

2017

KERANG WETLANDS
RAMSAR SITE ACTION PLAN

APPENDICES

2025



CONTENTS

| | | |
|------------|---|---|
| Appendix 1 | Australian Ramsar Management Principles | 3 |
| Appendix 2 | Relevant legislation, policy and strategies | 4 |
| Appendix 3 | Roles and responsibilities | 7 |
| Appendix 4 | Risk Assessment | 9 |

APPENDIX 1 – Australian Ramsar Management Principles

1 General principles

- 1.1 The primary purpose of management of a declared Ramsar wetland must be in accordance with the Ramsar Convention:
 - (a) to describe and maintain the ecological character of the wetland; and
 - (b) to formulate and implement planning that promotes:
 - (i) conservation of the wetland; and
 - (ii) wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.
- 1.2 Wetland management should provide for public consultation on decisions and actions that may have a significant impact on the wetland.
- 1.3 Wetland management should make special provision, if appropriate, for the involvement of people who:
 - (a) have a particular interest in the wetland; and
 - (b) may be affected by the management of the wetland.
- 1.4 Wetland management should provide for continuing community and technical input.

2 Management planning

- 2.1 At least 1 management plan should be prepared for each declared Ramsar wetland.
- 2.2 A management plan for a declared Ramsar wetland should:
 - (a) describe its ecological character; and
 - (b) state the characteristics that make it a wetland of international importance under the Ramsar Convention; and
 - (c) state what must be done to maintain its ecological character; and
 - (d) promote its conservation and sustainable use for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem; and
 - (e) state mechanisms to deal with the impacts of actions that individually or cumulatively endanger its ecological character, including risks arising from:
 - (i) physical loss, modification or encroachment on the wetland; or
 - (ii) loss of biodiversity; or
 - (iii) pollution and nutrient input; or
 - (iv) changes to water regimes; or
 - (v) utilisation of resources; or
 - (vi) introduction of invasive species; and
 - (f) state whether the wetland needs restoration or rehabilitation; and
 - (g) if restoration or rehabilitation is needed—explain how the plan provides for restoration or rehabilitation; and
 - (h) provide for continuing monitoring and reporting on the state of its ecological character; and
 - (i) be based on an integrated catchment management approach; and

- (j) include adequate processes for public consultation on the elements of the plan; and
- (k) be reviewed at intervals of not more than seven years.

3 Environmental impact assessment and approval

- 3.1 This principle applies to the assessment of an action that is likely to have a significant impact on the ecological character of a Ramsar wetland (whether the action is to occur inside the wetland or not).
- 3.2 Before the action is taken, the likely environmental impact of the action on the wetland's ecological character should be assessed under a statutory environmental impact assessment and approval process.
- 3.3 The assessment process should:
 - (a) identify any part of the ecological character of the wetland that is likely to be affected by the action; and
 - (b) examine how the ecological character of the wetland might be affected; and
 - (c) provide adequate opportunity for public consultation.
- 3.4 An action should not be approved if it would be inconsistent with:
 - (a) maintaining the ecological character of the wetland; or
 - (b) providing for the conservation and sustainable use of the wetland.

- 3.5 Approval of the action should be subject to conditions, if necessary, to ensure that the ecological character of the wetland is maintained.
- 3.6 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions.

APPENDIX 2 – Relevant legislation, policy and strategies

2.1 International conventions and agreements

Ramsar Convention

The Kerang Wetlands were listed as a Wetland of International Importance under the Ramsar Convention in 1982. The Ramsar Convention provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention obliges contracting parties to maintain the ecological character of Ramsar sites, and to formulate and implement planning to promote the sustainable use of all wetlands.

Bilateral agreements and conventions for migratory species

Australia is a signatory to a number of bilateral agreements, initiatives and conventions for the conservation of migratory birds which are relevant to the Kerang Wetlands Ramsar site. These include:

- Japan–Australia Migratory Bird Agreement (JAMBA): the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds in Danger of Extinction and their Environment, 1974;
- China–Australia Migratory Bird Agreement (CAMBA): the Agreement between the Government of the People's Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment, 1986;
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA): the Agreement between the Government of the Republic of Korea and the Government of Australia for the Protection of Migratory Birds and their Environment, 2006; and

- Convention on the Conservation of Migratory Species of Wild Animals (known as CMS or Bonn Convention) – adopts a framework in which countries with jurisdiction over any part of the range of a particular species cooperate to prevent migratory species becoming endangered. For Australian purposes, many of the species are migratory birds.

Indigenous peoples

The Australian Government has ratified several international human rights instruments that recognise and protect Indigenous peoples' special connection to land and waters and provide for the right to practice, revitalise, teach and develop culture, customs and spiritual practices and to utilise natural resources (for example, the United Nations Declaration of Rights of Indigenous Peoples).

2.2 National legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is 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. Nine matters of national environmental significance have been identified under the Act and include Ramsar wetlands and listed migratory species.

The EPBC Act supports the implementation of the Ramsar Convention. The EPBC Act regulates actions that will or are likely to have a significant impact on matters of national environmental significance, including Ramsar wetlands. Such actions are subject to environmental assessment and approval under the Act. Actions, as defined by the Act, may be a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these.

The EPBC Act also establishes a framework for managing Ramsar listed wetlands through the Australian Ramsar Management Principles, which are set out in Schedule 6 of the *Environment Protection and Biodiversity Conservation Regulations 2000*. The principles are intended to promote national standards of management, planning, environmental impact assessment, community involvement and monitoring for all Australian Ramsar wetlands in a way that is consistent with Australia's obligations under the Ramsar Convention.

Native Title Act 1993

The *Native Title Act 1993* (Cth) provides a framework for the protection and recognition of native title. The Act gives Indigenous Australians who hold native title rights and interests - or who have made a native title claim - the right to be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land.

Water Act 2007

The *Water Act 2007* (Cth) established the Murray-Darling Basin Authority (MDBA) and requires the MDBA to prepare the Basin Plan – a strategic plan for the integrated and sustainable management of water resources in the Murray-Darling Basin. The Act also established the Commonwealth Environmental Water Holder to manage the Commonwealth's environmental water.

The *Water Amendment Act 2008* amends the *Water Act 2007* to transfer functions and powers from the Murray-Darling Basin Commission to the MDBA.

Murray-Darling Basin Plan

The Murray-Darling Basin Plan provides guidance to governments, regional authorities and communities to sustainably manage and use the waters of the Basin. The overarching aim of the plan is to strike a balance between access to water for Basin communities and provision of adequate water for the environment (MDBA 2016).

2.3 State legislation

Aboriginal Heritage Act 2006

All Aboriginal places, objects and human remains are protected under the *Aboriginal Heritage Act 2006*. The Act provides for the management of Victoria's cultural heritage. On-ground works, including those to protect or enhance biodiversity, must not contravene the Act.

Catchment and Land Protection Act 1994

The *Catchment and Land Protection Act 1994* provides an integrated catchment management framework and facilitates the management and wise use of land and water resources at a whole-of-catchment scale. Catchment management authorities (CMAs) are established under this Act to develop and implement a regional catchment strategy, which sets out how the catchments in a region are to be managed. It identifies objectives for the quality of the land and water resources of the catchments in the region and sets a program of measures to promote improved use of land and water resources and to treat land degradation.

Crown Land (Reserves) Act 1978

Under the *Crown Land (Reserves) Act 1978*, land is reserved for a variety of public uses, managed either by DELWP, or another land manager on their behalf. Amongst the Kerang Wetlands, this is Parks Victoria and Goulburn Murray Water.

Environment Protection Act 1970

The *Environment Protection Act 1970* provides a regulatory framework for protection of environmental assets, particularly water quality. The Act aims to prevent pollution and environmental damage by setting environmental quality objectives and establishing programs to meet them. The Act requires the Environment Protection Authority to recommend State Environment Protection Policies (SEPPs) to the Governor in Council. The SEPPs provide more detailed requirements and guidance for the application of the Act to Victoria. There are SEPPs for air quality, land contamination, groundwaters and waters, amongst other things.

Fisheries Act 1995

The *Fisheries Act 1995* provides for the regulation, management and conservation of fisheries and aquatic habitats, together with the reform of law relating to fisheries.

Flora and Fauna Guarantee Act 1988 (FFG Act)

This is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. It allows the listing of threatened species, threatened communities and potentially threatening processes. Once a species, process or community is listed, the government prepares an Action Statement that sets out the actions to conserve and manage it. The Act also allows for the development and use of interim conservation orders for the urgent protection of critical habitat for a listed threatened species or community.

Parks Victoria Act 1998

The *Parks Victoria Act 1998* enables Parks Victoria to provide services to the state and its agencies for the management of parks, reserves and other public land. The Act requires that, in carrying out its functions, Parks Victoria must not act in a way that is not environmentally sound.

Planning and Environment Act 1987

The *Planning and Environment Act 1987* establishes objectives for planning in Victoria and outlines the planning process and requirements for planning schemes. Under all Victorian planning schemes a planning permit is required to remove, lop or destroy native vegetation, including dead trees of a particular height or width, unless a relevant exemption applies. Native vegetation includes any and all locally native trees, shrubs, herbs and grasses. Planning schemes are administered by local governments.

Local Government may also develop and implement local policies and overlays, which may add additional permit conditions in relation to vegetation removal. A local council can also protect rare wetlands and other biodiversity assets through their planning scheme.

Water Act 1989

The *Victorian Water Act 1989* provides the framework for allocating surface water and groundwater throughout Victoria. The Act details the Crown's entitlements to water and private entitlements to water from all rivers, streams and groundwater systems in Victoria.

The main provisions of the Act relate specifically to private consumptive rights, meeting the needs of the environment and other purposes such as provision for the integrated management of all elements of the terrestrial phase of the water cycle, and to eliminate inconsistencies in the treatment of surface water and groundwater resources and waterways.

Wildlife Act 1975

The *Wildlife Act 1975* provides for the protection of all native wildlife and habitat. It also protects all kinds of deer, non-indigenous quail, pheasants and partridges, and all terrestrial invertebrate animals listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act). The Act regulates the hunting, trading and taking of wildlife.

