual basis in winter-spring. Rainfall and run-off from the surrounding catchment filled the wetland and it would eventually drawdown and dry out in the summer-autumn (Refer to Section 2.1 Wetland History).

The wetland was privately owned until a land parcel was taken over in the mid-1980s by the former Shire of Numurkah. As a result of Council amalgamations in 1994, the parcel of land owned by the Shire of Numurkah was transferred to the ownership of Moira Shire Council. Moira Shire Council entered into a Trust for Nature Conservation Covenant agreement on their parcel of land in 2008 to secure its environmental values and Council's investment for the long term. Another parcel of land adjoining the Council land was purchased by Goulburn-Murray Water during the mid-1990s.

In 1999, the Muckatah Depression Main Drain (Muckatah Surface Water Management Scheme) was constructed to provide drainage to ~60,000 hectares of the Muckatah catchment above Kinnairds Wetland (Figure 2). Part of the design included constructing a wide bunded drainage area with deeper pools to allow water from the main drain to primarily flow through the northern and eastern sections of Kinnairds Wetland. This created an open herbaceous wetland area to provide minor flood retardation, nutrient and sediment reduction and control discharge rates from the catchment into the Broken Creek. It also provided the capacity, under normal flows, to manage the flooding regime of the western natural section of Kinnairds Wetland, a remnant of the 'natural' terminal wetland depression (Figure 4). During other than low level flooding events, water disperses throughout the greater 'natural' terminal wetland depression.

Former Prime Minister John Howard declared the first stage of the Muckatah Surface Water Management Scheme open at Kinnairds Wetland on 5th August 1999. Works were undertaken on the Goulburn-Murray Water and Moira Shire Council land to allow public access and facilities for passive recreational uses compatible with the site's environmental values and purpose.

The wetland is now a well-known eco-tourism location which attracts a large amount of visitors each year (Refer to section 5 Community Involvement and Recreation).

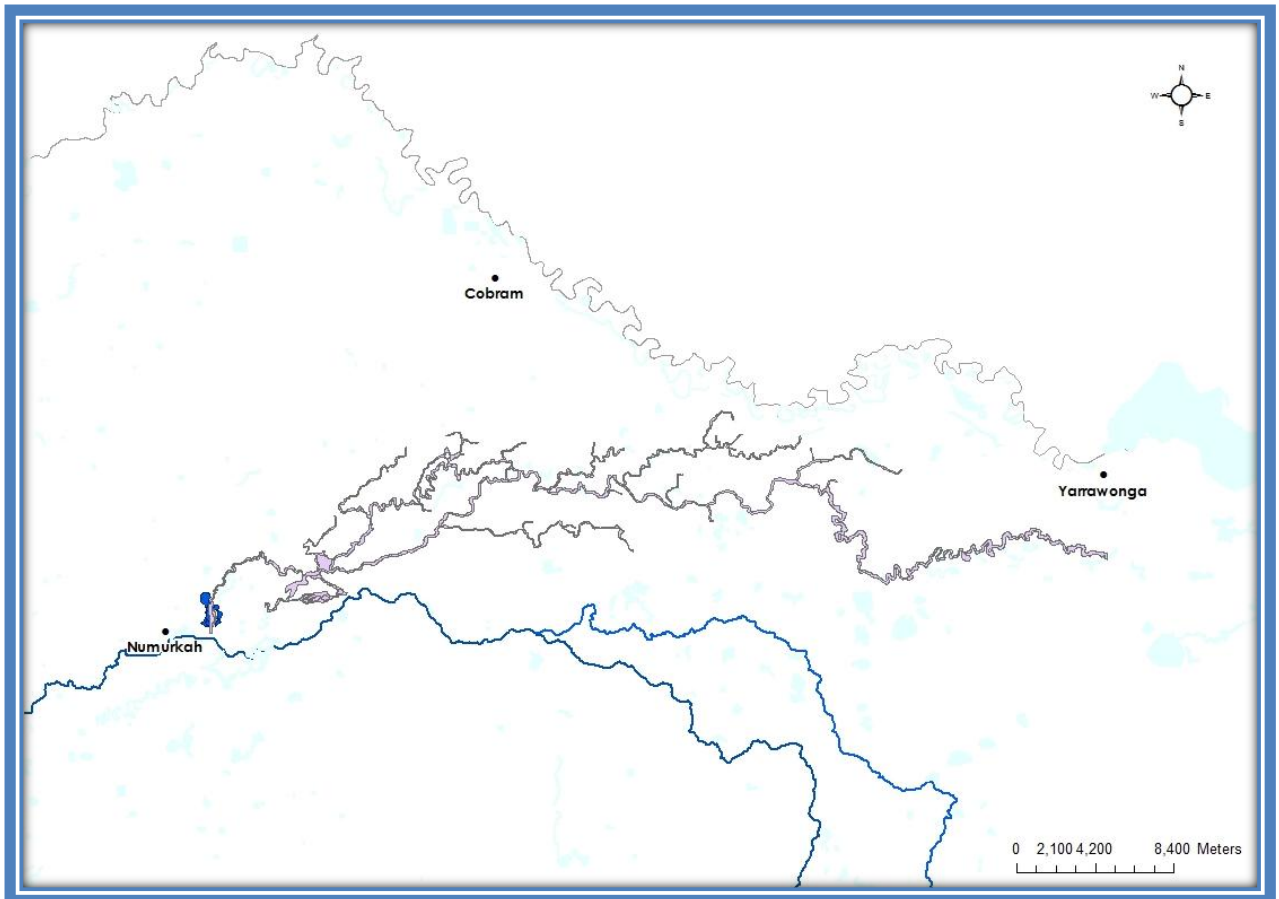


FIGURE 2: LOCATION OF KINNAIDS WETLAND (BLUE) IN RELATION TO THE MUCKATAH DEPRESSION (RUNNING FROM THE SOUTH OF YARROWONGA TO NUMURKAH)

1.3 PLAN DEVELOPMENT AND CONSULTATION

This environmental management plan for Kinnairds Wetland was prepared by the Goulburn Broken Catchment Management Authority on behalf of the Moira Shire Council. It is the second edition of the plan which was originally developed in 2003 by the former named Department of Primary Industries. This plan takes into account the existing operational management arrangements between Goulburn Broken Catchment Management Authority, Goulburn-Murray Water and Moira Shire Council. It also takes into account historical and current information, reports and research findings that relate to the wetland area.

Throughout the plan's review and development process, key stakeholders have been consulted, kept informed and provided with opportunities for input and comment. This has included working closely with Goulburn-Murray Water, Moira Shire Council, Goulburn Broken Catchment Management Authority, Kinnairds Wetland Advisory Committee and Goulburn Broken Wetland Management Group.

1.4 VISION

The vision for Kinnairds Wetland is:

"To maintain Kinnairds Wetland as a biologically diverse functioning wetland system dominated by indigenous flora and fauna, enhancing their successful breeding opportunities and encouraging the utilisation from rare and threatened species, whilst providing suitable retardation and water purifying attributes for the Muckatah Surface Water Management Scheme and valued by the community for passive recreation, ecotourism and ecological benefits".



FIGURE 3: KINNAIRDS WETLAND AFTER FLOODING IN APRIL 2012

Photo: J.Wood, GB CMA 2012

1.5 POLICY SUPPORT

The issues and directions for wetland management are outlined in a number of federal, basin, state, and catchment management strategies (Appendix 1). The primary emphasis of the strategies is to protect natural systems from degrading processes and, where possible, restore the natural functioning of degraded systems to enhance indigenous biodiversity.

Key policy documents and management strategies of influence for this management plan include:

International treaties, conventions and initiatives:

Japan Australia Migratory Birds Agreement (JAMBA) 1994

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979

China Australia Migratory Birds Agreement (CAMBA) 1986

Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) 2002

Commonwealth legislation and policy:

Australian Heritage Commission Act 1975 (Register of the National Estate)

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Part IIA)

Native Title Act 1993

Wetlands Policy of the Commonwealth Government of Australia 1997

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Water Act 2007

A Framework for determining Commonwealth Environmental Watering Actions 2009

Victorian Legislation:

Environmental Effects Act 1978

Planning and Environment Act 1987

Flora and Fauna Guarantee Act 1988 (FFG 1988)

Water Act 1989

Catchment and Land Protection Act 1994

State Environment Protection Policy (Waters of Victoria) 2003

Aboriginal Heritage Act 2006

Victorian regional and local policy, codes of practice, charters and strategies:

Muckatah Catchment Strategy 1999 (G-MW, 1999)

Securing our Water Future Together - Our Water Our Future 2004 (DSE, 2004)

Northern Regional Sustainable Water Strategy 2009 (DSE, 2009b)

Lower Broken Creek and Nine Mile Creek Environmental Watering Plan 2010 (GBCMA, 2010)

Biodiversity strategy for the Goulburn Broken Catchment, Victoria 2010-2015 (Miles et al., 2010)

Environmental Sustainability Strategy Moira Shire 2012 (MSC, 2012)

Goulburn Broken Regional Catchment Strategy 2012 (GBCMA, 2012)

2013/14-2016/17 Council Plan (MSC, 2013a)

1.6 SUPPORTING DOCUMENTATION

Information used in the development of this updated Plan was compiled from various sources including:

- Kinnairds Wetland Environmental Management Plan (DPI, 2003b)
- Goulburn Broken Regional River Health Strategy (GBCMA, 2005)
- Birds recorded at Kinnairds Wetland, Numurkah, Victoria. 6th May 2004 – 5th May 2005 (Deayton, 2005)
- Kinnairds Wetland Revegetation Plan (MSC, 2007)
- Kinnairds Wetland Biological Monitoring Plan (TFN, 2008)
- Micro Bat (*Microchiroptera*) survey of Kinnairds Wetland (Caryl et al., 2009)
- Trust for Nature DRAFT Management Plan for the Covenant of Kinnairds Wetland (TFN, 2010)
- Ecological Monitoring of flora and fauna response to environmental water delivery in 2008 and 2010 (Cook et al., 2009, Jolly and Osler, 2011)
- Kinnairds Wetland Environmental Water Management Plan (GBCMA, 2011)
- Kinnaird Wetland Reptile Habitat Project (ICS, 2012)
- Birds recorded at Kinnairds Wetland, Numurkah Victoria. May 2004-July 2013 (MSC, 2013b)

This information was supplemented by discussions with people with an intimate knowledge of the wetland area, its environmental values, and the management and operation of Kinnairds Wetland.

In addition, a number of data sets and digital mapping layers were used including the:

- Wetland environments and extent up to 1994
- Biodiversity Action Planning – Central Creek Landscape Zone (DPI, 2003a)
- Eremaea Birds (Eremaea, 2003)
- Flora Information System of Victoria (DSE, 2005a)
- Atlas of Victorian Wildlife (DSE, 2007a)
- Bioregional Conservation Status of Ecological Vegetation Classes
- Moira Shire Aerial photography (2009 layer)
- Atlas of Living Australia (ALA, 2013)

1.7 WETLAND MANAGEMENT

Kinnairds Wetland is jointly managed by Moira Shire Council, Goulburn-Murray Water and Goulburn Broken Catchment Management Authority through a management agreement to implement the Kinnairds Wetland Environmental Management Plan. Land managers of the site include Goulburn-Murray Water (18 ha), Moira Shire Council (59.15ha) and a private landowner (16 ha). Flood and drainage easements in favour of Goulburn-Murray Water exist over private land occurring within the wetland basin delineated by the outer confining bank constructed as part of the Surface Water Management Scheme (Figure 4).

1.7.1 ADVISORY COMMITTEE

Recommendations made in this plan are implemented by Moira Shire Council, Goulburn-Murray Water and the Goulburn Broken Catchment Management Authority with support from the Kinnairds Wetland Advisory Committee (KWAC). This committee was formed to support the Environmental Management Plan and has been assisting with implementing actions from the Kinnairds Wetland Environmental Management Plan (DPI, 2003b). The committee is made up of members from Moira Shire Council, Birdlife Murray Goulburn, Broken Creek Field Naturalists Club Broken Boosey Conservation Management Network, Goulburn-Murray Water, Goulburn Broken Catchment Management Authority, Numurkah and District Development Committee Inc., Numurkah Tourism, Department of Environment and Primary Industries, Trust for Nature, Yorta Yorta Aboriginal Corporation and three community representatives. Maintaining this group is important for the wetlands successful management and continuous environmental improvement. Moira Shire Council seeks nominations for this committee on a regular basis, which includes inviting current members to renominate as well as promoting the opportunity for members of the broader community to be nominated.

Action: Maintain the Kinnairds Wetland Advisory Committee and key contacts to ensure that it can provide informed advice, respond to specific issues and promote the values associated with Kinnairds Wetland.

1.7.2 PLANNING AND MANAGEMENT RESPONSIBILITY

Kinnairds Wetland is surrounded by various land uses including urban development, irrigated agriculture, cropping, pastures and Broken Creek crown land. It also receives many visitors, all of which can have an influence on Kinnairds Wetland.

A range of management agencies have responsibility for ensuring that Kinnairds Wetland is soundly managed and that this complies with a broad range of legislative requirements. Lead management agencies and their key responsibilities are summarised in Table 1.

The broader community including adjacent landholders, Yorta Yorta Peoples, Trust for Nature, visitors and recreational users also have an interest and important role in responsible management of the area. Successful management of the area relies on shared understanding, responsibility and effective cooperation between all involved.

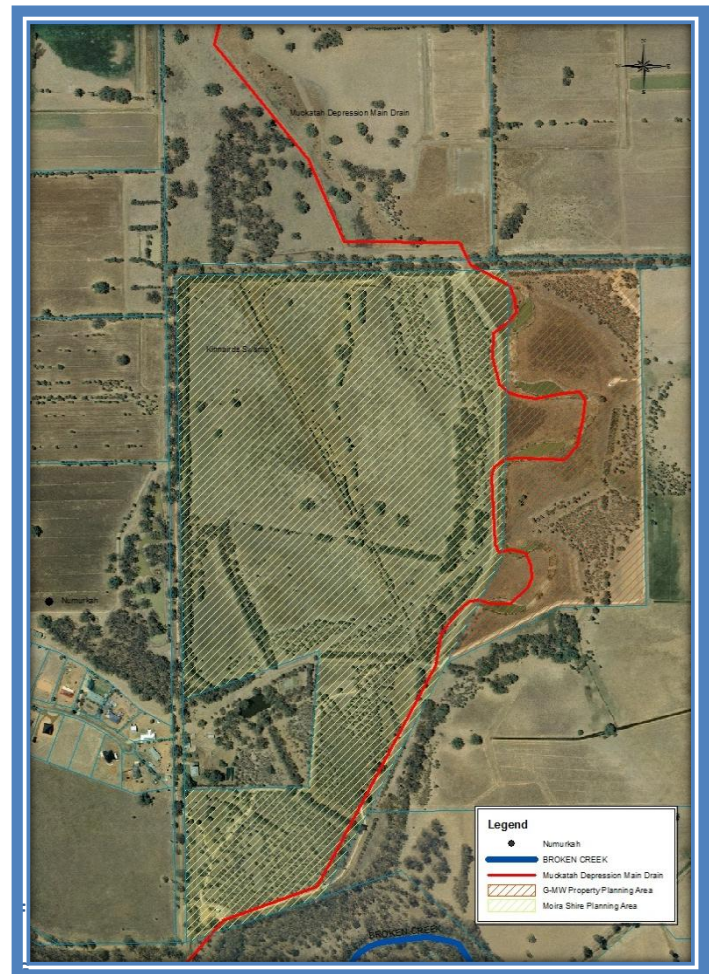


FIGURE 4: MAP OF KINNAIRDS WETLAND INDICATING PROPERTY BOUNDARIES

TABLE 1: LEAD GOVERNMENT AGENCIES AND THEIR KEY RESPONSIBILITIES

Agency	Responsibility
Aboriginal Affairs Victoria	Promote knowledge and understanding within the wider community of the study area's Aboriginal people and their history. Administer legislation protecting Aboriginal heritage sites within the study area (<i>State Aboriginal Heritage Act 2006</i> and Part IIA of the Commonwealth Aboriginal Torres Strait Islander Heritage Protection Act 1984).
Department of Environment and Primary Industries	Provide technical and extension support for the sustainable management of fisheries, agriculture, minerals and petroleum. Provide financial, policy and strategic support for the management of public and private land. Management of flora and fauna, State Forest and public Land Water Frontage. Management of hunting and domestic stock licensing on public land.
Environmental Protection Authority	Protect, restore and enhance air, land and water quality and control of unwanted noise.
Goulburn Broken Catchment Management Authority	Implementation of the Goulburn Broken Regional Catchment Strategy. Works on waterways, regional drainage and floodplain management, and co-ordinating Commonwealth and State natural resource management investment. Determining the environmental water requirements of wetlands and streams, developing and submitting annual water proposals to DEPI for consideration, and managing the delivery of environmental water in accordance with DEPI's watering plan.
Goulburn-Murray Water	Part owners/ managers of Kinnairds Wetland. Assist with upgrades of Muckatah Surface Water Management System and implement on ground works to allow efficient Environmental Water delivery to the Wetland.
Kinnairds Wetland Advisory Committee	Assist with the implementation of management actions that have arisen from the Kinnairds Wetland Environmental Management Plan.
Murray-Darling Basin Authority	The Murray-Darling Basin Authority's principal aim is to manage the Basin's water resources in the national interest.
Moira Shire Council	Part owners/ managers of Kinnairds Wetland. Coordinate land and visitor management with other land owners and management agencies. Coordinate Kinnairds Wetland Advisory Committee
Victorian Environmental Water Holder	Management of environmental water entitlements on behalf of the Minister for Environment as of July 2011.