2.4 State policy and strategies

Victorian threatened flora and fauna species advisory lists

The Threatened Species Advisory Lists are maintained by the Victorian Government and are based on technical information and advice obtained from a range of experts. There are no direct legal requirements or consequences that flow from inclusion of a species in advisory lists, although their habitat is afforded some protection through the 'Permitted clearing of native vegetation – Biodiversity Assessment Guidelines'. These lists can be used in a range of planning processes such as management plans, local government planning schemes, regional catchment strategies and in setting priorities for actions to conserve biodiversity.

Victorian Waterway Management Strategy (VWMS)

This strategy outlines the direction for the Victorian Government's investment over an eight year period (beginning in 2012-13). The overarching management objective is to maintain or improve the environmental condition of waterways to support environmental, social, cultural and economic values (DEPI 2013a).

River Red Gum Parks Management Plan (under development)

Parks Victoria is developing a management plan that will guide the protection of Victoria's River Red Gum floodplain parks and reserves, which includes wetlands, cultural sites and the management of tourism and recreation. The final plan is expected in 2017 and will relate to the Kerang Wetlands.

2.5 Regional strategies and plans

North Central Regional Catchment Strategy (RCS)

The 2013-19 *North Central RCS* provides the long-term vision for natural resource management in the North Central CMA region. It sets regional priorities for managing natural assets, and also sets the overall direction for investment and coordination of efforts by landholders, partner organisations and the wider community. The Kerang Wetlands are identified as a key priority wetland asset in the RCS that supports highly depleted wetland types and significant threatened flora and fauna species.

North Central Waterway Strategy (NCWS)

The 2014–2022 NCWS is an action out of the VWMS. The NCWS is an integrated strategy for managing and improving the region's waterways (rivers, streams and wetlands). The strategy sets priorities and outlines a regional works program to guide investment over the next eight years. The strategy also guides coordination of efforts by landholders, partner organisations and the wider community. The NCWS incorporates provisions for the management planning of Ramsar sites, including the Kerang Wetlands.

2.6 Local plans

Kerang Wetlands Ramsar Site Strategic Management Plan 2004

The *Kerang Wetlands Ramsar Site Strategic Management Plan* (DSE, 2004) established a management framework to facilitate conservation and wise use of the site in order to maintain the ecological character of the Kerang Wetlands. Since the time of writing, there has been a substantial improvement in our understanding of the Ramsar site, along with a raft of legislative and policy changes and new management priorities. This document - the *Kerang Wetlands Ramsar Action Plan*, along with the NCWS - supersede the Kerang Wetlands Ramsar Site Strategic Management Plan.

Environmental Water Management Plans

Environmental Water Management Plans are ten year management plans that set out long-term objectives for the priority environmental values of a wetland, and outline a watering regime to achieve these objectives. The plans are based on both scientific information and stakeholder consultation and form the basis for annual environmental water planning by the North Central CMA, DELWP and the Victorian Environmental Water Holder (VEWH). Within the Kerang Wetlands Ramsar site, environmental water management plans are complete for Lake Cullen, Hird Swamp and Johnson Swamp. The 2016 Environmental Water Management Plan for Johnson Swamp supersedes the *Johnson Swamp Environmental Water Plan* developed as part of the Northern Victorian Irrigation Renewal Project - now the Goulburn Murray Water (GMW) Connections Project.

Land and On-water Management Plans

Goulburn Murray Water facilitates land and on-water management plans for specific water storages, and aims to provide guidance for GMW and other agencies to manage activities, facilities and development on and around the storages. Land and on-water management plans aim to address a range of land and on-water issues such as increasing community awareness and involvement, community safety, recreation and tourism, maintaining healthy ecosystems and cultural heritage (GMW 2015). The plans are not designed to make recommendations on storage operations, such as water levels and releases. In the Kerang Wetlands, land and on-water management plans will be developed for Lake Charm and Kangaroo Lake.

APPENDIX 3 – Roles and responsibilities

| Partners | Roles and responsibilities/links with waterways |
|--|--|
| State Government agencies and statutory bodies | |
| Department of Environment, Land, Water and Planning (DELWP) | <p>The Department of Environment, Land, Water and Planning (DELWP) is responsible for the development of waterway policy, co-ordination of regional delivery and prioritisation of government investment in waterways. DELWP is also responsible for other aspects of natural resource management relevant to waterways, including:</p> <ul style="list-style-type: none"> – ensuring the sustainable management of Victoria's water resources – overseeing the catchment planning framework to promote integrated catchment management throughout Victoria – managing biodiversity and threatened species – managing public land, including Crown frontages. The department is responsible for Crown land administration, including licensing for riparian management and for grazing and ensuring compliance with licence conditions. The department also has a direct on-ground responsibility for unlicensed Crown frontages and is responsible for some aspects of waterway management on public land. – bushfire management on public land – delivering sustainability and environment services at the regional level, including some services that relate to waterway management. |
| Department of Economic Development, Jobs, Transport and Resources (DEDJTR) | <ul style="list-style-type: none"> – managing fisheries and recreational fishing in waterways to optimise economic and social value while ensuring the sustainability of resources – investing in and delivering farming programs on private land where waterways occur – overseeing the management of biosecurity, including aquatic invasive species |
| Environment Protection Authority Victoria (EPA) | <p>The EPA Victoria is an independent body responsible for the protection and improvement of Victoria's environment by establishing environmental standards, regulating and working with organisations to meet these standards. The EPA's roles and responsibilities include:</p> <ul style="list-style-type: none"> – identifying and setting the level of environmental quality needed to protect aquatic environments through the State Environmental Protection Policy (SEPP, Waters of Victoria) – acting in partnership with DELWP and regional bodies to monitor water quality and waterway health and investigating water quality incidents classified as 'pollution'. |
| Parks Victoria | <p>Parks Victoria manages parks and conservation reserves in which many waterways are located, including national, state, wilderness, metropolitan and regional parks, marine national parks and sanctuaries and conservation and natural features reserves. Parks Victoria creates, manages and maintains visitor sites and manages a range of assets, including visitor facilities and access points, piers and jetties, sporting facilities and navigation aids, many of which are associated with waterways.</p> |
| Victorian Environmental Water Holder (VEWH) | <p>The VEWH is appointed under the <i>Water Act 1989</i> to manage Victoria's environmental water entitlements. The VEWH works with the waterway managers, Commonwealth Environmental Water Holder, Murray-Darling Basin Authority; storage operators and land managers to ensure environmental water entitlements are used to achieve the best environmental outcomes.</p> |
| North Central Catchment Management Authority (North Central CMA) | <p>The North Central CMA was established under the <i>Catchment and Land Protection Act 1994</i>. The primary goal of the North Central CMA is to ensure the protection and restoration of land and water resources, the sustainable development of natural resources-based industries and the conservation of our natural and cultural heritage. Under Part 10 of the <i>Water Act 1989</i>, the North Central CMA is the designated responsible manager of waterways, drainage and floodplains. In terms of waterway management, the North Central CMA's key functions are to:</p> <ul style="list-style-type: none"> – develop a regional waterway strategy and associated action plans – develop and implement works programs – authorise works on waterways and act as a referral body for planning applications, licences to take and use water and – construct dams, for water use and other waterway health issues – identify regional priorities for environmental watering and facilitating water delivery – provide input into water allocation processes – develop and co-ordinate regional floodplain management plans – manage regional drainage, as appropriate – respond to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms – undertake community participation and awareness programs. |

| Partners | Roles and responsibilities/links with waterways |
|---|--|
| National/other state authorities | |
| Murray–Darling Basin Authority (MDBA) | <p>The MDBA was established under the federal <i>Water Act 2007</i> as an independent, expertise-based statutory agency. The primary roles of the Authority as outlined in the <i>Water Act 2007</i> (Cth) include:</p> <ul style="list-style-type: none"> – preparing and reviewing the Basin Plan – measuring, monitoring and recording the quality and quantity of the Basin's Water resources – supporting, encouraging and conducting research and investigations about the Basin's Water Resources – developing equitable and sustainable use of Basin water resources – disseminating information, and engaging and educating the Australian community about the Basin's water resources. |
| Water Corporations | |
| Goulburn Murray Water (GMW) Lower Murray Water (LMW) | <p>Water corporations in Victoria are established under the <i>Water Act 1989</i> and provide a range of water services to customers within their service areas. Water corporations provide a combination of irrigation services, domestic and stock services, bulk water supply services and urban water and wastewater services in the North Central Region. Their links with the Kerang Wetlands Ramsar Action Plan include:</p> <ul style="list-style-type: none"> – broader catchment health and improved water quality links to water supply – water reform, and an operational role in environmental water management. |
| Local Government | |
| Gannawarra Shire Council | <p>Councils are involved in the management of waterways in Victoria through their role as responsible planning authorities, managers of stormwater drainage and on-site domestic wastewater systems, users of integrated water systems, land managers, emergency management bodies, and supporters of community groups. Specifically with regard to waterways, local government has the following roles and responsibilities:</p> <ul style="list-style-type: none"> – incorporating waterway restoration and catchment management objectives, priorities and actions into statutory planning processes – undertaking floodplain management and assisting in flood warning in accordance with the Victoria Flood Management Strategy – developing and implementing urban stormwater plans – managing adjoining waterways under Committees of Management. |
| Traditional Owners | |
| Traditional Owner Boards/ Councils | <p>Traditional Owners with recognised native title rights or formal agreements with the state are important in land and water management. Joint management co-operative agreements can involve establishing majority Traditional Owner boards or councils that prepare management plans and/or provide advice about the management of specific areas.</p> |
| Community | |
| Landholders | <p>Landholders near or adjacent to the Kerang Wetlands can have an impact on the Ramsar site, as works on privately owned land or land management practices can have a substantial impact on catchment health. Under the <i>Catchment and Land Protection Act 1994</i> landholders are required to:</p> <ul style="list-style-type: none"> – protect water resources – avoid causing or contributing to land degradation which causes or may cause damage to land of another owner – conserve soil – eradicate regionally prohibited weeds and prevent the growth and spread of regionally controlled weeds – prevent the spread of, and as far as possible eradicate, established pest animals. |
| Community Groups | <p>Community individuals or groups (such as Landcare, Waterwatch, 'Friends of' groups) participate in regional planning, priority setting and the implementation of regional works programs. They also participate in monitoring and reporting of waterway condition and can undertake projects in priority areas.</p> |

APPENDIX 4 – Risk Assessment

Table 1. Assessment of current risks to the ecological character of the Kerang Wetlands. Risks are considered in the context of the current ecological character of the site.

| # | Values impacted by threat | Threats What is the action or activity that could affect some aspect of the ecological character? | Stressor What are the physical or chemical changes that could result from this activity? | Effect description Biological or physical effect of the stressor on the endpoint | Likelihood of impact Exposure of the endpoint to the stressor | Consequence of impact Potential effect of the stressor on the endpoint | 1. Permanent regulated open water storages Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | 2. Salt/sewage disposal basins Tutchewop, William, Kelly, LL Kelly, Fosters | 3. Freshwater natural features reserves Back, Town, Cullen, Johnson, Hird | 4. Unregulated freshwater wetlands. Bael Bael, Avoca Marshes, Cemetery, Stevenson | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
|---|---|--|---|---|--|---|---|--|--|--|---|--|---|
| 1 | Native flora | Water resource use and regulation | Increased freshwater inflows | Waterlogging can result in reduced species richness of canopy and understorey plants (i.e. tree deaths, seasonal species) that fringe the wetlands. | Very Low (2,3,4) Moderate (1) | Moderate (1, 2, 3, 4) | Moderate | Low | Low | Low | Vegetation has historically been lost due to more permanent water regimes in some of these wetlands i.e. loss of red gum canopy. This occurred prior to Ramsar listing so the likelihood of losing plants due to overwatering is lower now and would only occur if there was an extended natural flood. | Vegetation diversity | C3, C4 |
| 2 | Native flora | Water resource use and regulation | Increased freshwater inflows | A wetter watering regime advantages native species such as Typha and Phragmites which can spread in monospecific patches, reducing local biodiversity and diversity of habitat. | Very Low (2,3,4) Moderate (1) | Very Minor (1, 2) Minor (4) Major (3) | Low | Very Low | Moderate | Very Low | Typha and phragmites are already an issue at Johnson and Hird swamps and can take over the majority of the wetland. Risk is lower at 4 because the wetlands are dry for long periods, which limits the extent of these species. | Vegetation diversity | C3 |
| 3 | Native flora; Aquatic fauna; Terrestrial fauna; Waterbirds | Water resource use and regulation | Increased freshwater inflows | Lack of or reduced drying phases reduce food web complexity. | Very Low (2,3,4) Moderate (1) | Minor (2) Moderate (1, 3, 4) | Moderate | Very Low | Low | Low | Increased freshwater inflows (i.e. greater permanency) are unlikely to occur at 2, 3, or 4. Wetlands in group 1 are permanent and so an increase or maintenance of current water levels is likely to result in reduced food web complexity, without the wetting and drying phases. In addition, the seasonality of filling and drawing down is inversed at these wetlands i.e. higher from August-May and lower in winter. If there were increased inflows at 3 and 4, this could result in reduced productivity if the drying phase did not occur. | Waterbird abundance and diversity; Physio-chemical | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
|---|-----------------------------|---|---|---|--|--|---|--|---|---|--|--|---|
| | | What is the action or activity that could affect some aspect of the ecological character? | What are the physical or chemical changes that could result from this activity? | Biological or physical effect of the stressor on the endpoint | Exposure of the endpoint to the stressor | Potential effect of the stressor on the endpoint | Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | Tutchewop, William, Kelly, LL Kelly, Fosters | Back, Town, Cullen, Johnson, Hird | Bael Bael, Avoca Marshes, Cemetery, Stevenson | | | |
| 4 | Native flora | Water resource use and regulation | Altered timing of inundation | <ul style="list-style-type: none"> Unseasonal inflows impact on ability of flora complete germination and recruitment phases Advantage invasive exotic and native species above others. | Moderate (1, 2, 3, 4) | Very Minor (2) Moderate (1, 3, 4) | Moderate | Low | Moderate | Moderate | Unseasonal inflows are moderately likely at any of the wetlands. Permanent wetlands have an inverse seasonality; salt wetlands can receive water from Barr Creek at any time; backed up irrigation flows from the weir pool impact Town Swamp; unseasonal natural floods could occur at any of the wetlands. | Vegetation diversity | C3, C4 |
| 5 | Waterbirds | Water resource use and regulation | Altered timing of inundation | Impact on waterbird breeding cycles as flows may come at the wrong time of year to miss the breeding season, or could inundate nests of birds that create platforms for breeding (i.e. Bitterns, Swamp hens). | Moderate (1, 2, 3, 4) | Minor (2) Moderate (1) Major (3, 4) | Moderate | Low | High | High | Group 1 comprises permanent wetlands, but if the stressor does occur there is an ibis rookery at Middle Reedy Lake which could be impacted. Waterbirds are considered unlikely to breed at 2, so unseasonal flows unlikely to have a large impact. Greater risk at 3 and 4 if water comes at the wrong time of year to either miss the breeding cycles or flood nests. | Waterbird breeding, Threatened species | C2, C3, C4, C6 |
| 6 | Water quality; Wetland type | Water resource use and regulation | Decreased inflows | Increased salinity from a lack of freshening flows. | Very Low (1) Moderate (2, 3, 4) | Minor (1, 2), Moderate (3, 4) | Very Low | Low | Moderate | Moderate | Decreased inflows unlikely at 1. Moderately likely at 2, 3, and 4. Decreased inflows would likely assist in improving the salt lakes as it would mean less salt going in. Increased salinity would have a moderate impact on 3 and 4. | Hydrology; Salinity | C1 |
| 7 | Refuge | Water resource use and regulation | Decreased inflows | Reduced permanency of water storages or reduced availability of water in the landscape impacts on availability of drought refuge | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Reduced availability of water is unlikely to reduce the permanency of the storages in Group 1 (and would probably have ecological benefit if they dried out). However, impacts of reduced availability of water are already evident in waterbird numbers and observed breeding, and if there was no water in the landscape this would have major impacts for fauna. | Hydrology; Wetland diversity | C4 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
|----|---------------------------|---|---|---|--|--|---|--|---|---|---|--|---|
| | | What is the action or activity that could affect some aspect of the ecological character? | What are the physical or chemical changes that could result from this activity? | Biological or physical effect of the stressor on the endpoint | Exposure of the endpoint to the stressor | Potential effect of the stressor on the endpoint | Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | Tutchewop, William, Kelly, LL Kelly, Fosters | Back, Town, Cullen, Johnson, Hird | Bael Bael, Avoca Marshes, Cemetery, Stevenson | | | |
| 8 | Recreation | Water resource use and regulation | Decreased inflows | Reduced permanency of water storages or reduced inflow to wetlands impacts on recreational activities e.g. boating, duck hunting | Very Low (1) Moderate (2, 3, 4) | Moderate (1, 2) Major (3, 4) | Low | Moderate | High | High | Reduced permanency would have a low impact on recreational activities at the permanent wetlands (they can still occur when there is water). Salt lakes are less likely to have ducks. 3 and 4 include high profile duck hunting wetlands when wet, so reduced inflows will impact on duck hunting in the region. | Recreation and tourism | – |
| 9 | Wetland type | Water resource use and regulation | Decreased inflows | Reduced frequency, volume and duration of flows (e.g. modernisation of irrigation system may reduce inflows) will change the hydrological character of the wetland. | Very Low (1) Moderate (2, 3, 4) | Moderate (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Decreased freshwater inflows unlikely at 1, but would have a major impact on hydrological character if did occur. Moderately likely at 2, 3 and 4. As intermittent wetlands that naturally undergo dry phases, hydrological character may only change over a long period of time. This risk could potentially be higher at Town Swamp if it does have a permanent water regime (knowledge gap). | Hydrology | C1 |
| 10 | Native flora | Water resource use and regulation | Decreased inflows | Changed frequency and duration of inflows could go beyond hydrological tolerances of vegetation. | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Decreased freshwater inflows unlikely at 1, but would have a major impact on existing vegetation at any of the wetlands if dry tolerances were exceeded, through mortality and reducing the ability of plants to germinate and complete life cycle. | Vegetation diversity | C3, C4 |
| 11 | Waterbirds | Water resource use and regulation | Decreased inflows | Reduced opportunities for waterbird breeding. | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Decreased inflows to 2, 3 and 4 would reduce the available habitat for waterbird breeding. Impacts could be severe, especially if there are already reduced areas in the landscape that could otherwise provide this. | Waterbird breeding, Threatened species | C3, C4, C5, C6 |
| 12 | Waterbirds | Water resource use and regulation | Decreased inflows | Reduced opportunities for waterbird feeding. | Very Low (1) Moderate (2, 3, 4) | Moderate | Low | Moderate | Moderate | Moderate | Decreased inflows to 2, 3 and 4 would reduce the available habitat for waterbird feeding. Waterbirds are mobile so potentially could feed elsewhere, but this is dependent on whether there are other places in the landscape that could otherwise provide feeding areas. | Waterbird abundance and diversity; Threatened species | C3, C4, C5 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| | | What is the action or activity that could affect some aspect of the ecological character? | What are the physical or chemical changes that could result from this activity? | Biological or physical effect of the stressor on the endpoint | Exposure of the endpoint to the stressor | Potential effect of the stressor on the endpoint | Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | Tutchewop, William, Kelly, LL Kelly, Fosters | Back, Town, Cullen, Johnson, Hird | Bael Bael, Avoca Marshes, Cemetery, Stevenson | | | |
| 13 | Aquatic fauna | Water resource use and regulation | Decreased inflows | Reduced opportunities for native fish species to feed, spawn and/or recruit. This includes Murray Cod and Golden Perch at the permanent wetlands; and potentially Murray Hardyhead at the salt lakes during a large natural flood. | Very Low (1) Moderate (2, 3, 4) | Minor (3, 4) Moderate (2) Major (1) | Moderate | Moderate | Low | Low | A number of threatened fish species are present in 1. The salt lakes have supported Murray Hardyhead (MHH) in the past and periodically support populations when there is sufficient freshwater inflow, such as a natural flood. The salt lakes do not support MHH when they are dry, however MHH are found in the Tutchewop Main Drain - the water supply for the lakes. While this is not in the Ramsar site, it is acknowledged as a source population and refuge for the species from which fish can migrate into the lakes when there are inflows. MHH are also being translocated from the drain into nearby Lake Elizabeth. The population in the Tutchewop Main Drain is significant and maintained through provision of adequate flows pumped from the Barr Creek system. While the salt lakes are not considered a short-term priority for maintaining MHH, they could provide habitat in future if delivery of environmental water can be secured. Low rating for 3 and 4 as they dry out. Knowledge gap - unknown whether native fish utilise Town Swamp if more permanent than previously understood. | Threatened species | C2, C4 |
| 14 | Soils; Water quality; Native flora; Native fauna | Water resource use and regulation | Exposure of wetland sediments | Reduced inflows can expose acid sulfate soils, which can have severe impacts on water quality, native flora and fauna. | Very Low (1) High (2, 3, 4) | Minor (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Likelihood is low at Reedy Lakes and Little Lake Charm due to their permanency for water storage. However, as they are permanently inundated the impact is greater if they dry out compared to the other wetlands which already do dry out and do not have known acid sulfate issues at present. Knowledge gap: Back and Town Swamp have been identified as having a high hazard characterisation from acidic materials, but it is unclear whether the current watering regime can have an impact on the likelihood of this risk occurring. | Vegetation diversity; Waterbird abundance and diversity; Threatened species; Soils | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 15 | Soils; Water quality; Native flora; Native fauna | Water resource use and regulation | Exposure of wetland sediments | Acid sulfate soils can increase the solubility of metals and therefore metal mobilisation. This risk is dependent on metal loading within soils and water at a particular wetland. | Very Low (1) High (2, 3, 4) | Minor (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Likelihood is low at Reedy Lakes and Little Lake Charm due to their permanency for water storage. However, as they are permanently inundated the impact is greater if they dry out compared to the other wetlands which already do dry out and do not have known acid sulfate issues at present. Knowledge gap: Back and Town Swamp have been identified as having a high hazard characterisation from acidic materials, but it is unclear whether the current watering regime can have an impact on the likelihood of this risk occurring. | Vegetation diversity; Waterbird abundance; Threatened species | C3 |
| 16 | Wetland type | Water resource use and regulation | Reduced hydrological connectivity from regulating infrastructure (e.g. levees) or increased regulation | Reduced connectivity between wetlands impacts on wetland type i.e. construction of a sill | Very Low | Major | Moderate | Moderate | Moderate | Moderate | It is very unlikely that any infrastructure that would impact connectivity would be approved. However, the impacts would be severe if water is somehow withheld from a wetland. For example past experience with the sill at the Avoca Marshes demonstrated that water was withheld and did not travel downstream. | Hydrology; Ecological connectivity | C4 |
| 17 | Native flora | Water resource use and regulation | Reduced hydrological connectivity from regulating infrastructure (e.g. levees) or increased regulation | Reduced flows and barriers between wetlands impact on connectivity that facilitates seed dispersal | Very Low | Major | Moderate | Moderate | Moderate | Moderate | It is very unlikely that any infrastructure that would impact connectivity would be approved. However, the impacts would be major if seed dispersal is inhibited, especially at wetlands with limited seed banks that would otherwise not be replenished. | Vegetation diversity; Ecological connectivity | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 18 | Aquatic fauna | Water resource use and regulation | Reduced hydrological connectivity from regulating infra-structure (e.g. levees) or increased regulation | Reduced flows and barriers between wetlands impact on connectivity for native fish movement. | Very Low | Moderate (2, 3, 4) Major (1) | Moderate | Low | Low | Low | <p>Connectivity is the biggest threat for native fish. Risks are particularly high for the permanent wetlands where native fish are present.</p> <p>The salt lakes have supported Murray Hardyhead (MHH) in the past and periodically support populations when there are sufficient freshwater inflows, such as a natural flood. The salt lakes do not support MHH when they are dry however MHH are found in the Tutchewop Main Drain - the water supply for the lakes. While this is not in the Ramsar site, it is acknowledged as a source population and refuge for the species from which fish can migrate into the lakes when there are inflows. MHH are also being translocated from the drain into nearby Lake Elizabeth. The population in the Tutchewop Main Drain is significant and maintained through provision of adequate flows pumped from the Barr Creek system. While the salt lakes are not considered a short-term priority for maintaining MHH, they could provide habitat in future if delivery of environmental water can be secured.</p> <p>3 and 4 do dry out, but may provide some feeding or nursery habitat. As water is delivered via the irrigation system native fish are not expected to be present in high abundances. Knowledge gap - unknown whether native fish utilise Town Swamp if more permanent than previously understood.</p> | Threatened species; Ecological connectivity | C2, C3 |
| 19 | Wetland type | Climate change and severe weather events – Drought | Decreased availability of water in the system | Decreased environmental water allocations. | Moderate | Major | N/A | N/A | High | N/A | Decreased availability of e-water means that water must be stretched further between wetlands in the region that can receive e-flows. These wetlands would suffer as a result. For example the Australasian Bittern is currently supported at Johnson Swamp where natural floods do not occur often enough to support the population, but e-water fills that gap in the watering regime. | Hydrology | C2, C3, C4, C6 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 20 | Native flora | Climate change and severe weather events – Unseasonal flooding | Altered timing of inundation | Unseasonal inflows impact on ability of flora complete germination and recruitment phases – advantage invasive exotic and native species above others. | Moderate (1, 2, 3, 4) | Very Minor (2) Moderate (1, 3, 4) | Low | Moderate | Moderate | Moderate | While inflows altogether are less likely during drought periods, climate change may see any floods occurring at unseasonal times, as it did in late summer 2010-11. Unseasonal inflows could also still occur at 2 due to the need for drainage of Barr Creek. They may also occur at Back/Town Swamps due to backed-up irrigation water passing through the Loddon or Pyramid Creek systems. | Vegetation diversity | C3, C4 |
| 21 | Waterbirds | Climate change and severe weather events - Unseasonal flooding | Altered timing of inundation | Impact on waterbird breeding cycles as changing weather patterns mean that flows may come at the wrong time of year to miss the breeding season, or could inundate nests of birds that create platforms for breeding (i.e. Bitterns, Swamp hens). | Moderate (1, 2, 3, 4) | Minor (2), Moderate (1) Major (3, 4) | Moderate | Low | High | High | While inflows altogether are less likely during drought periods, climate change may see any floods occurring at unseasonal times, as it did in late summer 2010-11. Group 1 wetlands are permanent wetlands, but if the stressor does occur, there is an ibis rookery at Middle Reedy Lake which could be impacted. Waterbirds are considered unlikely to breed at 2, so unseasonal flows unlikely to have a large impact. Greater risk at 3 and 4 if water comes at the wrong time of year to either miss the breeding cycle or flood nests. | Waterbird breeding; Threatened species | C3, C4, C5, C6 |
| 22 | Water quality; Wetland type | Climate change and severe weather events - Drought | Decreased inflows | Increased salinity from a lack of freshening flows. | Very Low (1) Moderate (2, 3, 4) | Minor (1, 2), Moderate (3, 4) | Very Low | Low | Moderate | Moderate | Decreased inflows unlikely at 1. Moderately likely at 2, 3 and 4. Decreased inflows would likely assist in improving the salt lakes as it would mean less salt going in. Increased salinity would have a moderate impact on 3 and 4. | Hydrology; Salinity | C1 |
| 23 | Refuge | Climate change and severe weather events - Drought | Decreased inflows | Reduced permanency of water storages or reduced availability of water in the landscape impacts on drought refuge. | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Group 1 wetlands are unlikely to reduce in permanency. However, impacts of reduced availability of water in the landscape are already evident in waterbird numbers and observed breeding, and if there was no water in the landscape, this could have major impacts for fauna. In addition, an increase in the length of time between inundations could impact the character of a wetland. | Hydrology; Waterbird abundance and diversity | C4 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 24 | Recreation | Climate change and severe weather events – Drought | Decreased inflows | Reduced permanency of water storages or reduced inflow to wetlands impacts on recreational activities e.g. boating, duck hunting. | Very Low (1) Moderate (2, 3, 4) | Moderate (1, 2) Major (3, 4) | Low | Moderate | High | High | Reduced permanency would have a low impact on recreational activities at the permanent wetlands (they can still occur when there is water). Salt lakes are less likely to have ducks. 3 and 4 include high profile duck hunting wetlands when wet, so reduced inflows will impact on duck hunting in the region. | Recreation and tourism | - |
| 25 | Wetland type | Climate change and severe weather events – Drought | Decreased inflows | Reduced frequency, volume and duration of flows will change the hydrological character of the wetland. | Very Low (1) Moderate (2, 3, 4) | Moderate (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Decreased freshwater inflows unlikely at 1, but would have a major impact on hydrological character if did occur. Moderately likely at 2, 3 and 4. As intermittent wetlands that naturally undergo dry phases, hydrological character may only change over a long period of time. This risk could potentially be higher at Town Swamp if it does have a permanent water regime (knowledge gap). | Hydrology | C1 |
| 26 | Native flora | Climate change and severe weather events – Drought | Decreased inflows | Changed frequency and duration of inflows could go beyond hydrological tolerances of vegetation. | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Decreased freshwater inflows unlikely at 1, but could have a severe impact on existing aquatic/submergent vegetation if dry tolerances were exceeded, causing mortality or reducing plants ability to complete life cycles. However, some dry phases or fluctuation may provide an ecological benefit at the permanent wetlands. | Vegetation diversity | C3, C4 |
| 27 | Waterbirds | Climate change and severe weather events – Drought | Decreased inflows | Reduced opportunities for waterbird breeding. | Very Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Decreased freshwater inflows unlikely at 1, but would have a major impact on existing vegetation at any of the wetlands if dry tolerances were exceeded. | Waterbird breeding, Threatened species | C3, C4, C5, C6 |
| 28 | Waterbirds | Climate change and severe weather events – Drought | Decreased inflows | Reduced opportunities for waterbird feeding. | Very Low (1) Moderate (2, 3, 4) | Moderate | Low | Moderate | Moderate | Moderate | Decreased inflows to 2, 3 and 4 would reduce the available habitat for waterbird breeding. Impacts could be severe, especially if there are already reduced areas in the landscape that could otherwise provide this. | Waterbird abundance and diversity; Threatened species | C3, C4, C5, C6 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 29 | Aquatic fauna | Climate change and severe weather events - Drought | Decreased inflows | Reduced opportunities for native fish species to feed, spawn and/or recruit. | Very Low (1) Moderate (2, 3, 4) | Minor (2, 3, 4) Major (1) | Moderate | Moderate | Low | Low | Threatened fish are present in 1. The salt lakes have supported Murray Hardyhead (MHH) in the past and periodically support populations when there are sufficient freshwater inflows, such as a natural flood. The salt lakes do not support MHH when they are dry, however MHH are found in the Tutchewop Main Drain - the water supply for the lakes. While this is not in the Ramsar site, it is acknowledged as a source population and refuge for the species from which fish can migrate into the lakes when there are inflows. MHH are also being translocated from the drain into nearby Lake Elizabeth. The population in the Tutchewop Main Drain is significant and maintained through provision of adequate flows pumped from the Barr Creek system. While the salt lakes are not considered a short-term priority for maintaining MHH, they could provide habitat in future if delivery of environmental water can be secured. Low rating for 3 and 4 as they dry out. Knowledge gap - unknown whether native fish utilise Town Swamp if more permanent than previously understood. | | C2, C4 |
| 30 | Soils; Water quality; Native flora; Aquatic fauna | Climate change and severe weather events - Drought | Exposure of wetland sediments | Reduced inflows can expose acid sulfate soils, which can cause soil acidification. | Very Low (1) High (2, 3, 4) | Minor (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Likelihood of soil exposure is low at Reedy Lakes and Little Lake Charm due to their permanency for water storage. However, as they are permanently inundated the impact is greater if they dry out compared to the other wetlands which already do dry out and do not have known acid sulfate issues at present. Knowledge gap: Back and Town Swamp have been identified as having a high hazard characterisation from acidic materials, but it is unclear whether the current watering regime can have an impact on the likelihood of this risk occurring. | Vegetation diversity; Waterbird abundance and diversity; Threatened species; Soils | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 31 | Soils; Water quality; Native flora; Aquatic fauna | Climate change and severe weather events - Drought | Exposure of wetland sediments | Acid sulfate soils can increase the solubility of metals and therefore metal mobilisation. This risk is dependent on metal loading within soils and water at a particular wetland. | Very Low (1) High (2, 3, 4) | Minor (2, 3, 4) Major (1) | Moderate | Moderate | Moderate | Moderate | Likelihood of soil exposure is low at Reedy Lakes and Little Lake Charm due to their permanency for water storage. However, as they are permanently inundated the impact is greater if they dry out compared to the other wetlands which already do dry out and do not have known acid sulfate issues at present. Knowledge gap: Back and Town Swamp have been identified as having a high hazard characterisation from acidic materials, but it is unclear whether the current watering regime can have an impact on the likelihood of this risk occurring. | Vegetation diversity; Waterbird abundance and diversity; Threatened species; Soils | C3 |
| 32 | Recreation | Climate change and severe weather events - High temperatures | Increased occurrence of toxic algal blooms in the system | Reduced capacity for recreational activities. | Moderate (2, 3, 4) High (1) | Very Minor (2, 3, 4) Moderate (1) | High | Low | Low | Low | Higher impact on recreation activities at the permanent wetlands used for boating/ watersport activities. | Recreation and tourism | - |
| 33 | Water quality | Climate change and severe weather events - High temperatures | Increased occurrence of toxic algal blooms in the system | Low dissolved oxygen or toxic impacts to aquatic fauna. | Moderate (2, 3, 4) High (1) | Moderate | High | Moderate | Moderate | Moderate | Higher impact at the permanent wetlands where aquatic fauna are most likely to be impacted. The extent to which toxic algal blooms impact native fauna at the Kerang Wetlands is a knowledge gap, as in the recent bloom there have been no reported fish kills. | | - |
| 34 | Public health | Climate change and severe weather events - High temperatures | Increased occurrence of toxic algal blooms in the system | High levels of certain types of algae can be toxic to humans, livestock, native fauna. | Moderate (2, 3, 4) High (1) | Moderate | High | Moderate | Moderate | Moderate | Potentially toxic to humans and native fauna anywhere. | Physio-chemical | - |
| 35 | Water supply | Climate change and severe weather events - High temperatures | Increased occurrence of toxic algal blooms in the system | Economic impact on consumptive use - irrigation water, stock water, domestic use. | Moderate (2, 3, 4) High (1) | Very Minor (2, 3, 4) Moderate (1) | High | Low | Low | Low | At 2, 3 and 4 water is not known to be used for consumptive purposes. Toxic algal blooms would limit the use of water at 1. | Agriculture; Irrigation | - |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 36 | Aquatic fauna | Climate change and severe weather events – High temperatures | High temperatures changing environmental triggers for fish spawning | For many fish, spawning is often related to water temperatures - not too cold or warm. Too high temperatures can mean fish will not have the climatic cue to spawn e.g. Golden Perch. | Moderate (2, 3, 4) High (1) | Moderate (1, 2, 3, 4) | High | Moderate | Moderate | Moderate | Risk is higher at permanent wetlands where fish are present. If the temperature cue is missing more frequently, there will be less opportunities for fish to spawn, potentially impacting the population. | Biodiversity; Threatened species | C2, C3 |
| 37 | Waterbirds | Climate change and severe weather events – High temperatures | High temperatures resulting in increased mortality of juvenile waterbirds | Juvenile waterbirds unable to survive high temperatures. | Low (2) High (1, 3, 4) | Major | Very High | Moderate | Very High | Very High | Considered to be a major risk at all wetlands where breeding is known to occur, resulting in juvenile mortality and consequently reduced populations. | Waterbird breeding; Threatened species | C2, C4 |
| 38 | Water quality; Aquatic fauna | Climate change and severe weather events – High temperatures | Increased microbial activity in high temperatures | Increased microbial activity in high temperatures can result in low dissolved oxygen that cannot support aquatic biota (e.g. hypoxic blackwater events). This risk is also dependent on the carbon loading at the time. | Very Low (2, 3, 4) Low (1) | Major | Moderate | Moderate | Moderate | Moderate | Hypoxic blackwater is not known to occur very often in the Kerang Wetlands. However, high temperatures combined with a significant input of carbon (e.g. in a wetland that has not been flooded for a long time) could result in such an event and could have a major impact, including fish kills. However, the lack of canopy trees throughout the wetlands reduces the carbon inputs. | Threatened species | C2, C3, C4 |
| 39 | Wetland type | Water resource use and regulation | Increased demand for water | Competition for delivery of environmental water. | Moderate | Moderate | N/A | N/A | Moderate | N/A | Competing demand for water and constraints of the irrigation system can mean that environmental water is delivered at sub-optimal times, and can impact germination or breeding/recruitment times for flora and fauna. | Hydrology | C1 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 40 | Native flora; Aquatic fauna; Waterbirds | Changes to system operations | Alterations to management of the water storages or salt disposal basins - increased or decreased inflows | Increased or decreased inflows and their timing, duration and frequency will impact native flora and fauna. | Moderate | Minor (1) Moderate (2) | Low | Moderate | N/A | N/A | Alterations to management of the wetlands in Group 1 are considered to have a relatively minor impact as there will likely always be water available. The salt lakes may be moderately impacted if there are increased inflows bringing more salt into the wetlands. | Waterbird abundance and diversity | C3 |
| 41 | Wetland type | Changes to system operation - GMW Connections Project | Bypass of Third Reedy Lake | Significantly reduced water levels or drying out of a currently permanent freshwater wetland. | Assessed through separate GMW processes. | Assessed through separate GMW processes. | Assessed through separate GMW processes. | N/A | N/A | N/A | Threats of the possible bypass have been assessed through a separate process. | Hydrology | - |
| 42 | Wetland type; Water quality | High regional groundwater levels | Increased groundwater intrusion | Increased salinity levels beyond EC recommendations. | Very Low (1) Low (3, 4) | Minor (1) Major (3, 4) | Low | N/A | Moderate | Moderate | Regional groundwater levels may rise as a result of wetter climatic conditions or from some irrigation practices. Prior to the recent prolonged drought, groundwater tables had reached within one metre of the surface. The likelihood of groundwater intrusion is considered to be very low at the permanent wetlands. While it is unlikely that it would occur at 3 and 4, it would have major consequences for wetland flora and fauna if the EC recommendations for the wetlands were exceeded. The salt/sewage disposal basins in 2 are considered N/A as there are no EC recommendations for these wetland types. | Wetland diversity; Salinity | C1 |
| 43 | Waterbirds; Native flora; Aquatic fauna | High regional groundwater levels | Increased groundwater intrusion | Increased salinity levels impact on native flora and fauna. | Very Low (1) Low (2, 3, 4) | Minor (1, 2) Major (3, 4) | Low | Low | Moderate | Moderate | Regional groundwater levels may rise as a result of wetter climatic conditions or from some irrigation practices. Prior to the recent prolonged drought, groundwater tables had reached within one metre of the surface. The likelihood of groundwater intrusion is considered to be very low at the permanent wetlands. Given that group 2 are already saline, groundwater intrusion and subsequent salinity would likely only have a minor impact on the whole. While it is unlikely that it would occur at 3 and 4, it would have major consequences for wetland flora and fauna if the EC recommendations for the wetlands were exceeded. | Waterbird diversity; Vegetation diversity; Threatened species | C3, C4 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 44 | Native flora | Invasive non-native species - woody weeds e.g. willows, boxthorn, blackberry, briar rose | Increased competition for water and nutrients | Displacement of native flora and reduced biodiversity around wetland riparian zones. | High | Moderate | High | High | High | High | Woody weeds are an issue at all wetlands in the riparian zones. While a lot of work has been done at some wetlands, woody weeds will continue to be a threat. | Vegetation diversity | C3 |
| 45 | Native flora | Invasive non-native species - non-woody weeds e.g. creepers | Increased competition for water and nutrients | Displacement of native flora and reduced biodiversity around wetland riparian zones. | High | Moderate | High | High | High | High | Non-woody weeds such as bridal creeper, horehound, thistles etc. are present at all wetlands, especially during dry phases. They continue to be a major threat to maintaining or improving diversity of flora species at the wetlands. | Vegetation diversity | C3 |
| 46 | Native flora | Invasive non-native species - aquatic vegetation e.g. Arrowhead | Increased competition for water and nutrients | Displacement of native flora and reduced biodiversity. | Very Low (2) Moderate (1, 3, 4) | Minor (2) Moderate (3, 4) Major (1) | High | Very Low | Moderate | Moderate | Low risk at salt disposal basins as salinity inhibits growth of aquatic vegetation, including most aquatic weeds. Risk is considered moderate at 3 and 4 as drying cycles help to control aquatic weeds. Major risk at 1 as there is no drying phase to control them, meaning they can stay present all year round. | Vegetation diversity | C3 |
| 47 | Native flora | Invasive native species - aquatic vegetation e.g. Cumbungi and typha | Increased dominance and extent of these species | Displacement of other native flora and reduced biodiversity. | Low (4) Moderate (1) High (3) | Moderate (1, 4) Major (3) | Moderate | N/A | Very High | Low | Cumbungi and phragmites dominance are known issues at Johnson and Hird swamps, and could have moderate impacts at 1 although likely that cumbungi and phragmites have already spread as far as they are able in these wetlands. Risk is lower at 4 because of longer drying periods. | Vegetation diversity | C3 |
| 48 | Native flora | Invasive non-native species: Rabbits | Overgrazing of native emergent, understory and overstorey flora | Reduced abundance and diversity of native flora. | High | Major | Very High | Very High | Very High | Very High | Rabbits are considered to be present and have major impacts on vegetation at all wetlands. Particularly a risk for threatened species e.g. if there is only one local population of a threatened flora species that gets eaten by a rabbit, it could become locally extinct. Also new young shoots are more palatable, reducing the ability of plants to complete their life cycles. | Vegetation diversity | C3, C4 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 49 | Native flora | Invasive non-native species: Rabbits | Grazing of threatened native flora | Loss of threatened flora species. | High | Major | Very High | Very High | Very High | Very High | Rabbits are considered to be present and have major impacts on vegetation at all wetlands. Particularly a risk for threatened species e.g. if there is only one local population of a threatened flora species that gets eaten by a rabbit, it could become locally extinct. | Threatened species | - |
| 50 | Aboriginal values | Invasive non-native species: Rabbits | Burrowing habits and overgrazing | Disturbance of cultural heritage. | High | Major | Very High | Very High | Very High | Very High | Rabbits are considered to be present at all wetlands. Burrowing habits are known to be a high threat to cultural heritage as it disturbs the soil layers and overgrazing can expose culturally significant sites. | Culture | - |
| 51 | Soils | Invasive non-native species: Rabbits | Burrowing habits | Degradation of soil structure and erosion. | High | Moderate | High | High | High | High | Burrowing habits disturb the soil structure and can cause serious erosion problems. | Soils | |
| 52 | Waterbirds, Aquatic fauna | Invasive non-native species: Cats | Predation on native fauna e.g. turtles, waterbirds, and their eggs. | Reduced abundance and diversity of native fauna. | High | Major | Very High | Very High | Very High | Very High | Cats are a major issue around many of the wetlands, especially as there are legislative restrictions for controlling them. However, they are a significant predator of native fauna. | Waterbird abundance and diversity; Waterbird breeding; Threatened species | C2, C3, C4, C6 |
| 53 | Recreation | Invasive non-native species: Cats | Predation on waterbirds | Impacts to waterbird abundance affect opportunities for recreational activities i.e. duck hunting. | High | Minor | Moderate | Moderate | Moderate | Moderate | Cats are a major issue around many of the wetlands, especially as there are legislative restrictions for controlling them. However, they are a significant predator of native fauna, including juvenile waterbirds. Less likely to impact duck hunting as there are eight game species, part of the wider bird population. | Recreation | - |
| 54 | Recreation | Invasive non-native species: Cats | Predation on waterbirds | Impacts to waterbird abundance affect opportunities for recreational activities i.e. bird watching. | High | Moderate | High | High | High | High | Cats are a major issue around many of the wetlands, especially as there are legislative restrictions for controlling them. However, they are a significant predator of native fauna including waterbirds. Slightly higher risk than for hunting as cats are a predator all year round. | Recreation | - |
| 55 | Waterbirds, Aquatic fauna | Invasive non-native species: Foxes | Predation on native fauna e.g. turtles, waterbirds, and their eggs. | Reduced abundance and diversity of native fauna. | High | Major | Very High | Very High | Very High | Very High | Foxes are a major issue around most, if not all, wetlands and have major impacts on native fauna, especially turtle populations. | Waterbird abundance and diversity; Waterbird breeding; Threatened species | C2, C3, C4, C6 |