2. SITE OVERVIEW

2.1 WETLAND HISTORY

2.1.1 CULTURAL HERITAGE – PRE-EUROPEAN SETTLEMENT

Kinnairds Wetland and the surrounding catchment have a long history of traditional owner occupation by the Yorta Yorta Peoples and are an important part of their cultural and spiritual heritage. Kinnairds Wetland would have provided the Yorta Yorta Peoples with a rich and diverse supply of plant and animal resources for food, medicines, shelter, clothing and tools. Evidence of past traditional owner occupation includes scarred trees and artefact scatters recorded along the Broken Creek. There are no registered sites within 4km of Kinnairds Wetland (Sutherland, 2010). However, Kinnairds Wetland has not been extensively surveyed for Aboriginal archaeological sites and past land uses may have destroyed existing sites. Water bodies throughout the Muckatah Depression, such as Kinnairds Wetland, and other prior stream depressions in such a semi-arid landscape dominated by Grey Box woodlands and open grassland, would have provided a valuable water and food gathering resource.

Action: Engage Yorta Yorta to undertake an archaeological survey of the wetland reserve.

2.1.2 POST-EUROPEAN SETTLEMENT

Post-European settlement saw Kinnairds Wetland partially cleared in the 1840s for pig and sheep farming and cropping (Bossence, 1979). The name Kinnairds comes from a land owner that had property surrounding the current wetland area. The property flooded in May 1889 and Bossence (1979) states “an immense sheet of water spread over the land....water flowed over the top fence wires on Mr Alan Kinnairds Farm”.

Irrigated agriculture was introduced into the Numurkah area post World War II with the area now identified as Kinnairds Wetland being used for grazing and cropping oats (DPI, 2003b) however, irrigation run-off caused prolonged flooding along the Muckatah Depression and into Kinnairds Wetland. Between the 1950s and the 1970s a variety of attempts were made to control or eliminate the flooding of the wetland with drains and banks being constructed from the Broken Creek to the upper reaches of the wetland. However, this was to no avail and prolonged flooding caused changes to vegetation characteristics by drowning trees and creating open areas dominated by sedges, rushes and other species adapted to prolonged inundation.

Cropping of the wetland was abandoned in the early 1980s and the drought of the 1980s saw a change of focus to harvesting water for pastures by creating a network of dams, banks and drains in the wetland. Subsequently, the annual drying frequency and duration reduced as the wetland remained wet through summer and into autumn.

The landscape of the area has also been influenced by large flood events including those in 1956, 1974-75, 1992-93 and 2012. One lasting effect is the post flood regeneration of River Red Gums (*Eucalyptus camaldulensis*) which occurred over time along fence lines, channel banks and in scattered patches. This has resulted in a diversity of tree age classes and densities.

In 1999, the Muckatah Depression Main Drain was constructed to provide drainage to ~60,000 hectares of the Muckatah Catchment above Kinnairds Wetland (Figure 2). Part of the design included constructing a wide bunded drainage area with deeper pools to allow water from the main drain to primarily flow through the northern and eastern sections of Kinnairds Wetland. This created an open herbaceous wetland area to provide minor flood retardation, nutrient and sediment reduction and control discharge rates from the catchment into the Broken Creek. It also provided the capacity, under normal flows, to manage the flooding regime of the western ‘natural’ section of Kinnairds Wetland, a remnant of the ‘natural’ terminal wetland depression (Figure 4). During other than low level flooding events, water disperses throughout the greater ‘natural’ terminal wetland depression.

2.2 CATCHMENT ACTIVITIES

The Muckatah catchment is situated in the Victorian Riverina which is characterised by flat to gently undulating landscape on recent unconsolidated sediments with evidence of former stream channels and wide floodplain areas associated with major river systems and prior streams. Alluvium deposits from the Cainozoic period gave rise to the red brown earths and texture contrast soils which dominate the Riverine Plain (DSE, 2011). The catchment is however, characterised by the shallow meandering ancestral watercourse known as the Muckatah Depression in which Kinnairds Wetland is at the terminal end. The Muckatah Depression is a prior stream depression and fed from a 600km² catchment beginning near Yarrowonga and outfalls into the Broken Creek downstream of Kinnairds Wetland (DPI, 2003b, G-MW, 1999). The depression and its anabranches traverse the catchment for over 100 kilometres, forming at times a continuous series of freshwater meadows and marshes. These depression wetlands cover an area of approximately 2,000 hectares when flooded (O'Connor, 1995). Kinnairds Wetland is located on the floodplain of the lower Broken Creek at the terminal end of the Muckatah Depression.

Native vegetation in the Muckatah catchment has been extensively cleared for agriculture since European settlement in 1840s. The idea of irrigated agriculture was proposed in 1881, however the land was deemed unsuitable by irrigation specialists the Chaffey brothers and farmers had to rely on rainfall for farming activities. In 1939 the Yarrowonga Main Channel began carrying water towards Numurkah, but work was delayed by World War II. Resumption of irrigation works coincided with soldier settlement after the war. In 1946 as land holdings were acquired for subdivision into orchards and dairy farms, irrigation and drainage was constructed (Bossence, 1979). Fifty per cent of the Muckatah Catchment is now utilised for irrigation purposes (G-MW 1999).

The current primary activities of the Muckatah catchment include intensive horticulture, dairy, cropping and livestock production.

2.3 RECENT ACTIVITIES

2003 – a) Development and sign off of the Kinnairds Wetland Environmental Management Plan.

b) Formation of the Kinnairds Wetland Advisory Committee.

2007 – Revegetation Plan developed and implemented to improve species and structural diversity in woodland areas of wetland reserve. Plantings focussed on understorey and mid-storey species. This was part of a state funded project supported by the former named Department of Sustainability and Environment Bush Tender grant. Since 2007, approximately 11,000 seedlings have been planted at Kinnairds Wetland with an approximate survival rate of 75 per cent.

2008 – 413ML of environmental water delivered to Kinnairds Wetland during April and May. Ecological monitoring takes place to determine effects of environmental water.

2010 – 400ML of environmental water delivered to Kinnairds Wetland during April and May. Ecological monitoring takes place to determine effects of environmental water.

2013 – In 2013 upgrades to the wetlands regulating structures and outfall structures was funded by the Department of Environment and Primary Industries and works conducted by Goulburn-Murray Water with approval from Moira Shire (Figure 5). This included:

- The installation of box culverts at the northern end of the wetland to increase water delivery efficiency and control by allowing water to be independently delivered to either section of the wetland (B)

- Installation of 600 millimetre culvert with a control door under the inner confining bank to allow more efficient delivery of environmental water from the constructed section of the wetland to the natural section (C).
- Replace the current drop board system with a padman stop system and a retaining wall to provide greater control over ponding height and duration in the wetland and maintain filtering vegetation. This is particularly important during bird breeding events (D).
- Installation of a 300 millimetre pipe with door and reinstate the height of the access track to allow water flows to be delivered to the River Red Gum EVC in the southern section of the wetland. This also allows low flow events to be filtered via the southern section of the wetland before entering the Broken Creek (E).
- Breach the disused channel in the southern section of the wetland to increase water delivery efficiency into the River Red Gum EVC (F).



FIGURE 5: UPGRADES TO KINNAIRDS WETLAND IN 2013

3. WETLAND CHARACTERISTICS, CONDITION AND VALUES

3.1 WETLAND CHARACTERISTICS

Wetlands in Victoria are currently classified using a system developed by Corrick and Norman which includes information on water depth, permanency and salinity (Corrick and Norman, 1980). Wetlands through Victoria were mapped and classified between 1975 and 1994 and developed into spatial layers (DSE, 2007b).

Kinnairds Wetland is classified as a shallow freshwater marsh in the Department of Sustainability and Environment wetlands 1994 layer and a Palustrine wetland in the new wetlands 2013 layer (Figure 6). Kinnairds Wetland has a mean depth of 0.5 metres and has a calculated capacity of approximately 482.5 ML². Kinnairds Wetland outfalls into the Broken Creek and is at the terminal end of the Muckatah Depression which both are listed on A Directory of Important Wetlands (EA, 2001). However, Kinnairds Wetland is not listed on *A Directory of Important Wetlands* (EA, 2001), but an application to include Kinnairds Wetland on the Directory of Important Wetlands will be pursued due to its unique environmental values within the Muckatah Depression. The wetland contains important woodland habitat which is home to numerous terrestrial bird species (refer to section 3.4 Wetland Values).

Kinnairds wetland is located within the Victorian Riverina bioregion within the Muckatah Depression (Table 2).

Action: Pursue an application to include Kinnairds Wetland on Directory of Important Wetlands.

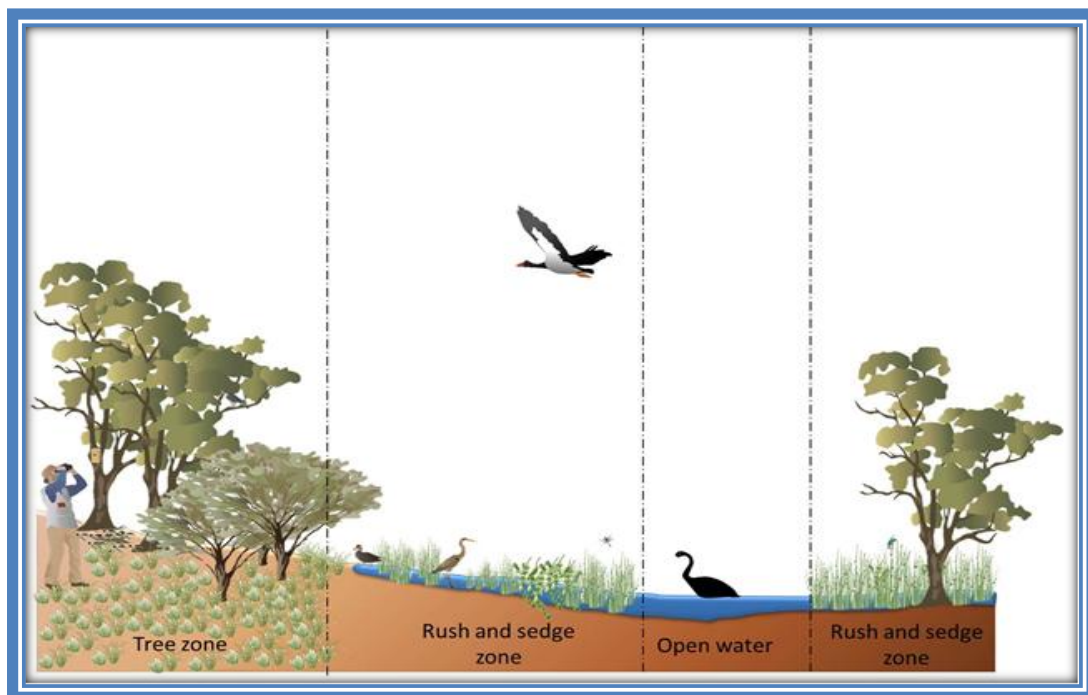


FIGURE 6: A CROSS SECTIONAL DIAGRAM OF KINNAIRDS WETLAND

Developed: J.Wood, GB CMA 2013

² Environmental water allocation volumes will vary corresponding with ecological and hydrological targets that need to be met at the time of delivery.

TABLE 2: SUMMARY OF SITE CHARACTERISTICS

Characteristics	Description
Name	Kinnairds Wetland
Mapping Id	7925619057
Area (hectares)	93.15
Bioregion	Victorian Riverina
Conservation Status	Trust for Nature Covenant
Land Status	Public and Private
Land Manager	Goulburn-Murray Water, Moira Shire, Private
Surrounding Land Use	Irrigated Agriculture, Residential and Public Land Conservation
Water Supply	Muckatah Depression and Lower Broken Creek
1788 Wetland Category	Shallow Freshwater Marsh
1994 Wetland Category	Shallow Marsh
2013 Wetland Category	Palustrine
Wetland Capacity (ML)	482.5
Mean wetland depth at Capacity (metres)	0.5

3.2 WETLAND CONDITION

The condition of Kinnairds Wetland was assessed in December 2010 using a method developed by the Department of Environment and Primary Industries called the Index of Wetland Condition (IWC). The IWC defines wetland condition as the state of the biological, physical, and chemical components of the wetland ecosystem and their interactions (DSE, 2007b).

The IWC has six subindices based on the catchment of the wetland and its fundamental characteristics: physical form, hydrology, water properties, soils and biota. Each subindex is given a score between 0 and 20 based on the assessment of a number of measures. The overall IWC score is not a simple summation of the subindex scores. A formula is used that weights each subindex according to the contribution it makes to the overall condition of the wetland. The wetland hydrology subindex for example contributes more to the overall score than the soils subindex. Further information on the method can be found on the IWC website: www.dse.vic.gov.au/iwc.

The overall IWC score for Kinnairds Wetland in December 2010 was six out of ten, which is considered to be moderate (Table 3). Of note, the subindices hydrology and wetland catchment were considered to be in very poor and poor condition respectively. Hydrology was considered to be very poor due to the impacts of irrigation development and the construction of levees on the natural wetting and drying regime of the site. Wetland catchment was considered poor as 75 per cent of the land surrounding Kinnairds Wetland is used for high or medium intensity land uses such as urban development, irrigated agriculture and cropping.

TABLE 3: KINNAIRDS WETLAND IWC SUBINDEX SCORE, OVERALL SCORE AND ASSOCIATED CONDITION CATEGORIES

IWC subindex	Score	Condition category
Wetland catchment	7/20	Poor
Physical form	16/20	Good
Hydrology	0/20	Very poor
Water properties	17/20	Excellent
Soils	18/20	Excellent
Biota	14/20	Moderate
Overall IWC Score	6/10	Moderate

3.3 MONITORING AND INDICATOR SPECIES

A biological monitoring plan of Kinnairds Wetland was developed for the Moira Shire by Trust for Nature (TFN, 2008). The plan discusses the types of monitoring that should be used at the wetland, its benefits and the results of monitoring which may assist with management decisions. These monitoring actions have been incorporated into the relevant sections of this Environmental Management Plan.

Previous monitoring of Kinnairds Wetland has included:

- State wide Mandatory Monitoring from 1997-2006
- Bird Surveys 2004-2005
- Microbat Surveys 2009
- Environmental Water Monitoring 2008, 2009 and 2010
- Reptile Habitat Monitoring (sites established) 2012
- Bird observations from bird observers groups and individuals 2004-2013.

Goulburn-Murray Water has recently established a series of continuous monitoring stations to monitor water quality and flow from the Muckatah Depression into the Broken Creek. This program automatically records the parameters of salinity, flow, temperature, and turbidity, with fortnightly monitoring of key nutrients. Such monitoring sites have been located upstream and downstream of Kinnairds Wetland (e.g. at the outfall to Broken Creek in Stage 1A and at Naring Hall Road in Stage 1B).

3.4 WETLAND VALUES

3.4.1 FAUNA

Kinnairds Wetland provides habitat for a wide variety of water dependent and terrestrial fauna species. To date 203 species have been recorded at the wetland. These include 153 bird species (98 non-wetland species and 56 wetland species), 20 aquatic macro invertebrate species, seven frog species, three reptile species and 19 species of mammals (Appendix 2).

Of these species, two are listed under the Convention on the Conservation of Migratory Species (Bonn) (Figure 7), ten are listed under the *Flora and Fauna Guarantee Act* (FFG 1988), four are listed under the *Environmental Protection Biodiversity Conservation Act* (EPBC 1999), 25 are considered endangered, vulnerable or near threatened on the Department of Environment and Primary Industries (DEPI) Advisory list of threatened vertebrate fauna in Victoria (2007). Six birds are listed under the Japan Australia Migratory Bird Agreement (JAMBA), seven birds are listed under China Australia Migratory Bird Agreement (CAMBA) and two birds are listed under Republic of Korea Australia Migratory Bird Agreement (ROKAMBA). Brolga (*Grus rubicunda*) were observed at Kinnairds Wetland for the first time in 50 years in 2008 during an Environmental water delivery (O'Connor, 2011).

Importantly, Kinnairds Wetland also contains woodland habitat which is home to a large number of terrestrial species. The EPBC (1999) listed Swift Parrot (*Lathamus discolor*) and the DEPI listed Brown Tree Creeper (*Climacteris picumnus victoriae*) and Black Falcon (*Falco subniger*) have been recorded within the woodland area of the wetland (Table 4).