| # | Values impacted by threat | Threats What is the action or activity that could affect some aspect of the ecological character? | Stressor What are the physical or chemical changes that could result from this activity? | Effect description Biological or physical effect of the stressor on the endpoint | Likelihood of impact Exposure of the endpoint to the stressor | Consequence of impact Potential effect of the stressor on the endpoint | 1. Permanent regulated open water storages Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | 2. Salt/sewage disposal basins Tutchewop, William, Kelly, LL Kelly, Fosters | 3. Freshwater natural features reserves Back, Town, Cullen, Johnson, Hird | 4. Unregulated freshwater wetlands. Bael Bael, Avoca Marshes, Cemetery, Stevenson | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 56 | Recreation | Invasive non-native species: Foxes | Predation on waterbirds | Impacts to waterbird abundance affect opportunities for recreational activities i.e. duck hunting. | High | Minor | Moderate | Moderate | Moderate | Moderate | Foxes are a major issue around many of the wetlands, especially as there are legislative restrictions for controlling them. They are a significant predator of native fauna, including juvenile waterbirds. Moderate impacts to duck hunting as there are only eight game species in the context of the wider bird population that cats would prey upon. | Recreation | - |
| 57 | Recreation | Invasive non-native species: Foxes | Predation on waterbirds | Impacts to waterbird abundance affect opportunities for recreational activities i.e. bird watching. | High | Moderate | High | High | High | High | Foxes are a major issue around many of the wetlands, especially as there are legislative restrictions for controlling them. They are a significant predator of native fauna including waterbirds. Slightly higher risk than for hunting as cats are a predator all year round, for all species. | Recreation | - |
| 58 | Native flora | Invasive non-native species: Pigs | Wallowing, grazing and uprooting of native flora species | Reduced abundance and diversity of native flora. | Low (2) Moderate (4) High (1, 3) | Major | Very High | Moderate | Very High | High | Pigs have been reported at 3 and 4 over recent years, and are likely also present at the other wetlands, especially 1 where there is a permanent water source. Pigs can destroy native flora reducing diversity and harming threatened species. | Vegetation diversity | C3 |
| 59 | Waterbirds; Terrestrial fauna; Aquatic fauna | Invasive non-native species: Pigs | Wallowing, grazing and uprooting of native flora species | Impacts to vegetation reduce availability of habitat for birds, reptiles, mammals, amphibians. | Low (2) Moderate (4) High (1, 3) | Major | Very High | Moderate | Very High | High | Mortality and reduction of vegetation can result in the reduction of suitable habitat for a variety of native fauna. Pigs have been reported at 3 and 4 over recent years, and are likely also present at the other wetlands, especially 1 where there is a permanent water source. | Waterbird abundance and diversity | C3, C4 |
| 60 | Aboriginal values | Invasive non-native species: Pigs | Wallowing, grazing and uprooting of native flora species | Disturbance of cultural heritage. | High | Major | Very High | Very High | Very High | Very High | Wallowing and grazing from pigs is a high threat to cultural heritage as it disturbs the soil layers and overgrazing can expose culturally significant sites. | Culture | |
| 61 | Native flora | Invasive non-native species: Pigs | Spread of weeds and pathogens, and disease vector | Reduced abundance and diversity of flora; mortality of native flora and fauna and potentially nearby livestock from pathogens or other disease. | Very Low | Moderate | Low | Low | Low | Low | Pigs can spread weeds and pathogens in droppings or carry them from one site to another, and can act as disease vectors. Thought to be a low risk around the wetlands. | Vegetation diversity | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 62 | Waterbirds | Invasive non-native species: Pigs | Predation on eggs and fledgling waterbirds | Mortality of waterbirds resulting in reduced abundance of waterbirds. | High | Moderate | High | High | High | High | Pigs predate on eggs and juvenile waterbirds. Considered to be a high threat at all wetlands. | Waterbird abundance and diversity; Waterbird breeding | C2, C3 |
| 63 | Terrestrial fauna; Aquatic fauna | Invasive non-native species: Pigs | Competition for food with native fauna | Reduced abundance and diversity of native fauna. | Low | Minor | Low | Low | Low | Low | Pigs can provide some competition for resources but are more of a threat as a predator of native fauna. | Waterbird abundance and diversity; Threatened species | C2, C3, C4 |
| 64 | Aquatic fauna | Invasive non-native species: Carp and Gambusia | Predation on native fish and frog eggs and larvae, and competition for food. | Reduced diversity and abundance of native fish and frogs. | Moderate (3, 4) High (1) | Moderate | High | N/A | Moderate | Moderate | Higher impact at permanent wetlands where Carp and Gambusia are always present. http://www.dpi.nsw.gov.au/content/fisheries/pests-diseases/freshwater-pests/species/carp/general-information | | C3 |
| 65 | Water quality; Native Flora; Aquatic fauna | Invasive non-native species: Carp and Gambusia | Carp feeding habits i.e. mummbling | Carp stir up sediments through their feeding methods, increasing turbidity which inhibits growth of vegetation and reduces visibility for native fauna, which in turn may reduce their ability to feed. | Moderate (3, 4) High (1) | Moderate (3, 4) Major (1) | Very High | N/A | Moderate | Moderate | Higher impact at permanent wetlands where Carp are always present. No Carp screens on other wetlands so when inundated will likely have Carp present, however it is unknown how big an impact they have at these wetlands. Drying phases also help to control them. (checked against Environmental Water Management Plans). | | |
| 66 | Native flora | Invasive non-native species: Carp and Gambusia | Carp feeding habits i.e. mummbling | Uprooting of aquatic and emergent vegetation reduces abundance and diversity of vegetation. | Moderate (3, 4) High (1) | Moderate (3, 4) Major (1) | Very High | N/A | Moderate | Moderate | Higher impact at permanent wetlands where Carp are always present. No Carp screens on other wetlands so when inundated will likely have Carp present, however it is unknown how big an impact they have at these wetlands. In 3 and 4 Carp may not be present long enough before the dry phase to have a higher impact (checked against Environmental Water Management Plans). | Vegetation diversity | C2 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 67 | Native flora | Non-native game species: Deer | Overgrazing of native emergent, understory and overstorey flora | Reduced abundance and diversity of native flora. | Low | Moderate | Low | Low | Low | Low | Deer are present in very low numbers at the wetlands. However, the wetlands are too small to provide enough resources to support a large number of deer, so the likelihood is considered to be low. The wetlands would likely be used as dispersal corridors rather than breeding grounds. However, grazing of recruiting emergent, understory and overstorey flora would have a moderate impact on native flora at the wetlands. | Vegetation diversity | C3 |
| 68 | Native flora | Non-native game species: Deer | Grazing of threatened native flora | Loss of threatened flora species. | Low | Major | Low | Low | Low | Low | Deer are present in very low numbers at the wetlands. However, the wetlands are too small to provide enough resources to support a large number of deer, so the likelihood is considered to be low. The wetlands would likely be used as dispersal corridors rather than breeding grounds. However, grazing of native threatened species could have a major impact on local populations, especially if there are limited other populations nearby. | Vegetation diversity | C3 |
| 69 | Native flora; Soils | Non-native game species: Deer | Trampling of native vegetation and compaction of soil | Destruction of vegetation and compaction of soil can alter the vegetation community structure. | Low | Moderate | Low | Low | Low | Low | Deer are present in very low numbers at the wetlands. However, the wetlands are too small to provide enough resources to support a large number of deer, so the likelihood is considered to be low. The wetlands would likely be used as dispersal corridors rather than breeding grounds. Trampling and destruction of native vegetation is considered to have a moderate impact on vegetation structure. | Vegetation diversity | C3 |
| 70 | Terrestrial fauna; Soils | Non-native game species: Deer | Disease vectors | Spread of disease to other native fauna and potentially livestock surrounding the wetlands. | Very Low | Major | Moderate | Moderate | Moderate | Moderate | Deer are present in very low numbers at the wetlands. In low numbers the likelihood of spreading disease is very low, but the consequence could be major if it spreads to native fauna, or potentially to livestock surrounding the wetlands. | Vegetation diversity | C3 |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 71 | Waterbirds; Terrestrial fauna; Aquatic fauna | Loss of standing timber habitat | Dead trees (from previous inappropriate water management) are unstable and falling over with limited regeneration throughout the wetlands. | Reduced availability of feeding, nesting and roosting habitat for birds, bats and mammals. | Low (3, 4) High (1) | Major (1, 3, 4) | Very High | N/A | Moderate | Moderate | Dead trees are present in most wetlands across the four groups. Considered to be very high risk at permanent lakes, as once the trees fall over there will be no roosting or nesting habitat for birds, as there is no regeneration at these sites. There is some regeneration occurring at 3 and 4 so the risk is lower, but it will take some time before the trees are developed enough to support bird breeding again. | Waterbird abundance and diversity | C4 |
| 72 | Native flora | Wild fire | Destruction of native flora species or communities | Loss of native flora species. | Very low (1, 2) Moderate (3, 4) | Major | Moderate | Moderate | High | High | The risk of fire is relatively low at 1 and 2 (for 1 this risk relates to the riparian zone), and higher at 3 and 4 where there is more vegetation and of the type that burns more easily. Considered to have a major impact on native flora species at all wetlands as fire could destroy any individuals or local populations. | Vegetation diversity | C3 |
| 73 | Waterbirds; Terrestrial fauna; Aquatic fauna | Wild fire | Destruction of habitat and resources (e.g. standing dead timber, vegetation) | Reduced availability of feeding, nesting and roosting habitat for birds, bats, reptiles and mammals. | Very low (1, 2) Moderate (3, 4) | Major | Moderate | Moderate | High | High | The risk of fire is relatively low at 1 and 2 (for 1 this risk relates to the riparian zone), and higher at 3 and 4 where there is more vegetation and of the type that burns more easily. Considered to have a major impact at all wetlands as fire would destroy any dead standing timber and dry vegetation that provides critical habitat (in both dry and wet phases) e.g. rushes, lignum or red gums. | Waterbird abundance and diversity | C3, C4 |
| 74 | Waterbirds | Recreational activities - hunting | Removal of native waterbirds (ducks) | Reduced abundance of native waterbirds. | Low (1, 2) Moderate (3, 4) | Moderate | Low | Low | Moderate | Moderate | Duck hunting occurs more frequently at 3 and 4. Reduced abundances are expected to be moderate as the duck populations are monitored every year to inform the decision to allow hunting. | Waterbird abundance and diversity | C3, C5 |
| 75 | Native flora; Waterbirds; Terrestrial fauna; Aquatic fauna | Recreational activities - hunting | Destruction or trampling of native vegetation for hide-outs | Destruction of physical habitat for birds, mammals, reptiles etc. | Very low (1, 2, 3, 4) | Minor | Very Low | Very Low | Very Low | Very Low | Duck hunting occurs more frequently at 3 and 4. Destruction of native vegetation for bird-hides is very localised, or purpose-built, so they can return in following years. There are also only three species of native vegetation that can be used (Phragmites, Leptospermum and Typha spp.) | Waterbird diversity | C3 |

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| 76 | Waterbirds | Recreational activities - hunting | Use of lead shot for hunting other than ducks e.g. quail, rabbits, foxes | Lead shot left at the wetland can contaminate soils or be consumed by waterbirds that feed on wetland fringes or mudflats. | Very Low | Minor | Very Low | Very Low | Very Low | Very Low | Use of lead shot at these wetlands is unknown, but considered to have an impact if present due to the potential for lead poisoning of fauna. However, fauna would have to ingest several pellets to have a lethal impact, and likely that only a small number of fauna would be impacted, so the consequence is considered to be minor. | Waterbird abundance and diversity | C2 |
| 77 | Waterbirds | Recreational activities - hunting | Hunting of non-game waterbird species | Loss of non-game waterbirds and/or threatened species. | Low (1) Moderate (2, 3, 4) | Major | Moderate | High | High | High | Hunting of non-game species is known to occur at times and is considered to have major consequences particularly if it is a threatened species, i.e. Freckled Duck. | Waterbird abundance and diversity; Threatened species | C2, C3, |
| 78 | Recreation | Recreational activities - hunting | Hunting of non-native pest species at a State Game Reserve | Loss of non-native pest species. | Low (1, 2, 3, 4) | Very Minor | Very Low | Very Low | Very Low | Very Low | Hunting of pest species without permission is illegal on a State Game Reserve, for which a number of Ramsar wetlands are classed. While it is illegal, it is considered more likely to have a positive ecological impact. | Recreation | - |
| 79 | Waterbirds | Recreational activities - hunting | Increased noise and disturbance of aquatic habitats | Disturbance to waterbirds from shots and being flushed out. | High | Minor | Moderate | Moderate | Moderate | Moderate | Hunters flush out game species for shooting, and as a consequence may also flush out non-game species. Shots being fired can also disturb waterbirds. | Waterbird abundance and diversity; Threatened species | C2, C3, |
| 80 | Soils | Recreational activities - camping | Increased trampling of native vegetation, compaction of soil | Reduced abundance of native flora and associated habitat; compaction of soil. | Moderate | Minor | Low | Low | Low | Low | Many hunters camp around the wetlands during hunting season. Some trampling occurs but thought to be of minor consequence. | Soils | |
| 81 | Terrestrial fauna; Aquatic fauna | Recreational activities - camping | Collection of firewood | Reduced physical habitat diversity for native fauna. | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate likelihood of campers (or locals) collecting firewood for campfires, resulting in the removal of both live and dead timber that would otherwise be providing habitat for native fauna. | | |
| 82 | Aboriginal values | Recreational activities - visitors | Intentional or unintentional disturbance of cultural sites | Disturbance, destruction or removal of cultural heritage. | Moderate | Major | High | High | High | High | Disturbance of cultural heritage has occurred both intentionally and unintentionally. Any disturbance of cultural heritage is considered to have a major impact. | Culture | |