TABLE 4: CONSERVATION STATUS OF FAUNA SPECIES RECORDED AT KINNAIRDS WETLAND

Common Name	Scientific Name	Type	International agreements	EPBC	FFG	DSE Status
Australian Reed Warbler	<i>Acrocephalus australis</i>	B	B A2H			
Australasian Bittern	<i>Botaurus poiciloptilus</i>	B		End	L	End
Australasian Shoveler	<i>Anas rhynchos</i>	B				Vul
Ballion's Crake	<i>Porzana pusilla palustris</i>	B			L	Vul
Black Falcon	<i>Falco subniger</i>	B				Vul
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	B				NT
Blue-billed Duck	<i>Oxyura australis</i>	B				End
Brolga	<i>Grus rubicundas</i>	B			L	Vul
Brown Treecreeper (south-eastern species)	<i>Climacteris picumnus victoriae</i>	B				NT
Cattle Egret	<i>Ardea ibis</i>	B	J, C			
Eastern Great Egret	<i>Ardea modesta</i>	B	J,C,B		L	Vul
Fork-tailed Swift	<i>Apus pacificus</i>	B	J, C			
Glossy Ibis	<i>Plegadis falcinellus</i>	B	C, B			NT
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	M		Vu	L	Vul
Growling Grass Frog	<i>Litoria raniformis</i>	A		Vu	L	End
Hardhead	<i>Aythya australis</i>	B				Vul
Intermediate Egret	<i>Ardea intermedia</i>	B			L	End
Lace Monitor	<i>Varanus varius</i>	R				End
Latham's Snipe	<i>Gallinago hardwickii</i>	B	J, C, R,B		N	NT
Little Egret	<i>Egretta garzetta</i>	B			L	End
Magpie Goose	<i>Anseranus semipalmata</i>	B				NT
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	B				NT
Pied Cormorant	<i>Phalacrocorax varius</i>	B				NT
Rainbow Bee-eater	<i>Merops ornatus</i>	B	J			
Royal Spoonbill	<i>Platalea regia</i>	B				NT
Swift Parrot	<i>Lathamus discolor</i>	B		End	L	End
Whiskered Tern	<i>Chidonias hybridus</i>	B				NT
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	B	C		L	Vul
White-throated Needletail	<i>Hirundapus caudactus</i>	B	J,C,R			Vul

Legend

Type: Bird (B), Amphibian (A), Reptile (R), Mammal (M)

International: CAMBA (C), JAMBA (J), ROKAMBA (R), Bonn (B), A2H – species is a member of family listed in Bonn Appendix 2.

EPBC Status: Endangered (End), Vulnerable (Vu)

FFG Status: Listed as threatened (L)

DSE Status: Endangered (End), Vulnerable (Vu), Near Threatened (NT)

3.4.1.1 BIRDS

Many water birds such as herons, pelicans, spoonbills, cormorants, darters, ibis and ducks utilise the wetland as a breeding and feeding ground. Little Pied Cormorants (*Microcarbo melanoleuos*), Eurasian Coot (*Fulica atra*), Black Swan (*Cygnus atratus*), Pacific Black Duck (*Anas superciliosa*), and Grey Teal (*Anas gibberifrons*) are common species that have been known to breed and feed in the wetland. During a flooding event in 1992, the wetland also played host to approximately 1500 Pink-eared Ducks (*Malachorhynchus membranaceus*) (O'Connor pers. comm. 2000 cited in DPI 2003b). The EPBC (1999) listed Australasian Bittern (*Botaurus poiciloptilus*) near threatened Royal Spoonbill (*Platalea regia*) and vulnerable Australasian Shovelers (*Anas rhynchotus*) utilise the wetland as a breeding site (Refer to section 3.4.1.1.1 - Significant birds).



Whistling Kites (*Haliastur sphenurus*) regularly nest in a mature River Red Gum within the wetland.

Brolga may have been utilising the wetland as a feeding site when recorded in 2008. Brolga breeding at the site have not been recorded since the 1950s.

Hardhead (*Aythya australis*), Eastern Great Egrets (*Ardea modesta*), Magpie Geese (*Anseranus semipalmata*) and Glossy Ibis (*Plegadis falcinellus*) utilise the wetland as a feeding site when it is wet or in a period of drawdown.

FIGURE 7: BONN CONVENTION LISTED GLOSSY IBIS PHOTOGRAPHED AT KINNAIRDS WETLAND FOLLOWING THE DELIVERY OF ENVIRONMENTAL WATER IN 2008.

Photo: Paul O'Connor, DSE 2008

At an international level, the Muckatah Depression including the Kinnairds Wetland also plays an important role in providing habitat for international migratory species such as Latham's Snipe (*Gallinago hardwickii*) seen in Figure 8. Snipe have been observed around the margins of the wetland and in its upper reaches during several flood events (O'Connor pers. comm. 2000 cited in DPI, 2003). Aerial species such as White-throated Needletail (*Hirundapus caudacutus*) and Fork tailed Swift (*Apus pacificus*) have also been recorded at the wetland.



FIGURE 8: LATHAM'S SNIPE

Photo: Jo Wood, GB CMA 2006

Action: Establish Bird Atlas transects and monitor every five years, starting in 2015. Encourage visiting bird atlas members to undertake surveys and submit records. Record any other incidental observations.

As many as 96 terrestrial bird species utilise the woodland area within Kinnairds Wetland. This includes species such as the Brown Treecreeper (*Climacteris picumnus victoriae*), Black-chinned Honeyeater (*Melithreptus gularis*), Black Falcon (*Falco subniger*) and Brown Quail (*Coturnix ypsilophora australis*). The EPBC (1999) listed Swift Parrot (*Lathamus discolor*) has also been sighted during the winter months utilising the woodland area within Kinnairds Wetland. The connectivity of woodland habitats in Kinnairds Wetland to the Broken Creek corridor and other remnant woodlands in the region is a crucial feature for woodland birds.

3.4.1.1.1 Significant Wetland Birds

Kinnairds Wetland provides breeding habitat for the nationally (EPBC 1999) listed Australasian Bittern (*Botaurus poiciloptilus*), and the state listed near threatened Royal Spoonbill (*Platalea regia*), and vulnerable Australasian Shovelers (*Anas rhynchotis*).

The protection of Reed and Rush beds in the wetland is required to ensure breeding habitat for the Australasian Bittern is maintained (Figure 9). They breed between September and January and usually several females will nest within one males territory (Simpson and Day, 1996) . The Bittern nests in wetlands, generally in stands of Phragmites, Typha or rushes (e.g. *Juncus*, *Baumea spp*) up to 2.5 metres tall. Nests are usually placed about 30 centimetres above water level, but the water level can fall during the breeding season and leave the nest higher still.

The nest is a well-constructed saucer of flat pieces of reeds or rushes that are laid across one another; it measures about 35-40 centimetres across and 20-22 centimetres thick, and may be sheltered above by stems of the surrounding vegetation. The eggs are oval, smooth and glossy, and pure olive in colour; they measure 49.0-53.8 millimetres (Marchant & Higgins 1990). Clutch-size is usually four or five, but can range from three to six (Marchant and P.J, 1990, Serventy and H.M, 1976, CoA, 2013).

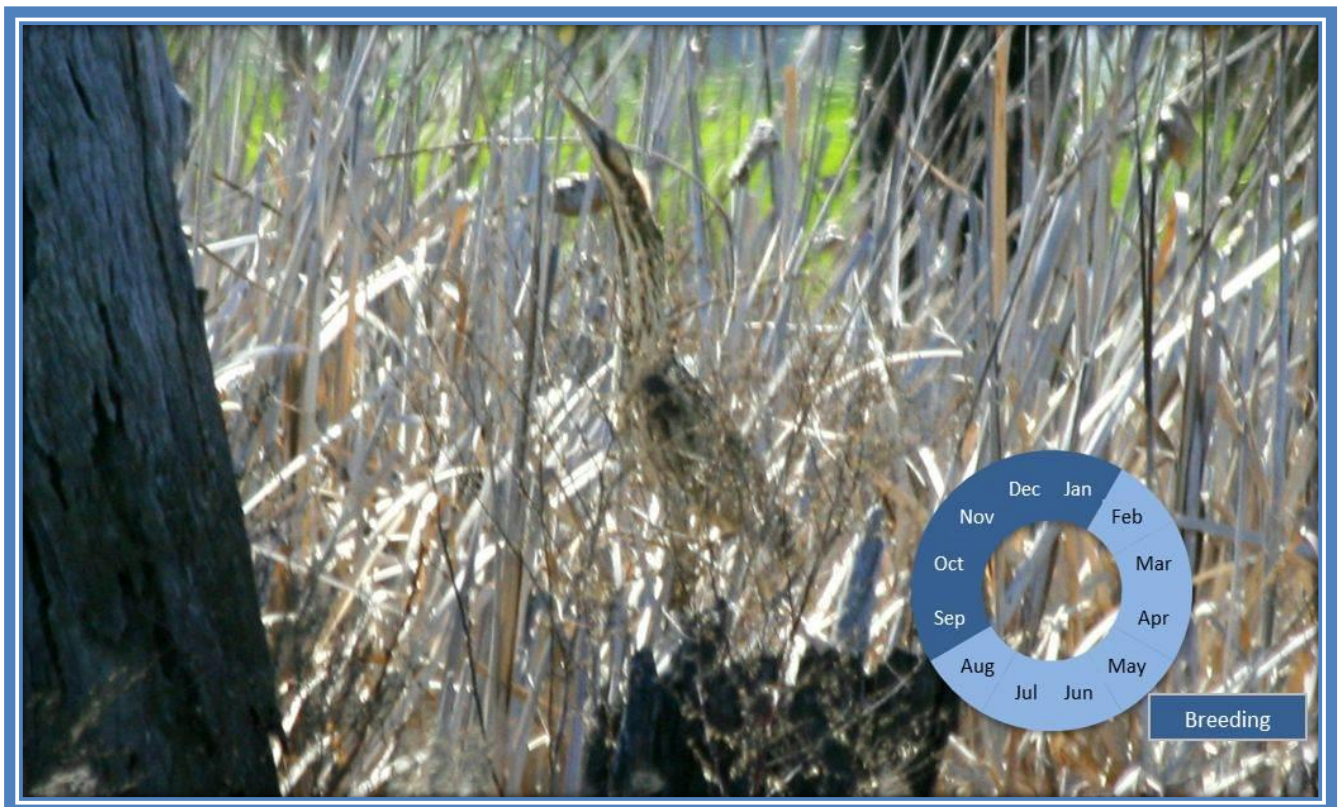


FIGURE 9: AUSTRALASIAN BITTERN

Photo: Paul O'Connor, DSE 2008

The protection of River Red Gums (*Eucalyptus camaldulensis*) in the wetland is required to ensure breeding habitat for the Royal Spoonbill is maintained (Figure 10). They breed between October and March and usually only have one brood per season of 3-4 eggs. Lag time³ and breeding duration have not been fully investigated but it has been estimated that a lag time of 1-2 months, breeding duration of 2-3 months and a flood duration of 4-5 months is required (Rogers and Ralph, 2011).



FIGURE 10: ROYAL SPOONBILL DISPLAYING BREEDING PLUMAGE

Photo: Paul O'Connor, DSE 2008

³ Lag time is the time when birds build up fat reserves before a breeding event YOUNG, W. S. 2003. *Murray Flow Assessment Tool* [Online]. Available: <http://www2.mdbc.gov.au/livingmurray/mfat/downloads.htm>.

Australasian Shovelers have been recorded breeding and feeding at Kinnairds Wetland (Figure 11). Australasian Shovelers nest on the ground and therefore do not have a water depth requirement (Kingsford, 1991). However, they do prefer to be near deep water and breeding is stimulated by flooding or factors associated with flooding such as large rainfall events and an increasing water level (Rogers and Ralph, 2011). They breed between August and December, have a breeding duration of 3 months that requires flooding of approximately 5-6 months and can have 9-11 eggs per clutch (Rogers and Ralph, 2011). The Shovelers feed at night or at dusk in shallow water.



FIGURE 11: AUSTRALASIAN SHOVELER (MALE)

Photo: Paul O'Connor, DSE 2009

Action: Provide opportunities for waterbird breeding especially Australasian Bittern, Royal Spoonbills and Australasian Shoveler during wet events.

3.4.1.1.2 SIGNIFICANT TERRESTRIAL BIRDS

Kinnairds Wetland provides breeding habitat for numerous woodland birds. It is home to more than 96 species which utilise the area to breed, feed and roost. Species such as the near threatened Black-chinned Honeyeater (*Melithreptus gularis*) and Brown Treecreeper (*Climacteris picumnus victoriae*) have been recorded breeding or feeding within the woodland area of Kinnairds Wetland.

Other species such as the Buff-rumped Thornbill (*Acanthiza reguloides*), Crested Shrike-tit (*Falcunculus frontatus*), Grey Shrike-thrush (*Colluricincla harmonica*), Grey-fantail (*Rhipidura albiscapa*), Jacky Winter (*Microeca fascinans*) and the Restless Flycatcher (*Myiagra inquieta*) have either bred or have the potential to breed within the woodland area also (Figure 12).

Connectivity of woodland habitats in Kinnairds Wetland to the Broken Creek corridor and other remnant woodlands in the region is a critical feature for woodland birds.



FIGURE 12: RESTLESS FLYCATCHER

Photo: K. Chalmers, DEPI 2010

Action: Provide opportunities for terrestrial bird breeding by retaining and enhancing habitat and promoting better habitat connectivity in the broader region.

3.4.1.2 AMPHIBIANS REPTILES AND FISH

Amphibians thrive at Kinnairds Wetland when it holds water due to the variety of available aquatic habitat with seven species having been recorded at the wetland. The EPBC (1999) listed Growling Grass Frog (*Litoria raniformis*) was recorded at the wetland in 2005 but has not been recorded since (Figure 13).



FIGURE 13: GROWLING GRASS FROG

Photo: D.Cook, 2008

Action: Undertake frog monitoring surveys to determine species utilising Kinnairds Wetland after natural wetting events or delivery of environmental water.

Reptiles recorded at the wetland include the endangered Lace Monitor (*Varanus varius*), the Eastern Brown Snake (*Pseudonaja textilis*) and Tiger Snake (*Notechis scutatus*). Reptile habitat monitoring stations have been set up within the wetland for monitoring (ICS, 2012).

Action: Survey reptile monitoring stations on a 12 monthly basis.

A single Eel-tail Catfish (*Tandanus tandanus*) was recorded from the wetland in 2000. This species was once common throughout the catchment (DPI, 2003b).

Action: Undertake a fish monitoring survey during a flood or environmental water event.

3.4.1.3 BATS AND OTHER MAMMALS

A brief survey of the presence of bats undertaken in 2009 indicated that Kinnairds Wetland was home to 10 species of bats (Figure 14). The mixture of habitats at Kinnairds Wetland, which along with the Red Gums along road reserves includes areas of dense regenerating Red Gum, open grassland and wetland in juxtaposition with one another, is cause for the high species diversity recorded (Caryl et al., 2009). One Gould's Long Eared Bat (*Nyctophilus gouldi*) was found in samples taken across Kinnairds Wetland. This species is becoming increasingly rare across Victoria and a study in 2005 by van der Ree and McCarthy found the likelihood of a mammalian species going extinct around Melbourne predicted that this was one of the most threatened (Caryl et al., 2009).

Monitoring of bats at Kinnairds Wetland highlighted the importance of maintaining remnant vegetation in highly modified agricultural landscapes. It is important that bat surveys are conducted on a regular basis to ensure habitat heterogeneity assists with maintaining these species at the wetland site.



FIGURE 14: GOULD'S LONG EARED BAT

Photo: L. Evans (Caryl et al., 2009)

Action: Undertake bat surveys every 5-10 years starting in 2015, to determine species and population changes at Kinnairds Wetland.

Other mammals occurring at Kinnairds Wetland include the Common Ringtail (*Pseudocheirus peregrinus*) and Brushtail possums (*Trichosurus vulpecula*). Availability of nest sites (tree hollows) may be a factor limiting abundance of the Common Ringtail Possum and Common Brushtail Possum (Strahan 1995). Maintenance of mammal nest boxes is imperative for habitat at Kinnairds Wetland. There are accounts of Water-rats (*Hydromys chrysogaster*) living in the wetland area (Walsh 1997 cited in DPI, 2003). Although Water-rats may have dense populations in some irrigated areas, particularly in drainage wetlands, wetland reduction and flood mitigation has removed much of the Water-rats habitat (Strahan, 1995) and hence wetlands such as Kinnairds Wetland are an increasingly important habitat (DPI, 2003b). Eastern Grey Kangaroo (*Macropus giganteus*) and Swamp Wallaby (*Wallabia bicolor*) also occur at the wetland. Grey-headed Flying-fox and Little Red Flying-fox have been observed flying over the wetland (Deayton, pers. comm.).

Action: Undertake mammal surveys every 3-5 years starting in 2015, using spotlight techniques or nest box monitoring techniques. Record any incidental observations.

Action: Maintain mammal nest box program in conjunction with Broken Boosey Conservation Management Network.