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| 83 | Aquatic fauna | Recreational activities - fishing | Removal of native fish species | Reduced abundance of native fish. | Very Low (3, 4) Moderate (1) | Minor | Low | N/A | Very Low | Very Low | Fishing mostly occurs in the permanent storages, which are stocked. | Threatened species | C2, C3 |
| 84 | Native flora | Recreational activities - unpermitted 4WD | Destruction of native vegetation | Reduced abundance and diversity of native flora. | Low | Moderate | Low | Low | Low | Low | Occurs sometimes at 2, 3 and 4. Can have moderate impact on native flora if destroyed by 4WD tracks. | Vegetation diversity | C3 |
| 85 | Waterbirds | Recreational activities - power boating | Increased noise and disturbance of aquatic habitats | Disturbance to waterbirds from boat noise and movement. | High | Minor | Moderate | N/A | N/A | N/A | Noise from powerboats can disturb waterbirds, but considered to be minor impact as they are mobile and can resettle elsewhere. | Waterbird abundance and diversity; Waterbird breeding | C4, C5, C6 |
| 86 | Soils | Recreational activities - power boating | Wave action | Erosion of bed and bank. | Moderate | Minor | Low | N/A | N/A | N/A | Considered to be a knowledge gap, but likely that wave action from power boats impacts bed and banks, especially at Lake Charm. | Physical form; Soils | |
| 87 | Water quality; Soils | Residential and commercial development | Presence of former landfill site | Toxins from the landfill site may leach into the Ramsar site or groundwater. | Low | Major | N/A | N/A | N/A | Moderate - Cemetery Swamp only | A rehabilitation plan exists for the former landfill site, so while it is unlikely, there would be major consequences if there is leaching of toxins. | Soils | |
| 88 | Water quality; Soils | Residential and commercial development | Illegal dumping of rubbish | Release of contaminants into waterways and soil that is harmful to flora and fauna, or plastics that do not break down can entangle native fauna. | High | Minor | Moderate | Moderate | Moderate | Moderate | Does occur at numerous wetlands, in varying degrees. | Soils | |
| 89 | Recreation | Residential and commercial development | Illegal dumping of rubbish | Impacts the aesthetic value of the wetland. | High | Moderate | High | High | High | High | Does occur at numerous wetlands, in varying degrees. | Recreation | - |
| 90 | Native flora | Resource use - grazing licenses | Grazing of livestock within the Ramsar site. | Reduced abundance and diversity of native flora at wetlands with a grazing licence. See comments for relevant wetlands. | Moderate (1, 2, 4) Low (3) | Major | High | High | Moderate | High | Grazing removes or inhibits recruitment of native flora, including threatened species. This may have significant consequences especially if there are local populations of a particular species. The risk ratings apply to the following wetlands that have grazing leases: Lake William, First Reedy, Third Reedy, Kangaroo Lake, Racecourse Lake, Lake Charm, Stevenson and Lake Kelly. | Vegetation diversity | C3 |

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| 91 | Soils | Resource use - grazing licenses | Grazing of livestock within the Ramsar site. | Compaction, pugging and erosion of soils at wetlands with a grazing license. See comments for relevant wetlands. | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | Livestock can cause significant damage to soils, resulting in erosion and changes to the soil structure. The risk ratings apply to the following wetlands that have grazing leases: Lake William, First Reedy, Third Reedy, Kangaroo Lake, Racecourse Lake, Lake Charm, Stevenson and Lake Kelly. | Soils | - |
| 92 | Water quality | Resource use - grazing licenses | Grazing of livestock within the Ramsar site. | Increased nutrients from livestock effluent that can result in algal growth at wetlands with a grazing license. See comments for relevant wetlands. | Moderate | Minor | Low | Low | Low | Low | It is possible that excess nutrient from grazing areas could contribute to degraded water quality in the wetland. This depends on the direction and volume of run-off and whether there is a buffer zone between the grazing areas and the wetlands. The risk ratings apply to the following wetlands that have grazing leases: Lake William, First Reedy, Third Reedy, Kangaroo Lake, Racecourse Lake, Lake Charm, Stevenson and Lake Kelly. | Physio-chemical | C3, C4 |
| 93 | Native flora | Resource use - grazing licenses | Grazing of livestock within the Ramsar site. | Introduction and spread of non-native weeds (e.g. Tall wheat grass, Rye grass) at wetlands with a grazing license. See comments for relevant wetlands. | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | Spread of non-native weeds from grazing is considered to be a threat at wetlands with a grazing licence, as livestock can bring weeds in through effluent or mud on hooves etc. The risk ratings apply to the following wetlands that have grazing leases: Lake William, First Reedy, Third Reedy, Kangaroo Lake, Racecourse Lake, Lake Charm, Stevenson and Lake Kelly. | Vegetation diversity | C3, C4 |
| 94 | Aboriginal values | Resource use - grazing licenses | Grazing of livestock within the Ramsar site. | Disturbance of cultural heritage sites at wetlands with a grazing license. See comments for relevant wetlands. | Moderate (1, 2, 4) Low (3) | Major | High | High | Moderate | High | Livestock can be a high threat to cultural heritage as compaction can disturb the soil layers and overgrazing can expose culturally significant sites. The risk ratings apply to the following wetlands that have grazing leases: Lake William, First Reedy, Third Reedy, Kangaroo Lake, Racecourse Lake, Lake Charm, Stevenson and Lake Kelly. | Culture | - |