3.4.1.4 MACROINVERTEBRATES

Macroinvertebrates are excellent indicators of water quality. Macroinvertebrate sampling was undertaken by the former Department of Primary Industries during 1997, 2003, 2004 and 2006. Results from this data collection found 17 different macroinvertebrate families sampled from the wetland (Deretic and Paganini, 2007); however the diversity of species composition changed significantly each year with differing water conditions. Continuation of monitoring of the wetland for macroinvertebrates should be timed with inundation events either natural or during environmental water delivery.

Action: Undertake aquatic invertebrate surveys to determine species population changes and utilisation of Kinnairds Wetland during natural wetting events or environmental water delivery.

3.4.1.5 – PEST SPECIES

A total of nine pest species have been recorded at Kinnaird Wetland. Pest animals threaten the ecological values of the wetlands by predated native species, transmitting diseases, competing for food and habitat and feeding on native fauna. A major pest of concern to the wetland and its health is the European Carp (*Cyprinus carpio*) (Figure 15). The following describes the impacts upon water bodies that have been directly attributed to Carp (Norris, 2011):

- Reduced water quality – when present in high numbers, carp contribute to poor water quality by uprooting vegetation and stirring up sediments during feeding, leading to increased turbidity. This in turn reduces light penetration, decreases plant growth, inhibits visual feeding by native species and can smother plants.
- Impacts on aquatic plants – Carp have significant effects on native aquatic plants both directly through grazing and uprooting plants whilst feeding, leading to a reduction in plant density and biomass. Soft-leaved, shallow-rooted and submerged plants are most likely to be affected.
- Disease – Carp can carry a number of disease-causing organisms. Some of these, such as the Asian fish tapeworm, now occur in Australia and may pose a risk to native fish.

Management of pest species such as Carp could include electrofishing, drawdown of the wetland if a prolonged wetting event has occurred and it is not to the detriment of breeding fauna. The installation of a Carp screen on the Muckatah surface water management scheme where it enters the wetland may be another option to control Carp entering the wetland body.



FIGURE 15: A MAJOR PEST SPECIES OF OUR WATERWAYS THE EUROPEAN CARP

Photo: J.Lyon, ARI, 2012

The history of terrestrial pest management at Kinnairds Wetland has focussed on Hare (*Lepus capensis*) and Fox (*Vulpes vulpes*) populations. During establishment of vegetation Hares can have a detrimental effect on plant growth and survival due to grazing on seedlings, however vegetation within the wetland has now established and Hares do not seem to be causing significant damage. Tree guards are installed to deter grazing.

There is little known about Fox occurrence and predation within Kinnairds Wetland. Fox control such as shooting and baiting in the wetland is problematic due to the proximity of urban and rural development and high public use of the area. Indian (Common) Myna may also pose threat to bird species within the wetland and woodland area due to predation and nest hollow invasion.

A pest management plan should be developed to assist with the control of pest species (both flora and fauna) within Kinnairds Wetland.

Action: Develop a pest management plan including both terrestrial and aquatic pest plants and animals for Kinnairds Wetland.

Action: Support an integrated and coordinated pest control program within Kinnairds Wetland.

3.5 FLORA

3.5.1 VEGETATION CLASSES

Kinnairds Wetland is dominated by a mosaic of Red Gum Swamp and Plains Grassy Wetland Ecological Vegetation Classes (EVCs) with smaller occurrences of Plains Rushy Wetland, Tall Marsh and Riverine Swampy Woodland (Cook et al., 2009, Jolly and Osler, 2011). Table 5 shows the conservation status of these EVCs. The Red Gum Swamp EVC is dominated by an open canopy of River Red Gum over a diverse community of semi-aquatic grasses, sedges and herbs. River Red Gum EVCs should be monitored post-flooding due to the possibility of thickets establishing. Maintenance of the Red Gum EVCs should occur to prevent thickets establishing within the wetland.

Action: Monitor areas such as River Red Gum EVC post flooding and take action to prevent establishment of thickets occurring.

Plains Grassy Wetland EVC is species rich with a diverse community of semi-aquatic grasses, sedges and verges of herbs (DSE, 2009a).

Plains Rushy Wetland EVC is rush dominated with species recorded at Kinnairds Wetland including Common Spike-sedge (*Eleocharis acuta*), Gold Rush (*Juncus flavidus*) and Common Blown-grass (*Lachnagrostis filiformis*).

Tall Marsh EVC is dominated by tall emergent rushes, sedges and reeds with species such as Giant Rush (*Juncus ingens*), Common Spike-sedge and Pacific Azolla (*Azolla filiculoides*) being found at Kinnairds Wetland.

Riverine Swampy Woodland is a River Red Gum woodland comprised of a grassy to sedgey herbaceous ground layer, with species indicative of water-logging (DSE, 2009a). Species recorded within this EVC at Kinnairds Wetland included Brown-backed Wallaby Grass (*Austrodanthonia duttonia*), Rigid Panic (*Walwhalleya proluta*), Poison Pratia (*Lobelia concolor*), River Bluebell (*Wahlenbergia fluminalis*), Lesser Joyweed (*Alternanthera denticulata*) Common Woodruff (*Asperula conferta*) and Rough Raspwort (*Haloragis aspera*).

Following the delivery of environmental water in 2008, the nationally threatened species Rigid Water-milfoil (*Myriophyllum porcatum*) and the state threatened Slender Water-milfoil (*Myriophyllum gracile var. lineare*) were recorded in the Red Gum Swamp and Plains Grassy Wetland EVCs. These populations are the largest known populations in Victoria and possibly Australia.

Action: Improve the diversity of native wetland and terrestrial flora species to be consistent with EVC benchmarks and undertake monitoring such as the Index of wetland condition every 2-3 years or during environmental water delivery events.

TABLE 5: CONSERVATION STATUS OF WATER-DEPENDENT ECOLOGICAL VEGETATION CLASSES RECORDED AT KINNAIRDS WETLAND

EVC number	EVC Name	Bioregional Conservation Status
292	Red Gum Swamp	Vu
125	Plains Grassy Wetland	En
961	Plains Rushy Wetland	Vu
821	Tall Marsh	De
815	Riverine Swampy Woodland	Vu

Legend: De = Depleted, En = Endangered, Vu = Vulnerable

3.5.2 HABITAT STRUCTURES AND FEATURES

Maintaining fallen debris is important within the wetland and woodland areas to provide habitat for wildlife and replenish the soil profile with nutrients as it breaks down. Areas with minimal debris should be re-established to provide this habitat.

Action: Maintain fallen timber and enhance suitable areas with woody debris to provide habitat for native wildlife and replenish nutrients within the soil profile.

Ongoing management is required for the continued health of the mature River Red Gum in the centre of Kinnairds Wetland that serves as an important colonial bird nesting trees. The main management action required to do this is to ensure that the site is not waterlogged by extended inundation periods (i.e., those exceeding a year or more without the punctuation of a sufficient dry period to begin to crack surrounding clays) or ensuring that the site does not experience drought stress (i.e., will depend on the tree and seasons, though three to four years without flooding is expected to promote drought stress).

Action: Maintain mature River Red Gums in centre of Kinnairds Wetland to ensure nesting sites for waterbirds are protected.

Since 2007 a planned revegetation program has been implemented to improve species and structural diversity in woodland areas of the wetland reserve. Plantings focussed on using indigenous understorey and mid-storey species to rehabilitate areas previously degraded by earthworks and for infilling areas of River Red Gum woodland. The future aim is to continue to maintain these areas and encourage natural regeneration from the plantings. Encouragingly some natural regeneration was noted in 2012. There is scope to enhance groundcover diversity in these areas with further planting.

Action: Maintain revegetation areas to increase species and habitat diversity consistent with the revegetation plan and conservation covenant plan.

Post flood regeneration of River Red Gum (*Eucalyptus camaldulensis*) has occurred over time along former fence lines and channel banks and in scattered patches on higher ground. This has resulted in a diversity of tree age classes, densities and habitat features throughout the area. Most of the scattered patches were established post 1993 flood and occupy around 12 ha or 15% of the site. Notably these patches provide an important habitat feature for a range of fauna including woodland birds.

Changes in wetland vegetation structure and growth rates of EVCs can be determined by photo point monitoring (Figure 16). Photo points record gross changes in the structure of the wetland area and should be taken from the same position looking in the same direction. Photo point monitoring at Kinnairds Wetland has been occurring since 2007. However, community involvement is also another way to determine changes in the wetland. The establishment of photo points along the wetland tracks for visitors to take photos and send to a localised database is another way to determine changes in wetland activity.



FIGURE 16: PHOTO POINTS SET UP BY MOIRA SHIRE FOR REVEGETATION MONITORING

Map provided by: G. Dayton, Moira Shire 2013.

Action: As part of a waterways citizen monitoring project, construct photo point sites to encourage visitors to take photos and send to a localised database.

3.5.3 SIGNIFICANT FLORA

A total of 181 native flora species have been recorded for Kinnairds Wetland from various sources listed (Appendix 3), including 70 water dependent species. Of these species five are considered rare, threatened, endangered or depleted in Victoria and Rigid Water-milfoil is considered to be vulnerable within Australia (Table 6).

TABLE 6: LISTED WATER-DEPENDENT FLORA SPECIES RECORDED AT KINNAIRDS WETLAND

Common Name	Scientific Name	EPBC Status	FFG Status	DSE Status
Plains Joyweed	<i>Alternanthera sp.1</i>			k
Late-flower Flax-lily	<i>Dianella tarda</i>			v
Bluish Raspwort	<i>Haloragis glauca</i>			k
Riverina Bitter-cress	<i>Cardamine moirensis</i>			r
Rigid Water-milfoil	<i>Myriophyllum porcatum</i>	V	L	v
Slender Water-milfoil	<i>Myriophyllum gracile var. lineare</i>		L	en
Smooth Minuria	<i>Miniuria integerrima</i>			r
Spoon-leaf Mud-mat	<i>Glossostigma cleistanthum</i>			v
Spurred Spear-grass	<i>Austrostipa gibbosa</i>			r
Variable Spike-sedge	<i>Eleocharis minuta</i>			en
Winged Water Starwort	<i>Callitriche umbonata</i>			r

Legend: EPBC Status: Vulnerable (V); FFG Status: Listed as threatened (L); DSE Status: Endangered (en), Vulnerable (v), Rare (r), Poorly known (k)

The most common species found within the wetland are Common Spike-rush (*Eleocharis acuta*), rushes (*Juncus spp.*), water-milfoils (*Myriophyllum spp.*), native docks (*Rumex spp.*), Pacific azolla (*Azolla filiculoides*) and River Red Gum (DPI, 2003b).

The River Red Gum EVC is dominated by the nationally vulnerable Rigid Water-milfoil (Figure 16), Common Spike-rush, Common Swamp Wallaby-grass (*Amphibromus nervosus*), Moira Grass (*Pseudoraphis spinescens*), Tussock Rush (*Juncus aridicola*) and Slender Water-milfoil (Cook et al., 2009). Riverine Bitter-cress (*Cardamine moirensis*), Common Blown-grass (*Lachnagrostis filiformis* var.1) and Ferny Small-flower Buttercup (*Ranunculus pumilio* var. *pumilio*) were also present. In 2010, Gold Rush (*Juncus flavidus*) and Short-fruit Nardoo (*Marsilea hirsuta*) were recorded for the first time in this EVC.

Plains Grassy Wetland EVC is dominated by the endangered Slender Water-milfoil (Figure 17), Common Spike-rush, Common Nardoo (*Marsilea drummondii*), Narrow-leaf Nardoo (*Marsilea costulifera*) and Common Swamp Wallaby-grass (Cook et al., 2009). Winged-water Starwort (*Callitriche umbonata*), Spoon-leaf Mud-mat (*Glossostigma cleistanthum*) and Bluish Raspwort (*Haloragis glauca*) are also present. In 2010 Gold Rush (*Juncus flavius*) was recorded for the first time in this EVC.

Kinnairds Wetland is of high conservation significance as it contains the largest known populations of the EPBC (1999) listed Rigid Water-milfoil (*Myriophyllum porcatum*) and the FFG (1988) listed Slender Water-milfoil (*Myriophyllum gracile* var. *lineare*) in Victoria.

Rigid Water-milfoil is an annual aquatic herb that occurs in shallow, ephemeral wetlands. It was recorded for the first time at Kinnairds Wetland in 2008 following the delivery of environmental water in autumn after a prolonged dry period. Little is known about the ecology of this species other than that it is found in ephemeral and seasonal wetlands and seed apparently persists in sediment when the wetland dries out. Plants have been observed flowering in September to October and fruiting from October to November (Orchard, 1985). Its habitat has been significantly reduced as a result of hydrological alteration such as wetland drainage and channelisation, increased nutrient loads from rural and urban catchments and the introduction of exotic species (DSE, 2005b, Bunn et al., 1997, Murphy, 2006).



FIGURE 17: THE EPBC LISTED RIGID WATER-MILFOIL (*MYRIOPHYLLUM PORCATUM*) GROWING AT KINNAIRDS WETLAND

Photo: Damien Cook, Australian Ecosystems 2008 (taken from GB CMA, 2011)

Slender Water-milfoil was recorded at Kinnairds Wetland in 2008 and 2010 following the delivery of environmental water and had been recorded at the wetland previously in small numbers. Population counts in 2008 determined that approximately 1000 plants were present making it the largest known population of this species in Victoria. Little is known about the ecology and biology of this perennial aquatic species, however it has been found in boggy swamps, shallow still waters and water from 1-2 metres deep in NSW (Orchard, 1985). Flowering begins around August and fruiting continues until March (Orchard, 1985).

The lack of knowledge on the ecological requirements of both these water-milfoil species is a significant knowledge gap.



FIGURE 18: SLENDER WATER-MILFOIL (*MYRIOPHYLLUM GRACILE* VAR. *LINEARE*) GROWING AT KINNAIRDS WETLAND

Photo: Damien Cook, Australian Ecosystems 2008, (taken from GB CMA 2011).

Action: Protect and maintain populations of the EPBC (1999) listed Rigid Water Milfoil and the FFG (1988) listed Slender Water Milfoil doing so by seeking funding for research into these *Myriophyllum* species requirements.

3.5.4 FLORA PEST SPECIES

Kinnairds Wetland has a total of 69 weed species (Appendix 3). Of concern for the wetland is some notable weed species within the catchment including the highly invasive emergent aquatic plant *Sagittaria* (*Sagittaria graminea*). This species is difficult to control, though appropriate efforts should be attempted for it to be eradicated throughout the catchment as a priority. *Sagittaria* is classified as a Weed of National Significance (WoNS) and can form dense monocultures in water up to 1 metre deep (CoA, 2012).

Action: Control *Sagittaria* from the Broken Creek outlet channel to Kinnairds Wetland. Investigate and trial options such as encouraging native species competition and installing piped breaks in the outlet channel.

During 2008-2013 a comprehensive targeted weed control program was implemented. Significant flora pest species occurrence was substantially reduced and woody weeds eradicated. It is important to continue this level of maintenance to keep weed species at controllable levels.

Pest species that have been identified as a threat to Kinnairds Wetland and classified under the *Catchment and Land Protection Act* (1994) List can be found in Table 7.

TABLE 7: SIGNIFICANT FLORA PEST SPECIES OF KINNAIRDS WETLAND

Common Name	Scientific Name	CaLP Category
Saffron Thistle	<i>Carthamus lanatus</i>	Regionally Controlled
Sagittaria	<i>Sagittaria graminea</i>	WONS
Spear Thistle	<i>Cirsium vulgare</i>	Restricted
Patterson's Curse	<i>Echium plantagineum</i>	Regionally Controlled
St Johns Wort	<i>Hypericum perforatum</i>	Regionally Controlled
Variegated Thistle	<i>Sylibum marianum</i>	Regionally Controlled
Bathurst Burr	<i>Xanthium spinosum</i>	Regionally Controlled

Legend

Regionally Controlled – These invasive plants are usually widespread in a region. To prevent their spread, ongoing control measures are required. Land owners have the responsibility to take all reasonable steps to prevent the growth and spread of regionally controlled weeds on their land.

Restricted Weeds – This category includes plants that pose an unacceptable risk of spreading in this State and are a serious threat to another State or Territory of Australia. Trade in these weeds and propagules, either as plants, seeds or contaminants in other materials is prohibited.

WONS = Weed of National Significance

Action: Use selective treatments to reduce risk to non-target species. Use passive methods to control weed species where possible such as encouraging competition from native species.

See action from 3.4: Develop a pest management plan including both terrestrial and aquatic pest plants and animals for Kinnairds Wetland.

3.6 FIRE

On 9 February 2014 a large fire (over 10,000 ha) occurred in the Numurkah and Wunghnu areas. Around 95 per cent of Kinnairds Wetland was burnt during this event. Prior to this there had been no significant fires within the wetland and no burning-off periods for at least 70 years (DPI, 2003b). Cultural burns may have occurred prior to European settlement in the district, though current vegetation structure and diversity is not determined by fire. The main factors that shaped vegetation diversity and structure within the wetland were flooding, grazing and cultivating regimes (especially over the last 90 years). Currently and in future, flooding and drying will be key drivers of vegetation diversity along with targeted revegetation of the site to increase native vegetation diversity and habitat. Vegetation types and habitats at Kinnairds Wetland are at risk from fire.

Protecting habitats throughout the wetland as much as practicable from fire should be a high priority and include the implementation of fire mitigation measures, including:

- the use of existing tracks as fire breaks
- ensuring track sides and fence lines are slashed (where possible)
- burning, ploughing or spraying should not be used to create a fire break
- if broader scale biomass reduction is deemed necessary, slashing should be implemented when conditions are suitable to avoid adverse impacts
- works at the wetland such as slashing, mowing, driving vehicles off track, using other equipment should be avoided on high fire risk days

Some immediate effects and short term impacts of wildfire are apparent, such as the loss of large hollow bearing trees, woody debris, groundcover, understorey, tree damage and disruption to foraging opportunities for fauna. However, longer term effects are not so clear. It is important that post fire consequences are monitored and lessened where possible through informed rehabilitation efforts.

Action: Maintain practical fire mitigation measures to reduce the likelihood and consequences of wildfire, including maintenance of tracks within the wetland for management and emergency vehicle access.

Action: Monitor post fire effects on wetland and woodland areas and undertake appropriate rehabilitation.

4. HYDROLOGY

4.1 FLOOD REGIME

4.1.1 PRE-REGULATION

Under natural conditions, Kinnairds Wetland would have received water from run-off within the Muckatah Depression or in high flood events from the Broken Creek. When the wetland filled it spilled into the Broken Creek and would have flooded most years during winter and spring and dried out in summer and autumn, i.e. had a seasonal wet-dry water regime.

Kinnairds Wetland has experienced protracted flooding since the Muckatah catchment was cleared and irrigated agriculture was introduced. However, the issue of waterlogging was symptomatic of many areas within the catchment rather than restricted to Kinnairds Wetland.

4.1.2 POST-REGULATION

Settlement in the Muckatah Catchment occurred around the 1840s. At this time Kinnairds Wetland was cleared for grazing and cropping. Irrigation was introduced to the area post World War II and the wetland experienced prolonged flooding until construction of the Muckatah Primary Surface Water Management System in 1999.

In 1999, the construction of the Muckatah Primary Surface Water Management System to provide drainage to ~60,000 hectares of the catchment above Kinnairds Wetland began. Stage One of the Muckatah Surface Water Management System constructed an artificial wetland on the eastern side of the wetland with a set of low-level confining banks around the wetland margin to retard the one in two year flow events. The purpose of constructing this wetland is to be used as a retardation basin to aid in flood retention, filtering sediments and nutrients and minimising discharge into the Broken Creek. It also provides the ability to manage the flooding regime of the natural section of Kinnairds Wetland.

4.1.3 ENVIRONMENTAL WATER

In April 2008, an Environmental Water Allocation of 413ML was delivered to Kinnairds Wetland from Murray Valley Channel 5/3 (MV 5/3) via the Muckatah Depression Main Drain. This flooded the 18 hectare eastern section and part of the western 78.5 hectare section of Kinnairds Wetland before the wetland dried in the spring of 2008. This triggered a response from flora including the nationally threatened Rigid Water-milfoil (which had never previously been recorded at the site) and state threatened Slender Water-milfoil. In addition, breeding and feeding habitat was provided for a wide range of wetland dependant fauna including the international migratory species Latham's Snipe.

Between the 12th April and 26th May 2010, 400ML of Environmental Water was delivered to Kinnairds Wetland. The cover of native wetland flora species increased markedly following the watering event. High rainfall events from September 2010 to March 2012 then kept water within the wetland (Figure 19). The wetland eventually began to dry out in November 2012.

The delivery of these environmental water allocations has increased the abundance, distribution and diversity of native aquatic dependent species in the wetland.



FIGURE 19: ENVIRONMENTAL WATER DELIVERY TO KINNAIRDS WETLAND IN 2008

Photo: P.O'Connor, DSE 2008

Environmental water can currently be delivered to Kinnairds Wetland via the Muckatah Depression Drain. Due to delivery constraints and transmission losses from this delivery method, a scoping study has been undertaken to determine a more efficient delivery method. The study recommended environmental water should be delivered via Murray Valley 4 channel at Hendys Road (Paynter, 2010). This would allow small volumes of water to be delivered directly to the eastern side of the wetland.

The construction of a delivery channel or pipeline to the wetland from Hendys Road (eastern supply route) may also provide an ability to supply water to the wetland from irrigation water supply sources. The design of the delivery channel should be the maximum capacity possible within the constraints of current infrastructure to enable appropriate water delivery rate and efficiency. Design also needs to consider providing water to the constructed wetland as well as minimising periods of supply channel use conflict with other diverters.

Action: Investigate options to construct a delivery channel or pipeline to the wetland from supply channel on Hendys Road primarily to improve and maintain vegetation condition therefore improving filtering capacity in the constructed wetland

An important opportunity to be considered is the purchase or long-term management of land parcels under floodway easement or any other adjoining land comprising the greater wetland. This would provide multiple benefits including greater flexibility in broad ecological management and security of Environmental Water usage, improved management of known threatened species populations and increase the extent, diversity and security of habitats. There are also social and economic benefits for adjacent landholders such as relief from management responsibility for example weed control, infrastructure maintenance and flooding.

Action: Work with landholders to negotiate the purchase or long-term management agreement of land parcels under floodway easement or any other adjoining land comprising the greater wetland to improve flexibility and security in ecological management and Environmental Water usage.

Another important opportunity which may assist with broader ecological management and security of environmental water usage is to register both shire and GMW sections of the wetland with the Land for Wildlife program. The State Government program supports land holders or managers who provide habitat for native wildlife on their land. The program was established in 1981 and includes a wide range of ecosystems found on private land including forests, woodlands, heathlands, grasslands and freshwater environments.

Action: Moira Shire and Goulburn Murray Water register with the Land for Wildlife program.

4.1.4 WATERING REGIME

The watering regime for Kinnairds Wetland is for flooding to occur 5 to 7 years in 10. This should occur during late autumn to late spring and should dry within a year (GBCMA, 2011). Reinstating a more natural wetting and drying regime will encourage the restoration of EVCs, allow submerged aquatic plants to germinate and grow and reduce the abundance of weed species. This watering regime also coincides with waterbird breeding events. Some environmental watering events may need to be extended into summer in order to avoid birds abandoning nests with a slow drawdown. Monitoring of nesting birds will need to occur during environmental water delivery to determine how long water should be held within the wetland.

Action: Implement the Kinnairds Wetland Environmental Water Management Plan (GB CMA 2011) including delivery of environmental water to Kinnairds wetland 5-7 years in 10 years, if natural flooding events do not occur.

4.1.5 GROUNDWATER

The soils of the Muckatah Catchment around Kinnairds Wetland have bedrock that consists of Permian mudstone of marine origin. Above this lie sand, clay and loams that have been deposited by prior streams carrying sediment from the highlands. These soils are classified as Muckatah Clay Loam, Mywee Clay, Boosey Loam and Naninganingalook Loam (DPI, 2003b, Bowler and Macumber, 1973).

The impermeable clay substrate to the wetland possibly prevents groundwater seeping up into the wetland (Kelly, 1994, DPI, 2003b). However, saline inflows, concentrated by evaporated losses, can occur and flora and fauna living close or on the bottom can be killed by a stagnant saline layer (McGuchin, 1990, DPI, 2003b). Stagnant layers often persist in wetlands longer than they do in creeks and rivers due to limited mixing with freshwater.

Introduction of irrigation to the Muckatah Catchment around World War II gave no consideration to drainage at the time (DPI, 2003b, G-MW, 1999). Following land clearing, the watertables have since risen in the last 30 years from around 20 metres to the current level of approximately 2-3 metres below the ground surface (Figure 20).

Effects of saline groundwater increase as the watertable rises closer to the surface. Once in the region of 2-3 metres within the grounds surface, salt can affect vegetation by the capillary action of their roots (DPI, 2003b, Duff and Garland, 1988). Frequency of flora and fauna taxon that are salt sensitive will decrease while populations of salt tolerant species may increase. For example, salt tolerant species such as Spiny Rush (*Juncus acutus*), Couch (*Cynodon dactylon*) and Water Buttons (*Cotula coropifolia*) become dominant and out-compete salt sensitive species (Kelly, 1994).

The Muckatah Surface Water Management Scheme is designed to relieve the onset of accessions to the watertable of the Muckatah Catchment by providing catchment drainage for irrigation induced run-off. Suppression of rising watertables has been implemented in conjunction with the Muckatah Catchment Management Strategy (G-MW, 1999). Landholders have been encouraged to undertake Whole Farm Planning to improve their irrigation efficiency, groundwater pumping options and the undertaking of catchment wide revegetation projects.

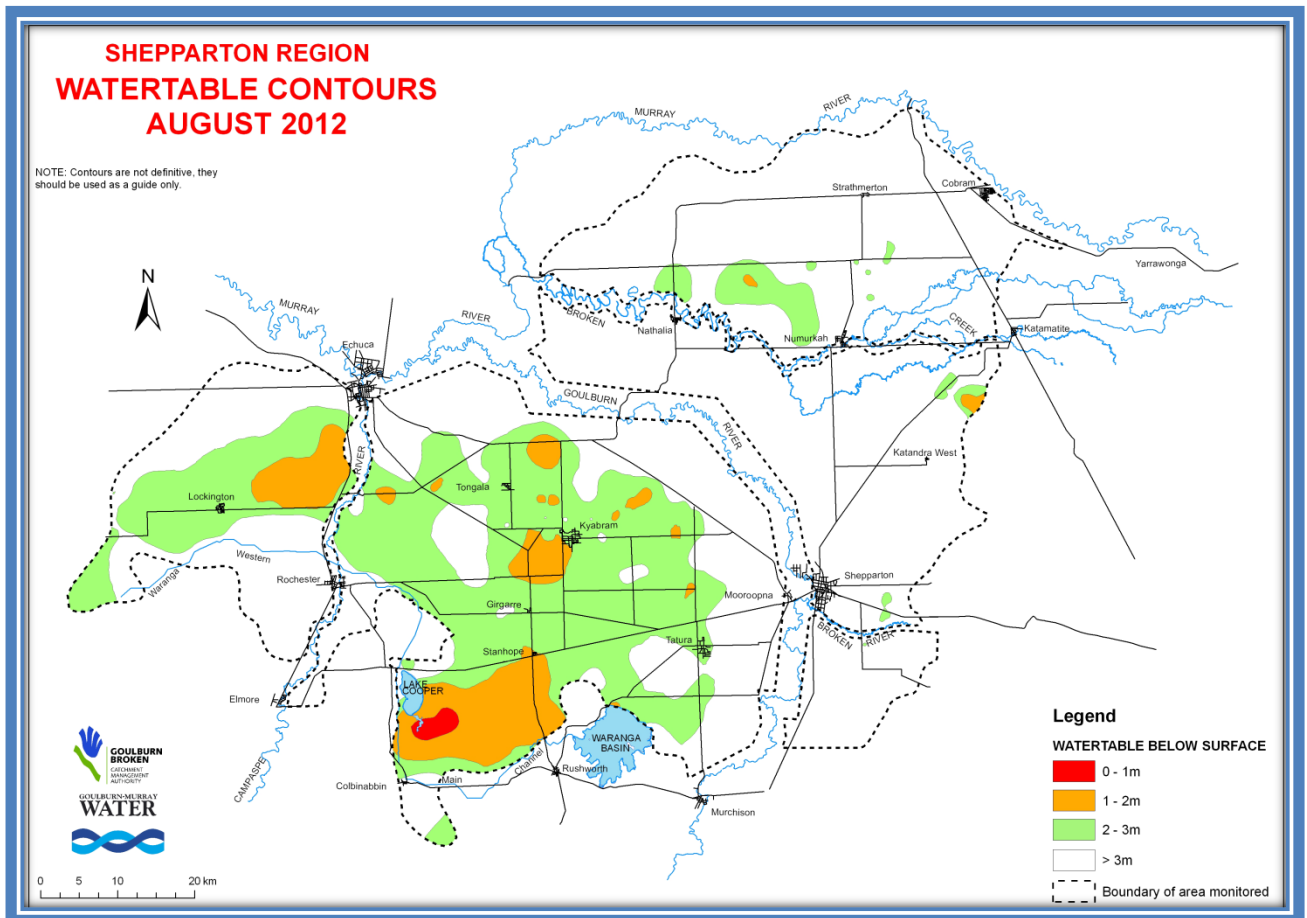


FIGURE 20: WATERTABLE CONTOURS FOR 2012 – NOTE WATERTABLE AT NUMURKAH AT 2-3M BELOW SURFACE

4.1.6 CONSTRUCTED WETLAND SURFACE WATER MANAGEMENT SCHEME

The Muckatah Primary Surface Water Scheme was constructed in 1999. A set of low level confining banks were constructed around the margin of the wetland to retard 1 in 2 year flow events with the purpose of using the wetland as a retardation basin and act as a filter for sediments and nutrients from the Muckatah Scheme entering into the Broken Creek. The Scheme is also designed to minimise a 225 ML/d 1 in 2 year event to 150ML/d mimicking more natural outfall conditions.

Water from the Scheme spills into the wetland when flows are higher than 110ML/d which can pass over the 107.4m AHD lower confining bank. The scheme works so that flows can be passed down the constructed wetland only or can be pushed into the natural wetland when required. The scheme has practical limitations and can only hold so much water for so long.

The constructed wetland which forms part of the Muckatah Surface Water Management System should also follow the watering regime of flooding to occur 5 to 7 years in 10. However, surface water inflows usually occur from August to May and need to be controlled more efficiently to protect and maintain reed beds within the wetland. Reed beds are important habitat for cryptic species of fauna such as the Australasian Bittern.

Action: Control water levels in constructed wetland to promote filtering, growth of native vegetation, aid weed control and maintain reed beds to increase habitat for cryptic species such as the EPBC (1999) listed Australasian Bittern.

Action: Continue monitoring water quality entering into the wetland.

4.1.7 REGULATING STRUCTURES MANAGEMENT

A plan and agreement governing the operation of the regulating structures for implementation of the watering regime should be developed. The plan should include guidelines that provide for flexibility in management to cater for any number of the potential scenarios which may arise. The plan and agreement should be directly linked to and align with this Environmental Management Plan and Environmental Water Management Plan objectives. It should clearly define the responsibility and obligations of all parties. Key parties to the plan and agreement would be Goulburn Murray Water, Moira Shire Council and Goulburn Broken Catchment Management Authority.

Action: Develop and implement a regulating structures management plan in conjunction with partner agencies.

5. COMMUNITY INVOLVEMENT AND RECREATION

Kinnairds Wetland has been classified as Numurkah’s number one tourist attraction. The visitor centre has approximately 6,500 visitors a year with a majority of these people visiting the wetland (Tourism, 2013). Field naturalists and bird observer groups visit the wetland on a regular basis to appreciate its natural values.

Kinnairds Wetland is utilised by school groups both local and nationally for educational purposes. A Numurkah “fun run” is held every year, when appropriate or possible at the site. Many research, information and education events have been held at the wetland. The wetland has received interest and visits from Federal and State government representatives as well as various agencies. Recently Victorian Environment Minister Ryan Smith launched the iSpy Frog iPhone application and Reptile and Frog booklet in 2012 (Figure 21).



FIGURE 21: LAUNCH OF THE GB CMA ISPY FROG APP AND REPTILE AND FROG BOOKLET. MINISTER RYAN SMITH LAUNCHES THESE PROMOTIONAL MATERIALS AT KINNAIRDS WETLAND.

Photo: J. Wood, GB CMA 2012

5.1 PASSIVE RECREATION

Kinnairds Wetland is classified as a passive recreation area. Passive recreation refers to non-consumptive activities such as wildlife observation, walking and bike riding (non-motorised). The goal for providing passive recreational usage is to ensure minimum impact occurs on the wetland ecosystem. Access around the wetland is via designated walking tracks (Figure 22). The tracks have interpretive signage which allows visitors to walk through a variety of vegetation zones and to look for fauna that reside at the wetland. Two bird hides have been constructed at the wetland to allow visitors to observe waterfowl and other fauna utilising the wetland. This decreases wildlife disturbance and allows visitors to enjoy the fauna in their natural habitat.

Action: Maintain passive recreation within Kinnairds Wetland reserve including restricted visitor access and current facilities.