| # | Values impacted by threat | Threats | Stressor | Effect description | Likelihood of impact | Consequence of impact | 1. Permanent regulated open water storages | 2. Salt/sewage disposal basins | 3. Freshwater natural features reserves | 4. Unregulated freshwater wetlands. | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
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| 95 | Native flora; Water quality | Resource use - Unlicensed grazing | Unlicensed grazing of livestock within the Ramsar site. | Same as risks for grazing licences. | Low (1) Moderate (2) High (3, 4) | Major | Moderate | High | Very High | Very High | Unlicensed grazing is known to be an issue at the Avoca Marshes and Town Swamp, and some others. Same issues arise as for licensed grazing. | Vegetation diversity; Physio-chemical | C3, C4 |
| 96 | Water quality | Pollution - agricultural effluents and drainage | Increased nutrients in run-off from adjacent land use (fertilisers, animal industries) in the wetlands | Increased occurrence of algal blooms in the system has the same impacts as 'Climate change and severe weather events - High temperatures.' | Moderate | Minor | Low | Low | Low | Low | Impacts from this risk depend on the type of land use e.g. cropping or pasture. The actual impact is considered a knowledge gap here, and is dependent on the size and condition of any buffer zones. | Physio-chemical | C3, C4 |
| 97 | Native flora | Pollution - agricultural effluents and drainage | Drainage water from adjacent land | Unseasonal inflows to the wetland can cause mortality of flora species through waterlogging, especially during warmer months e.g. regenerating red gums. | Very low (1) Low (2, 3, 4) | Minor | Very Low | Low | Low | Low | At present this risk is considered to be relatively unlikely, although the extent of its occurrence is unknown. The impact is expected to be relatively minor, and in some cases may be sustaining patches of wetland flora rather than killing it. | Vegetation diversity | C3 |
| 98 | Native flora | Pollution - agricultural effluents and drainage | Drainage water from adjacent land | Unseasonal inflows to the wetland can support the proliferation of invasive species (native or non-native) (i.e. Phragmites or Typha). | Very low (1) Low (2, 3, 4) | Minor | Very Low | Low | Low | Low | At present this risk is considered to be relatively unlikely, although the extent of its occurrence is unknown. The impact is expected to be relatively minor as it would only support these species in localised areas of the wetland, i.e. unlikely to spread beyond the water line. | Vegetation diversity | C2, C3, C4 |
| 99 | Native flora; Aquatic fauna | Pollution - saline drainage water | Disposal of saline drainage water | Increased salinisation of the wetland can impact on native flora and aquatic fauna. | Moderate | Moderate | N/A | Moderate | N/A | N/A | If the current disposal of salt from the Barr Creek system continues the risk of increasing salinisation will continue to occur. However, as the wetlands are already saline, the threat is considered to be moderate. | Waterbird abundance and diversity; Threatened species | C3, C4 |

| # | Values impacted by threat | Threats What is the action or activity that could affect some aspect of the ecological character? | Stressor What are the physical or chemical changes that could result from this activity? | Effect description Biological or physical effect of the stressor on the endpoint | Likelihood of impact Exposure of the endpoint to the stressor | Consequence of impact Potential effect of the stressor on the endpoint | 1. Permanent regulated open water storages Kangaroo, Racecourse, Charm, LL Charm, First Reedy, Middle Reedy, Third Reedy | 2. Salt/sewage disposal basins Tutchewop, William, Kelly, LL Kelly, Fosters | 3. Freshwater natural features reserves Back, Town, Cullen, Johnson, Hird | 4. Unregulated freshwater wetlands. Bael Bael, Avoca Marshes, Cemetery, Stevenson | Comments | Ramsar Components, Processes and Services (CPS) potentially affected by the threat (bold denotes 'critical' CPS) | Which Ramsar criteria does the value relate to, if any? |
|-----|-----------------------------|--|---|--|--|---|---|--|--|--|---|--|---|
| 100 | Pollution control | Pollution - saline drainage water | Accumulation of salt | Salt accumulation can limit the effectiveness of the wetlands for salt disposal as their evaporation rates decrease and salt precipitates. | Low | Minor | N/A | Moderate | N/A | N/A | If the current disposal of salt from the Barr Creek system continues, the possibility that the wetlands will lose their effectiveness as salt disposal basins is likely. If this is the case, it has broader implications for salt in the wider system. | Pollution control - salt disposal | - |
| 101 | Native flora; Aquatic fauna | Pollution - sewage and stormwater | Discharge of treated wastewater and stormwater into the wetland | Increased pollutants in the wetland can impact on native flora and aquatic fauna. | Moderate | Minor | N/A | Low - Fosters Swamp only | N/A | N/A | Thought to be a low impact with a management plan in place. | Vegetation diversity; Hydrology; Pollution control | C1, C3 |
| 102 | Water quality | Pollution - sewage and stormwater | Discharge of treated wastewater and stormwater into the wetland | Impacts from an increased nutrient load result in algal growth. | Moderate | Minor | N/A | Low - Fosters Swamp only | N/A | N/A | Thought to be a low impact with a management plan in place. | Vegetation diversity; Physio-chemical | C3 |
| 103 | Water quality | Pollution - agricultural effluents and drainage | Increased nutrients and chemicals in floodwaters from the broader catchment (fertilisers, animal industries, pesticides etc.) entering wetlands | Increased occurrence of algal blooms and potentially impacts to native flora. | Moderate | Minor | Low | Low | Low | Low | In large floods, floodwater can move across agricultural land that may have chemicals or fertiliser applied, or potentially through buildings or areas that house agricultural chemicals. The impact of contaminated floodwaters is considered to be a knowledge gap, though it may impact the growth of native vegetation. | Vegetation diversity | C3 |

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| 104 | Water quality | Pollution - power boats | Increased chemicals from power boat fuels. | Increased levels of harmful chemicals. | Low | Low | Low | Low | Low | Low | Increased residues and chemicals from fuels can degrade water quality and potentially impact native vegetation, as well as recreational users (e.g. swimming). This is considered a knowledge gap. | | |
| 105 | Recreation | Recreational activities - unpermitted 4WD | Degradation of vehicle tracks | Reduced ability for recreational visitors to access the wetlands. | Low | Minor | Low | Low | Low | Low | Occurs sometimes at 2, 3 and 4. Can make vehicle tracks unusable in or after wet weather. | Vegetation diversity | C3 |
| 106 | Aboriginal values | Recreational activities - fishing | Digging for Bardi Grubs | Disturbance to cultural heritage. | Very Low | Moderate | Low | N/A | Low | Low | Fishing mostly occurs in the permanent storages, which are stocked. | Threatened species | C2, C3 |
| 107 | Water supply | Water resource use and regulation | Increased sedimentation | Reduced capacity of wetlands for water supply. | Low | Moderate | Low | N/A | N/A | N/A | Altered hydrology and regulation of the water storages has meant that sediment builds up more frequently than if there were no constraints to flow. Eventually increased sedimentation will reduce the capacity of the wetlands for water storage. | | |
| 108 | Waterbirds | Flood mitigation | Raised water levels flooding out nests | Increased water levels at the Reedy Lakes above a certain level would inundate nests and cause mortality of juveniles. | Moderate (1) | Major | High | N/A | N/A | N/A | Distribution of floodwaters throughout the system can lead to increased water levels in the Reedy Lakes, potentially flooding out nesting waterbirds and causing the death of juveniles. As this is a critical area within the Ramsar site, if this were to occur it would severely impact the values for which the site is listed. | Waterbird breeding; Threatened species; Flood mitigation | C4 |