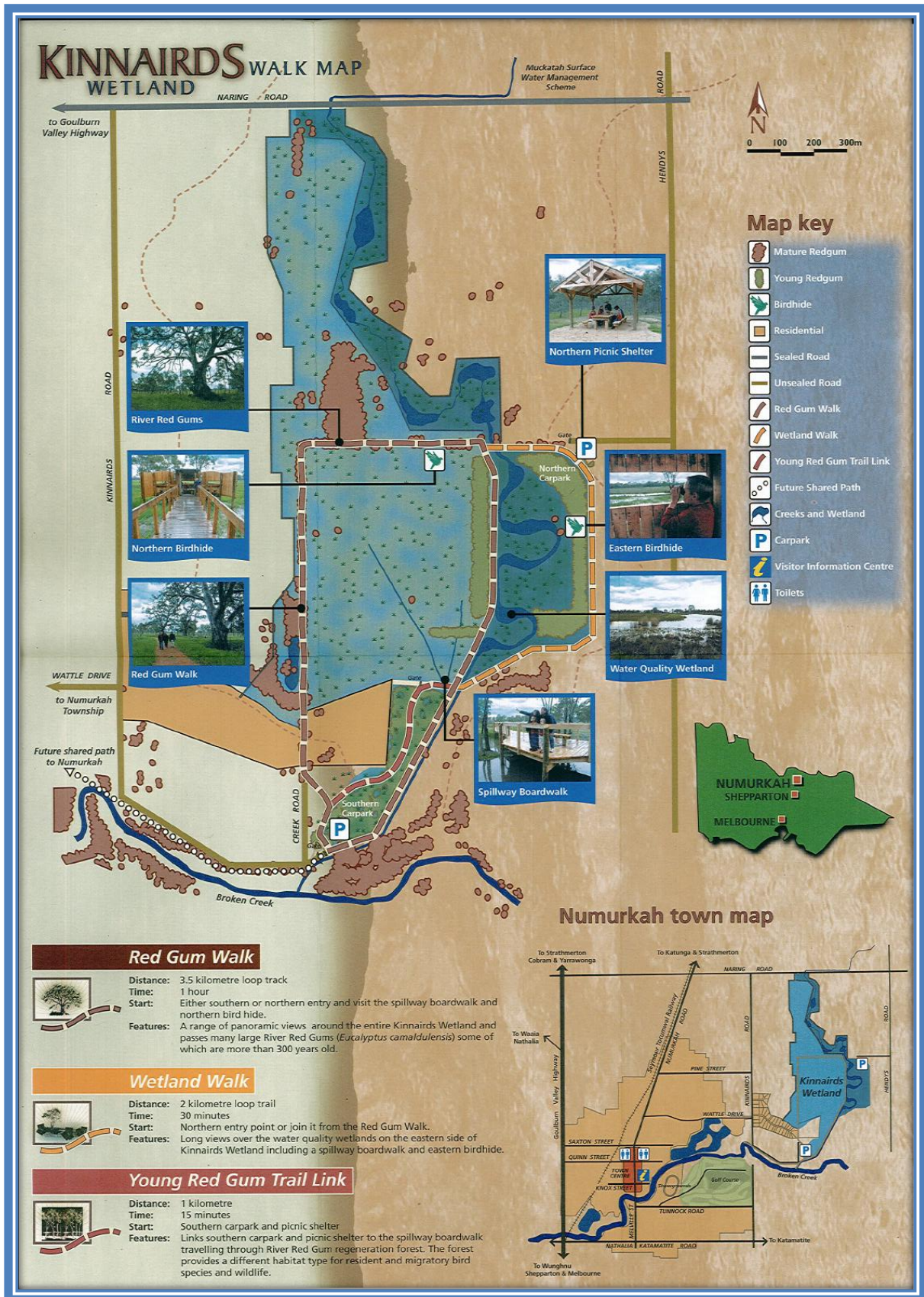


FIGURE 22: KINNAIDS WETLAND WALKING MAP

5.2 PUBLIC USE AND ACTIVITIES MANAGEMENT

This section refers to land at Kinnairds Wetland owned by Goulburn Murray Water and Moira Shire Council. Access to private land is a matter for the landowner.

Maintaining public access and passive use of Kinnairds Wetland is very important however this imposes considerable responsibility on the land owners to carefully manage public use and activities. To address related management issues such as adverse environmental, public safety and amenity impacts it is necessary to prohibit activities which are not consistent with the purpose and sound management of Kinnairds Wetland.

The broader community also has a key role and responsibility in maintaining public access and passive use of Kinnairds Wetland. Acting responsibly and spreading awareness of the significance of this to others is essential.

Public use and activities prohibited at Kinnairds Wetland include but are not restricted to the following:

- hunting (including use of firearms or trapping)
- motorbike riding or driving any other unauthorised motorised vehicles (including pushbikes with motors attached)
- horse riding
- camping
- lighting fires
- fishing
- removal of animals for bait such as yabbies, mudeyes and bardi grubs
- dogs are not permitted
- removal of fallen timber
- rubbish dumping including garden waste
- disturbance, damage or removal of any flora or fauna
- introduction of any plants or animals

Visitors should not enter private land without appropriate land owner consent.

Action: Monitor and manage public use and activities to ensure compliance with requirements.

6. MANAGEMENT RECOMMENDATIONS

Management recommendations for Kinnairds Wetland are presented on the basis of priority. A description of required management action and the agency or groups responsible for implementing each action are included.

PRIORITY	MANAGEMENT RECOMMENDATIONS
High	Actions of high priority should be implemented as soon as possible. These management actions may or may not require the most resources and commitment.
Medium	Actions of medium priority should also be implemented as soon as possible, but focus should be turned to these actions after high priority actions have been addressed.
Low	Actions of low priority should be considered after high and medium priority actions have been addressed.
On-going	Ongoing action to be implemented over the life of the plan. Unless otherwise specified, ongoing actions are to be considered the same priority as high priority actions.

Section	Action	Responsible Agency	Actioned By	Priority	Cost
Section 1 Introduction					
1.7.1 Advisory Committee	Maintain the Kinnairds Wetland Advisory Committee and key contacts to ensure that it can provide informed advice, respond to specific issues and promote the values associated with Kinnairds Wetland.	Moira Shire	Moira Shire	High	
Section 2 Site Overview					
2.1.1 Cultural Heritage – Pre-European Settlement	Engage Yorta Yorta to undertake an archaeological survey of the wetland reserve.	Moira Shire	Moira Shire	Medium - High	
Section 3 Wetland characteristics, conditions and values					
3.1 Wetland Characteristics	Pursue an application to include Kinnairds Wetland on <i>A Directory of Important Wetlands</i> .	Moira Shire and GBCMA	Moira Shire and GBCMA	High	
3.4.1.1 Birds	Establish Bird Atlas transects and monitor every five years, starting in 2015. Encourage visiting bird atlas members to undertake surveys and submit records. Record any other incidental observations.	Moira Shire	Moira Shire	Medium – High	
3.4.1.2 Significant Wetland Birds	Provide opportunities for waterbird breeding especially for Australasian Bittern, Royal Spoonbills and Australasian Shovelers during wet events.	Moira Shire, GMW and GBCMA	Moira Shire, GMW and GBCMA	High	
3.4.1.2 Significant Terrestrial Birds	Provide opportunities for terrestrial bird breeding by retaining and enhancing habitat and promoting better habitat connectivity in the broader region	Moira Shire and GBCMA	Moira Shire, GMW and GBCMA	High	
3.4.1.3 Amphibians, Reptiles and Fish	Undertake frog monitoring surveys to determine species utilising Kinnairds Wetland after natural wetting events or during environmental water delivery.	Moira Shire and GBCMA	Moira Shire and GBCMA	Medium – High	

Section	Action	Responsible Agency	Actioned By	Priority	Cost
	Survey reptile monitoring stations on a 12 monthly basis.	Moira Shire	Moira Shire	High	
	Undertake a fish monitoring survey during a flood or environmental water event.	Moira Shire and GBCMA	Moira Shire and GBCMA	Medium	
3.4.1.5 Bats and other mammals	Undertake bat surveys every 5-10 years starting in 2014, to determine species and population changes at Kinnairds Wetland.	Moira Shire in conjunction with Melbourne University or Arthur Rylah Institute (DEPI)	Moira Shire and BBCMN	Medium – High	
	Undertake mammal surveys every 3-5 years starting in 2015, using spotlight techniques or nest box monitoring techniques. Record any other incidental observations.	Moira Shire, GBCMA and BBCMN	Moira Shire, GBCMA and BBCMN	Medium – High	
	Maintain mammal nest box program in conjunction with Broken Boosey Catchment Management Network.	Moira Shire, GBCMA and BBCMN	Moira Shire and BBCMN	Medium – High	
3.4.1.5 Macroinvertebrates	Undertake aquatic invertebrate surveys to determine species population changes and utilisation of Kinnairds Wetland during natural wetting events or environmental water delivery.	Moira Shire and GBCMA	Moira Shire and GBCMA	Medium – High	
3.1.5 Fauna Pest species	Develop a pest management plan including both terrestrial and aquatic pest plants and animals for Kinnairds Wetland.	Moira Shire, GMW and GBCMA	Moira Shire, GMW and GBCMA	High	
	Support an integrated and coordinated pest control program within Kinnairds Wetland.	Moira Shire and GMW	Moira Shire and GMW	Medium -High	
3.5.1 Vegetation Classes	Monitor areas such as River Red Gum EVC post flooding and take action to prevent establishment of thickets occurring. <i>Any new Red Gum regeneration (establishment of thickets) should be managed through a combination of a recommended wetting and drying regime to keep encroachment to a minimum and to maintain the current footprint of Red Gums within the site.</i>	Moira Shire, GMW and GBCMA	Moira Shire GMW and GBCMA	Medium – High	
	Improve the diversity of native wetland and terrestrial flora species to be consistent with EVC benchmarks and undertake monitoring such as the Index of Wetland Condition every 2-3 years or during environmental water delivery events.	Moira Shire, GMW and GBCMA	Moira Shire GMW and GBCMA	High	

Section	Action	Responsible Agency	Actioned By	Priority	Cost
3.5.2 Habitat Structures and Features	Maintain fallen timber and enhance suitable areas with woody debris to provide habitat for native wildlife and replenish nutrients in the soil profile.	Moira Shire and GBCMA	Moira Shire and GMW	High	
	Maintain mature Red Gums in centre of wetland to ensure nesting sites for waterbirds are protected.	Moira Shire and GBCMA	Moira Shire	High	
	Maintain revegetation areas to increase species and habitat diversity consistent with the revegetation plan and conservation covenant plan.	Moira Shire	Moira Shire		
	As part of a waterway citizen monitoring project, construct photo point sites and encourage visitors to take photos and send to a localised database.	Moira Shire and GBCMA	Moira Shire and GBCMA	Medium	
3.5.3 Significant Flora	Protect and maintain populations of the EPBC (1999) listed Rigid Water Milfoil and the FFG (1988) listed Slender Water Milfoil doing so by seeking funding for research into these species requirements.	Moira Shire GMW and GBCMA	Moira Shire GMW and GBCMA	High	
3.5.4 Flora Pest Species	Control <i>Sagittaria</i> from the Broken Creek channel to Kinnairds Wetland. Investigate and trial options such as encouraging native species competition and installing piped breaks in the outlet channel.	Moira Shire and GMW	GMW	High	
	Use selective treatments to reduce risks to no-target species. Use passive methods to control weed species where possible such as encouraging competition from native species. Use selective treatments where possible to reduce the risk to non-target species. <i>See also action 3.1.5 Develop a pest management plan including both terrestrial and aquatic pest plants and animals for Kinnairds Wetland.</i>	Moira Shire and GMW	Moira Shire and GMW	High	
3.6 Fire	Maintain practical fire mitigation measures to reduce the likelihood and consequences of wildfire, including maintenance of tracks within the wetland for management and emergency vehicle access.	Moira Shire and GMW	Moira Shire and GMW	High	
	Monitor post fire effects on wetland and woodland areas and undertake appropriate rehabilitation.	Moira Shire and GBCMA	Moira Shire and GBCMA	High	
Section 4 Hydrology					
4.1.3 Environmental Water	Investigate options to construct delivery channel or pipeline to wetland from supply channel on Hendy's Road primarily to improve and maintain vegetation condition therefore improving filtering capacity in the constructed wetland.	GMW, Moira Shire and GBCMA	GMW, Moira Shire and GBCMA	High	
	Work with landholders to negotiate the purchase or long-term management agreement of land parcels under floodway easement or any other adjoining land comprising the great wetland to improve flexibility and security in ecological management and environmental water usage.	Moira Shire, GMW and GBCMA	Moira Shire, GMW and GBCMA	Medium – High	

Section	Action	Responsible Agency	Actioned By	Priority	Cost
	Moira Shire and Goulburn Murray Water register with the Land for Wildlife program.	Moira Shire and GMW	Moira Shire and GMW	High	
4.1.4 Watering regime	Implement the Kinnairds Wetland Environmental Water Management Plan (GB CMA 2011) including delivery of environmental water to Kinnairds Wetland 5-7 years in 10 years, if natural flooding events do not occur.	Moira Shire GMW and GBCMA	Moira Shire GMW and GBCMA	High	
4.1.6 Constructed Wetland Surface Water Management Scheme	Control water levels in constructed wetland to promote filtering, growth of native vegetation, aid weed control and maintain reed beds to increase and protect habitat for cryptic species such as the EPBC listed Australasian Bittern.	GMW, Moira Shire and GB MA	GMW	High	
	Continue monitoring water quality entering the wetland.	GMW	GMW	High	
4.1.7 Regulating Structure Management	Develop and implement a regulating structure management plan in conjunction with partner agencies <i>This plan will include the development of an operational agreement of the regulating structure for both the constructed and natural sections of Kinnairds Wetland which will be consistent with hydrological requirements stated in the Kinnairds Wetland Environmental Water Management Plan (GB CMA 2011).</i>	GMW, Moira Shire and GBCMA	GMW	High	
Section 5 Community Involvement and Recreation					
5.1 Passive Recreation	Maintain passive recreation within Kinnairds Wetland reserve including restricted visitor access and current facilities.	Moira Shire	Moira Shire	High	
5.2 Public use and activities management	Monitor and manage public use and activities to ensure compliance with requirements.	Moira Shire and GMW	Moira Shire and GMW	High	

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8. APPENDICES

APPENDIX 1: AGREEMENTS LEGISLATION AND STRATEGIES

Bilateral Migratory Bird Agreements

Japan Australia Migratory Birds Agreement (JAMBA) 1994: Agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds in Danger of Extinction and their Environment.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979: The convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an Intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 118 (as of January 2013). Parties from Africa, Central and South America, Asia, Europe and Oceania.

China Australia Migratory Birds Agreement (CAMBA) 1986: Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. These agreements require that the parties protect migratory birds by:

- Limiting the circumstances under which migratory birds are taken or traded;
- Protecting and conserving important habitats;
- Exchanging information; and
- Building cooperative relationships.

Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) 2002: Agreement between the Government of Australia and the Government of the Republic of Korea on the protection of Migratory birds.

Commonwealth legislation and policy

Australian Heritage Commission Act 1975 (Register of the National Estate): An Act to establish an Australian Heritage Commission.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Part IIA): An Act to preserve and protect places, areas and objects of particular significance to Aboriginals, and for related purposes.

Native Title Act 1993: Legislation to protect any native title that has survived 200 years of colonisation.

Wetlands Policy of the Commonwealth Government of Australia 1997: A policy to ensure that the activities of the Commonwealth Government promote the conservation, ecologically sustainable use and where possible enhancement, of wetland functions.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): The Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as matters of national environmental significance.

Water Act 2007: An Act to make provision for the management of the water resources of the Murray-Darling Basin, and to make provision for other matters of national interest in relation to water and water information, and for related purposes.

Water Amendment Act 2008: An Act to amend the Water Act 2007, for related purposes.

Framework for determining Commonwealth Environmental Watering Actions 2013: A framework for determining Commonwealth environmental water use and the process for making these decisions. The framework is designed to be entirely consistent with the Commonwealth Environmental Water Holder's statutory obligations and should be interpreted in this way.

Victorian Legislation

Environmental Effects Act 1978: Potential environmental impacts of a proposed development are subject to assessment and approval under this Act. A structural works program and any associated environmental impacts would be subject to assessment and approval under this Act.

Planning and Environment Act 1987: Controls the removal or disturbance to native vegetation within Victoria by implementation of a three step process of avoidance, minimisation and offsetting.

Flora and Fauna Guarantee Act 1988: The key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes.

Water Act 1989 (Victorian): The legislation that governs the way water entitlements and establishes the mechanisms for managing Victoria's water resources.

Catchment and Land Protection Act 1994: This Act has an objective of establishing a framework for the integrated and coordinated management of catchments which will;

- Maintain and enhance long-term land productivity while also conserving the environment, and
- Aim to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.

The Act established ten Catchment and Land Protection Boards, nine of which have since expanded their roles to become Catchment Management Authorities. The CaLP Act (1994) provides for the development of Regional Catchment Strategies which, among other things, must assess the nature, causes, extent and severity of land degradation of the catchments in the region and identify areas for priority attention. Local planning schemes must have regard for the Regional Catchment Strategies.

State Environment Protection Policy (Waters of Victoria) 2003: These policies are pivotal in protecting water environments as they set uses and values of water environments that communities want to protect, establish 'goalposts' so we know when they are protected and provide clear guidance on what we need to do to protect them. These policies are legal tools made under the Environment Protection Act 1970 and they set in law community expectations, needs and priorities for protecting and sustainably using Victoria's water environments.

Aboriginal Heritage Act 2006: The main purpose of this Act is to provide for the protection of Aboriginal cultural heritage in Victoria.

Advisory list of rare or threatened species in Victoria (DEPI): Three advisory lists are maintained by DEPI for use in a range of planning processes and in setting priorities for actions to conserve biodiversity. Unlike other threatened species lists, there are no legal requirements or consequences that flow from inclusion of a species on an advisory list. The advisory list comprises:

- Advisory list of Rare and Threatened Plants in Victoria – 2005
- Advisory list of Threatened Vertebrate Fauna in Victoria – 2013
- Advisory list of Threatened Invertebrate Fauna in Victoria - 2009

Victorian policy, codes of practice, charters and strategies:

Muckatah Catchment Strategy 1999 (G-MW, 1999):

Our Water Our Future 2004: Sets out 110 actions for sustainable water management aimed at every sector of the community, seeking to secure water supplies and sustain growth over the next 50 years.

Northern Regional Sustainable Water Strategy 2009 (DSE, 2009b):

Lower Broken Creek and Nine Mile Creek Environmental Watering Plan 2010: The environmental watering plan assesses the hydrological impact of the G-MW Connections on the creek system downstream of Katamatite and reviews the likely impact of the hydrological modification on the high value environmental assets.

Biodiversity strategy for the Goulburn Broken Catchment, Victoria 2010-2015:

Environmental Sustainability Strategy Moira Shire 2012: The ESS is a key strategic document which will provide clear guidance and direction to Council about environmental sustainability policies, roles and responsibilities. This includes actions Council can take relevant to its operations and services and what it can do to support residents and community groups to transition to a more sustainable lifestyle.

Goulburn Broken Regional Catchment Strategy 2012 (GBCMA, 2012): A strategy that sets the framework for Natural resource Management and the context for sub-strategies and action plans within the Goulburn Broken Catchment.

2013/14-2016/17 Council Plan (MSC, 2013a): Moira Shire Council's four year plan which includes Strategic Goals, Strategies, Strategic Indicators and a Strategic Resource Plan

APPENDIX 2: FAUNA SPECIES LIST

Fauna list of Kinnairds Wetland – taken from Victorian Fauna Database 2010, G. Deayton 2004-2013 counts, P. O'Connor 2008-2009 counts and D. Cook 2008-2009 counts.

E – Listed as endangered under the Environmental Protection Biodiversity Conservation Act (1999)

L = listed as threatened under the Flora and Fauna Guarantee Act (1988)

vu = Listed as vulnerable on the DSE Advisory list of threatened vertebrate fauna (2007)

en = Listed as endangered on the DSE Advisory list of threatened vertebrate fauna (2007)

nt = Listed as near threatened on the DSE Advisory list of threatened vertebrate fauna (2007)

dd = Listed as data deficient on the DSE Advisory list of threatened vertebrate fauna (2007)

cr = Listed as critically endangered on the DSE Advisory list of threatened vertebrate fauna (2007)

w Water dependant species or Waterbirds

b Observed breeding at the Wetland

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
BIRDS					
Australasian Bittern	<i>Botaurus poiciloptilus</i>	En	L	en	w
Australasian Darter	<i>Anhinga novaehollandiae</i>				w
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>				w
Australasian Pipit	<i>Anthus novaeseelandiae</i>				
Australasian Shoveler	<i>Anas rhynchotis</i>			vu	w b
Australian Hobby	<i>Falco longipennis</i>				
Australian Magpie	<i>Gymnorhina tibicen</i>				
Australian Pelican	<i>Pelecanus conspicillatus</i>				w
Australian Raven	<i>Corvus coronoides</i>				
Australian Reed-Warbler	<i>Acrocephalus stentoreus</i>				w
Australian Shelduck	<i>Tadorna tadornoides</i>				w b
Australian Spotted Crake	<i>Porzana fluminea</i>				w
Australian White Ibis	<i>Threskiornis molucca</i>				w
Australian Wood Duck	<i>Chenonetta jubata</i>				w
Baillon's Crake	<i>Porzana pusilla palustris</i>		L	vu	w
Black Falcon	<i>Falco subniger</i>			vu	
Black Kite	<i>Milvus migrans</i>				
Black Swan	<i>Cygnus atratus</i>				w
Black-chinned Honeyeater	<i>Melithreptus gularis</i>			nt	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>				
Black-fronted Dotterel	<i>Elsayornis melanops</i>				w

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
Black-shouldered Kite	<i>Elanus axillaris</i>				
Black-tailed Native-hen	<i>Gallinula ventralis</i>				w
Black-winged Stilt	<i>Himantopus himantopus</i>				w
Blue-billed Duck	<i>Oxyura australis</i>			en	w
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>				
Brolga	<i>Grus rubicunda</i>			vu	w
Brown Falcon	<i>Falco berigora</i>				
Brown Goshawk	<i>Accipiter fasciatus</i>				
Brown Quail	<i>Coturnix ypsilophora australis</i>				b
Brown Songlark	<i>Cincloramphus cruralis</i>				
Brown Treecreeper (south-eastern ssp.)	<i>Climacteris picumnus victoriae</i>			nt	
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>				
Budgerigar	<i>Melopsittiacus undulates</i>				
Buff-banded Rail	<i>Gallirallus philippensis</i>				w
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>				
Cattle Egret	<i>Ardea ibis</i>				w
Chestnut Teal	<i>Anas castanea</i>				w
Cockatiel	<i>Nymphicus hollandicus</i>				
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>				
Common Bronzewing	<i>Phaps chalcoptera</i>				
Crested Pigeon	<i>Ocyphaps lophotes</i>				
Crested Shrike-tit	<i>Falcunculus frontatus</i>				
Crimson Rosella	<i>Platycercus elegans</i>				
Crimson Rosella and (Yellow form)	<i>Platycercus elegans</i>				
Dusky Moorhen	<i>Gallinula tenebrosa</i>				w
Dusky Woodswallow	<i>Artamus cyanopterus</i>				
Eastern Barn Owl	<i>Tyto alba</i>				
Eastern Great Egret	<i>Ardea modesta</i>		L	vu	w
Eastern Rosella	<i>Platycercus eximius</i>				
Eurasian Coot	<i>Fulica atra</i>				w
European Goldfinch	<i>Carduelis carduelis</i>				
Fairy Martin	<i>Hirundo ariel</i>				
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>				
Flame Robin	<i>Petroica phoenicea</i>				

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
Fork-tailed Swift	<i>Apus pacificus</i>				w
Freckled Duck	<i>Stictonetta naevosa</i>		L	en	w
Fuscous Honeyeater	<i>Lichenostomus fuscus</i>				
Galah	<i>Eolophus roseicapilla</i>				
Glossy Ibis	<i>Plegadis falcinellus</i>			nt	w
Golden Whistler	<i>Pachycephala pectoralis</i>				
Golden-headed Cisticola	<i>Cisticola exilis</i>				
Great Cormorant	<i>Phalacrocorax carbo</i>				w
Grey Fantail	<i>Rhipidura albiscarpa</i>				
Grey Shrike-thrush	<i>Colluricincla harmonica</i>				
Grey Teal	<i>Anas gracilis</i>				w
Hardhead	<i>Aythya australis</i>			vu	w
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>				w
Intermediate Egret	<i>Ardea intermedia</i>		L	en	w
Jacky Winter	<i>Microeca fascians</i>				
Latham's Snipe	<i>Gallinago hardwickii</i>		N	nt	w
Laughing Kookaburra	<i>Dacelo novaeguineae</i>				
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>				w
Little Corella	<i>Cacatua sanguinea</i>				
Little Eagle	<i>Hieraaetus morphnoides</i>				
Little Egret	<i>Egretta garzetta</i>		L	en	w
Little Friarbird	<i>Philemon citreogularis</i>				
Little Grassbird	<i>Megalurus gramineus</i>				w
Little Lorikeet	<i>Glossopsitta pusilla</i>				
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>				w
Little Raven	<i>Corvus mellori</i>				
Long-billed Corella	<i>Cacatua tenuirostris</i>				
Magpie Goose	<i>Anseranus semipalmata</i>			nt	w
Magpie-lark	<i>Grallina cyanoleuca</i>				
Masked Lapwing	<i>Vanellus miles</i>				w
Masked Woodswallow	<i>Artamus personatus</i>				
Musk Lorikeet	<i>Glossopsitta concinna</i>				
Nankeen Kestrel	<i>Falco cenchroides</i>				
Nankeen Night Heron	<i>Nycticorax caledonicus</i>			nt	w

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
Noisy Friarbird	<i>Philemon corniculatus</i>				
Noisy Miner	<i>Manorina melanocephala</i>				
Olive-backed Oriole	<i>Oriolus sagittatus</i>				
Pacific Black Duck	<i>Anas superciliosa</i>				w b
Pallid Cuckoo	<i>Cuculus pallidus</i>				
Peaceful Dove	<i>Geopelia striata</i>				
Peregrine Falcon	<i>Falco peregrinus</i>				b
Pied Butcherbird	<i>Cracticus nigrogularis</i>				
Pied Cormorant	<i>Phalacrocorax varius</i>			nt	w
Pied Currawong	<i>Strepera graculina</i>				
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>				w
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>				w
Purple Swampphen	<i>Porphyrio porphyrio</i>				w
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>				
Rainbow Bee-eater	<i>Merops ornatus</i>				
Red Wattlebird	<i>Anthochaera carunculata</i>				
Red-capped Robin	<i>Petroica goodenovii</i>				
Red-kneed Dotterel	<i>Erythronys cinctus</i>				w
Red-rumped Parrot	<i>Psephotus haematonotus</i>				
Restless Flycatcher	<i>Myiagra inquieta</i>				
Royal Spoonbill	<i>Platalea regia</i>			nt	w b
Rufous Songlark	<i>Cincloramphus mathewsi</i>				
Rufous Whistler	<i>Pachycephala rufiventris</i>				
Sacred Kingfisher	<i>Todiramphus sanctus</i>				
Scarlet Robin	<i>Petroica boodang</i>				
Silver Gull	<i>Chroicocephalus novaehollandiae</i>				w
Silvereye	<i>Zosterops lateralis</i>				
Southern Boobook	<i>Ninox novaeseelandiae</i>				
Spotless Crake	<i>Porzana tabuensis</i>				w
Spotted Pardalote	<i>Pardalotus punctatus</i>				
Straw-necked Ibis	<i>Threskiornis spinicollis</i>				w
Striated Pardalote	<i>Pardalotus striatus</i>				
Stubble Quail	<i>Coturnix pectoralis</i>				
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>				

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
Superb Fairy Wren	<i>Malurus cyaneus</i>				
Swamp Harrier	<i>Circus approximans</i>				w
Swift Parrot	<i>Lathamus discolor</i>	E	L	en	
Tawny Frog Mouth	<i>Podargus strigoides</i>				
Tree Martin	<i>Hirundo nigricans</i>				
Varied Sittella	<i>Daphoenositta chrysoptera</i>				
Wedge-tailed Eagle	<i>Aquila audax</i>				
Weebill	<i>Smicrornis brevirostris</i>				
Welcome Swallow	<i>Hirundo neoxena</i>				
Western Gerygone	<i>Gerygone fusca</i>				
Whiskered Tern	<i>Chidonias hybridus</i>			nt	w
Whistling Kite	<i>Haliastur sphenurus</i>				b
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>				
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		L	vu	w
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>				
White-browed Woodswallow	<i>Artamus superciliosus</i>				
White-faced Heron	<i>Egretta novaehollandiae</i>				w
White-necked Heron	<i>Ardea pacifica</i>				w
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>				
White-throated Gerygone	<i>Gerygone olivacea</i>				
White-throated Needletail	<i>Hirundapus caudactus</i>			vu	w
White-throated Treecreeper	<i>Cormobates leucophaea</i>				
White-winged Chough	<i>Corcorax melanorhamphos</i>				
White-winged Triller	<i>Lalage sueurii</i>				
Willie Wagtail	<i>Rhipidura leucophrys</i>				
Yellow Thornbill	<i>Acanthiza nana</i>				
Yellow-billed Spoonbill	<i>Platalea flavipes</i>				w
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>				
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>				
Zebra Finch	<i>Taeniopygia guttata</i>				
Aquatic Invertebrates					
Aquatic caterpillar	Family Crambidae				w
Backswimmer	Family Notonectidae				w
Beetle	Family Hydraenidae				w

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin and guild
Beetle	Family Hydrochidae				w
Beetle	Family Ceratopogonidae				w
Biting Midge	Family Ceratopogonidae				w
Caddis Fly	Family Leptoceridae				w
Creeping water bugs	Family Naucoridae				w
Damselfly	Family Aeshnidae				w
Damselfly	Family Zygoptera				w
Dragonfly	Family Coenagrionidae				w
Dragonfly	Family Hemicorduliidae				w
Dragonfly	Family Lestidae				w
Giant water bug	Family Belostomatidae				w
Mayfly	Family Baetidae				w
Non-biting Midge	Family Chironomidae				w
Predacious diving beetle	Family Dytiscidae				w
Pygmy back swimmer	Family Pleidae				w
Timber weevil	Family Nanophyidae				w
Water boatman	Family Coroxidae				w
Amphibians					
Barking Marsh Frog	<i>Limnodynastes fletcheri</i>				Banks of lakes or rivers
Common Froglet	<i>Crinia signifera</i>				Moist depressions
Peron's Tree Frog	<i>Litoria peronii</i>				Wet and Dry areas
Growling Grass Frog	<i>Litoria raniformis</i>	Vu	L	En	Permanent – seasonally wet areas
Plains Froglet	<i>Crinia parinsignifera</i>				Moist depressions
Pobblebonk	<i>Limnodynastes dumerilii</i>				Most areas except Alpine and extreme dry
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>				Common in farm dams and wetlands

Mammals					
Chocolate Wattled Bat	<i>Chalinobus morio</i>				
Common Brushtail Possum	<i>Trichosurus vulpecular</i>				
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>				
Eastern Grey Kangaroo	<i>Macropus giganteus</i>				
Freetail Bat (eastern form)	<i>Mormopterus sp</i>				
Gould's Long Eared Bat	<i>Nyctophilus gouldi</i>				
Grey-headed Flying Fox	<i>Pteropus poliocephalus</i>	Vulnerable	L		
Gould's Wattled Bat	<i>Chalinobus gouldii</i>				
Inland Broadnose Bat	<i>Scotorepans balstoni</i>				
Lesser Long Eared Bat	<i>Nyctophilus geoffroyi</i>				
Little Forest Bat	<i>Vespadelus vulturnus</i>				
Little Red Flying-fox	<i>Pteropus scapulatus</i>				
Southern Forest Bat	<i>Vespadelus regulus</i>				
Southern Freetail Bat (long penis)	<i>Mormopterus sp</i>				
Swamp Wallaby	<i>Wallabia bicolor</i>				
Water Rat	<i>Hydromys chrysogaster</i>				
White-striped Freetail Bat	<i>Tadarida australis</i>				
Reptiles					
Eastern Brown Snake	<i>Pseudonaja textilis</i>				
Tiger Snake	<i>Notechis scutatus</i>				
Lace Monitor	<i>Varanus varius</i>			vu	

Introduced species					
Brown Hare	<i>Lepus capensis</i>				
Common Blackbird	<i>Turdus merula</i>				
Common Starling	<i>Sturnus vulgaris</i>				
Common Myna	<i>Sturnus tristis</i>				
European Carp	<i>Cyprinus carpio</i>				w
European Goldfinch	<i>Carduelis carduelis</i>				
House Sparrow	<i>Passer domesticus</i>				
Northern Mallard	<i>Anas platyrhynchos</i>				
Red Fox	<i>Vulpes vulpes</i>				
Spotted Dove	<i>Streptopelia chinensis</i>				

Appendix 3: Flora species recorded in Kinnairds Wetland (& district), Numurkah

Flora list of Kinnairds Wetland – taken from Victorian Flora Database 2010, DPI Kinnairds Wetland Management Plan Flora list, Walsh counts 1997 and D. Cook 2008-2011 counts.

Note: EVC information is recorded only from D.Cook Surveys.

L = Listed as threatened under the Flora and Fauna Guarantee Act (1988)

E = Listed as Endangered under the Environmental Protection Biodiversity Act (1999)

e = Endangered in Victoria in DSE Advisory list of rare and threatened plants in Victoria (2005)

k = Poorly known in Victoria in DSE Advisory list of rare and threatened plants in Victoria (2005)

v = Vulnerable in Victoria in DSE Advisory list of rare and threatened plants in Victoria (2005)

r = Rare in Victoria in DSE Advisory list of rare and threatened plants in Victoria (2005)

w = Wetland species

p = Planted

= Native to Victoria but grows outside natural range

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Gold-dust Wattle	<i>Acacia acinacea s.l.</i>				
Silver Wattle	<i>Acacia dealbata</i>				
Mallee Wattle	<i>Acacia montana</i>				
Golden Wattle	<i>Acacia pycnantha</i>				
Water Plantain	<i>Alisma plantago-aquatica</i>				w
Lesser Joyweed	<i>Alternanthera denticulata s.l.</i>				w
Plains Joyweed	<i>Alternanthera sp.1</i>				
Long-nosed Swamp Wallaby-grass	<i>Amphibromus macrorhinus</i>				
Common Swamp Wallaby-grass	<i>Amphibromus nervosus</i>				w
Brush Wire-grass	<i>Aristida behriana</i>				
Nodding Chocolate-lily	<i>Arthropodium fimbriatum</i>				
Small Vanilla-lily	<i>Arthropodium minus</i>				
Lily	<i>Arthropodium sp.</i>				
Chocolate Lily	<i>Arthropodium strictum s.l.</i>				
Common Woodruff	<i>Asperula conferta</i>				
Berry Saltbush	<i>Atriplex semibaccata</i>				
Spiny-fruit Saltbush	<i>Atriplex spinibractea</i>			e	
Sprawling Saltbush	<i>Atriplex suberecta</i>				#
Leafy Wallaby-grass	<i>Austrodanthonia bipartita s.l.</i>				
Common Wallaby-grass	<i>Austrodanthonia caespitosa</i>				w
Brown-back Wallaby-grass	<i>Austrodanthonia duttoniana</i>				w

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Hill Wallaby-grass	<i>Austrodanthonia eriantha</i>				
Bristly Wallaby-grass	<i>Austrodanthonia setacea</i>				
Plump Spear-grass	<i>Austrostipa aristiglumis</i>				
Spurred Spear-grass	<i>Austrostipa gibbosa</i>			r	
Knotty Spear- grass	<i>Austrostipa nodosa</i>				
Rough Spear-grass	<i>Austrostipa scabra subsp. falcata</i>				
Pacific Azolla	<i>Azolla filiculoides</i>				w
Tah-vine	<i>Boerhavia dominii</i>				#
Yellow-tongue Daisy	<i>Brachyscome chrysoglossa</i>		L	v	
Variable Daisy	<i>Brachyscome ciliaris</i>				
Bulbine Lily	<i>Bulbine bulbosa</i>				
Milkmaids	<i>Burchardia umbellata</i>				
Sweet Bursaria	<i>Bursaria spinosa subsp. spinosa</i>				
Winged Water-starwort	<i>Callitriche umbonata</i>			r	w
Lemon Beauty-heads	<i>Calocephalus citreus</i>				
Cut-leaf Burr-daisy	<i>Calotis anthemoides</i>				
Riverina Bitter-cress	<i>Cardamine moirensis</i>			r	w
Tall Sedge	<i>Carex appressa</i>				w
Common Sedge/ Knob Sedge	<i>Carex inversa</i>				w
Poong'ort / Rush Sedge	<i>Carex tereticaulis</i>				w
Drooping Cassinia	<i>Cassinia arcuata</i>				
Common Sneezeweed	<i>Centipeda cunninghamii</i>				w
Flat Spurge	<i>Chamaesyce drummondii</i>				#
Small-leaf Goosefoot	<i>Chenopodium desertorum ssp. microphyllum</i>				
Clammy goosefoot	<i>Chenopodium pumilio</i>				
Windmill Grass	<i>Chloris truncata</i>				
Common Everlasting	<i>Chrysocephalum apiculatum s.l.</i>				
Bindweed	<i>Convolvulus erubescens</i>				
Pink Bindweed	<i>Convolvulus erubescens spp. agg.</i>				
Grass Bindweed	<i>Convolvulus remotus</i>				
Spreading Crassula	<i>Crassula decumbens var. decumbens</i>				
Purple Crassula	<i>Crassula peduncularis</i>				w
Sieber Crassula	<i>Crassula sieberiana s.l.</i>				
Crassula	<i>Crassula spp.</i>				

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Tall Flat-sedge	<i>Cyperus exaltatus</i>				w
Star Fruit	<i>Damasonium minus</i>				w
Pale Flax-lily	<i>Dianella longifolia s.l.</i>				
Black-anther Flax-lily	<i>Dianella revoluta s.l.</i>				
Scarlet Sundew	<i>Drosera glanduligera</i>				
Tall Sundew	<i>Drosera peltata</i>				
Pale Sundew	<i>Drosera peltata subsp. peltata</i>				w
Common Barnyard Grass	<i>Echinochloa crus-galli</i>				
Yellow Twin-heads	<i>Eclipta platyglossa</i>				# w
Nodding Saltbush	<i>Einadia nutans subsp. nutans</i>				
Waterwort	<i>Elatine gratioloides</i>				w
Common Spike-sedge	<i>Eleocharis acuta</i>				w
Variable Spike-sedge	<i>Eleocharis minuta</i>			e	
Small Spike-sedge	<i>Eleocharis pusilla</i>				w
Common Wheat-grass	<i>Elymus scaber var. scaber</i>				
Ruby Saltbush	<i>Enchylaena tomentosa var. tomentosa</i>				
Spider Grass	<i>Enteropogon acicularis</i>				
Variable Willow-herb	<i>Epilobium billardierianum subs. cinereum</i>				w
Blue Devil	<i>Eryngium ovinum</i>				
River Red-gum	<i>Eucalyptus camaldulensis</i>				w
Yellow Box	<i>Eucalyptus melliodora</i>				
Grey Box	<i>Eucalyptus microcarpa</i>				
Common Cudweed	<i>Euchiton involucratus sp</i>				
Annual Cudweed	<i>Euchiton sphaericus</i>				
Common Eutaxia	<i>Eutaxia microphylla var. microphylla</i>				
Spoon leaf Mud-mat	<i>Glossostigma cleistanthum</i>			v	w
Variable Glycine	<i>Glycine tabacina s.l.</i>				
Tiny Cudweed	<i>Gnaphalium indutum</i>				
Silky Goodenia	<i>Goodenia fascicularis</i>				
Slender Goodenia	<i>Goodenia gracilis</i>				w
Cut-leaf Goodenia	<i>Goodenia pinnatifida</i>				
Rough Raspwort	<i>Haloragis aspera</i>				
Bluish Raspwort	<i>Haloragis glauca</i>			k	
Common Heliotrope	<i>Heliotropium europaeum</i>				

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Hypoxis	<i>Hypoxis spp.</i>				
Yellow Star	<i>Hypoxis vaginata</i>				
Grass Cushion	<i>Isoetopsis graminifolia</i>				
Broad-fruit Club-sedge	<i>Isolepis cernua var. platycarpa</i>				
Grassy Club-sedge	<i>Isolepis hookeriana</i>				w
Narrow Plover-daisy	<i>Ixiolaena leptolepis</i>				
Hollow Rush	<i>Juncus amabilis</i>				w
Tussock Rush	<i>Juncus aridicola</i>				w
Toad Rush	<i>Juncus bufonius</i>				w
Yellow Rush	<i>Juncus flavidus</i>				w
Joint-leaf Rush	<i>Juncus holoschoenus</i>				w
Giant Rush	<i>Juncus ingens</i>				w
Hoary Rush	<i>Juncus radula</i>				
Plains Rush	<i>Juncus semisolidus</i>				w
Rush	<i>Juncus sp</i>				w
Finger Rush	<i>Juncus subsecundus</i>				w
Billabong Rush	<i>Juncus usitatus</i>				w
Common Blown-grass	<i>Lachnagrostis filiformis var.1</i>				w
Stalked Plover-daisy	<i>Leiocarpa websteri</i>				
Common Duckweed	<i>Lemna disperma</i>				w
Scaly Buttons	<i>Leptorhynchos squamatus</i>				
Austral Mud-mat	<i>Limosella australis</i>				w
Large Mudwort	<i>Limosella curdieana</i>				w
Native Flax	<i>Linum marginale</i>				
Poison Pratia	<i>Lobelia concolor</i>				w
Poison Lobelia	<i>Lobelia pratioides</i>				w
Scented Mat-rush	<i>Lomandra effusa</i>				
Clove-strip	<i>Ludwigia peploides subsp. montevidensis</i>				w
Small Loosestrife	<i>Lythrum hyssopifolia</i>				w
Black Cotton-bush	<i>Maireana decalvans</i>				
Wingless Bluebush	<i>Maireana enchylaenoides</i>				
Dwarf Bluebush	<i>Maireana humillima</i>				
Bluebush	<i>Maireana spp.</i>				
Narrow-leaf Nardoo	<i>Marsilea costulifera</i>				w

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Common Nardoo	<i>Marsilea drummondii</i>				w
Rough-barked Honey-myrtle	<i>Melaleuca parvistaminea</i>				p
Creeping mint	<i>Mentha satureoides</i>				
Yam Daisy	<i>Microseris scapigera</i> spp. agg.				
Smooth Minuria	<i>Minuria integerrima</i>			r	
Tangled Lignum	<i>Muehlenbeckia florulenta</i>				w
Mouse-tails	<i>Myosurus minimus</i> var. <i>australis</i>				w
Woolly-heads	<i>Myriocephalus rhizocephalus</i>				
Upright Water-milfoil	<i>Myriophyllum crispatum</i>				w
Clustered Water-milfoil	<i>Myriophyllum glomeratum</i>				w
Slender Water-milfoil	<i>Myriophyllum gracile</i> var. <i>lineare</i>		L	e	w
Robust Water-milfoil	<i>Myriophyllum papillosum</i>				w
Rigid Water-milfoil	<i>Myriophyllum porcatum</i>	V	L	v	w
Water-milfoil	<i>Myriophyllum</i> spp				
Red Water Milfoil	<i>Myriophyllum verucosum</i>				w
Grassland Wood-sorrel	<i>Oxalis perennans</i>				
Panic	<i>Panicum</i> sp				w
Slender Knotweed	<i>Persicaria decipiens</i>				w
Pale Knotweed	<i>Persicaria lapathifolia</i>				w
Creeping Knotweed	<i>Persicaria prostrata</i>				w
Austral Pillwort	<i>Pilularia novaehollandiae</i>				w
Curved Rice-flower	<i>Pimelea curviflora</i> s.s.				
Weeping Pittosporum	<i>Pittosporum angustifolium</i>				
Narrow Plantain	<i>Plantago gaudichaudii</i>				
Grey Tussock-grass	<i>Poa sieberiana</i> var. <i>sieberiana</i>				
Red Pondweed	<i>Potamogeton cheesemanii</i>				w
Floating Pondweed	<i>Potamogeton tricarinatus</i>				w
Jersey Cudweed	<i>Pseudognaphalium luteoalbum</i>				
Moir Grass	<i>Pseudoraphis spinescens</i>				w
Mulla Mulla	<i>Ptilotus exaltatus</i>				
Drumsticks	<i>Pycnosorus globosus</i>				#
River Buttercup	<i>Ranunculus inundatus</i>				w
Ferny Small-flower Buttercup	<i>Ranunculus pumilio</i> var. <i>pumilio</i>				w
Annual Buttercup	<i>Ranunculus sessiliflorus</i>				

Common Name	Scientific Name	EPBC	FFG	VROTS	Origin
Paper Sunray	<i>Rhodanthe corymbiflora</i>				
Slender Dock	<i>Rumex brownii</i>				w
Glistening Dock	<i>Rumex crystallinus s.l.</i>				
Narrow-leaf Dock	<i>Rumex tenax</i>				w
Common Bog-sedge	<i>Schoenus apogon</i>				w
Water Figwort	<i>Scrophularia auriculata</i>				
Cotton Fireweed	<i>Senecio quadridentatus</i>				
Variable Sida	<i>Sida corrugata</i>				
Quena	<i>Solanum esuriale</i>				
Sand-spurrey	<i>Spergularia brevifolia</i>				
Thin Duckweed	<i>Spirodela oligorrhiza</i>				w
Spear Grass	<i>Stipa sp</i>				
Broughton Pea	<i>Swainsona procumbens</i>				
Grey Germander	<i>Teucrium racemosum s.l.</i>				
Common Sunray	<i>Triptilodiscus pygmaeus</i>				
Trithuria	<i>Trithuria submersa</i>				w
Fairies' Aprons	<i>Utricularia dichotoma s.l.</i>				w
Fuzzy New Holland Daisy	<i>Vittadinia cuneata</i>				
Woolly New Holland Daisy	<i>Vittadinia gracilis</i>				
River Bluebell	<i>Wahlenbergia fluminalis</i>				
Annual Bluebell	<i>Wahlenbergia gracilentia s.l.</i>				
Rigid Panic	<i>Walwhalleya proluta</i>				w
Tiny Duckweed	<i>Wolffia australiana</i>				
Broad-leaf Early Nancy	<i>Wurmbea latifolia subsp. vanessae</i>				

Introduced Species		
Golden Wreath Wattle	<i>Acacia saligna</i>	
Creeping Knapweed	<i>Acroptilon repens</i>	
Quicksilver Grass / Small Hair-grass	<i>Aira cupaniana</i>	
Orange Fox-tail	<i>Alopecurus aequalis</i>	w
Pimpernel	<i>Anagallis arvensis</i>	
Cape Weed	<i>Arctotheca calendula</i>	
Aster-weed	<i>Aster subulata</i>	w
Bearded Oat	<i>Avena barbata</i>	
Wild Oat	<i>Avena fatua</i>	
Oat	<i>Avena sp</i>	
Lesser Quaking-grass	<i>Briza minor</i>	
Great Brome	<i>Bromus diandrus</i>	
Soft Brome	<i>Bromus hordeaceus subsp. hordeaceus</i>	
Thread Water Starwort	<i>Callitriche hamulata</i>	w
Water Starwort	<i>Callitriche stagnalis</i>	w
Thistle	<i>Carduus sp</i>	
Saffron Thistle	<i>Carthamus lanatus</i>	
Centaury	<i>Centaureum spp.</i>	
Fat Hen	<i>Chenopodium album</i>	
Square Cicendia	<i>Cicendia quadrangularis</i>	
Spear Thistle	<i>Cirsium vulgare</i>	
Fleabane	<i>Conyza bilbaoana</i>	
Ferny Cotula	<i>Cotula bipinnata</i>	
Water Crassula	<i>Crassula natans</i>	w
Umbrella Sedge	<i>Cyperus eragrostis</i>	w
Stinkwort	<i>Dittrichia graveolens</i>	
Barn-yard Grass	<i>Echinochloa crus-galli</i>	
Paterson's Curse	<i>Echium plantagineum</i>	
Ox-tongue	<i>Helminthotheca echioides</i>	
Barley Grass	<i>Hordeum sp</i>	
Smooth Cat's-ear	<i>Hypochoeris glabra</i>	
Cat's Ear	<i>Hypochoeris radiata</i>	
Spiny Rush	<i>Juncus acutus subsp. acutus</i>	
Capitate Rush	<i>Juncus capitatus</i>	
Sharp-leaved Fluellen	<i>Kickxia elatine ssp. crinata</i>	

Introduced Species		
Willow-leaf Lettuce	<i>Lactuca saligna</i>	
Prickly Lettuce	<i>Lactuca serriola</i>	
Hairy Hawkbit	<i>Leontodon taraxacoides subsp. taraxacoides</i>	
Perennial Rye-grass	<i>Lolium perenne</i>	
Wimmera Rye-grass	<i>Lolium rigidum</i>	
Burr Medic	<i>Medicago polymorpha</i>	
Medic	<i>Medicago spp.</i>	
Thread Iris	<i>Moraea setifolia</i>	
Brazilian Water Milfoil	<i>Myriophyllum aquaticum</i>	
Red Bartsia	<i>Parentucellia latifolia</i>	
Common Bartsia	<i>Parentucellia latifolia ssp. latifolia</i>	
Water Couch	<i>Paspalum distichum</i>	w
Paspalum	<i>Paspalum spp.</i>	
Paradoxical Canary-grass	<i>Phalaris paradoxa</i>	
Sticky Ground-cherry	<i>Physalis viscosa</i>	
Prostate Knotweed	<i>Polygonum aviculare</i>	
Onion Grass	<i>Romulea rosea</i>	
Curled Dock	<i>Rumex crispus</i>	w
Scorzonaera	<i>Scorzonera sp</i>	
Variegated Thistle	<i>Silybum marianum</i>	
Black Nightshade	<i>Solanum nigrum</i>	
Common Sow-thistle	<i>Sonchus olercea</i>	
Coast Sand-spurrey	<i>Spergularia media</i>	
Narrow-leaf Clover	<i>Trifolium angustifolium var. angustifolium</i>	
Hare's-foot Clover	<i>Trifolium arvense var. arvense</i>	
Hop Clover	<i>Trifolium campestre var. campestre</i>	
Cluster Clover	<i>Trifolium glomeratum</i>	
Annual-white Clover	<i>Trifolium michelianum var. michelianum</i>	
Knotted Clover	<i>Trifolium striatum</i>	
Subterraneum Clover	<i>Trifolium subterraneum</i>	
Woolly Clover	<i>Trifolium tomentosum</i>	
Wandering Speedwell	<i>Veronica peregrine</i>	w
Squirrel-tail Fescue	<i>Vulpia bromoides</i>	
Bathurst Burr	<i>Xanthium spinosum</i>	